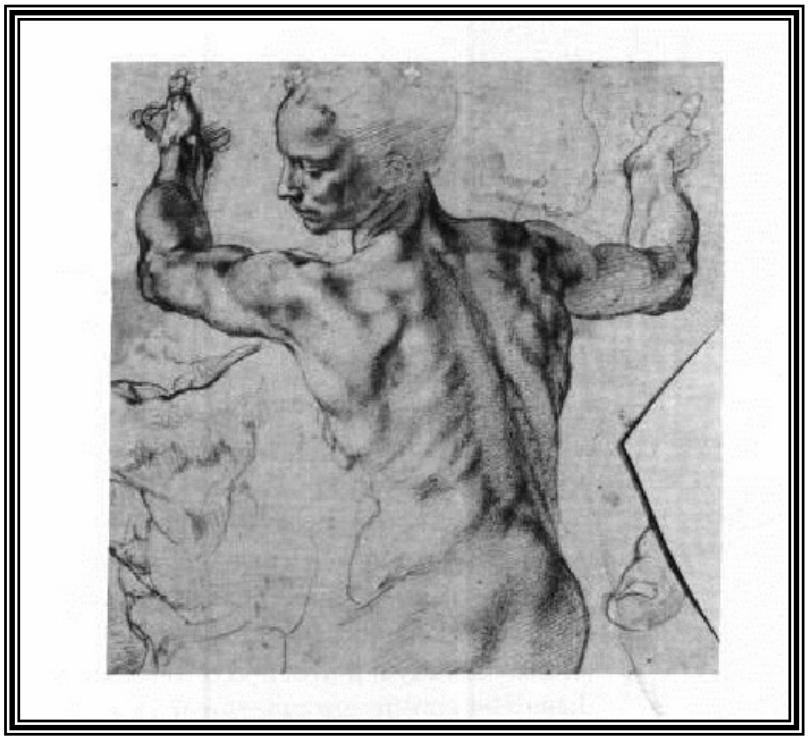

VALIDATING CHIROPRACTIC

Cutting-Edge Research to Improve Patient Outcomes

Validating Chiropractic Table of Contents

Introduction: Chiropractic Philosophy & Science

Role of Chiropractic Philosophy - A Doctrine of Strongly Held Beliefs: Provides Chiropractors with a sense of Purpose, Vision, an Overview: timeless Wisdom.

1. Health comes from within
2. Health is a natural condition of the body
3. Chiropractic cares for people not treat diseases.
4. It helps improve health & restore internal resistance to disease not treat external causes of disease.
5. The patient is the center of care not a disease or symptoms
6. Health is multidimensional not just physical
7. Some things are not measurable
8. Science only acknowledges what it can quantify. It is materialistic.
9. The wisdom inherent in the body is capable of maintaining the body in health if there is no interference in its functioning
10. Ultimate responsibility for health is the patient's
11. The doctor's role is to unleash the natural healing power within
12. A shift away from disease to wellness care

Passive Care: Interventions that a patient passively receives (massage, P.T. modalities, heat, cold, etc., mobilization, adjustments, pain meds, surgery, etc)

Active Care: care in which the patient actively participates: stretching strengthening, endurance exercises, cardiovascular fitness, stress reduction, weight loss, etc. Active care becomes essential in patient tending toward chronicity (> 3 months). Helps reduce complications of prolonged passive care: 1) patient dependency & 2) passive coping, 3) overutilization, 4) chronicity.

Restoring Function

Teasell, MD & Harth, MD. Spine 1996;21(7):844-847

The failure of the medical model in relieving the pain suffering & disability of CLBP has led to a gradual switch in management strategy characterized by the functional restoration approach. **The focus is no longer on diagnosis or treatment but on maximizing functional abilities.**

Saal, MD. Spine 1997;22(14):1545-1552. Presidential Address to the North American Spine Society. We must remind ourselves tt our care must be centered around Pts' needs & desires. We must listen to our Pts and understand their motivations for obtaining care... We must adopt the principle of improving Pt function as our new paradigm. Improving Pt function must be the credo of care.

Difficulty Diagnosing the Cause of Back Pain - Nonspecific & Mechanical Back Pain

Bigos, MD. ALBP in Adults. AHCPR, Dec 1994: 8. Different disciplines use a variety of

diagnosis that suggest a cause for LBP. However, these labels are often unreliable. **Even after an extensive work-up, only about 15% of Pts can be given a definitive diagnosis.**

Deyo RA, MD, MPH. Scientific American 1998; August: 48-53. BP may be a Sx of serious underlying diseases such as cancer, bone infection, or rare forms of arthritis. Fortunately, such critical causes are extremely rare. **About 98% of BP Pts suffer from injury, usually temporary, to the muscles, ligaments, bones or discs. Up to 85% of Pts w LBP are left w/o a definite Dx.** Most Pts can't recall a specific incident tt brought on their suffering, & heavy lifting or injuries, though risk factors, do not account for most episodes. BP often seems just to happen & t medical community has, by no means, reached a consensus as to t causes of garden-variety cases. If Pts are confused, they are not alone.

Kool J et al. Exercise reduces sick leave in patients with non-acute non-specific low back pain: a meta-analysis. J Rehabil Med 2004; 36: 49-62. Evidence suggests that less than 15% of individuals with back pain can be assigned to a specific back pain category such as:
Nerve root compression; Vertebral fracture; Tumor; Infection; Inflammatory disease; Spondylolisthesis; Spinal stenosis; In the majority of patient LBP is non-specific.

Wiesel, S., MD. Diagnostic Precision Still Elusive. Backletter 2005; 20(4): 48. The fact that at least 85% of Pts with BP are not receiving a diagnosis is quite disturbing. But this reflects scientific reality. Over the past decade there has been very little progress in determining where Pts' pain is coming from. However accurate, the label 'nonspecific back pain' is simply not a useful diagnosis. Nonspecific back pain is intellectually and scientifically inadequate & fails to provide any biological basis for real understanding, but this term betrays our ignorance and leads to failure of communication, to confusion and lack of confidence.

Hadler MD, Carey MD. JAMA 2000; 248(21): 2780-1. The findings of Wassell et al. (JAMA. 2000; 284:2727-2732) suggest tt back belts should be viewed as no more than an option in apparel. There is little direct evidence that most back pain stems from a discrete injury or repetitive trauma. There is little direct evidence that most back pain stems from a discrete injury or repetitive trauma. Regional musculoskeletal disorders afflict otherwise well, working-age adults who have had no physical exposure unusual for them. Back pain seldom results from a fall, direct impact or extraordinary physical demands.

Wiesel, S, MD. Are individuals with back pain at heightened risk of permanent spinal injury? Backletter 2002;17(1): 1, 8-10. The injury model of LBP - routine BP is attributable to a discrete injury. Many researchers believe that the injury model itself is flawed & outmoded. Most BP cannot be attributed to any specific injured structure. BP typically does not have any obvious traumatic precedent.

Disturbed Neuromuscular Control

Panjabi, M, PhD. Clinical spinal instability and low back pain. J Electromyogr Kinesiol;2003: 371-379. The etiology of LBP in most Pts is not known. It may be hypothesized tt a certain percent of these Pts may have suboptimal neuromuscular control, especially under dynamic conditions. Studies have looked at this aspect of LBP and demonstrate significant increases in body sway in CLBP Pts vs healthy controls especially when standing on one foot on an unstable surface w eyes closed.

Nies, Sinnott. Variations in balance & body sway in middle-aged adults. Subjects w healthy backs compared w subjects w low-back dysfunction. Spine 1991; 16(3): 325-30. In 45 middle aged adults, 20 w LBP & 25 ctls w healthy backs, balance responses (body sway) were measured under with computerized force plate stabilometry. Compared w ctls, LBP Ss demonstrated significantly greater postural sway, kept their center of force significantly more posterior, & were significantly less likely to be able to balance on one foot w eyes closed. Tx of LBP Pts may require attention to postural alignment, strength, flexibility, joint stability, balance reactions, & postural strategies.

O'Sullivan, Twomey, PhD, Allison, PhD. J Man & Manip Therapy 1997;5(1):20-26. Muscular dysfunction in t presence of LBP does not so much affect t strength of trunk muscles, but influences t patterns of trunk muscle co-activation & recruitment. When a muscle is weakened there may be shifts in t pattern of motor activity, enabling synergistic muscles to generate t forces required for functional tasks - muscle substitution. LBP results not only in changes to levels of trunk muscle activity, but also to t patterns of recruitment & activation between different trunk synergists during movement. CLBP often results in changes to t neural control system, affecting timing of patterns of co-contraction, balance, reflex & righting responses. **Altered mechanoreceptive & proprioceptive input into t neural system can result in disruption to patterns of muscle activation, leaving t person biomechanically vulnerable to further injury or increased chronicity.**

Radebold AM et al. Impaired postural control of the lumbar spine is associated with delayed muscle response times in Pts w CLBP. Spine 2001;26:724-30. Balance performance in 16 unstable CLBP Pts & 14 ctls sitting w eyes open & closed. EMG trunk muscle response from 12 major trunk muscles in response to a quick force release. Results: LBP Pts have poor lumbar spine position sense. CLBP Pts had poorer balance than ctls especially w eyes closed. Lack of visual feedback seems to overburden impaired PR w postural control tasks. In t absence of visual feedback, t remaining sensory input systems were more challenged, wh resulted in a more pronounced deficiency in postural control. CLBP Pts also had delayed muscle response times to quick force release. A deficiency in PR may cause both a delayed muscle response & poor balance performance w LBP. Injury causes localized PR deficits. Trunk muscles & ligs, t main dynamic stabilizers of t spine, may contain damaged PRs in LBP Pts. Maintaining whole body balance is complex & involves

interactions of t 3 major sensory input systems: Visual, Vestibular, Somatosensory (MRs & Ncs), As well as precisely coordinated motor output from 3 levels of motor control: 1) Spinal reflexes: provide unconscious jt stability, uses PR input from jt PRs, muscle spindles & GTOs; 2) Brain stem pathways: control motor programs involved w posture & balance, coordinates vestibular & visual input with PR input from jt & muscle receptors; 3) Cognitive programming: voluntary movements are based on stored central commands wh can be voluntarily adjusted depending on sensory feedback.

Cholewicki, J., Silfies, S. P. et al. Delayed trunk muscle reflex responses increase the risk of low back injuries. Spine 2005; 30(23): 2614-20. There are changes in motor control in Ss w CLBP & in athletes w a Hx of low back injury (LBI), but it's not known whether these changes are a risk for or a result of LBI. Methods: Muscle reflex latencies in response to a quick force release in trunk flexion, extension, and lateral bending were measured in 292 college athletes (148 females and 144 males). Information was obtained regarding a Hx of LBI. Results: During t 2-3 yr F-U, 31 (11%) of Ss had a LBI. T odds of sustaining LBI increased 2.8-fold when a Hx of LBI was present & increased by 3% with each millisecond of abdominal muscle shut-off latency. This latency was 14 milliseconds longer for athletes who sustained LBI vs athletes who did not. There were no signif changes in muscle response latencies on retest following the injury. Conclusions: Delayed muscle reflex response signif increases the risk of sustaining a LBI. These delayed latencies appear to be a preexisting risk factor & not the effect of LBI.

Brumagne, S., et. al. Anticipation of postural instability alters body orientation in persons with reucrrent LBP. Spine Journal 2005; 5(4): S121. In 20 healthy Ss & 28 recurrent LBP Ss body inclination was evaluated during quiet stance eyes open & eyes closed, after vibration of t triceps surae muscles to induce postural instability. Results: There was signif more forward inclination in LBP Ss when vision was occluded & when vibration induced postural instability was anticipated at the expense of increased trunk muscle activity. Conclusions: LBP Ss seem to have an altered internal representation of body orientation, probably due to an inaccurate proprioceptive postural control.

Hitt, JR, et al. Decreased margin of stability in response to postural perturbations in persons with LBP. Spine Journal 2005; 5(4): S121. 26 LBP Pts & 24 non-LBP Ss were given support surface translations, randomly in 12 different horizontal directions using a kinematic force plate. Net center of pressure, total body center of mass, & joint angular displacements were analyzed. Results: LBP Pts have altered automatic postural coordination, both in magnitude & timing responses indicating alterations in neruomuscular control. Conclusions: Data suggest t automatic postural control of Ss w LBP is altered such tt there is an overall stiffening strategy. LBP Ss respond such tt their margin of stability for balance is reduced.

Shum, BSc., Crosbie, PhD, Lee, PhD. Effect of LBP on t kinematics & joint coordination of the lumbar spine & hip during sit-to-stand and stand-to-sit. Spine 2005; 30(17): 1998-

2004.
Study examines differences in kinematics & jt coordination of t lumbar spine (LS)& hips during sit-to-stand & stand-to-sit between 20 healthy Ss & 60 subacute LBP Ss (1 - 12 wks) using a 3-dimensional electromagnetic tracking device. T kinematic patterns of LS & hips were analyzed. Coordination between t 2 jts was studied. Results: T mobility of t spine & hips was signif limited in BP Ss. T contribution of t LS relative to tt of t hip was reduced for LBP Ss to avoid extremes of lumbar flexion & minimize pain. LBP Ss, esp those w +SLR, showed a signif reduction in velocity in both LS & hip jts & took a longer time to complete t sit-to-stand & stand-to-sit mov'ts. BP Pts may reduce their trunk velocities & acceleration to avoid provocation of pain caused by muscle contraction & high levels of acceleration. Ss w +SLR demonstrated >changes in jt mov't & coordination than those w LBP only. LBP Ss have limited range & velocity of spinal motion as well as altered coordination between t LS & t hip jts. Clinical rehab programs should include strategies to restore coordination of mov'ts between jts.

Panjabi, PhD. The stabilizing system of the spine. Part I. Function, dysfunction, adaptation, & enhancement. J Spinal Disorders 1992; 5(4):383-9. 3 Subsystems for stabilizing the spine: 1) Neural Control: transducers (receptors) in jt capsules, ligaments, muscles, & discs monitor position, motion, & loads, to determine requirements for spinal stability, measuring & setting each muscle's tension until required stability is achieved. 2) Active Stability: Muscles generate forces to provide required stability; 3) Passive Stability: vertebrae, facets, discs, ligaments. To achieve stability, t neural subsystem has t enormously complex task of continuously & simultaneously monitoring & adjusting t forces in each of t muscles surrounding t spinal column. Instantaneous decisions are made to redistribute muscle tensions, if there is a change in posture or external loads. Kinds of error: one or more muscles may fire in a manner tt is undesirable: too small or too large force or too early or too late firing due to faulty information transmitted from t spinal system transducers (receptors) or due to a fault of motor control. Errors may result in soft tissue injury & explain ALBP where negligible loads are involved. Such an incident might happen while performing complex maneuvers (combined flexion, bending, & twisting), when t synchronizing capability of t neural control system may be extended to its maximum. Muscle force errors may overload passive structures. An awkward maneuver repeated many times (at work) may increase t chance of an error occurring. Neural control dysfunction may become chronic. Chronic LBP & Spinal stenosis Pts have greater body sway compared w normal ctls suggesting tt control of t spinal stabilizing system is permanently altered in these chronic Pts. Training enhances t ability to perform complex mechanical tasks. If a specific group of muscles responsible for a particular directional stability can be identified, then training will enhance t particular directional stability. (Repetition of the training tasks will enhance the connectivity of sensory & motor neurons involved)

McGill S, PhD. Ultimate Back Fitness and Performance. Waterloo, Canada, Wabuno Publishers; 2004. Just as motor patterns are perturbed from having injury, inappropriate motor patterns can also cause injury. Some injuries just happen as t

result of motor control errors & may be more likely in people w poor motor control systems. Perturbed motor control systems both cause, & are a consequence of injury. Those w back troubles develop aberrant motor patterns tt remain as both a detriment to performance & an impediment to recovery. T presence of pain prevents t re-establishment of healthy motor patterns. Training w pain will ensure t establishment of perturbed motor patterns. For rehabilitation objectives exercises must be pain free. T presence of pain inhibits specific muscle & motor patterns tt may be essential to both injury avoidance & ultimate performance. What distinguishes the best athletes? Are they t ones w t largest muscles? Rarely. Their distinguishing qualities are motor control: t ability to exert strength quickly & with perfect synergy throughout t body linkage while in dynamic balance. Many body building principles such as isolating a muscle during training were simply intended to hypertrophy muscle. Training a whole body motion involves balance of force throughout t linkage. Too much force, or too little at a joint, or force applied at an incorrect time results in poor performance & injury. Motor control is what separates t best athletes from t poorer competitors even though t poorer performers may have larger muscles. Motor learning involves t programming & encoding of motor patterns together w training t ability to react & modify patterns for optimal performance in a changing environment. Massive gains in performance early in training programs are a consequence of motor learning accomplished at t muscular & t motor program level. Neural systems are highly trainable. Joint proprioception is also critically important in enhancing both t rehab process & ultimate performance. Muscles need both motor stimulation & t stimulation supplied from t jt receptors. Optimal functional training must involve loading t entire MS system even when training t back. "Isolating a jt" is a misguided wisdom from t body building culture. T use of machines to isolate individual muscles not only retard t various levels of motor learning required for optimal functional performance, but can encode patterns tt are directly detrimental to both performance & t avoidance of injury. Machines can regulate the magnitude of the resistance, the speed of joint motion, & the motion in adjacent joints, but they diminish the need for balance, stabilization & coordination of multi-joint function. Machines can't create t many variations of force development w/i a muscle to stimulate all motor units. Full stimulation & training of motor units can't be achieved w machines tt prescribe motion profiles & tt offer support & stability to some jts. An excellent training program recognizes t value of free motion, balance, velocity, range, eccentric & concentric contraction. T task of squatting requires full PR integration to be optimal. This can't be achieved w a seated leg press machine. No control over body balance, joint stability, or synergistic torque control at several joints simultaneously is required. Forget machines tt artificially stabilize & constrain motion to a joint, tt minimize t effect of gravity & are often performed in a sitting posture. They starve t athlete of PR feedback & training opportunity. Training in a propriocepitvely starved environment does not challenge the system in ways needed to ensure that no tissue experiences damaging overload. Free weights are considered more "functional" given the need to stabilize the body linkage & project forces thru the kinetic chain to the floor. The mainstay of free resistance training are barbells. Yet very few tasks have t hands tied together with a bar – they move independently. Dumbells better

mimic the natural environment and movement patterns. Using a dumbell in just one hand is asymmetric loading of t torso. This challenges t torso stabilizing mechanism to train optimal force transfer from t upper & lower body.

Panjabi, M. M. A hypothesis of chronic back pain: ligament subfailure injuries lead to muscle control dysfunction. Eur Spine J 2005. Online: July 27. Hypothesis: Trauma or cumulative microtrauma causes subfailure injury (injury caused by stretching of t tissue beyond its physiological limit, but <its failure point) of spinal ligaments & injury to MRs in t ligaments. The transducer signals from MRs are corrupted. Neuromuscular control unit has difficulty in interpreting t corrupted transducer signals because there's a mismatch between t normally expected & t corrupted signals received. T muscle response pattern generated by t neuromuscular control unit is corrupted, affecting coordination & activation of each spinal muscle. T corrupted muscle response pattern leads to corrupted feedback to t control unit from GTOs & injured MRs further corrupting t muscle response pattern. Corrupted muscle response pattern produces high stresses & strains in spinal components leading to further subfailure injury of spinal ligaments, MRs & muscles, & overload of facet jts. Abnormal stresses & strains produce inflammation of spinal tissues wh are abundant in NCs. Over time, chronic back pain may develop. In t injured spine, subfailure injuries of ligaments & embedded MRs lead to corrupted transducer signals describing vertebral position, motion, spinal loads, etc. There is loss of spatial & temporal integrity of received transducer signals from MRs. T neuromuscular control unit senses a mismatch between normal & received transducer signals & has difficulty choosing t appropriate muscle response pattern. T corrupted muscle response pattern affects t choice of spinal muscles to activate; t force of onset, intensity & shut-off. T coordination of spinal muscles responsible for spinal stability, posture & motion is disrupted. Additionally, t t feedback to t neuromuscular control unit & MRs is negatively affected, further corrupting t muscle response pattern resulting in adverse effects: Higher stresses/strains; Injuries may develop in ligaments & MRs; Facet jts may be overloaded; Spinal muscles may fatigue or be injured; Over time, these injurious stresses & strains can initiate inflammation of neural tissues & accelerate disc & facet jt degeneration. Thus, a vicious cycle is set up, leading to chronic dysfunction of t entire spinal system, resulting in back pain.

Jarvik JG, MD, MPH ,et al. Three-year incidence of low back pain in an initially asymptomatic cohort. Spine 2005; 30(13): 1541-1548. Study to determine predictors of new LBP (MRI findings, Roland-Morris, pain frequency index, HRQF (SF-12), comorbidities) as well as t 3-yr incidence of MRI findings in 148 randomly selected V.A. outPts w/o LBP in t past 4 mos. Results: 131 Ss were F-U at 3 yrs & 123 had repeat MRI. 3-yr incidence of pain was 67%. Depression was t strongest predictor of subsequent BP, w a greater hazard ratio than any imaging findings. Ss w depression at baseline were 2.3X more likely to have BP. Of baseline imaging findings, central canal stenosis & nerve root contact had t highest though nonsignif hazard ratio. We didn't find an assoc between new LBP & endplate changes, disc degen, annular tears, facet degen. All 5 Ss w new disc extrusions & 4 Ss w new nerve root impingement had new pain. Conclusion: Depression is an important predictor of new

LBP, w MRI findings likely less important in predicting new LBP than psychological factors.

Currie SR, Wang J. More data on major depression as an antecedent risk factor for first onset of chronic back pain. Psychol Med 2005;35:1275-82. Study examines major depression as both a risk factor & consequence of chronic back pain (CBP) in the general population. 9909 pain-free Ss =/>15 yrs w no Hx of back problems were drawn from t National Population Health Survey & followed up 24 mos later. Major depression was assessed using a structured diagnostic interview. Results: At 24 mos F-U t rate of new cases of CBP in persons who were depressed at baseline was 3.6% compared to 1.1% in non-depressed persons. After controlling for other factors, pain-free people Dx w major depression at baseline were almost 3X more likely to develop CBP 24 mos later. Consistent with other longitudinal studies major depression increases the risk of developing future chronic pain. The causal mechanism linking these conditions is unknown.

Dersh J, Gatchel RJ, PhD Mayer T, MD et al. Prevalence of Psychiatric Disorders in Patients With Chronic Disabling Occupational Spinal Disorders. Spine 2006;31:1156-62. Study to assess t prevalence of psychiatric disorders among 1,323 Pts w chronic disabling occupational spinal disorders (CDOSDs) attending a tertiary referral center for Pts w CDOSD, using t Diagnostic and Statistical Manual of Mental Disorders a reliable & valid diagnostic instrument. Psychiatric disorders interfere with successful treatment of CDOSDs, but little data are available regarding the psychiatric characteristics of Pts w work-related injuries. Results: Prevalence of psychiatric disorders was elevated in CDOSD patients. 65% of Pts were Dx w at least one current psychiatric disorder vs 15% of t general population: Major Depressive Disorder (56%); Substance Use Disorders (14%); Anxiety Disorders (11%), & Axis II Personality Disorders (70%) were the most common diagnoses.
Conclusions: Clinicians Tx CDOSD Pts must be aware of the high prevalence of psychiatric disorders in these Pts & be prepared to use mental health professionals to assist in identifying & stabilizing these Pts. Failure to follow a biopsychosocial approach to treatment will likely contribute to prolonged disability in a many of these chronic pain patients.

Deyo, MD, MPH, Weinstein, DO. Low back pain. NEJM. 2001; 344(5): 363-369. 85% of Pts w LBP cannot be given a precise pathoanatomical diagnosis. The assoc between Sx an imaging results is weak. Risk factors include heavy lifting, poor conditioning, although LBP is common in Ss w/o these risk factors. Because a precise anatomical Dx is elusive, t diagnostic evaluation is often frustrating. For Pts w nonspecific LBP a precise pathoanatomical Dx is often impossible.

Bogduk, N. MD., PhD. What's in a name? The labeling of back pain. Med J of Australia. 2000; 173(October 16): 400-401. In "The Taxonomy of Pain," t taxonomy subcommittee of t International Assoc for t Study of Pain (IASP) wrestled w t Dx of spinal pain. It recognized tt many Dx labels were illegitimate, inappropriate, or

fanciful & stipulated strict criteria to be satisfied if a particular Dx label was to be used to ensure consistent & accountable use of terms. However, often, t criteria could not be satisfied using Hx & exam alone, or even conventional investigations. In effect, t exercise established tt it was essentially impossible to render any conventional or traditional Dx for LBP. T means to do so were not available, reliable, nor valid. The subcommittee argued tt t only intellectually & clinically honest Dx for most cases of LBP was "l**umbar spinal pain of unknown or uncertain origin**." This label is cumbersome. Despite its accuracy & honesty, t term conveys t sense that the doctor does not know what is going on. Facet joint pain & discogenic pain can not be Dx clinically. Some labels are simply wrong & can have deleterious effects. "Degenerative disc disease" conveys to Pts tt they are disintegrating, which they are not.

Deyo, MD, MPH, Weinstein, DO. Low back pain. NEJM. 2001; 344(5): 363-369. Early or frequent use of imaging (plain films, MRI, CT) is discouraged because disc & other abnormalities are common among asymp adults. Degenerated, bulging, & herniated discs are frequently accidental findings, even among Pts w LBP & may mislead to overdiagnosis, anxiety, dependence on med care, conviction about t presence of disease & unnecessary test or Txs. Sequential MRI studies reveal tt t herniated portion of t disc tends to regress w time, w partial or complete resolution in 2/3ds of cases after 6 mo.

Borenstein, MD et al. The value of MRI of the lumbar spine to predict LBP in asymptomatic subjects: a 7 yr F-U study. J Bone Joint Surg Am 2001; 83-A(9): 1306-11. In 1989, 67 Ss (ave 35 yrs) w/o a Hx of BP had MRI of t lumbar spine. 31% of Ss had an abnormality of a disc or spinal canal (herniation, protrusion, extrusion, free fragment, stenosis, disc bulge, disc degeneration). Study investigates whether MRI findings predicted development of LBP in asymp Ss. The 1989 & a repeat MRI, 7 yrs later of 31 Ss, were read by 2 neuroradiologists & a orthopaedic spine surgeon. Results: Of 50 Ss (ave 43.6 yrs) followed 7 yrs later, 42% (21 Ss) developed LBP, including 12 Ss w normal scans. Findings on MRI did not predict t development or duration of LBP. Example: 5 of 6 Ss w herniation on MRI in 1989 had repeat MRI. Over 7 yrs, only 1 of t 5 had radiating pain longer than 2 wks. Findings discovered by MRI can only confirm t clinical suspicions of t clinician. Tx should not be based solely upon MRI abnormalities in t absence of clinical indicators.

Peterson, RN, DC, DACBR, MMEd et al. A cross-sectional study correlating degeneration of the cervical spine with disability and pain in United Kingdom patients. Spine 2003; 28(2):129-133. Study of t relation between degeneration of cervical spine jts & t effects of litigation on pain & disability levels in trauma & nontrauma Pts. The link between spinal degeneration Sx remains controversial. Questionnaires about NP, disability (Neck Disability Index), chronicity, etiology, & litigation from 180 consecutive NP Pts were collected. Radiographs were evaluated for number of levels of degeneration & severity of degeneration in discs, uncovertebral, & facet jts. Results: 40.57% (71 Pts) reported NP due to injury, but only

5.1% had litigation. There was no signif difference in pain or disability levels between Pts w & w/o cervical degeneration. The number of levels & severity of degeneration in discs, facets, & uncovertebral jts are not related to levels of pain & disability. Pts w neck pain due to injury had a tendency to more pain during the preceding week & signif more disability including worse pain intensity, reading, headaches, ability to drive, & concentration in Pt w injury. Women had more pain & disability than men, but not more jt degeneration. Conclusions: In NP Pts, there's no difference in pain & disability between those w & w/o evidence of cervical spine degeneration. Pts whose neck pain is the result of trauma report more pain & disability than nontrauma Pts. This is not because of more spinal degeneration or overriding litigation issues.

Wiesel S, MD. Biochemical diagnosis. Backletter 1998;13(8):85, 94. One of the greatest problems in contemporary spine care is diagnostic imprecision. Despite space age imaging capabilities, it is usually impossible to conclusively determine the tissue source of a patient's pain.

Deyo, MD, MPH. Diagnosis of LBP. Arch Intern Med 2002; 162(July 8):1444-1447. In most LBP Pts, t precise cause remains unclear. Anatomic abnormalities can be readily identified by imaging studies, but most of these are common in healthy Ss. This seems to be equally true for myelography, CT, MRI. Often, these abnormalities result from age-related degenerative changes, wh begin to appear even in early adulthood & are in some way analogous to gray hair & wrinkles. T high prevalence of anatomic abnormalities such as herniated discs, bulging discs, & annular tears among "normal" asymptomatic Ss in t absence of Sx suggests tt making causal inferences is often hazardous because many findings in symptomatic people may be coincidental. In t absence of corresponding clinical findings from Hx & PE, these anatomic derangements seem to be irrelevant & inconsequential. Thus, finding a cause for LBP is often difficult or impossible.

Ehrlich, GE. Low Back Pain. Bulletin of the World Health Organization 2003; 81(9):671-76. The prevalence of LBP is roughly the same the world over and ranks often first as a cause of disability & interference with the quality of life. In the vast majority of instances the cause of LBP is obscure. Acute episodes (up to 3 mo) are the commonest presentation, although recurrent bouts of such episodes are the norm. Many doctors order elaborate studies for non-specific LBP including X-ray & MRI with little guidance to Tx decisions being the result. Disc herniations & spinal canal narrowing are so common as to be shown on imaging in most Pts in their later years, & in most cases, such conditions are not responsible for the pain. Tx for chronic BP (pain lasting beyond the normal tissue healing time (3 mo)) remains notoriously difficult, & no single panacea has emerged. Often surgery is offered as an ultimately desperate last measure, but almost always it is unjustifiable & usually fails to provide permanent relief.

Ito T et al. Spine 2001; 26(6):648-51 & Postacchini F. Lumbar disc herniation. Spine 2001; 26(6): 601. Pts w uncontained lumbar disc herniation (UDH) - (one tt has

breached t annulus) can be Tx w/o surgery if they can tolerate their Sx for t 1st 2 mo. T body's defense system attacks & absorbs uncontained disc herniations, leading to early radiographic & clinical resolution. Prospective study - all these orthopedic surgeons' Pts w Sx disc herniations underwent conservative care for at least 8 wks - except w cauda equina syndrome, severe motor weakness. This protocol reduced disc surgery rate by almost 50%. None of t Pts who waited at least 8 wks had an uncontained disc herniation at surgery. Findings provide further evidence tt uncontained disc herniations often resolve quickly. In most Pts w an extruded & sequestered herniation, t Sx & t herniation itself disappear in a few wks to a few mo. Unable to accurately differentiate contained from uncontained on MRI.

Mechanical Back Pain

Kuritzky, MD. Physician & Sports Medicine 1997;25(1):56-64. Bend your index finger backward until it's intensely painful. A biopsy of the finger won't reveal a tumor, infection or any identifiable lesion, because there is none. But releasing the finger & letting it return to its "position of comfort" will allow the pain to subside. We need to reorient ourselves to think about LBP in a similar way **-functionally instead of pathoanatomically**. Rather than focusing on discovering the pathoanatomic disturbance leading to dysfunction, clinicians should strive to restore correct posture & normal productivity. **97% of BP seen by primary care physicians is mechanical in origin** - there's something wrong with the muscles, ligaments, or connective tissues. Most Pts with BP don't have ruptured discs, but it's notorious, partly because imaging studies dramatically overestimate the frequency. I want practitioners to understand that surgery is a last resort. If we prescribe mobilization & allow sufficient time, with rare exception, people will get better. I didn't know this when I experienced my own BP. I've addressed literally thousands of primary care physicians & they all tell me the same thing: They didn't know it either.

Deyo, MD, MPH, Weinstein, DO. NEJM. 2001; 344(5): 363-369. Differential Dx of LBP: Mechanical Back Pain: 97% (refers to anatomical or functional abnormality w/o malignant, neoplastic, or inflammatory disease.) **Mechanical LBP or leg pain**: lumbar strain, sprain (70%): DJD of discs & facets (10%); Herniated disc (4%); Spinal Stenosis (3%); Osteoporotic compression Fx (4%); Spondylolisthesis (2%); Traumatic Fx (< 1%); Cogenital disease (< 1%) [severe kyphosis, severe scoliosis, transitional vert]; Spondylolysis, Internal disc disruption or discogenic LBP; Presumed instability. **Nonmechanical Spinal Conditions**: (about 1%): Neoplasia (0.7%); Infections (0.01%); Inflammatory Arthritis (0.3%): ankylosing spondylitis, psoriatic spondylitis, Reiter's syndrome, inflam bowel dis, Scheuremann's, Pagets. **Visceral Disease** (2%): Disease of pelvic organs: prostatitis, endometeriosis, Chronic PID; Renal disease; Aortic aneurysm; GI disease: pancreatitis, cholecystitis, penetrating ulcer.

Takahashi I, MD, Kikuchi S, MD, PhD, et al. Mechanical Load of the Lumbar Spine During Forward Bending Motion of the Trunk. Spine 2006;31:18-23. Study measures mechanical load on the lumbar spine, intradiscal pressure, EMG activities of the trunk muscles, & motion analysis of the trunk in 3 young healthy men performed

simultaneously from neutral to 30° forward flexion w & w/o lifting a weight of 10 kg. Results. The load of the lumbar spine & EMG activities of the back muscles increased in proportion to the tilting angle. Conclusions. The increase of the actual spinal load during trunk flexion consisted of t spinal load & t load generated by back muscle activity. When t load in t standing upright position w/o weight bearing is regarded as 100%, t mechanical load of t IVD when trunk is bent forward 30° increased to 360% w/o 10 kg weights & 430% w weights. There was more activity of back muscles than expected wh resulted in increased biomechanical load. Findings suggest tt loads heavier then previously believed are facing t lumbar spine even during everyday motions, such as "just bending the trunk forward." Consequently, disc injuries or herniations may be considered to be induced by simple everyday motions of t trunk while bending forward.

McGill S, PhD. Ultimate Back Fitness and Performance. Waterloo, Canada: Wabuno Publishers, 2004: 134-7. Lifting w t torso while flexing about t hips rather than flexing t spine reduces strss on t spine. Spinal flexion causes strain of t posterior ligaments & markedly increases shear loading & risk of injury. When t spine is in flexion, t strained interspinous ligs generate forces wh impose an anterior shear. A fully flexed spine is weaker than one tt is moderately flexed. T fully flexed spine is assoc w myoelectric silence in back extensors & strained posterior passive tissues & high shearing forces on t L-sp. Recent study shows tt a fully flexed spine is 20-40% is weaker than if it were in a neutral posture.

Waddell G. MD. The Back Pain Revolution. Churchill Livingstone 1998: 151-151. Dysfunction may become self-perpetuating. Pain may be due to disturbed function without any structural damage. You do not need structural damage to have pain from musculoskeletal dysfunction.

Role Manipulation in Mechanical Back Pain

Lauretti W, DC. J Am Chiro Assoc 1998;35(6):50-52. SM involves specialized examination techniques to evaluate t motion & alignment of joints in t spine. We determine which jts are "locked up" - lacking t normal degree of movement. These jts are usually tender & are often accompanied by local muscle tightness. DCs use their hands to quickly apply a specific force tt moves t jt beyond its limited range & through its complete, normal range of movement using t minimum force necessary. **DCs offer a mechanical solution to a mechanical problem**.

Redwood DC. What massage therapists should know about chiropractic. Massage Magazine 2000;87:140-149. Evaluation of spinal joint mechanics is a key aspect of the DC's initial exam. This portion of the spinal exam, which requires highly developed palpation skills, is wholly absent from the physical examination provided by most medical physicians. What chiropractors look for in this portion of the physical exam includes postural imbalances, muscular inequalities, and, most of all, abnormalities of joint movement.

Animal Model for Subluxation/Degeneration

Henderson, DC, PhD, Cramer DC, PhD. Rat model yields evidence of biomechanical basis for subluxation. JACA;2004 41(2): 22-25. Study of t effects of hypomobility in rats using fixation of 3 contiguous lumbar segments (L4-6) by implanting saddle devices (spinal attachment units) over spinous processes & linking t devices for intervals from 1 - 16 wks. Yokes are removed to study t potential for jt motion recovery for intervals from 1-12 wks. Assessed remodeling, osteophyte formation & facet surface changes (adhesions, roughening, pitting, elevations). Jt fixation in rats leads to degenerative changes, w facet degeneration preceding t formation of osteophytes.

Results are consistent w our current theoretical model of one of t beneficial effects of chiro adjusting. Hypomobility causes degenerative changes of t spine & tt articular surfaces undergo changes fairly early - changes tt precede bony changes. Areas of t spine tt are mechanically linked become stiffer & after t links are removed, continue to get stiffer. T longer segments are linked t stiffer they become, & t more severe t degenerative changes are. Articular surface degeneration begins w/i 1 wk of initial experimental fixation & osteophytes begin to form after 1 wk of fixation. Hypomobility does result in degenerative changes tt precede spur & osteophyte formation.

Increased mobility may put t brakes on this degeneration. If animal have fixation for 4 wks & then are unfixed for several wks, there is a trend toward improvement. Re-establishing mobility tends to improve t jts. But t window of opportunity for such improv't is limited. There seems to be a threshold. After a certain period of fixation, it becomes difficult to bring t jts back toward a nl state. If t bony changes have just begun, it's possible for improvement. But if they're fairly well established, it seems tt we're not going to have much effect on t bony changes. This indicates tt it's important for people w jt hypomobility to increase mobility as early as possible - before tt threshold time is reached when it's not possible to reverse degenerative changes.

Chapman-Smith. White Rats of Davenport. Basic Science Research Affirms the Foundation of Chiropractic. Chiropractic Report. 2004; 18(3):1-8. There's evidence supporting chiropractic theory tt t loss of function & fixation can lead to early osteoarthritic changes in jt, changes tt later cause pain & disability. Major degenerative joint changes over a period of 16 wks of joint mobilization, with first degenerative changes apparent from 1 2k. W/I 12 wks jts were completely fused & immobilized.

Cramer, DC, PhD et al. Degenerative changes following spinal fixation in a small animal model. JMPT 20004; 27:141-54. Facet Joints become hypomobile. Hypomobility results in degenerative changes & adhesions of the facet joints. Adjusting gaps the joints. Gapping breaks up adhesions and re-establishes joint motion. Gapping breaks up adhesions and re-establishes joint motion. Gapping breaks up adhesions and re-establishes joint motion. Increased joint motion slows (or reverses) degenerative changes. Findings support the notion tt degenerative

changes were reversible up to a certain time threshold, after which degenerative changes remained relatively constant (were found to remain throughout 12-wk postfixation survival time). Articular surface degeneration changes tt showed no sign of reversal occurred between 1 & 4 wks of fixation (hypomobility). Osteophytic changes tt showed no signs of reversal occurred between 4 & 8 wks of fixation. Findings support tt inducing motion into hypomobile segments as early as possible & before this threshold is reached may be clinically important. Estimating the human equivalent of the time span form the formation of degenerative changes based on this study would be purely speculative & could be misleading.

Cramer, DC, PhD. The effects of side-posture positioning and spinal adjusting on the lumbar Z joints. Spine 2002; 27(22):2459-66. 64 healthy Ss (22 to 30 yrs) w no Hx LBP were randomized to receive either side-posture SM & side-posture positioning. MRI measurements of facet jts were taken before & after. Side-posture adjusting showed greater gapping than side-posture positioning (mean difference of 0.71 mm). Important is tt what was visualized on MRI was a "residual" or "left-over" gapping (15-20 min after SM). It can be assumed tt much greater jt gapping occurred during t SM thrust. This indicates tt at least some adhesions, if present, w/i a hypomobile facet jt would break under t forces generated during SM. Because adhesions are composed of collagen fiber bridges between articular surfaces, any gap may be capable of breaking t bridging of microscopic fibers tt make up such adhesions. This remains speculative.

Pickar, J, DC, PhD. Neurophysiological effects of spinal manipulation. The Spine Journal 2002; 2(9):357-71. Cramer et al demonstrated tt side-posture SM gaps t facet jts. T synovial space of t lumbar facet jts increased in width by up to 0.71 mm after SM compared to nonmanipulated ctls.
This raises t possibility tt tissues surrounding t facet jt could be stretched for periods of time longer than t duration of t SM itself. Graded sensory input from tissues surrounding t facet jt could elicit reflex muscle responses similar to tt measured by Indahl et al.

Indahl A, MD et al. Spine 1997;22(24):2834-2840. Stimulation of receptors w/i t anulus fibrosus (AF) of t disc elicits reactions in t paraspinal muscles (multifidus & longissimus). Injection of physiologic saline into t facet jt results in stretching of t facet jt capsule & a reduction in t motor unit action potential amplitude. Conclusions: Introduction of physiologic saline into facet jt reduced t stimulation pathway from t IVD to t paraspinal muscles. T facet jts may have a regulating function, controlling t intricate neuromuscular balance in t lumbar motion segment. For LBP, SM of facet jts is widely used. Stimulation of MRs in facet jts causes a reflex muscle response. Paraspinal muscle activation caused by stim in t AF of a lumbar IVD can be altered by saline injec into t facet jt. Normally, paraspinal muscle activity decreases as flexion of t trunk increases, & t muscles become electrically silent in t fully bent posture - t Flexion-Relaxation Phenomenon. This may be explained as **muscular inhibition caused by stretching of t facet jt capsule in full flexion**. In Pts w HNP, t

flexion-relaxation phenomenon is absent. In such Pts, there is an imbalance between neurologic discharges to t muscles from a pathologic structure & inhibitory discharges from t facet jt capsule in forward bending. Inhibitory discharges from facet jt capsules can explain why SM & mobilization of t facet jt provide relief in some cases of LBP. Stretching of more than one jt can increase inhibition & make t Tx more effective. Muscle spasm is common in Pts w back problems & SM of t facet jts may elicit a stretch reflex from t capsule, contributing to an inhibitory action on muscle spasm thereby relieving pain.

Brumagne S, PT, Lysens R, MD, PhD. Effect of paraspinal muscle vibration on position sense of the lumbosacral spine. Spine 1999; 23(13):1328-1331. Indhal hypothesized that motion & stabilization of the spine are based on a complex reflex activation system in wh PRs in the anulus fibrosus, facet jts, & paraspinal muscles initiate various reflex patterns. These reflexes are modulated by interneurons which receive input from muscle spindles & by higher levels of the CNS. Indahl proposed that the focus of the Tx regimen must be to restore the reflex system. If muscle afferent responses appear to be decreased in Pts with LBP (dysafferentation), optimizing muscle spindle afferent input of the paraspinal muscles should be another goal of spinal rehab.

Articular Neurology and Chiropractic Adjustments

McCloskey (School of Physio & Pharmacology). Physiologic Reviews 1978;58(4):763-820. The greatest level of afferent firing occurs at or near the extremes of flexion & extension with comparatively little activity in between. Receptors' rate of firing is related to rate of displacement. The nearer the joint approaches maximal extension or flexion the greater the number of units active & the greater their discharge frequencies.

Zimny (Dept of Anatomy). Am J Anatomy 1988;182:16-32. Joint & muscle receptors detect limits of movement of a joint & play a role in synchronizing mechanisms (motor control) involved with control of movement. The densities of MRs are greater in areas related to extreme movements (if a jt can't move to its end ROM, t MRs cannot be fully stimulated to discharge). MRs are the first line of defense in sensing the safe limits of ROM of a joint. Discharges provide the CNS with information about possible joint injury. **This input activates reflex mechanisms that act to prevent joint injury.**

Swinkels Annette, MSc, Dolan Patricia, PhD. Spine 1998;23(5):590-597. Proprioception (PR) describes sensations generated within t body tt contribute to awareness of t relative orientation of body parts, at rest & in motion and are fundamental to control of human movement. Recent work suggests tt **position & mov't sense may be impaired in t presence of joint disease**. Consequently, an improv't in PR is considered by many as an essential part of rehabilitation.

Swinkels MSc, Dolan PhD. Spine 2000;25(1):98-105. PR has 2 components: position sense (awareness of t relative orientation of body parts in space & movement sense (kinesthesia) - t perception of velocity & acceleration. Afferent inputs from jt tissues, muscles, skin, eyes, & vestibular apparatus all contribute to PR. Ligamentous & capsular afferents are most active at t limits of jt mov't, input from muscle spindles provides t primary source of jt position sense over most of t physiologic range. **Position sense in healthy Ss is accurate to w/i a few degrees, but may be impaired by pathology**. Mov't of one vertebra relative to another will produce t most strain in small intersegmental muscles (richly endowed with muscles spindles) & ligaments.

Hassan, B. S. et al. Static postural sway, PR, & maximal voluntary quadriceps contraction in Pts w knee osteoarthritis & nl control Ss. Ann Rheum Dis 2001; 60(6): 612-8. Muscle spindles are more important for detecting changes in joint angulation in the mid-range of motion. Joint mechanoreceptors, which detect stretch of ligaments & deep tissues, are more important at the extremes of joint movement.

Stress Strain Curve (load deformation curve). Neutral zone -deformation occurs easily with minimal resistance - tissue are very compliant & it takes little muscular energy to move a joint. Elastic zone (recoverable or elastic deformation): more muscular effort is needed to deform tissues because of the resistance of molecular bonds in connective tissue structures (ligaments, muscles, tendons, etc which comprise the normal restrictive barriers limit the joint to a normal ROM & prevent tissue damage . Normal ROM = neutral zone + elastic zone. End range of motion is the Yield Point (the line of demarcation between elastic and plastic zones). If tissues are deformed beyond the yield point into the Plastic Zone, molecular bonds are progressively disrupted and tissue resistance declines - tissue damage ensues - plastic or irrecoverable deformation.

Evans DW, BSc Ost, Breen AC, DC, PhD. A biomechanical model for mechanically efficient cavitation production during spinal manipulation: prethrust position and the neutral zone. JMPT 2006;29:72-82. In the neutral zone t load-displacement behavior is highly flexible. This is t motion region of a jt where passive osteoligamentous stability mechanisms exert little or no influence. During passive physiological movement motion occurs in this region against minimal internal resistance. It is a region in wh a small load causes a relatively large displacement. T elastic zone is t remaining region of FSU motion tt continues from t end of t neutral zone to t point of maximal resistance provided by passive osteoligamentous stability mechanism limiting t ROM.

Braddom, RL, MD, MS. Physical Medicine & Rehabilitation. Saunders Co. 1996: 422

Vernon, H., DC, PhD, Mrozek J, DC. A revised definition of manipulation. J Manipulative Physiol Ther 2005; 28(1): 68-72. Joint dysfunction and blockage or hard end-feel occur not at t very end ROM but earlier within the ROM. DCs have used the

terms "subluxation" & "fixation"; osteopaths use the term "somatic dysfunction"; medical & PT specialists use terms such as "dysfunction," "barrier," & "loss of end-play." All of these terms contain t notion of "hypomobility." We propose tt t generic term for this problem is "JOINT DYSFUNCTION." With normal motion there is a feeling of smooth motion ending in a feeling of "play" or "spring" at t end of t passive range. DOs use t term "ease" to describe this normal feeling. An abnormal finding is described in t term of "blockage," whereby t palpated motion is felt to stop before t expected end-range & be accompanied by a "hard end-feel."

Adjustments use high velocity, low amplitude forces:
1. To generate the kinetic energy necessary to overcome the resistance/restriction of abnormal restrictive barriers (mechanical effect).
2. To produce maximal frequency of discharge of the mechanoreceptors in & around the joint (neurological effect).
3. To take the joint to its maximal, normal end range of motion, (mechanical effect) stimulating the maximal number of receptors (neurological effect).
4. These effects enhance kinesthesia & position sense, producing temporal & spatial summation.
5. The low amplitude force refers to the depth of thrust so the joint is taken thru the restrictive barriers to its end ROM, but not beyond, preventing over-distraction, strain/sprain & injury.
6. MRs are stimulated, recruited to fire & prevented from atrophy to restore proprioception & neuromuscular control, including normal sequencing, recruitment, & coactivation of muscles to protect & stabilize t spine, and provide normal ROM, kinematics & biomechanics.

Pickar, DC, PhD, Wheeler, DC. Response of muscle proprioceptors to spinal manipulative-like loads in the anesthetized cat. JMPT 2001;24(1):2-11. Study evaluated muscle spindle and Golgi tendon organ (GTOs) in paraspinal muscles responses to a mechanical load w a force-time profile similar to a SM applied to t L6 spinous process in anesthetized cats in compressive and distractive directions at 2 different angles. The L6 dorsal root was isolated for electrophysiological recordings while the L6-L7 vertebrae and paraspinal tissues on one side were left intact. **Result**s: GTO & muscle spindle discharge frequencies increased more to the SM impulse than to the preload. Generally, the GTOs became silent immediately at the end of each impulse. Muscle spindles discharged at rest & responded to t preload & to t SM. Muscle spindle discharge increased 201% during t impulse but only 29% during t plateau. Afferent discharge from muscle spindles often didn't immediately return to control values after each SM. Recovery times ranged from 100 ms to 21.2 sec (mean 3.6 sec). Based on our findings, we speculate tt combined activation of GTO afferents & silencing of muscle spindle afferents during SM can decrease spontaneous EMG activity by reflex inhibition or disfacilitation of alpha-motoneurons. Results suggest tt SM bombards t CNS w sensory input from muscle PRs & this is followed by a prolonged silence. T central effects of these responses is not known, but input from muscle spindles & GTOs can converge on common reflex pathways in

t CNS. SM may affect impulse based neural activity by altering t inflow of sensory info to t spinal cord. SM may remove a source of aberrant sensory input or possibly add a novel input. SM induced changes in sensory input may affect central neural integration w/i motor, nociceptive, &/or autonomic neuronal pools & thereby elicit changes in efferent somatomotor & visceromotor activity. Conclusion: t data suggest tt HVLA load of a SM can stimulate muscle spindles & GTOs. Both muscle spindles & GTOs can be coactivated by SM.

Sung, PT, PhSc, PhD, Kang, PhD, Pickar DC, PhD. Effect of Spinal Manipulation Duration on Low Threshold MRs in Lumbar Paraspinal Muscles: A Preliminary Report. Spine 2005; 30(1): 115-122. Study to determine how t duration of a SM impulse affects t signaling properties (instantaneous frequency of discharge) of low threshold MRs (muscle spindles & GTOs) in paraspinal muscles in cats by applying identical loads of force at varying impulse durations from 25 to 800 ms. Impulse duration during manual SM range from 30 to 400 ms. 200 ms impulse increased afferent discharge 3 fold. 25 ms impulse increased afferent discharge nearly 12 fold higher than t increase w 800 ms impulse. There was an abrupt increase in frequency of discharge as t impulse duration shortened & approached tt typically used during SM. T high-velocity (short duration) mechanical load during SM may alter sensory input from primary afferents in spinal tissues, thereby having corrective actions on central neural mechanisms regulating: Paraspinal muscles; Biomechanics &/or Cord reflexes. As t duration of t SM decreased, instantaneous discharge frequency increased. The increase was abrupt as t SM was delivered more rapidly. T high speed short duration thrust of SM may present paraspinal tissues w a novel mechanical stimulus evoking an unusual or distinctive pattern of somatosensory input to t CNS. SM evoked high frequency discharges in both muscle spindle & GTO afferents. Passive movements don't usually evoke such simultaneous responses from these 2 MRs. Augmented tension produced during t small passive displacement of SM may atypically coactive muscle spindles & GTOs & comprise part of t mechanism contributing to SM's physiologic effects.

Pickar JG, DC, PhD, Kang YM, PhD. Paraspinal muscle spindle responses to the duration of a spinal manipulation under force control. JMPT 2006;29:22-31. This study determined how the duration of a lumbar HVLA-SM affects the discharge of paraspinal muscle spindles in anesthetized cats. Neural activity was recorded from individual spindles in multifidus & longissimus muscles. SM loads of 25, 50, 100, 200, 400, & 800 msecs, delivered at 33%, 66%, or 100% body weight were applied to the L6 vertebra. Results: Instantaneous discharge frequency increased w decreasing impulse duration. Muscle spindle discharge changed greatly with decreasing impulse duration. After SM, muscle spindle afferents often became silent. Conclusions: Muscle spindle responses to HVLA-SM provide a novel stimulus to t CNS because t high frequency discharge is higher than typically generated from paraspinal muscles. Korr proposed SM's effects may arise from t barrage of afferent impulses from muscle spindles & t central effects may change motor circuits. Increasing evidence shows short-lasting, high-frequency bursts from primary

afferents can shape t function of spinal cord neurons & alter activity of alpha motoneurons. Knowing how sensory neurons respond to mechanical inputs like SM should help us understand mechanisms underlying SM.

DeVocht JW, DC, PhD, Pickar, JG, DC, PhD, et al. Spinal manipulation alters EMG activity of paraspinal muscles. JMPT 2005; 28(7): 465-71. Study examines t effect of SM on EMG activity in areas of localized tight muscle bundles in 16 LBP Pts: 8 received Activator & 8 Diversified. Surface EMG activity was collected over t 2 sites of greatest paraspinal muscle tension in each Pt as determined by palpation. Results: EMG activity decreased by at least 25% after Tx in 24 of 31 sites. There was decreased <25% changes at 3 sites & >25% increase at 4 sites. Conclusions: Results indicate tt SM induces a virtually immediate change, usually a reduction in resting EMG levels in at least some LBP Pts & tight paraspinal muscle bundles. In some cases, EMG activity increased during t Tx protocol & then usually, but not always, decreased to a level lower than t preTx level. Study shows tt resting EMG activity level usually decreased in 16 LBP Pts receiving either AMI or Diversified protocol. 27 of 31 (87%) pre-Tx resting EMG levels decreased after Tx. Reduction in resting EMGs after SM is consistent w & supports t commonly held perception tt tight muscle bundles are assoc w LBP & can be alleviated by SM. It is presumed tt elevated resting EMG levels would indicate some aberrant neuromuscular or biomechanical state tt's correctable by SM. Most cases were consistent w our expectation. Results support t notion tt SM has a virtually immediate & presumably beneficial effect on at least some LBP Pts usually resulting in lower EMG activity of hyperactive paraspinal muscles. Findings are consistent w t premise of chiro Tx tt tight muscle bundles are indicative of spinal dysfunctions tt are correctable by SM.

Shearar K, MTech, Colloca, CJ, DC et al. A RCT of manual versus mechanical force manipulation in the treatment of sacroiliac joint syndrome. JMPT 2005; 24(7): 493-501. Study evaluates t effect of traditional manual-delivered compared w instrument-delivered chiro adjustment in t Tx of SJ joint syndrome Pts (>2 wks & >4 wks of LBP in past yr) in a prospective RCT. Ss were randomized into 2 grps of 30 Ss. Each received 4 SM over 2 wks & were evaluated at 1 wk F-U. Grp 1 received Diversified HVLA side posture SM, Grp 2 received mechanical-force manually assisted (MFMA) SM using an Activator Adjusting Instrument. Results: No signif differences between grps were noted at initial consult for any of t outcomes. Stat signif improv'ts were observed for both grps from t 1st to 5th consults for: Improv'ts in mean numerical pain rating scale 101: Divers: drop from 49.1 to 23.4; Act drop from 48.9 to 22.5; Revised Oswestry: Divers drop from 37.4 to 18.5; Act drop from 36.6 to 15.1; Orthopedic rating score - based on "thigh thrust test," Patrick's FABER test, Ganslen's test, Yeoman's test: Divers drop from 7.6 to 0.6; Act drop 7.5 to 0.8 ; Algometry: Divers threshold increased from 4.8 to 6.5; Act from 5.0 to 6.8. Conclusions: Results indicate tt a short regimen of either HVLA or MFMA chiro adjustments were assoc w a beneficial effect of a reduction in pain & disability in SI jt syndrome Pts. Neither HVLA or MFMA adjustments were found to be more effective than t other. Both regimens had an equal effect.

Pfefer MRMD, Cooper SD, Menke JMD. Comparison of mechanical force manually

assisted Activator manipulation vs manual side-posture, 42 Ss w constant or intermittent LBP </=16 wks were randomly assigned to receive either Activator or diversified adjustments for up to 6 wks & assessed by VAS & revised Oswestry. Results: Pts were highly satisfied in both Tx grps although Pts in Activator group rated their Tx as more comfortable than t diversified group. Mean number of Txs was slightly lower in Act group but there was no stat signif differences between groups in end-point outcomes. Effects of using a MFMA Act device using t AMCT protocol appear to be similar to those w diversified adjustments in Pts w acute & subacute BP.

Gemmell H, Miller P. Comparative effectiveness of manipulation, mobilization and the Activator instrument in treatment of non-specific neck pain: a systematic review. Chiropractic & Osteopathy 2006;14:7. T first systematic review to critically appraise t lit tt directly compares SM, mobilization (MO), & Activator (ACT) for non-specific neck pain. Electronic databases (Medline, MANTIS, & CINAHL) were searched thru October 2005 for all English RCTs tt directly compared t above. Results: 5 studies were identified, 3 of 5 were pilot studies limited to a single Tx. Methodological quality was low due to: Small sample size; Lack of F-U; Lack of control for placebo response; Lack of double blinding; Comparability of relevant baseline characteristics. Findings were mixed & no one therapy was shown to be more effective than t others. Vernon et al (1990): 1 Tx of SM or MO in 9 Pts. Outcome pressure pain threshold. SM superior to MO. F-U: none. Cassidy et al (1992) 1 Tx of SM vs MO in 100 Pts. Outcome: NRS, ROM. SM superior to MO in pain relief, both equal in ROM. F-U: none. Yurkiw & Mior (1996) 1 Tx of diversified HVLA to Act in 14 Pts. Outcomes: VAS & cervical lat flex. No difference between HVLA & Act. F-U: none. Wood et al (2001) Max of 8 Txs of diversified vs Activator in 30 Ss. Outcome: NRS, McGill, NDI, ROM. No difference between HVLA & Act. F-U: 1 mo. Hurwitz et al (2002) SM vs MO (at least 1 Tx) in 360 Pts. Outcomes NRS, NDI, SF-36, Adverse reactions, Satisfaction w care, Pt global assm't. SM & MO had comparable outcomes. Heat & Elec Stim add nothing. F-U: 6 mo. Conclusions: Further high quality research has to be done before a recommendation can be made as to t most effective manual method for non-specific neck pain.

Flynn T, PT, PhD et al. The audible pop from high-velocity thrust manipulation and outcome in individuals with low back pain. JMPT 2006;29:40-5. Study to determine t relationship between an audible pop w SM & improvement in pain & function in LBP Pts. 70 Pts were randomly assigned to receive HVLA SM. Pts were managed 2X in first wk, & 1X/wk for 3 wks, total of 5 sessions. A single HVLA thrust was used on t first 2 visits. Whether an audible pop was heard was recorded. In t first 2 sessions, Pts also got a pelvic tilt ROM exercise. On visits 3-5, Pts began a stabilization program (aerobic & lumbar strengthening). Outcomes: a pain rating scale, Oswestry Disability Index & lumbopelvic flexion ROM. Repeated measures were used to examine whether an audible pop resulted in improved outcome. Results: An audible pop was noted in 59 (84%) Pts. No differences were detected at baseline or at any F-U period in pain, Oswestry score, or ROM based on whether a pop occurred.

Conclusions: Results suggest tt an audible pop may not relate to improved outcomes from HVLA-SM for LBP Pts at either immediate or longer-term F-U. This study failed to show important differences between Pts w or w/o an audible. Findings suggest tt t audible should not be t primary focus of SM.

Fernadez-de-las-Penas C, PT, Alonso-Blanco C, PT, Cuadrado M, MD, PhD, et al. Spinal mnaipulative therapy in the management of cervicogenic headache. Headache 2005;45:1260-70. T study analyzed t quality & t outcomes of published RCTs assessing t effectiveness of SM in cervicogenic headache. Of 121 relevant articles, only 2 met all inclusion criteria. Methodological quality scores were 8/10 & 7/10. Both t trials reported positive results on HA intensity, duration, & medication intake. SM obtained strong evidence of effectiveness (level 1) w regard to these outcomes. SM obtained limited evidence (level 3) in reducing HA frequency, as it was analyzed only in one study w positive results. More well-designed, RCTs are needed to confirm or refute t effectiveness of SM in t management of CeH.

Song, XJ, MD, PhD et al. Spinal manipulation reduces pain and hyperalgesia after lumbar intervertebral foramen inflammation in the rat. JMPT 2006;29:5-13.Study evaluates t effects of Activator-assisted SM (ASM) on pain & hyperalgesia after acute IVF inflammation due to in vivo delivery of inflammatory mediators (bradykinin, histamine, prostaglandin) directly into the L5 IVF in 48 rats. Thermal & mechanical hyperalgesia were determined (behavioral changes). Intracellular recordings from L5 DRG neurons were measured (electrophysiological changes), & pathology was microscopically evaluated. A series of 10 ASM was applied to the spinous of L4, L5, & L6 beginning 24 hours after surgery & daily for 7 days, then every other day during 2nd week. Results: ASM applied to L5, L6, or L5 & L6 spinous significantly reduced the severity & duration of thermal & mechanical hyperalgesia due to IVF inflammation. ASM to L4 didn't affect t response. Electrophysiological studies showed tt hyperexcitability of DRG neurons due to IVF inflammation was significantly reduced by ASMT. Pathological studies: DRG inflammation (increased vascularization & satellitosis (marked accumulation of glia cells around neurons, often a prelude to neuronophagia (phagocytosis of nerve cells) resulting in cell death) were significantly reduced 2 to 3 weeks after ASM. Conclusions: ASM can significantly reduce severity & shorten duration of pain & hyperalgesia due to IVF inflammation. This may result from ASM-induced faster elimination of inflammation & recovery of excitability of inflamed DRG neurons by improving blood & nutrition to the DRG in t inflamed IVF. T mechanism of action is unknown but t lumber vertebrae exhibited coupled motion in more than just t one vertebrae receiving a direct thrust. Increased movement may contribute via improving blood & nutrition supply to t DRG in t affected IVF. SM may normalize articular afferent input to t CNS w recovery of muscle tone, mobility, & sympathetic activity. T thrust may coactivate all mechanically sensitive receptor types & activate receptors in t spinal cord & some ascending & descending pathways involving pain modulation. This study is t first to demonstrate reduced hyperalgesia from DRG inflammation & also indicates tt specificity may be important in tt a thrust applied to L4 produced no effect whereas

those applied to L5 or 6 did.

Santilli V, MD et al. Chiropractic manipulation in the Tx of acute BP & sciatica w disc protrusion: a randomized double-blind clinical trial of active & simulated spinal manipulations. Spine J 2006:1-7. Study to assess t effects of SM on acute BP & sciatica w disc protrusion (Dx via MRI) in a RCT comparing active & simulated SMs in Rome, Italy. 102 ambulatory Pts w =/>moderate pain on a VAS for local pain &/or radiating pain. Outcomes: Pain-free Pts at end of Tx, Tx failure (Pts stopping Tx because of lack of effect); number of days w no, mild, moderate, or severe pain; quality of life (SF-36); number of days on NSAIDs & Rx drugs; VAS1 & 2 scores; psychosocial findings, reduction of disc protrusion on MRI. Methods: SMs or simulated SMs were done 5 days/wk by DCs up to a max of 20 using HVLA. 102 Pts were assessed at admission & 15, 30, 45, 90, & 180 days.
Results: 53 Pts given SM, 49 simulated SM. SMs were more effective: more pain-free cases, less number of days w pain, & less days w moderate or severe pain & had lower mean pain scores. There were no signif differences in QoF & psychosocial scores. F-U MRIs were unchanged from baseline. Conclusions: Active SMs have more effect than simulated SMs on pain relief for acute BP & sciatica w disc protrusion.

Beyerman KL, RN, EdD, et al. Efficacy of treating LBP & dysfunction secondary to osteoarthritis: chiropractic care compared with moist heat alone. JMPT 2006;29 (2):107-14. Study evaluates t efficacy of chiro SM, flexion/distraction, & hot packs for Tx of LBP from osteoarthritis (OA) compared w moist heat alone. 252 LBP Pts secondary to OA (documented arthritis, OA, DJD, degen disc Dx, or facet arthropathy confirmed w X-ray or radiologist's report) & w LBP at t time of t study were randomly assigned to either: moist hot pack + chiro care or moist heat alone. All Pts had 20 Tx (2-3/wk). At visits 1, 5, 10, 15, 20, Pts rated pain via VAS, ADLs via Oswestry, & a ROM (J-Tech Dual Digital Inclinometer). Results: At baseline, both grps were equivalent on pain & ROM scores. Chiro grp reported greater & more rapid pain reduction & greater & more rapid ROM improv't than t moist heat grp. Chiro grp also had greater improv'ts than the moist heat grp in 4 of 9 ADLs on Oswestry. Until this study none had evaluated t effectiveness of chiro care in Tx of OA. Conclusion: Chiro care w heat is more effective than heat alone for Tx OA-based LBP.

Palmgren, DC, Heikkila, MD, PhD et al. Improvement after chiropractic care in cervicocephalic kinesthetic sensibility & subjective pain intensity in Pts w nontraumatic chronic neck pain. JMPT 2006;29:100-6. Study examines alterations in head repositioning accuracy (HRA), ROM, & pain intensity in 41 chronic cervical pain Pts (continuous pain =/>3mo) w/o Hx of cervical trauma. Pts randomly assigned to a ctl or chiro Tx grp (3-5 Tx over 5 wks) included HVLA SM, proprioceptive neuromuscular facilitation, ischemic compression of myofascial trigger points, & spinal rehabilitation exercises to normalize cervical ROM & HRA. All Pts given info on basic anatomy/physio of spine, ergonomic principles for t neck, & basic instructions on how to exercise & cope w pain. Results: No difference between grps at baseline. At 5-wk F-U, chiro Pts showed signif reductions in pain (29%) & improv't of all 6 HRA

measures. Ctl Ss didn't show any reduction in pain & improved in only 1 of 6 HRA measures. There were no signif differences in ROM between grps. Results suggest chiro Tx can be effective in PR sensibility & cervical pain. A short course of chiro may alter t course of chronic cervical pain. Head orientation uses visual, vestibular, & cervical PR cues. Neck muscle PR system influences t oculomotor & vestibular systems, as well as, postural & oculomotor control. Disturbed kinesthetic sensitivity is implicated in functional instability of jts, susceptibility to reinjury, chronic pain, & DJD. Removal of deleterious or abnl afferent input alone may result in improved PR & motor response. HVLA is likely to affect t deep interarticular muscles & change MR input from t facets & deep muscles wh play a substantial role in providing a detailed representation of head position & head mov't. Increased muscle tension & sensitized muscle spindles may give rise to erroneous PR signaling esp if spindles in dissimilar neck muscles or on different sides of t neck are disproportionately sensitized. Erroneous neck PR info converges in t CNS w vestibular & visular signals & may affect t perception of body orientation & lead to misinterpretation of relation to t surrounding. Chiro Tx can be effective in influencing PR sensibility & pain of cervical origin. HRA dysfunction may be improved in Ss w nontraumatic NP. Changes in t quality of PR info from C-sp may affect postural control as well as reduction of C-pain.

Colloca CJ, DC, Keller T, PhD et al. Comparison of mechanical force of manually assisted chiropractic adjusting instruments. JMPT 2005;28:414-22. Study quantifies & compares t force-time & force-delivery characteristics of 6 handheld chiropractic adjusting devices. 4 spring-loaded instruments: Activator Adjusting Instrument; Activator II; Activator III; Activator IV; & 2 electromechancial devices: Harrison Handheld Adjusting Instrument (HAI); Neuromechanical Impulse Adjusting Instrument (NMI). All were applied to a dynamic load cell. 10 force-time histories were obtained at each of 3 force excursion settings (minimum to max) for each of t 6 adjusting instruments. Results: T 4 Activator instruments produced similar minimum to maximum peak forces. T electromechanical adjusting instruments produced short duration impulses (~2-4 ms) w more linear minimum-to-max peak forces. T force-time profile of t electromechancial devices resulted in a more uniform and greater energy dynamic frequency response in comparison to t spring-loaded mechanical adjusting instruments. Conclusions: T handheld, electromechanical instruments produced a greater peak force & a larger range of forces compared to t spring-load devices. T electromechanical devices were faster & produced greater dynamic frequency range.T handheld, electromechanical instruments produced substantially larger peak forces & ranges of forces compared to t spring-load devices.

Keller T, PhD, Colloca CJ, DC, et al. Increased multiaxial lumbar motion responses during multiple-impulse mechanical force manually assisted spinal manipulation. Chiropractic & Osteopathy 2006;14:6. 15 sheep were had tri-axial accelerometers attached to pins fixed to L1 & L2 lumbar SPs. A hand-held electromechanical chiropractic adjusting instrument (Impulse) was used to apply single & repeated force impulses (13 over 2.5 sec) at low, medium, high force settings along t PA axis of t T12 SP. Acceleration responses in adjacent segments (L1, L2) were recorded. Segmental (L1, L2) & intersegmental acceleration transfer for each axis & each force setting were

computed. T acceleration response for a single thrust & during 12 multiple impulse trains were compared. Results: Segmental & intersegmental acceleration responses mirrored t peak force magnitude produced by t Impulse Adjusting Instrument. Multiple impulses produced significantly greater (3% to 26%) segmental & intersegmental acceleration responses. Conclusions: Results indicate tt impulse-type adjusting instruments tt deliver multiple thrusts significantly increase multi-axial spinal motion.

Tony S. Keller, PhD is Professor & Chair, Department of Mechanical Engineering, & Professor, Department of Orthopedics & Rehabilitation, University of Vermont. Together Drs. Keller & Colloca have authored over 50 scientific publications & previously co-authored the textbook Activator Methods Chiropractic technique (Mosby Year-Book 1997). At t right frequency more bone movement occurs & more neural receptors are stimulated thru t adjustment. Dr. Keller has several patents for his research on improving t frequency characteristics of hand-held spring-loaded activation type adjusting instruments.
"We were never able to achieve t forces & frequency inputs w t spring-loaded activation devices like we do with Impulse wh incorporates an electronic trigger mechanism instead of having to be hand squeezed so it is more comfortable to use. The Impulse was found to be twice as fast as t spring-loaded activation devices & about 100 times faster than manual SM.

Freedman, MD, MSCE, Bernstein, MD, MS. Educational deficiencies in musculoskeletal medicine. J Bone Joint Surg Am; 2002 84-A(4): 604-8. Authors previously reported the results of a study (J Bone Joint Surg 1998;80:1421-7) in which a basic competency musculoskeletal (MS) medicine exam was given to a group of recent medical school graduates. T exam was validated by 124 orthopaedic program directors who established a passing grade of 73.1%. 82% of the examinees failed to demonstrate basic competency in MS medicine. It was suggested that a different passing grade might be set by program directors of internal medicine departments. To test this, t validation process was repeated with program directors of internal medicine residency departments. 58% the program directors of internal medicine residency departments in t US responded, suggesting a passing score of 70.0%. The mean test score of 85 examinees was 59.6%. 78% failed to demonstrate basic competency on the criterion set by the internal medicine program directors. Conclusions: A large majority of recent medical graduates failed to demonstrate basic competency in musculoskeletal medicine. Medical school preparation in MS medicine is inadequate. T average amount of time spent in courses or rotations dedicated to orthopedics was only 2.1 wks for all examinees, & 33% had graduated from medical school w no such exposure. One or two wks, representing < 2% of t entire typical curriculum, is probably insufficient. Medical schools must place a greater emphasis on MS med. Because of t aging of t population, t prevalence of bone & jt diseases, already t primary reason tt people seek medical care - is sure to rise. T demands will soon be even greater. Students must master t topic of MS medicine. T results of these studies suggest tt they have not. A Pt comes in complaining of LBP

that wakes him from sleep. What 2 Diagnoses are you concerned with? A Pt comes in complaining of LBP that wakes him from sleep. What 2 Diagnoses are you concerned with? Tumor & infection: 33% correct. A Pt has a disc herniation pressing on the 5th lumbar nerve root. How is motor function of the 5th lumbar nerve root tested? Dorsiflexion of the great toe or toe extensors. 20% correct. A Pt presents with a new onset of LBP. Under what conditions are plain radiographs indicated. Name 5 (full credit for 4 responses). Age > 50, neuro deficit, bowel or bladder changes, Hx of cancer, pregnancy, drug use or steroid use; systemic Sx (night pain, fever); pediatric population. 50% correct. What muscle(s) are involved in lateral epicondylitis? Wrist extensors (extensor carpi radialis brevis/longis, digitorum communis). 18% correct. What muscle(s) control external rotation of the humerus? Infraspinatus or teres minor or rotator cuff. 28% correct.

Tuchin, PJ, DC, Bonello R. A Comparison of Chiropractic Student Knowledge Versus Medical Residents. WFC Proceedings 2001: 255. A published questionnaire (Q) designed by chief orthopedic residents to evaluate basic competency in MS exam was given to a chiropractic student group (at Macquarie University) to compare w t results of t medical resident grp. 51 volunteers (20-47 yrs) were given t questionnaire in their first wk of their final semester of t Master of Chiropractic degree. The Q was graded based on t grading system published by t J Bone Jt Surg. Results: T chiro grp showed stat signif higher ave grade than t medical residents.
70% of t chiro students passed t Q vs 80% failure rate for t residents. Results suggest tt chiro student NMS knowledge is as good or better than medical residents.

Petersen, D. AMA Resolves to ensure musculoskeletal training for med students. Dyn Chiro;2003 21(17): 3. In June 2003, t AMA's House of Delegates passed a resolution (# 310) introduced by: Am Orthop Foot & Ankle Society and Am Acad of Orthop Surgeons. Subject: Musculoskeletal Care in Graduate Medical Education. Strongly urges med schools to formally reevaluate t MS curriculum. Urges med schools to ensure tt students have t appropriate education & training in MS care, making competence a requirement for graduation. Encourages t committees on Medical Education, Accreditation & Residency Review to promote higher standards in basic competence in MS care.

Akesson, MD et al. Improved education in musculoskeletal conditions is necessary for all doctors. Bulletin of the World Health Organization. Bone & Joint Decade; 2003 81(9): 677-83. Pts w complaints about bones & jts are often ignored & their problems underestimated by doctors partly as a reflection of inadequate education.
Undergraduate medical students spend very few hours on t MS system. It would be considered negligent for a medical graduate to be incompetent at adequately assessing t heart or lungs, yet it is quite common for students to leave med school w/o being able to make a general assessment of t MS system. MS complaints are 2nd most common reason for a consultation exceeded only by disorders of t respiratory system & constitute 14-28% of primary care practice. Many GPs & family docs don't have adequate training & consequently lack t competency, skills & confidence to

manage MS disorders. In elective programs less than 1% had training in rheumatology, sports med & physical med combined.
Medical teaching in MS disorders in all parts of t world is currently brief & not directly relevant to t skills commonly required for management of these conditions in an outpatient setting. T preclinical curriculum devotes only 3% of its time to t teaching of MS injuries & diseases. Clinical undergraduate yrs frequently contain little training in this area & usually emphasize surgically managed MS problems, wh results in a bias towards more severe cases tt are not relevant to t future practice of most doctors. In t UK MS teaching represents <4% of t curriculum w a decrease over t last decade from 6%. As a result PCPs have a poor foundation of knowledge & insufficient competency in this area.

Matzkin, MD, et al. Adequacy of education in musculoskeletal medicine. J Bone Joint Surg Am 2005; 87-A(2): 310-314. A validated musculoskeletal (MS) cognitive exam was given to 334 volunteer medical students, residents, & staff MDs of multiple disciplines to assess t adequacy of their MS medicine training. Results: T average score was 57%. Only 21% obtained a score of +/>73.1%, t recommended mean passing score. Of those w a passing score, 58% were orthopedic residents & orthopedic staff MDs w an ave score of 94%. T ave score was 69% of Ss who stated they had taken a required elective course in orthopedics during their training compared w an ave of 50% for those who had not taken an orthopedic course. When t score for those in orthopedics (residents & staff MDs) were excluded, t ave score for those who had taken an orthopedic course was 59%. Conclusions: 79% of Ss failed t basic MS exam. This suggests tt training in MS medicine is inadequate in both medical school & nonorthopedic residency training programs.
In 2002 the CDC reported tt MS problems are 2nd only to upper respiratory illness as reasons why people seek medical attention in t ER. MS Sx are also t most common reason for visits to outPt departments.

Deconditioning Syndrome: 1. Decreased strength, 2. Decreased endurance, 3. Decreased flexibility, 4. Decreased cardiovascular fitness, 5. Decreased awareness of position sense & kinesthesia.

Carpenter, Nelson. Low back strengthening for the prevention and treatment of low back pain. Med Sci Sports Exerc 1999; 31(1):18-24. Because of the association of physical activity w increased pain, CLBP Pts often avoid using their backs. Their decreased jt mobilization is assoc w wasting of trunk muscles, a decrease in muscular strength & endurance and cardiovascular fitness, as well as, stiffness of ligaments & jts, reduced metabolic activity, & an increased susceptibility to sprains, strains, & muscle spasms. These deleterious effects of muscle/jt disuse provoke symptoms, causing greater avoidance of activity. This cyclical pattern of pain/avoidance of activity/ deconditioning/more pain, referred to as t "Deconditioning Syndrome" is a defining characteristic of t CLBP Pt. Studies show tt CLBP Pts have signif lower trunk strength compared w ctls. Also, weak trunk muscles are an important risk factor for LB problems.

Fear Avoidance Behavior leads to inactivity, immobilization & disuse. This may result in tissue impairment, reduced strength & ROM, stiffness & weakness. As a result there are reduced motor skills, proprioception, balance, stability, & increased risk of injury leading to more fear/avoidance.

Fritz, George, et al. The role of fear-avoidance beliefs in ALBP: relationships w current & future disability & work status. Pain;2001 94(1): 7-15Waddell et al (1993) developed t Fear-avoidance beliefs questionnaire & showed tt fear-avoidance beliefs (FABs) are an important psychosocial variable in Pts w chronic disability due to LBP. The importance of FABs in ALBP Pts has not been explored. In 78 Ss w work-related LBP < 3 wks, measures of pain intensity, physical impairment, disability, nonorganic signs & symptoms, & depression were initially evaluated, as were FABs. Disability & work status were re-assessed after 4 wks of PT. FABs were significant predictors of 4-wk disability & work status after controlling for all other variables. FABs are present in ALBP Pts & may be t most important factor in determining the transition from acute to chronic LBP. Higher FABs are established early in t course of LBP & are related to more persistent disability & difficulty returning to full work status. Screening for FABs may be useful for identifying Pts at risk of prolonged disability and work absence.

Liddle, SD et al. Exercise and chronic low back pain: what works? Pain; 2004 107(1-2): 176-90. (Rehabilitation Sciences Research Group, Univ of Ulster). Pts who demonstrate fear-avoidance beliefs about activity are less likely to comply with a physical exercise program. Exercise is thought to decrease fear-avoidance & facilitate functional improvements, despite ongoing pain. This is an important part of t biopsychosocial model of CLBP management. Long-term maintenance of these benefits requires Pt education & motivation towards behavioral change & exercise compliance.

Rainville, MD, et al. Exercise as a treatment for chronic low back pain. Spine J; 2004, 4(1): 106-15. Subjects with fear-avoidance responses are more prone to developing CLBP, physical impairment & disability. Studies demonstrate tt fears, attitudes & beliefs strongly influence BP-related disability. Exercise can be used to confront fears, reshape attitudes & beliefs and alter behavioral responses to pain. Exercise performed in a quota-based manner of pre-established performance expectations tt are not dependent on pain may function as a fear-desensitizing process. Such exercise may be a method of conditioning w t goal of decreasing illness/disability behaviors & reinforcing wellness/exercise behaviors. Exercise performed this way increases activity & exercise tolerance, decreases use of pain meds, reduces disability & have a high rate of RTW. The literature suggests that exercise Tx is more effective in treating depression than no Tx, & as effective in treating depression as psychotherapy & antidepressant medications.

Mercado, A., Carroll, L. J., et al. Passive coping is a risk factor for disabling neck or low

back pain. Pain 2005; 117: 51-57. To assess t relationship between coping & development of disabling pain in a cohort of individuals w non-disabling neck &/or LBP (n=571). Ss were F-U at 6 & 12 mo after t initial survey. Coping was measured w t Vanderbilt Pain Management Inventory. T Chronic Pain Q was used to measure t presence of disabling neck &/or LBP. T role of passive coping in t development of disabling pain was investigated while controlling for confounders. Results: Passive coping was a strong, independent risk factor for disabling neck &/or BP. Those w moderate to high levels of passive coping strategies were at an over 5 fold increased risk of developing disabling neck &/or BP. Active coping wasn't a signfi risk factor for disabling neck &/or BP. Conclusion: Passive coping is a strong & independent predictor of disabling neck &/or BP. Passive coping is a marker for risk of disability & can allow for t identification of individuals at risk & in need of intervention to improve outcomes.

Turk, DC. Psychological factors in chronic pain - their role in treatment outcomes. Presented at t NASS annual meeting 2005. Wiesel, S, MD (ed). Backletter 2005;20:137. Psychological factors can predict disability. They can affect emotional & behavioral response to pain and patients response to treatment. Their influence can be profound.

Liebenson C. Active Self-care: Functional Reactivation for Spine Pain Patients. In Liebenson C ed. Rehabilitation of the Spine 2nd Edition: Lippinocott Williams & Wilkins, 2007:295-329. Pts at greatest risk for chronic disabling pain often have poorly developed coping skills, tend to catastrophize & feel powerless to help themselves. Such Pts are less likely to resume activity or perform exercise. It's easy for them to become dependent on short-term passive symptom relieving Txs (SM, massage, medication, PT modalities). To get a Pt to become active in their own self-care program is to shift them from being a pain avoider to a pain manager. If fear of pain persists, unless it is specifically recognized & treated, it leads inexorably to pain-avoidance & disuse. T goal w a fearful Pt is to increase confidence in normal activities & exercises. T main goal for Tx of BP has shifted from Tx of pain to Tx of activity intolerances related to pain. How well Pts w chronic pain do depends more on what they do than what is done to them.

Solomon, D. H., MD, MPH. Selective cyclooxygenase 2 inhibitors and cardiovascular events. Arthritis Rheum 2005; 52(7): 1968-78. While there has been recent evidence for a reduction in
NSAID-associated GI morbidity, the Arthritis, Rheumatism, & Aging Medical Information System investigators suggested that ~16,500 deaths & 107,000 hospitalizations annually appear to be related to NSAID-associated GI toxicity.

Relative Risk of NSAIDs & Cervical Spinal Adjustment & Strokes
CBC Newsworld. Fri, 16 Jan 2004 22:24:28. Chiropractic treatment needs safety review.
TORONTO - The death of an Ontario woman who had her neck adjusted by a chiropractor was an accident, but more information is needed about the treatment's possible dangers, a coroner's jury ruled Friday. Lana Dale Lewis died of a stroke in

1996, 17 days after having her neck adjusted by Toronto chiropractor. It was the second stroke she had suffered in that period of time. The Ontario coroner's inquest was called to determine if the strokes were related to the neck manipulation. Jurors in such cases are never asked to find blame, only the cause of death. Unless it's a suicide or homicide, the options are generally natural, accidental or undetermined. Since jurors did not conclude that the death was natural or undetermined, the ruling of an "accident" means they found a relationship between the neck manipulation and the stroke, according to Amani Oakley, the Lewis's family lawyer. "This is a complete and utter victory," said Oakley. The lawyer had argued that an upper neck manipulation led to the 45-year-old woman's death. A lawyer for t Canadian Chiro Assoc & Canadian Memorial Chiro College called t outcome disappointing. "It represents a massive miscarriage of justice," said Tim Danson. "We think t ruling is perverse." Danson, who plans to appeal t decision, told CBC tt he's upset by the list of recommendations submitted by the jury. The 17 recommendations for avoiding future deaths include further study of the link, "if any," between neck manipulation and strokes, and the creation of a a database of all spinal manipulations performed in the province. The jury also recommended chiropractors and doctors get "written and informed consent" from the patient before proceeding with the Tx. The Canadian Chiro Assoc said the death had nothing to do with the Tx, which Lewis was receiving for migraine headaches. But dozens of neurologists signed a letter in February 2002 saying blood vessels can tear if the neck is rotated improperly. Critics of the treatment have warned that it could trigger strokes by damaging the lining of an artery supplying blood to the brain. Lawyers representing the chiropractic profession argued that Lewis was in poor health. She was a heavy drinker and smoker, had high blood pressure, severe headaches and a weight problem.

CTV.ca News Staff. Jan 16, 2004. Chiropractic patient died “by acciden.” The 1996 death of an Ontario woman who received a chiropractic neck treatment was ruled by accident, a coroner's jury said Friday. The lawyer for the family of Lana Dale Lewis told Canada AM that was the verdict they were hoping for. "A finding of accident would be the jury concluding that it was a neck manipulation that caused the death," Amani Oakley explained. Lewis, 45, died eight years ago, two weeks after visiting a Toronto chiropractor for an upper-neck adjustment as a remedy for migraine headaches. Six days later, she suffered a minor stroke. That was followed by a larger stroke a week later, one which proved to be fatal. After her fatal stroke, doctors discovered a tear in the artery at the back of the neck. The coroner's jury was charged with determining whether the neck adjustment played a role in the death. They could have reached five possible findings -- homicide, accident, natural causes, undetermined and suicide. The Canadian Chiropractic Association and the Canadian Memorial Chiropractic College expressed disappointment with the jury's verdict, saying "it represents a massive miscarriage of justice." Tim Danson, the chiropractors' lawyer, put it this way: "It's like saying two plus two equals 12 million. Only a grossly flawed process could produce such a stunning and perverse result." The chiropractors argued the finding should have been "natural causes." They said Lewis, a heavy smoker and drinker, had been in poor health prior to her death and had been

at risk of a stroke. They are going to try and have the verdict erased by a judicial review, saying they weren't allowed to produce key evidence. "This is one case, one incident ... and there are about 35 to 40 million cervical neck adjustments are done annually," said Stan Gorchinsky of the Canadian Chiropractic Association. The coroner's probe began almost two years ago. The purpose of the inquest was not to assign blame, only to determine the cause of death. The jury also unveiled 17 recommendations to prevent similar deaths in the future. They include: That the Ontario Ministry of Health fund a study on the relationship between high neck manipulation and stroke. That patients provide "written and informed consent" to neck manipulations and That chiropractors keep written records of the exact procedure performed. While the ruling went the Lewis family's way, Wendy Abrams, Lewis's sister, said: "We did not win anything. What we have done is found justice and proven to the community at large that these chiropractic neck manipulations must not continue." Some neurologists agree, saying they have found 10 deaths linked to neck adjustments, and will publish details in the spring. 'The numbers of deaths is astonishingly high," said Dr. Brad Stewart, one of those neurologists. "We're having a fair amount of difficulty getting the families to release the info. Some instances, there have been settlements and not allowed to talk about it. In some cases they just don't want it brought up again." Lewis' brother Mike Ford said the family has also launched a $12-million lawsuit against the chiropractor involved, Philip Emanuale, pending the jury's finding. But Ford said the real purpose of their efforts has been to raise awareness. 'The totality of our efforts have been to ensure that the truth comes out, that the common Canadian is aware of the fact that there are serious risks associated with having your neck manipulated," Ford told CTV. The Canadian Chiropractic Association argues the practice of neck adjustments carries only minimal risks. But critics charge the practice can trigger strokes by tearing the lining of an artery supplying blood to the brain. A study from the Canadian Stroke Consortium at Toronto's Sunnybrook Hospital, found chiropractic neck manipulation to be the leading cause of stroke due to damaged neck arteries in people under 45. The Lewis case is only the second inquest in Canada to put chiropractic neck adjustments under the microscope. In 1998, a coroner's inquest into the death of a 20-year-old Saskatchewan woman recommended that patients be informed about possible risks to their health before undergoing such treatment.

Smith, MD, PhD, et al. Spinal manipulative therapy is an independent risk factor for vertebral artery dissection. Neurology. 2003; 60(5): 1424-1428. A review of all < 60 yrs Pts w cervical arterial dissection (n = 151) & ischemic stroke or TIA from 1995 & 2000 at Stanford & UCSF stroke centers vs matched controls who had other types of stroke (n = 306). Results: 51 Pts w dissection (ave 41 yrs; 59% female) & 100 ctls. Pts w dissection were more likely to have had SM w/i 30 days (14% vs 3%), have had neck or head pain preceding stroke or TIA (76% vs 40%), & use alcohol (76% vs 57%). 27% of Pts w dissection had stroke/TIA w/i 12 hrs of pain onset, 50% w/i 3 days, & 80% w/i 1 wk. Vertebral artery dissections (VAD) were independently associated with SM w/i 30 days & pain before stroke/TIA. Conclusions: SM is independently associated w vertebral arterial dissection, even after controlling for neck pain. Pts having SM

should be consented for risk of stroke or vascular injury. A significant increase in neck pain following SM warrants immediate medical evaluation.

Williams, MD, Biller, MD. Vertebrobasilar dissection and cervical spine manipulation. A complex pain in the neck. Neurology;2003; 60: 1408-9. Smith et al's finding tt CSM independently increased t risk of vert artery dissection & stroke or TIA by approximately 6 fold must be taken seriously. However, case control studies are inherently susceptible to bias, especially selection & recall bias. Recall bias may influence Ss' recollection of events around t time of their stroke, & verification of t timing & specific type of CSM by review of the chiropractic records were not done. Risk estimates for stroke after CSM will always be difficult to quantify since bias in retrospective case-control & cohort studies can signif impact relative risk estimates & since confidence intervals around risk estimates are wide when t number of observed events is low. In t Smith et al study, there were only 7 Ss w dissection & cervical SM w/i 1 wk of their stroke.

Rosner A, PhD. Response to vertebral artery dissection study. 2003, May 18. T number of Pts in wh SM was reported to occur w/i 30 days is just 7 vs 3 in t ctl grp. T difference of just 4 Ss is a paltry number upon wh to base association - let alone any hint of causality. T fact tt 2 Pts actually experienced a stroke or TIA immediately following SM is clearly more compelling. T risk of fatal stroke following CSM has been assessed in an exhaustive systematic lit review to be 3 per 10 million CSMs or about 0.00025%. T mortality rate from stroke in t general population in 1992-93 was 0.00057%, wh raises t possibility tt t death rate from stroke in t general pop could conceivably be higher than tt amongst chiro Pts. Chiropractic has been shown to be many orders of magnitude safer than medication or surgery. Assuming tt each Pt receives an ave of 10 SMs, death rates following CSM calculate to between 1/100-1/400 t rates seen in t use of NSAIDs for t same condition. Death rates from lumbar spine operations have been reported to be 300 times higher than t rate produced by CVAs in SM. For cervical surgeries recent death rates have been estimated to be 700 fold greater. Given t frequency of complications from CSM (6/10 million CSM) or 0.0006% & given t many lifestyle activities shown to trigger CVAs, it seems nearly impossible to attribute t VA dissections reported at indefinite time periods following SM to SM. This association, based on a vague recollection of Pts of events in t past, cannot be counted upon to definitively identify SM as a causative event. Spontaneous VADs in hospital settings is estimated to occur 1-1.5 per 100,000 Pts. Reported VAD in a community setting is reported to be twice as high. It becomes apparent tt t proposed exposure rate for CVAs attributed to to CSM is equivalent to t spontaneous rates for cervical arterial dissections as previously reported in the literature. T fact tt Smith et al's study has been so extensively & immediately propagated in t media, in contrast to many investigations wh have supported CSM w no reports of side effects represents a major disservice to t public.

Voluntary Risks	**Risk of Death/Person/Year**
Smoking 1 in 20	1 in 200
Drinking 1 bottle of wine/day	1 in 13,000

Soccer	1 in 25,500
Automobile racing	1 in 1,000
Automobile driving	1 in 5,900
Motorcycling	1 in 50 (???)
Rock Climbing	1 in 7,150
Taking contraceptive pills	1 in 5,000
Power boating	1 in 5,900
Canoeing	1 in 100,000
Horse racing	1 in 740
Amateur boxing	1 in 2 million
Professional boxing	1 in 14,300
Skiing	1 in 4,350
Pregnancy	1 in 4,350
Abortion legal <12 wks	1 in 50,000
Abortion illegal >14 wks	1 in 5,000

Haneline, DC, Croft DC, MS, MPH, Frishberg, MD. Association of Internal Carotid Artery Dissection and Chiropractic Manipulation. The Neurologist 2003; 9(1): 35-44. Putting the risks in perspective: Risk of CSM related Internal Carotid Artery Dissection (ICAD) compared with other events:Death from CMT related ICAD 1: 3,606,870,000; Developing CMT-related ICAD. 1: 601,145,000; Death from CMT 1: 5,850,000; Death by lightening strike/yr 1: 2,000,000; Death by earthquake in CA/yr 1: 588,000; Death by being struck by a car/yr 1: 20,000; Death by regular NSAID use/yr 1: 4,000; Death related to C-spine surgery 1: 145.

Lauretti, W. DC. Estimated Risks of Common Chiropractic Txs & Common Medical Txs. Comparative Safety of Chiropractic, Chap 26. Redwood D, Cleveland CS III, DC (eds). Fundamentals of Chiropractic 2004, Mosby: 577.

Complications from Procedure or Activity	Estimated Risk
Cauda equina from lumbar SM	1 in 100,000,000
Death in fatal plane crash (flying 425 miles)	1 in 4,000,000
Death in motor vehicle accident driving 14.5 miles	1 in 4,000,000
Stroke or serious neurologic injury from CSM	1 in 1 to 5 million Tx 1 in 100,000 Pts
Being disabled in MVA, driving 1.1 miles	1 in 1,000,000
Death/yr from GI bleeding due to NSAIDs for OA	400 in 1,000,000
Overall mortality rate for spine surgery	7 in 10,000
Death rate from cervical spine surgery	4-10 in 10,000
Serious complication from spinal stenosis surgery	5 in 100

Wolfe MM, MD et al. Gastrointestinal Toxicity of Nonsteroidal Antiinflammatory Drugs. New Eng J Med 1999; 340(24):1888-99. The annual number of hospitalizations for serious GI complications related to NSAIDs is estimated to be at least 103,000. Conservative estimates of NSAID-related deaths in the US is 16,500. If deaths from GI toxic effects of NSAIDs were tabulated separately, these effects would constitute the

15th most common cause of death in the US (similar to number of deaths related to AIDS & considerably greater than the number of deaths from multiple myeloma, asthma, cervical cancer & Hodgkin's disease).

Rubin, R. Scientist says FDA system broken. USA Today 2004; Nov 19-21: 1A (ad A)
David Graham, associate director of science & medicine in the FDA's Office of Drug Safety told the Senate finance committee investigators that t FDA is "virtually defenseless" against another "terrible tragedy & a profound regulatory failure," like Vioxx. "Simply put, FDA & its Center for Drug Evaluation & Research are broken." Graham estimates, based on Merck's own studies, tt Vioxx may have caused heart attacks or sudden cardiac deaths in up to 139,000 Americans. Graham told investigators tt t FDA was trying to block publication of his results wh found tt those who took Vioxx were more likely to suffer a heart attack or sudden cardiac death than those who took Celebrex.

Langreth, R. Pharma's New Enemy: Clean Living. Forbes 2004; Nov 29: 103-112
Do you really need all those prescription pills you're taking? Maybe not. There's a backlash against t cost, risk & side effects of medication, & it's bad news for t pharmaceutical industry. T results of pill dependence are insidious & devastating: billions of dollars in ever-higher drug costs; millions enduring sometimes highly toxic side effects; & close to 2 million cases annually of drug complications tt result in 180,000 deaths or life-threatening illness in t elderly. Dr. John Abramson, an instructor at Harvard Medical School notes: We have this exaggerated belief in biomedicine, in t same way tt primitive society believed in folk cures." He blames drug makers for exaggerating t benefits & minimizing t side effects of prescription medicines & urges t medical establishment to emphasize cleaner living. In t US employers, government, & consumers spent $216 billion on prescription drugs last year (2% of US economy), up 11.5% in a year. That paid for 3.4 billion prescriptions, a dozen for every man, woman & child in this country. Drug makers spend $3.2 billion/yr on DTC advertising as part of a $25 billion marketing budget. This distracts MDs & Pts from lifestyle changes tt could have far greater impact.

Lauretti W, DC. What are the risks of chiropractic neck adjustments? JACA 1999;36(9):42-47. NSAIDs: one study found a 4/10,000 annual mortality rate for NSAID induced ulcers in Pts tx for non-rhuematic conditions suchs as MS pain & DJD, extrapolates to 3,200 deaths in US/yr. A conservative estimate of risk from death due to stroke caused by cervical SM is @ one fatality per 4 million. **Summary:**1/2 o 2 CVAs per million Cervical Txs. @ 1/3 of cases resolve w mild to no residuals. @ 1/4 will prove fatal. Therefore, there are about 40 to 50 SM caused strokes in t US per yr & perhaps a dozen deaths. There may be as much as 100 times greater risk of dying from an ulcer due to taking NSAIDs. If you drive @ 8 miles each way to get to your chiro visit, you have a stat greater risk of being killed or seriously injured in a car accident while traveling to t office than of having a serious complication from a neck adj.

Terrett A, DC. Current Concepts in Vertebrobasilar Complications following Spinal Manipulation. NCMIC 2001. Age distribution of 255 cases of post-SM stroke. 1934-1999. Average age: Males 39.5; Females 37.1. Often t words chiropractic &/or chiropractor have been used in publications to describe any practitioner of manual therapy regardless of t training of t practitioner. T 1999 J Neurology report on 10 cases in an article titled "Stroke following chiropractic manipulation of the cervical spine." These chiro maneuvers were performed by 7 orthopedists, one PT & 2 health practitioners who cannot be accurately identified (no DCs) . In t text of t article t words "chiropractic manipulation" were used 14 times, "chiropractic manipulations" eight times, "chiropractic maneuver" twice, "chiropractic cervical spine manipulation" once, & "chiropractic cervical spine manipulations" once. Age & gender distribution indicates no greater risk in any age range. T increased number of accidents reported in t 30 to 45 yr age grp appears to reflect t age grp most likely to seek SM. Pt's age & t presence or absence of degenerative or vascular changes don't seem important in assessing a Pt's risk. Exact age & gender are known for 233 of 255 (91.4%) of Pts. Males (n= 101; 43.3%) age 7 - 87 w an ave of 39.5. Females (n= 132; 56.6%) ages 20 - 74 w an ave 37.1. Reflects t greater number of female Pts in chiro offices. Studies of chiro Pts reveal male 40.7% to female 59.3% and 44.8% to 55.2%. Pts who suffer VBS (vertebrobasilar stroke) after neck SM generally are young healthy adults, have an uneventful med Hx, have none or only a few of t stroke risk factors, cannot be identified a priori by clinical or radiologic exam & women do not appear to be at greater risk.

Terrett A, DC. Current Concepts in Vertebrobasilar Complications following Spinal Manipulation. NCMIC 2001. In the 65 yr period 1934-1999, there are only 37 cases of death known to have occurred in the world, from all different types of SM practitioners, w only 19 being related to DCs or chiropractic manipulation. Some may already have a stroke in evolution, & therefore had an identical outcome even if they had not consulted a DC. Yet MDs often portray DCs as a serious risk to the public. While it may be argued tt yrs ago there may have been an element of under-reporting, this is now less likely with increased awareness, & claims experience indicates tt significant injury will nearly always lead to litigation.

Lauretti, W. J., DC. Cerebral Vascular Accidents Associated with Cervical Manipulation: Another View. JACA;2003 40(3): 31, 36-38. Signs & Sx of vertebrobasilar insufficiency: 5 Ds And 2 Ns: 5 Ds: Dizziness, drop attacks, Diplopia, Dysarthria, dysphagia, And: Ataxia (unsteadiness of gait or hemiparesis), 2 Ns: Nausea, Numbness of hemianesthesia . If a Pt presents w any of these signs & Sx consider possible vertebrobasilar insufficiency. Warning sign: sudden onset of severe pain in t side of neck &/or head or in occipital region, particularly if different from any pain t Pt has had before. This may represent referred pain from an injury to t pain sensitive wall of t vert artery, & may herald t onset of a dissection. Pts may seek DC care for this type of pain. Many cases of VBA stroke are preceded by Sx of HA or neck pain days or even weeks before t stroke is complete & represent referred pain from injury to t arterial wall. The "true stroke" might occur later, after an embolus forms at t

site of trauma, breaks free, & lodges in t cerebral circulation. T Pt may have been seeing t DC for Tx of Sx tt were actually a result of t developing arterial dissection.

Haldeman, PhD, et al. Stroke, cerebral artery dissection, & cervical spine manipulation therapy. J Neurol 2002; 249 (8): 1098-104. A review of 64 medical legal cases of stroke temporally associated w cervical SM was performed. Files included post stroke testing by neurologists, expert testimony, hospital & DC records, etc. 92% of cases presented with a Hx of head &/or neck pain. 25% (16) of cases presented with a sudden onset of new & unusual HA and neck pain often associated with neurological Sx tt may represent a dissection in progress. Strokes were noted following any form of standard cervical SM including rotation, extension, lateral flexion, & non-force & neutral position SM. Vertebrobasilar dissection should be considered a random & unpredictable complication of any neck movement including cervical SM. The sudden onset of acute & unusual neck &/or head pain may represent a dissection in progress & be the reason a Pt seeks SM tt then serves as the final insult to the vessel leading to ischemia.

Licht, P., MD, PhD et al. Is cervical spinal manipulation dangerous? JMPT; 2003 26(1): 48-52. Many MDs frankly discourage t use of cervical SM because of fear of an unacceptable high risk. Fortunately, serious complications are rare... Estimations vary from 1 in 400,000 to 1 in 3,000,000 SMs. In perspective, serious CVA, after coronary bypass surgery occur in 1.3% & risk assessments have shown tt cervical SM is several hundred times safer than NSAIDs because of serious GI side effects. T rate of hospital errors is also much higher. A review of > 30,000 Pts showed tt iatrogenic disabling injury occurred in 3.7% of cases & 13% were fatal. Major suction lipectomy is considered to have a low complication rate, despite a rate of fatal complications of 1 per 7,500 operations. T fear of CVAs seems greatly exaggerated in view of t higher rate of complications w many generally accepted medical Txs. It is tempting to speculate tt t widespread fear of cervical SM w/i t medical profession is more a political than a factual issue.

Haldeman, DC, MD, PhD, Carey, DC. Arterial dissections following cervical manipulation: the chiropractic experience. Can Med Assoc J 2001; 165(7):95-6. Review of malpractice data from t Canadian Chiro Protective Assoc (CCPA) to eval all claims of stroke following chiro care for 10 yrs between 1988 & 1997. T Dx by t treating neurologist was obtained. Results suggested tt @ 134.5 million cervical manips were performed by DCs covered by CCPA during this period. There were 43 cases of neurological Sx following cervical manip over 10 yrs. Of these, 20 were minor & not Dx as a stroke. 23 cases of stroke or vertebral artery dissection following cervical manip were reported. There are over 4500 DCs in Canada. T likelihood tt a DC will be made aware of an arterial dissection following cervical manip is approx 1:8.06 million office visits, 1:5.85 million cervical manips, 1: 1430 chiro practice yrs & 1:48 chiro practice careers. This is signif less than estimates of 1:500,000 - 1 million cervical manip based on surveys of neurologists. It's probable tt t experience of DCs does not reflect all dissections tt occur following cervical manip.

Haldeman, S., DC, MD, PhD, et al. Unpredictability of cerebrovascular ischemia associated with cervical spine manipulation therapy. Spine 2002; 27(1): 49-55. A review of 64 unpublished medicolegal records w extensive documentation describing cerebrovascular ischemia (CVI) after cervical SM. This is t largest case series of CVI assoc w cervical SM. T next largest was only 10 cases. These 64 cases were referred to a Haldeman for review over 16 yrs from t United States & Canada. T study was unable to identify factors from the history & P.E. tt would assist in isolating Pts at risk of CVI after cervical SM. CVI after SM appears to be unpredictable & should be considered an inherent, idiosyncratic, rare complication of cervical SM. It's assumed CVI may be avoided by screening Pts thru Hx and head & neck positioning to evaluate patency of t vertebral arteries. In 27 cases, DC described screening before SM w Pt's neck in ext/rot. None of these Pts showed adverse responses to this screening test. Current frequency estimates vary from 1 in 400,000-500,000 to 1 in 3.85 million. Most CVAs occur in Pts 30-50 yrs. There is no evidence tt older Pts at risk for atherosclerotic vascular ischemia are more likely to incur complications from SM. None of t arteriographs in 64 cases showed t presence of arteriosclerotic plaquing. Therefore, t widely accepted risk factors for arteriosclerotic & thrombotic strokes probably do not apply; screening for bruits, hypertension, DM, smoking, to identify Pts at risk for arteriosclerotic strokes does not appear to be of any benefit in determining t likelihood tt a Pt may be at risk for a stroke after SM. Of 64 cases, 2 resulted in death & neither showed a pathology in t vertebral arteries on autopsy. One Pt had a hemangioma of t venous plexus in t pons wh hemorrhaged & t other had a ruptured berry aneurysm. None of t dissections resulted in death. Only 2 cases resulted from dissection of t internal carotid artery. Only 5 cases of carotid artery dissection are found in English lit. T current data on screening before SM by placing t head/neck in extension/rotation suggest tt this test is not capable of screening out Pts at risk, is consistent w recent studies showing tt rot/ext of t neck in vivo may not signif reduce vert artery flow. Most dissections occur in t absence of C-SM, spontaneously or after trivial trauma or common daily mov'ts of t neck, such as backing out of a driveway, painting t ceiling, playing tennis, sneezing, or yoga. Suggestions tt there may be an inherited arterial defect in t cerebral arteries tt makes some people prone to cerebral artery dissection may hold t answer for these seemingly random CVAs after SM.

Rosner, PhD. Spontaneous cervical artery dissections and implications for homocysteine. JMPT 2004; 27(2): 124-32. Risk of CVAs assoc w SM from 1 per 400,000 to 1 per 5.85 million. Risk from NSAIDs or surgery to Tx many of t same conditions as those managed by DCs is 400 to 700 times greater, yet warnings pertaining to t use of these options are often ignored in t media & medical lit. Death rates due to med side effects according to t Institutes of Medicine range from 230,000 to 280,000 per yr. NSAIDs approach an annual rate of 16,000 dwarfing any estimates of chiro fatalities by several orders of magnitude. T annual incidence of spontaneous VADs in hospital settings has been estimated to ccur at a rate of 1 to 1.5 per 100,000 Pts. In community settings has been reported to be twice as high. T proposed exposure rate for CVAs

attributed to SM is equivalent to t spontaneous rates for cervical artery dissections as reported. Evidence suggests tt t inherent fragility of t arterial wall rather than any trauma assoc w maneuvers by DC is t major culprit regarding arterial dissections. A genetic defect in humans is assoc w elevated levels of homocysteine results in t inability to convert homocysteine to methionine. Pts who had spontaneous cervical artery dissections (sCADs) have homocysteine levels more than 3Xs as much as asymp Pts & more than twice as much as Pts who have undergone ischemic strokes w/o arterial dissection. Homocysteine is implicated as a key component of atheroscleorsis & cardiovascular diseases. Findings point to t disruption of t structure of collagen & elastin in t arterial wall. In skin biopsies from Pts w CAD, irregular collagen fibrils & elastic fiber fragmentations have been found. Homocysteine activates metalloproteinases & serine elastases leading to t decrease in t elastin content of t arterial wall & premature fragmentation of t arterial elastic fibers & degradation of t extracellular matrix. Homocysteine has been shown to block aldehydic grps in elastin, inhibiting t cross-linking needed to stabilize elastin. Cross-linking of collagen may also be impaired by homocysteine. These changes result in potential defects of t extracellular matrix of t vessel wall & may play a role in t pathogenesis of arterial dissection. T common denominator pertaining to risks assoc w SM is arterial wall fragility. Arterial fragility attributable to inborn errors of metabolism tt may be detectable by a homocysteine assay.

Symons, DC, Leonard, Herzog, PhD. Internal forces sustained by the vertebral artery during SMT. JMPT; 2002 25(8): 504-10. Study quantifies strains & forces sustained by the vertebral artery (VA) during SM in 6 VAs from unembalmed cadavers. The cephalad (C0-C1) loop VAs were exposed & instrumented w a pair of piezoelectric ultrasonographic crystals. Strains were recorded during ROM, vertebrobasilar functional maneuvers, & during several SMs. VAs were then strained on a materials testing machine until mechanical failure (first point at wh t elongation of t VA produced a decrease in force). Results: SM on contralateral side of cervical spine resulted in an average strain of 6.2% + /- 1.3% to the cephalad loop of the VA - similar to or lower than the strains recorded during vertebrobasilar functional maneuvers & ROM. Failure testing: VAs could be stretched to 139% to 162% of their resting length before mechanical failure occurred. Therefore the strains sustained by the VA during SM represent about one ninth of the strain at mechanical failure. Conclusions: SM resulted in strains to the VA almost an order of magnitude lower than the strains required to mechanically disrupt it. Under normal circumstances, a typical HVLA SM thrust is very unlikely to mechanically disrupt the VA.

Licht, P. MD, PhD. Vertebral artery blood flow during chiropractic treatment of the cervical column. PhD Thesis. Odense University, Denmark 2000: 63. Cervical manip is used millions of times each yr to Tx NP & HA. Pt satisfaction is high compared to what GPs achieve. Reports on serious complications following cervical manip are extremely rare. It is estimated tt CVAs occur in one in 400,000 to one in 3 millioncervical SMs. In comparison, t risk assoc w several generally accepted pain relieving procedures in hospitals is much higher (coronary artery bupass grafting:

mortality 1.2%, & serious complications > 7%, or hip arthroplasty: mortality 1-2%). Even cosmetic procedure like liposuction has a mortality rate of 1 in 13,000. Therefore, one can hardly accuse cervical SM of being a risky procedure as long as there is a relevant indication for its use. It may even be tempting to speculate tt t widespread fear of cervical manipulation among MDs could be a political issue rather than a clinical one.

Licht, MD, Christensen DC, MD,, Hoilund-Carlsen MD, DMSc,. Is there a role for premanipulative testing before cervical manipulation? JMPT 2000;23(3):175-179. Study at a university hospital vascular lab of vertebral artery blood flow in 20 Pts w a positive premanipulative test for contraindication to SM referred by DCs in Denmark. Flow velocities were measured in both vertebral arteries by color duplex sonography. 5 Pts were excluded because Sx were not reproduced in t vascular exam. In 15 Pts w Sx (vertigo, blurred or double vision, nausea, hemicranial paresthesia) no signif difference in peak flow velocity or time averaged mean flow velocity w different head positions was found. 19 of 21 DCs surveyed would Tx a Pt w a positive premanipulative test if t vascular exam was normal. 8 of t Pts w a positive premanipulative test were Tx w/o complications. 6 are now Sx free & 2 have improve Sx. T remaining 8 Pts refused manip & continue to have t same Sx.Conclusion: A positive premanipulative test is not an absolute contraindication to cervical SM. If t test is positive & reproducible, Pts should be referred for a duplex exam of t vertebral artery flow. If t duplex flow is normal, t Pt should be eligible for cervical SM despite t postive premanipulative test. Controversy exists about t sensitivity & specificity of premanipulative tests. Studies indicate a test may be negative, despite occlusion of t vert artery, & CVAs may occur despite a negative test. Functional tests of t vertebral arteries include: Barre-Leiou's sign test, Geroge's cerebrovascular craniocervical functional test, Maigne's test, Hautant's test, Underberg's test, Hallpike maneuver, & deKleyn's or Wallenberg's tests. All are variations of t same theme: extreme rotation & extension of t head to provoke cerebral ischemia during positional change of t cervical spine. A test is positive if it provokes S&S of vertebrobasilar insufficiency (nystagmus, vertigo, dizziness, tinnitus, visual blurring, nausea or faintness). In this study there was no signif difference in either peak flow or time-averaged mean flow velocity in t various head positions. Results suggest tt a positive test is seldom assoc w changes in vert artery blood flow & tt a positive de Kleyn's test should not be considered an absolute contraindication to cervical SM.

Glass LS, MD (editor). Occupational Medicine Practice Guidelines. Am College of Occupational & Environmental Med (ACOEM) (2nd Ed) 2004: 173. Manipulation has been compared to various treatments for Pts w neck pain in nearly 20 RCTs. More than half favored SM, with one reporting better results in combination with exercise, while the remainder indicated Txs were equivocal. In rare instances (estimated at 1.0-1.5 per million) CSM has been assoc w CVA. Some studies suggest tt this risk is based on t position of t Pt, not t act of SM itself. Serious side effects are extremely rare & far less frequent than those associated w commonly prescribed alternatives such as NSAIDs.

Terrett A, DC. Current Concepts in Vertebrobasilar Complications following Spinal Manipulation. NCMIC 2001. Functional vascular tests are not a reliable indicator or predictor of VBI (vertebrobasilar ischemia). The tests have problems w false positive results, & often following SM to t neck &/or other spinal regions, t positive result cannot be reproduced. Functional vascular tests have problems w false negative results. T absence of a positive functional test cannot be absolutely interpreted to mean tt there is no underlying arteriopathic process. In all but t most grossly pathological or highly susceptible cases, these tests will give a false negative result & a false sense of security to t practitioner. It makes no sense to subject Pts to a screening test tt is invalid & gives t practitioner a false sense of security regarding t degree of risk for SM. This can only lead to t conclusion tt t tests should be abandoned, for clinical & medicolegal purposes, & should not be used for non-clinical risk management reasons. There is no evidence tt suggests positive results have any correlation w future VBS if SM is used. Current testing procedures are not able to predict susceptibility to VBS.

Proprioception, Dizzines, the Cervical Spine and Spinal Adjustment

Licht, MD, Christensen DC, MD,, Hoilund-Carlsen MD, DMSc,. Is there a role for premanipulative testing before cervical manipulation? JMPT 2000;23(3):175-179. Other conditions may be responsible for t Sx evoked by a premanipulative test. Neck PRs involved in postural adjustment, are closely related to vestibular function. T PRs are t jt receptors of t first 3 upper cervical vert. A positive premanipulative test could be from PR dysfunction, resulting in"cervical vertigo" by way of their projections to t vestibular nucleus. This presents a dilemma - t very Sx tt contraindicate therapy may most likely be relieved by t Tx they exclude. Pts in this study who were Tx got relief wh favors an explanation of this kind & suggests tt a positive deKleyn's test should generally not be considered a contraindication to SM.

Norre. Vertigo & the Cervical Spine. Medica Physica 1986; 9:183-194. Vertigo results from a disturbance in sensory input from vestibular apparatus, eyes, & proprioceptors (especially of the neck) which renders the pattern abnormal & dysharmonic. The dysfunction of one sensor makes its signal contradictory to that of the others resulting in a Sensory Mismatch. Neck PRs have a sensory function equivalent to vestibular function. Stimulation of neck PRs produce the same ocular reflexes as does the vestibular system: Cervico-ocular Reflex.

Brandt, Bronstein Cervical vertigo. J Neurol Neurosurg Psychiatry; 2001 71(1): 8-12. Neck afferent input is important in reflex control of muscle tone, head orientation, eye coordination, body posture & spatial orientation. Traumatic, degenerative, inflammatory or rheumatic diseases can alter upper cervical somatosensory input causing vertigo. Inflammation sensitizes muscle spindle receptors resulting in asymmetric somatosensory mismatch between vestibular & cervical inputs resulting in vertigo. Dizziness/unsteadiness of cervical origin can also be due to loss or inadequate stimulation of MRs w cervical pain. PR is mostly dependent on deep short

intervertebral neck muscles wh are extensively supplied w muscle spindles. Somatosensory cervical input converges w vestibular input to mediate multisensory control of orientation, gaze, & posture. Cervical vertigo may include Sx of disorientation, postural imbalance, & ocular motor signs.

Humphreys, Bolton. A cross-sectional study of the association between pain and disability in neck pain patients with dizziness of suspected cervical origin. J Whiplash & Related Disorders; 2002 1(2): 63-73. Cervicogenic dizziness & vertigo may arise from disturbed sensory input due dysfunctional jts & MRs, esp w trauma & are common complaints: 80%-90% of whiplash Pts report them. Of 180 neck pain (NP) Pts recruited at a chiro college clinic, 40.57% had NP from trauma, 33.5% had dizziness. NP Pts w dizziness were signif more likely to have had trauma, have greater pain intensity, more disability, & a longer duration of pain. Women report dizziness more often than men & are more prone to neck complaints esp w trauma as a result of a smaller cross-sectional area of muscle mass & a decrease in forces generated to stabilize, support & protect t cervical spine. Women's ligaments may be prone to greater injury & biomechanical stress due to reduced muscular support leading to pain & disability. Dysfunction or trauma to connective tissues (muscles & ligs) rich in PRs may lead to sensory impairment. Disturbed sensory input from neck PRs is commonly responsible for cervicogenic dizziness due to dysfunction of t somatosensory system of t neck.

Treleaven, Jull, et al. Dizziness & unsteadiness following whiplash injury: characteristic features and relationship with cervical joint position error. J Rehabil Med; 2003; 35(1): 36-43. Study regarding dizziness & unsteadiness to determine if they are related to cervical joint position error: the accuracy of returning to the natural head posture following extension and rotation. T procedure was performed by 102 Ss w persistent whiplash associated disorders (WAD) & 44 ctls. Results: Ss w chronic WAD had signif greater joint position error than ctls. Within t whiplash group, those w dizziness had greater joint position error than those w/o dizziness & more neck pain. Dizziness may be due to direct damage to t cervical MRs following trauma. T barrage of abnl afferent input can result from t sudden acceleration/deceleration forces placed on cervical structures &/or t effects of pain & inflammatory mediators on PR activity. Disturbances to t postural control system, including abnl cervical afferent input from damaged or functionally impaired neck jt & muscle receptors are t likely cause. Dizziness of cervical origin arises from abnormal afferent activity from t extensive neck muscle & jt PRs wh converge in t CNS w vestibular & visual signals confusing t postural control system. Results indicate t presence of deficits in cervical MR function in WAD. Between 12 & 40% WAD Pts develop persistent problems. After pain, dizziness/unsteadiness are t next most frequent Sx. Cervicogenic dizziness is exacerbated w neck mov'ts or increased pain. 40-70% of persistent WAD Pts have dizziness assoc w reports of loss of balance & falls.

Treleaven, J., G. Jull, et al. Standing balance in persistent whiplash: a comparison

between subjects with and without dizziness. J Rehabil Med 2005; 37(4): 224-9. Trauma in whiplash may damage any of t key systems for postural control (vestibular, neck receptors, or CNS). In t absence of traumatic brain injury, Sx after whiplash are thought to arise from abnormal cervical afferent input from damaged neck join & muscle receptors. Cervical afferent info is important to t control of posture, spatial orientation & coordination of t eyes & head. Evidence supports a cervical cause of Sx of dizziness & balance disturbances. Ss w WAD & dizziness vs those w/o this Sx have greater deficits in tests of postural control, cervical jt position error, & smooth pursuit neck torsion. These deficits reflect altered receptor input from cervical jt & muscle receptors.

Sjostrom, MD, et al. Trunk sway measures of postural stability during clinical balance tests in patients with chronic whiplash injury symptoms. Spine;2003 28(15): 1725-34

Trunk sway studied in 25 chronic WAD Ss & 170 ctls. WAD Ss had greater trunk sway for stance tasks & for complex gait tasks different from other Pt grps w balance disorders indicating possible pathologic vestibulo-cervical interaction. Severe tissue injury w collision occurs w/i first 100 millisec involving impulsive forces due to rapid accelerations & decelerations. Many structures are injured. Most WAD resolves quickly, but others (18% to 40%) develop prolonged Sx (neck & BP, HA, dizziness, blurred vision, paresthesias, cognitive difficulties). Sx may persist for months or yrs & are assoc w deficient balance control. Balance is controlled via 1) vestibular receptors in t inner ear, 2) via visual sensory systems, 3) via PR from muscles & jts. Postural instability can result from inappropriate interaction among these sensory inputs (sensory mismatch) tt provide orientation info to t CNS. Whiplash may injure sensory receptors in cervical structures: jt receptors, GTOs, & muscle spindles present in high density in deep cervical muscles. Afferents from deep muscles have a profound effect on postural reflexes. Deficits in sensory input may cause pathologic interactions w/i t vestibulospinal system leading to inappropriate control of balance or eye movements. PR deficiency in neck muscles may influence vestibular nuclei & lead to unsteadiness or vertigo. Direct damage to t brain, brain stem, cranial Ns, or inner ear labyrintine structures may also contribute. It's often not possible to track down t origin of vertigo to a single lesion. T different systems interact in a complex pathophysiology of dizziness w whiplash. 85% of WAD Pts report some kind of vertigo.

Heikkila MD, PhD et al. Effects of Acupuncture, Cervical Manipulation and NSAID Therapy on Dizziness and Impaired Head Repositioning of Suspected Cervical Origin, Man Ther 2000;5:151-157. 14 Pts w chronic (> 3 mo) dizziness/vertigo of suspected cervical origin were given in random order: 1) acupuncture - 3 Tx w/i 2 wks, 2) cervical SM -3 Tx w/i 2 wks, 3) no therapy, and 4) NSAID-percutan applied 2-3X/day over sore muscles in neck/shoulders for 1 wk to evaluate their effect on kinesthetic sensibility, dizziness/vertigo and pain. Outcomes were based on effects of each Tx on 1) cervical kinesthetic performance, 2) vertigo, 3) pain & 4) active cervical ROM. Results were compared w 39 ctls. SM was the only Tx to diminish the duration of dizziness/vertigo complaints in t past 7 days (before 4.5 & after Tx 2.2) & increase

cervical ROM. Both acupuncture & SM reduce dizziness/vertigo & positively effect head repositioning. NSAID-percutan application & acupuncture alleviated pain. Results suggest SM may impact most efficiently on the complex process of PR & dizziness of cervical origin. Sx of cervical vertigo are caused disturbed PR input from t neck. Erroneous cervical PR info converges in t CNS w vestibular & visual signals, affecting perception of body, orientation & t relation to t surroundings, wh may be misinterpreted, resulting in a feeling of dizziness of unsteadiness. Disturbed kinesthetic sensitivity may contribute to functional instability of jts & susceptibility to reinjury, chronic pain & DJD. Removal of abnl afferent input from jts may improve PR & motor response. Conclusion: Results suggest tt SM may be most effective in influencing t complex process of PR sensibility & dizziness of cervical origin.

Pollard, DC, MS, Ward, PhD. T effect of upper cervical or sacroiliac manipulation on hip flexion ROM. JMPT 1998; 21(9):611-616. Study compares t effectiveness of an upper cervical manip & a manip of t SI jt for increasing hip ROM based on a SLR in 52 Ss measured by a reliable digital electrogonimometer before & after Tx. 3 groups of Ss: 1) received cervical SM; 2) SI SM (side posture), & 3) sham (digital pressure on t mastoid process). Results: T 2 SM Txs resulted in increased flexion ROM at t hip, but only t upper cervical SM increased hip flexion ROM significantly. SM of t neck may affect hip ROM & indicates t existence of a link between C-spine & t lower extremity. A study by same authors found tt hip flexion ROM could be improved after 1) a stretch to t hamstring or 2) a stretch to t suboccipital muscles & t cervical stretch effect was greater than t effect of t locally applied stretch on hip ROM changes. Findings support DCs tt emphasize a role of upper cervical Tx on t function of sites removed from t spine, tt upper cervcial SM can affect extraspinal function. Potential mechanisms: Tonic Neck Reflexes: Result may be due to a change in muscle spindle output of t suboccipital muscles, causing reflex PR changes to centers controlling posture. It is likely tt lower limb flexion has resulted from stimulation of t suboccipital muscles & jt capsules assoc w a cervical SM of t area. It is possible tt these effects may manifest in other regions of t spine. As all muscles under consideration are postural in nature, it is highly probable tt all would be affected by such reflex activity. This is t first study to demonstrate improv't in an objective ROM measure of peripheral jt function after a single cervical SM. The study suggests a link between t neck & hip exists & t link can be affected by cervical SM. A potential reflex action of SM on long loop reflexes has been suggested as a possible mechanism for increased hip flex.

Outcomes Assessment

Yeomans, S., D.C. The Clinical Application of Outcomes Assessment. Stamford, CT, Appleton & Lange; 2000.

Outcomes assessment-based chiropractic care. What & Why? JACA;2003 40(4): 8-16. Outcomes-based care involves regular measurement of Pt's Sx & functional capabilities using research-based outcomes tools - questionnaires (Qs) answered by t Pt (self-reports) & physical performance tests. Outcomes assessment on t initial

visit establishes baselines & helps setting goals. It's critical to establish functional goals, then follow & document Pt status & progress. Outcomes allow t DC to measure Pt's progress against his/her own baseline & against normative data. It's frustrating to rely on orthopedic tests for measuring progress. Pts' orthopedic findings may be normal, yet they continue to complain of pain. Outcome tools guide t DC as to Pt progress. The 4 most useful types of questionnaires: General Health: used to measure effects of illness & care on general health, rather than more specific outcomes. Helpful when Pts have multiple problems & to evaluate out t effects of Tx on Pts' health related quality of life (HRQL). Assessment of Pain: difficult to interpret, but often t key component driving a Pt's satisfaction w care. May include numerical & visual analogue scales to evaluate current, average, best, & worst pain, (quadruple pain scales) & pain drawings. Useful in malpractice cases; when drawings completed by Pts show gradual improv't, but t Pt is saying t DC injured him, it's easy to prove innocence in a frivolous case. Condition specific tools: Oswestry, Roland, carpal tunnel, dizziness, upper extremity & lower extremity. Useful for NMS conditions. Psychosocial or Psychiatric Tools: including depression, anxiety, coping strategies (fear avoidance beliefs, passivity, dependence). Often t greatest barrier to recovery includes "yellow flags" - psychosocial factors tt can prolong recovery. These tools identify Pts at risk for prolonged recovery early in t course of care. The Tx plan can then emphasize t transition from passive to active care as early as possible so Pt's don't become dependent. T importance of t psychosocial domain can't be over emphasized - much of t health expense is caring for t few chronically disabled Pts wh these questionnaires help identify. These four domains are t strongest predictors of Pt outcome. Newer tools to predict Pts who may become chronic are "hybrid" questionnaires wh combine several outcomes related questions from a variety of domains into a single brief questionnaire wh is very practical. Yeomans uses t Bournemouth Questionnaires released in 1999 for LBP & in 2002 for neck pain. Both contain only 7 items graded 0 to 10. They're easy & fast for Pts to complete & score. They're quite sensitive to change over time. These 2 tools cover lumbar & cervical condition-specific pain & psychometric domains in 1 Q.

Deyo, MD, MPH et al. Spine 1998;23(18):2003-2013. Measurements of Pt outcomes of LBP has been a vexing problem. In an effort to achieve objectivity, physiologic measures such as ROM & muscle strength were widely used, but such measures are only weakly assoc w outcomes more relevant to Pts such as symptom relief, daily functioning, & work status. The appropriate dimensions of outcomes for LBP include: 1) Symptoms, 2) Functional Status, 3) Overall Well-being, 4) Work Disability

Most Widely Recommended Outcome Measures: Disability Scales (Activities of Daily Living Scales): Oswestry, Roland-Morris, Neck Disability Index. Pain Drawing & Quadruple Pain Scale (using visual analog vs numerical rating scale). A new disability measure: Functional Rating Index. Feise, DC, Menke, MS, DC. Functional rating index: a new valid and reliable instrument to measure the magnitude of clinical change in spinal conditions. Spine 2001; 26(1):78-87. Health Status Questionnaires: SF-36 or Rand 36 or SF-12.

Physical Impairment: anatomic or pathologic abnormality leading to loss of normal bodily ability.

Disability (aka Functional Impairment): diminished capacity for everyday activities & gainful employment Waddell, MD. Clin Ortho 1987;221:271-273

The basic grading of the Oswestry Disability Index and the Neck Disability Index: Have the patient follow the directions to check the box in each section that most closely describes them. Each section has 6 boxes.

The upper box in each section indicates no disability and is worth "0" points,
The next box indicates minimal disability and is worth "1" point
The next box indicates mild disability and is worth "2" points
The next box indicates moderate disability and is worth "3" points
The next box indicates severe disability and is worth "4" points
The last box indicates complete disability and is worth "5" points

Add up the scores of each of the 10 sections to get the "raw" score. Multiply the "raw" score by 2 to get the percent disability score. The highest possible raw score is 50 and when multiplied by 2 equals 100% functional disability. Take the patient's percent disability score and apply it to the following grading scales:

Oswestry Disability Index: (see Fairbank. Physiotherapy 1981; 66(8):271-3. Hudson-Cook. In Roland, Jenner (eds). Back pain new approaches to rehabilitation & education. Manchester Univ Press, Manchester 1989: 187-204). Scoring: 0-5% none, 6-20% mild, 21-40% moderate, 41-60% severe, 61-80% crippled, 81-100 bed-bound or exaggerating

Neck Disability Index (see Vernon, Mior. JMPT 1991;14(7):409-15). Scoring: 0-8% none, 10-28% mild, 30-48% moderate, 50-68% severe, >70% complete

For the **Roland-Morris Activity Scale** have the patient follow the directions. Add up the selections that are checked and subject them to the grading scale below. (Roland, Morris. Spine 1983;8(2):144-50. A raw score of over 14 of 24 is associated with a poor prognosis: 0-5 minimal, 6-10 moderate, 11-14 severe, 15-19 crippled, 20-24 bed bound or exaggerating

Frequency of Use for Outcomes Assesment: The patient should complete disability scales, pain drawings, & pain scales at baseline (initial visit), once a week for acute patients & at least once every four wks/month for chronic patients. Some researchers suggest every other week for chronic patients. Others also recommend completing the forms at the time of flare-ups & at the time of discharge. Others suggest following-up Pts at sometime between 2 wks, 4 wks, 6 wks or 8 wks after discharge to see if the Pt has been able to maintain his/her benefit from chiropractic care or

has been unable to maintain therapeutic gains and may therefore need supportive care including supervised exercise. Yeomans suggests using outcome measures every 2 weeks for all Pts.

Grotle M, MSc, Brox JI, PhD, Vollestad, NK, PhD. Functional status & disability questionnaires: what do they assess. Spine 2005; 30(1):130-40. Most of t back specific questionnaires (Qs) were designed to assess performance of what t Pt does in real-life situations. There is a subjective nature of a self-report questionnaire wh is capturing t Pt's perception of his/her problem - perceived self-efficacy. The two most frequently used and recommended questionnaires are the Roland Morris Disability Questionnaire and the Oswestry Disability Questionnaire. T Roland tends to me more sensitive to change in wh Pts have mild to moderate disability whereas t Oswestry seems more sensitive in Pts with more persistent severe disability.

Roland, MA, MRCS, Fairbank, FRCP. The Roland-Morris Disability Questionnaire and the Oswestry Disability Questionnaire. Spine 2000; 25(24):3115-24. The authors recommend use of t Oswestry in BP Pts who are likely to have persistent severe disability & t Roland-Morris in Pts who have relatively little disability. However, for most Pt grps, both instruments function satisfactorily in groups w severe disability. T Roland is a short & simple method of self-rated physical function in BP Pts. T ease of use makes it suitable for following t progress of Pts & for combining w other measures of function. T Oswestry is also an effective method of measuring disability in BP Pts w a wide range of severity & causes. Both instruments have stood t test of time & have been used in many countries. Both perform as well as most other currently available instruments & better than some. T Roland may be better suited to settings in wh Pts have mild to moderate disability & t Oswestry to situations in wh Pts have persistent severe disability.

Pietrobon, R., MD, R. R. Coeytaux, MD, et al. Standard scales for measurement of functional outcome for cervical pain or dysfunction: a systematic review. Spine; 2002 27(5): 515-22. The concept of functional measurement differs considerably from the traditional measurement of clinical signs & symptoms. Instead of focusing on signs & symptoms used for diagnostic purposes, functional scales measure the impact of a disease on the performance of ADLs. Assessment of the impact a traumatic injury or degenerative condition has on a Pt's life is necessary for proper follow-up to evaluate Pt progress & outcomes. A systematic review to evaluate standard scales for assessing neck pain or dysfunction was done. 5 standard scales were found: the Neck Disability Index (NDI) has been revalidated the most times in different study populations. It has accumulated the most evidence to show tt its psychometric characteristics should remain stable in different settings.

Nederhand, Hermens, et al. Chronic neck pain disability due to an acute whiplash injury. Pain;2003 102(1-2): 63-71. The Neck Disability Index (NDI) has been shown to have a high degree of test-retest reliability, internal consistency, acceptable level of validity & is sensitive to severity levels & to changes in severity over time.

Outcomes assessment-based chiropractic care. What & Why? JACA;2003 40(4): 8-16. **Objective outcomes** are also available but not yet in widespread use. These tools clearly demonstrate deconditioning wh is immediately appreciated by both t examiner & t Pt. Use of objective outcome tools are helpful in determining Pts functional status & setting long term goals. Often Pts show much improv't on subjective outcomes tools, but at re-exam 1 mo later, t same objective, functional tests show no change. For Pts w recurring CLBP, it's important to try to implement a program to improve their functional status & take them beyond where they've been at their previous best since they've been plagued w a recurring condition for yrs. This is where objective measures, called physical performance tests are needed to measure aerobic capacity, strength, endurance, PR, ROM, & non-organic signs. These tests should replace most orthopedic tests in re-exam at 4th to 6th wk. When pain & inflammation subside but t Pt still complains of problems, it's time for physical performance tests. Such exams can change Tx patterns esp for longer-term care. Each abnormal test relates to a specific exercise or manual release Tx wh represents a change from t previous passive SM approach. Each Pt is unique, functional status & progress must be individually assessed. Adopting t way re-exams are conducted promotes a transition from a passive to active care approach to case management.

Liebenson C, Yeomans S. Quantification of physical performance ability. In Liebenson C ed. Rehabilitation of the Spine 2nd edition: Lippincott, Williams & Wilkins, 2007:226-59.

Most MS physical exam tests are unreliable. Traditional exam methods such as othopedic, neurologic, & imaging tests can accurately Dx t cause of pain in only @10% of BP Pts. T focus of evaluation has shifted toward identification of functional or physical performance deficits. Physical performance tests can help to focus t Pt on t important goal of reactivation & functional restoration. Exam of physical performance ability (PPA) can identify impairments responsible for biomechanical overload & pain, and specific functional limitations tt disturb ADLs. PPA exam identifies targets for prescriptive active/exercise training, establishes a functional Dx & baseline levels of functional impairment from wh to judge future progress. Normative quantitative data bases are most helpful in reporting outcomes. Experts recommend t PPA exam 2 to 4 wks after injury to identify key functional deficits to be addressed w reactivation care. Testing isn't very helpful in t acute stage & isn't predictive of 12 mo outcomes. If performed at 4 wks functional tests are signif predictors of future pain & disability. Functional capacity eval should be mandatory for any Pt still having pain after 6-7 wks. PPA assessm't allows objective confirmation of Pt status to complement t Pt's subjective self-report of Sx. It allows provider to document Pt progress over time & helps motivate t Pt to reactivation after injury. Prolonged passive care directed at providing Sx relief may only achieve short-term effects. When Sx relief not functional outcomes are t Pt's only goal, dependency rather than reactivation advice can result. T sports med approach utilizes activation advice & active exercise to rehab injured tissues & is t standard of care for soft tissue injuries. This approach is best for alleviating pain, completing soft tissue healing, &

preventing recurrences. PPA exam can be done w minimal special equipment or high cost. Simple low tech tests are reliable.

Yeomans, S. DC, FACO. Manual: Quantitative Functional Capacity Evaluation (QFCE): 2nd Edition 2002. The QFCE incorporates 23 physical performance tests & takes about 40 min.to perform t entire battery of tests. A clinician may also perform a directed evaluation and only perform t tests relevant to t anatomical & functional components related to tt Pt's complaints. The 23 physical performance tests include: 8 strength & endurance tests; 6 muscle length tests; 5 Waddell non-organic signs; Cervical & lumbar ROM inclinometry tests; 1 leg standing tests (for balance); 1 aerobic capacity test. Each of the QFCE tests is based on a normative database and is a repeated measure to follow Pt progress. The clinician compares the Pt's baseline performance measures to normative databases published in the scientific literature in order to identify t Pt's specific objective functional deficits. In addition, t Pt's follow-up scores (retests of t original functional capacities, usually measured at 4 wk intervals) are recorded to measure & document t Pt's objective functional progress. Each test is prescriptive. If a Pt falls below 85% of a baseline score from the normative database, he/she has an objective functional capacity deficit. For each test score that falls below 85% of normal for tt Pt's age and sex, there is an exercise or exercises available to be used in conjunction with a chiropractic Tx plan to improve tt objective functional capacity for t Pt. Each Pt is unique. Functional status & progress must be individually assessed. Adopting this way conducting re-exams promotes a transition from a passive to active care approach to case management.

Gulati, M., et al. The prognostic value of a nomogram for exercise capacity in women. NEJM 2005; 353(5): 468-75. Recent studies demonstrate tt exercise capacity is an independent predictor of mortality in women. Normative values of exercise capacity for age in women are not well established. This study constructs a nomogram to determine predicted exercise capacity for age in women & assess the predictive value of the nomogram with respect to survival in 5721 asymptomatic women & in 4471 women w cardiovascular Sx who underwent a symptom-limited, maximal stress test. A nomogram was established to allow the percentage of predicted exercise capacity to be estimated on the basis of age & exercise capacity achieved. The nomogram was used to determine the percentage of predicted exercise capacity. Survival data were obtained & a survival analysis was used to estimate t rates of death from any cause & from cardiac causes in each group. Results: The risk of death among asymptomatic women whose exercise capacity was <85 % of predicted value for age was twice that among women whose exercise capacity was at least 85 % of the age-predicted value. Results were similar in the cohort of symptomatic women.

McGill S, PhD. Ultimate Back Fitness and Performance. Waterloo, Canada, Wabuno Publishers; 2004: 21-49. Mounting evidence supporting t role of aerobic exercise in reducing t incidence of LB injury & Tx LBP is compelling. General LB exercise programs tt combine cardiovascular components are more effective in both rehab & injury prevention.

Smeets R, MD, Wittink H, PhD, et al. Do Patients With Chronic Low Back Pain Have a Lower Level of Aerobic Fitness Than Healthy Controls? Spine 2006;31:90-7. Study compares t aerobic fitness level of CLBP Pts w healthy ctls matched for gender, age, & level of sport activity to evaluate the association of the difference in aerobic fitness level w pain intensity, duration & degree of disability, fear of injury, & level of activity during work, household & leisure time. 108 CLBP Pts completed questionnaires regarding pain, disability, fear of injury, and activity level and performed a modified a submaximal cycling test. Maximum oxygen consumption (VO2max) was calculated & compared w normative data. Results: Both men & women w CLBP had significantly lower VO2 max than healthy ctls. Conclusion: CLBP Pts have a reduced aerobic fitness level compared w normal Ss. Findings provide evidence for an assoc between a lower level of aerobic fitness & CLBP.

Rielly L, PT. Holcombe PT. Exercise for LBP: t effect of patient-specific exercise prescriptions using progressive resistance exercise. Spine J 2005; 5(4): S15. 121 consecutive LBP Pts >/= 6wks) w measurable strength deficits in trunk muscles are put thru a rehab program (6 wks & 13 visits) to address t deficits, & evaluate t relationship between isometric strength, Oswestry, a pain rating scale, & ROM. A standard protocol of progressive resistance exercises for lumbar extensors & abdominals on specialized equipment was continued to failure & progressed weekly. Pts were encouraged to work thru pain using a cognitive behavioral model of rehab. Results: Tx resulted in signif improv'ts in all outcome measures. Improv'ts in strength correlated well w improv'ts in pain & disability. Conclusions: A evaluation including objective measures of strength can identify Pts who benefit from a protocol of progressive resistive exercises.

Apkarian, AV, PhD, Sosa, Y et al. Chronic back pain is associated with decreased prefrontal and thalamic gray matter density. J Neurosci 2004; 24(46): 10410-5. The role of the brain in chronic pain conditions remains speculative. We compared brain morphology of 26 chronic back pain (CBP) Pts to age matched ctls. using MRI data. CBP Pts divided into neuropathic, (pain due to sciatic nerve damage), & non-neuropathic groups. Neocortical gray matter volume was compared after skull normalization. CBP Pts showed 5-11% less neocortical gray matter volume than healthy ctls. The magnitude decrease is equivalent to gray matter volume lost in 10-20 years of normal aging. The decreased volume was related to pain duration, Regional gray matter density in CBP Pts density was reduced in bilateral dorsolateral prefrontal cortex & right thalamus and was strongly related to pain characteristics in a pattern distinct for neuropathic & non-neuropathic CBP. Our results imply that CBP is accompanied by brain atrophy and suggest that the pathophysiology of chronic pain includes thalamocortical processes.

Aging Baby Boomers, Increased Musculoskeletal Problems, Disability, Future Trends and Increased Need for Chiropractic Care

Badley, PhD, Crotty, MD. An international comparison of the estimated effect of the aging of the population on the major cause of disablement, musculoskeletal

disorders. J Rheumatol 1995;22(10): 1934-40. The world's population is aging. This will be one of t most important influences on t health of t population & t need for health care services in t coming decades and will result in a disproportionate increase in the number of people w chronic disabling disorders. This is a global process - a reduction in mortality has resulted in a concomitant increase in disability & chronic conditions. Musculoskeletal (MS) disorders are, by a wide margin, t most frequent cause of physical disability in developed countries. MS disability & its 2 major subgroups, arthritis & back disorders will increase over t yrs 1985, 2000, 2010 & 2020. Estimates for 1985 US, adults w MS disability: 9,777,000. Estimates for 2020 US, adults w MS disability: 15,474,000. Percent change in total population: 28.3%. Percent change in number w MS disability: 58.3%. For arthritis in US in for 2020 percent change 64.9%. Back Disorders in US for 2020: 4,606,000; percent change 52%.

Bolen, PhD. Prevalence of Self-Reported Arthritis or Chronic Joint Symptoms Among Adults --- United States, 2001. Morbid Mort Wkly 2002; 51(42):948-950. Arthritis & rheumatic conditions comprise the leading cause of disability among adults in the United States. This is expected to increase as the U.S. population ages. In 2001, questions about arthritis & chronic joint symptoms (CJS) were asked of adults in every state. Findings indicate that the estimated prevalence of arthritis/CJS was 33.0% among adults, representing approximately 69.9 million lives, including 10.6% (22.4 million) of the adult population with physician-diagnosed arthritis. Prevalence increased with age. Women had higher prevalence than men. Other higher prevalence groups were persons who hadn't completed high school, the physically inactive, and the those who were obese. Increased efforts, including early diagnosis and appropriate clinical and self-management are needed to reduce the impact of arthritis and CJS.

Leopold, E. World getting older and few nations can cope. United Nations, Mar 28, 2002. Second World Assembly on Aging in Madrid from April 8-12. The figures are startling: Globally, in the next 50 years, the number of people above 60 years of age will nearly quadruple, growing from about 600 million to almost 2 billion people. Today, one in every 10 persons is 60 years or older but by 2050, one out of every 5 people will be an older person. In France, it took 115 years, 1865 to 1980, for the proportion of older persons to double from 7% to 17%. But developing nations are expected to see the older population increase by 200% to 300% over only 35 years. Today the median age for the world is 26 years. By 2050, the average world age is expected to have increased to 36 years. Dr. Robert Butler, founding director of the US National Institute on Aging, calls the aging phenomenon "the most significant population shift in history."

Thiel, S. Newsweek 2002; September 16: 34R-34X. The demographics are clear & irreversible. Two thirds of all seniors citizens who've ever lived are alive today. The number of people born between 1990 & 1995 was only about half as large as the number born between 1970 & 1975. This year the average Japanese turned 42 yrs old. In the USA this will happen around 2070. In 2012, 3 in 10 in Japan will be over

60.

Hootman, PhD, et al. Public Health & Aging: Projected Prevalence of Self-Reported Arthritis or Chronic Joint Symptoms Among Persons Aged >/= 65 Years - USA, 2005-2030. MMWR;2003 52(21):489-491. Arthritis & chronic joint symptoms (CJS) are among t most common chronic diseases, affecting 70 million U.S. adults in 2001, & are t leading cause of disability among adults. Arthritis prevalence increases w age, affecting about 60% of t U.S. population aged >/= 65 years. As a result of better Tx of other chronic diseases & lower mortality, adults are living longer, & the U.S. population is aging. CDC applied data from a 2001 state by state survey to project national population data for 2005-2030. Results: if arthritis prevalence rates remain stable, t number of affected persons aged >/= 65 years will nearly double by 2030. Sex-specific prevalence rates of CJS or physician-diagnosed arthritis: males: 51.6%; females: 63.9%. During 2005-2030, the percent of U.S. population aged >/= 65 years is expected to increase from 12.9% to 20.0%. The number of persons aged >/= 65 years projected to have arthritis or CJS will nearly double, from 21.4 million in 2005 to 41.1 million in 2030 with a median state-specific prevalence of 56.5%. The aging of the population is a critical issue facing the U.S. public health, medical, and economic systems. Arthritis contributes substantially to disability, poor health-related quality of life, & increased medical costs. Decreasing this impact will require effective public health interventions tt improve function, decrease pain, & delay disability among persons w arthritis. Fewer than 1% of persons with arthritis who could benefit from such interventions receive them.

Picavet, H. S., Schouten JS. Musculoskeletal pain in the Netherlands: prevalences, consequences & risk groups.. Pain 2003; 102(1-2): 167-78. Picavet, Schouten. MS pain in the Netherlands: prevalences, consequences & risk groups. Pain 2003; 102(1-2): 167-78. Study of t prevalence of musculoskeletal (MS) pain (location, duration, course), consequences (utilization of health care, sick leave & limits in ADLs) in t 3664 respondents from the general Dutch adult population. Pain was described as continuous (30%), recurrent (55%), mild (70%), severe (15%). In 30%, pain was accompanied by limitations in ADLs. 33% to 42% consulted GPs for their pain. MS pain is common in all subgroups & has far-reaching consequences for health, work & use of health care. 74.5% of t respondents reported MS pain in t past 12 mo. 53.9% reported MS pain at t time of t survey. 59.9% reported pain in more than 1 site in past 12 mo. Most Ss do not miss work. BP was t Sx most commonly assoc w sick leave. About 1/4 of those reporting BP had taken sick leave in t previous yr. Prevalence of BP peaked about age 50, then tailed off substantially. T prevalence of knee & hip complaints, rose steadily w age.

Yelin EH, PhD et al. Transitions in employment, morbidity, & disability among persons aged 51-61 w MS & non-MS conditions in t US, 1992-1994. Arthritis & Rheumatism 1999; 42(4): 769-79. A national survey of 8739 people found tt painful musculoskeletal (MS) conditions in middle age are normal. MS conditions affected about 2/3ds (62.4% & 70.5%) of persons aged 51-61 & accounted for all but 10% of

those w disabilities. These conditions exact a heavy disability toll. More than 40% of persons w MS conditions reported disability, wh was almost 90% of all persons w disability in this age grp. MS conditions were defined as self-perceived arthritis, rheumatism, or problems of t back or feet. Questions were designed to detect chronic ailments, not transient (episodic) ones, but persistent ones, tt have lasted or are expected to last.

McNeil J, Binette J. Prevalence of Disabilities and Associated Health Conditions Among Adults --- United States, 1999. Morbidity and Mortality Weekly Report 2001;50:120-125. The U.S. Bureau of the Census and CDC analyzed data from the 1996 Survey of Income and Program Participation (SIPP) - a stratified sample of the U.S. population. Ss were interviewed 12 times in 4 yrs. In late 1999 data was collected during interviews with Ss in 36,700 households. The analysis focused on 53,636 adults aged >18 years. In 1999, 44 million (22%) adults reported having a disability - 24% among women & 20% among men. Those w disabilities comprised persons reporting difficulty with ADLs, selected functional activities like climbing a flight of stairs, walking 3 city blocks, or lifting/carrying 10 lbs. or limitation in the ability to work around the house or at a job or business. 93.4% of adults w disabilities reported t main health condition associated with their disability: 17.5% had arthritis & rheumatism, 16.5% had back or spine problems, & 7.8% had heart trouble/hardening of the arteries. Of the total percentage of disabilities, 63% occurred among working adults (aged 8--64 years). The age-specific prevalence rate of disability was the highest among respondents aged >65.

Astin JA, PhD. Why patients use alternative medicine. JAMA 1998;279(19): 1548-1553. Survey of 1035 randomly selected subjects to determine reasons and frequency of using alternative health care. 40% of respondents reported using some form of alternative health care in t past yr. The top 4 Tx categories were Chiropractic (15.7%), lifestyle diet (8%), exercise/mov't (7.2%) & relaxation (6.9%). T top 5 of 26 health problems listed were 1) back pain (19.7%), 2) allergies (16.6%), 3) sprains/muscle strains (15.7%), 4) digestive problems (14.5%), 5) lung problems (13%). The most frequent noted benefits of the use of alternative health care. "I get relief for my symptoms, the pain or discomfort is less or goes away. I feel better.""The treatment works better for my particular health problem than standard medicine's Tx.""The treatment promotes health rather than just focusing on illness."

Petersen. Intersurvey 2000. Dyn Chiro 2000; 18(16): 1, 48 Internet survey of 1,148 Ss in 2000. 38% of American adults have tried Herbs, 37% have tried Chiropractic, 35% have tried Massage. 44% of those who tried chiropractic found it extremely helpful & 48% fond it somewhat helpful.

Eisenberg DM, MD et al. Trends in alternative medicine use in the United States, 1990-1997: JAMA 1998; 280: 1569-1575. Nat'l survey of 2055 Ss measures utilization of altern care in US between 1990 & 1997. Use of at least 1 of 16 altern therapies in previous yr increased from 33.8% (22 million) in 1990 to 42.1% (39 million) in 1997.

Percent of users who actually saw altern providers increased from 36.3% to 46.3%.Alternative therapies were used most frequently for chronic conditions (back problems, anxiety, depression & HA). There was a 47.3% increase in total visits to alternative providers, from 427 million in '90 to 629 million in '97 & exceeds total visits to all US primary care physicians by @ 243 million visits. Expenditures for altern professional services increased 45.2% between '90 & '97 estimated at $21.2 billion in '97, w at least $12.2 billion paid out-of-pocket. Total out-of- pocket expenditures relating to altern therapies was @ $27 billion, comparable w t 1997 out-of-pocket expenditures for all US physician services. In 1997, 5 therapies had a majority of users consulting a practitioner: chiro, massage, hypnosis, biofeedback & acupuncture. Unsupervised use is t usual method of use for all other altern therapies. Increases in use of altern therapies for medical conditions occurred for back problems, allergies, arthritis, & digestive problems. T highest condition-specific rates of altern care use in 1997 were: neck (57%) & back (47.6%) problems. In '90, 19.9% seeing an MD for a medical condition also used altern therapy. This increased to 31.8% in '97. For Ss ages 35 to 49 in '97 it is estimated tt 1 of every 2 persons used at least 1 altern therapy. In '97, 42% of all altern therapies used were exclusively attributed to Tx of existing illness, whereas 58% were used, at least in part, to "prevent future illness from occurring or to maintain health & vitality." In '97, 11% had seen a DC w a mean number of 9.8 visits for an estimated total in the US of 191,886,000 visits.

Eisenberg, MD et al. Perceptions about Complementary Therapies Relative to Conventional Therapies among Adults Who Use Both. Ann Intern Med. 2001;135:344-351. National survey of 2055 adults. 1802 (87%) saw an MD in past yr. 831 (45%) of these used CAM in past yr, & 411 (23%) saw a CAM provider in past yr. Only 21% of CAM users agreed w t statement, "Altern therapies are superior to conventional therapies," & 79% of respondents agreed tt "Using both conventional & alternative therapies is better than using either one alone for your problems." Only 15% said they saw a CAM provider first, 18.5% saw both at t same time & 51.2% saw an MD first. Asked about relative helpfulness for 10 of t most commonly reported medical conditions among users of both med & CAM for each condition. Relative helpfulness for 10 of t most commonly reported medical conditions among 411 users of both medical & CAM for each condition.

Med Conditions	Conventional Better %	CAM better %
Back conditions	12.4	46.1
Allergies	22.7	29.9
Fatigue	9.4	41.3
Arthritis	25.9	44.8
Headaches	19.0	39.1
Neck Conditions	6.4	61.0
High Blood Pressure	57.0	0
Strains or Sprains	7.8	22.5
Lung Conditions	25.9	23.5
Digestive Conditions	34.5	25.9

Of the 411 who saw both provider types, the percent who perceived "total" or "a lot of" confidence in their CAM provider was similar to t percent who perceived the same in their MD. (81% & 77% respectively). Among 831 who saw MD & used CAM, 63% didn't disclose use. T data contrasts w previous editorials tt t high prevalence of CAM in U.S. largely represents a rejection of orthodox med. We found tt CAM was perceived to be more helpful for chronic, disabling conditions such as HA, neck & back conditions. Adults typically seek services of their MD first. Many adults believe tt their MD will not understand their use of CAM, but <1in 5 feared disapproval from their MD. Many Ss, as consumers of care, view MDs as members of a larger, Pt selected health care team. Increasingly, MDs are being viewed as one of several professionals of health-related matters. This is consistent w trends toward increased autonomy & personal responsibility for one's own health.

Kessler, PhD et al. Long-Term Trends in the Use of Complementary and Alternative Medical Therapies in the United States. Ann Intern Med. 2001;135:262-268. A national survey of 2049 adult on current use, lifetime use, & age at first use for 20 CAM therapies. Results: Lifetime use & age at onset showed that 67.6% of respondents had used at least one CAM therapy in their lifetime. Lifetime use steadily increased with age. Approximately 30% of respondents in the pre–baby boom cohort, 50% in the baby boom cohort, and 70% in the post–baby boom cohort reported using some type of CAM by age 33 years. Of those who ever used CAM, nearly half continued to use many years later. A wide range of individual CAM therapies increased in use over time, and the growth was similar across all sociodemographic sectors. Conclusions: Use of CAM therapies by a large proportion of the sample is the result of a trend that began at least a half century ago & suggests a continuing demand for CAM therapies will affect health care delivery for the foreseeable future. Lifetime prevalence of CAM in US has increased steadily since t 1950s. T post-baby boom respondents had a higher rate of lifetime use by age 33 than pre- babyboomers by t age of 79. These results should dispel any suggestion tt use has increased for only singular CAM modalities or tt t use of CAM is a passing fad assoc w one particular generation. It's likely tt t proportion of people using CAM will increase as insurance coverage for these Txs expands in t future. 50% of all CAM use tt had been initiated at least 5 yrs before t interview had persisted at t time of t interview. Most CAM is used at least in part to prevent future illness or maintain health & vitality as part of lifestyle choices linked to t perceived value of disease prevention & health promotion. T trend of increased CAM use across all cohorts since 1950 coupled w t strong persistence of use, suggests a continuing increased demand for CAM tt will affect all facets of health care over t next 25 yrs.

Wolsko, MD, MPH et al. Patterns and perceptions of care for treatment of back and neck pain: results of a national survey. Spine 2003; 28(3): 292-7. National survey of Tx for BP or NP. Of 2055 adults, 644 (33%) reported BP or NP in past yr: 38%: LBP only, 16%: NP or upper BP only, 46% pain in >1 location. Of those w BP or NP, 29% used CAM alone, 25% used both CAM & conventional, 12% only conventional, 34% used neither. Most commonly used CAM for BP or NP was chiro (20%), massage (14%),

relaxation techniques (12%). Of those w BP or NP, 37% had seen a conventional provider, 54% had used CAM. Chiropractic, massage, and relaxation techniques were rated as "very helpful" for back or neck pain among users (61%, 65%, and 43%, respectively), whereas conventional providers were rated as "very helpful" by only 27% of users. Nearly 1/3 of all CAM provider visits (203 million of 629 million) were made to Tx BP or NP. BP & NP were most commonly Tx w CAM alone or a combination of CAM & conventional; use of conventional alone was infrequent (12%). For chiro mean number of visits 8.5/yr.

Kreitzer, RN, PhD et al. Attitudes toward CAM among medical, nursing, & pharmacy faculty & students. Alternative Therapies. 2002; 8(60) Nov/Dec: 44-7. Study to determine perceptions of medical, nursing, & pharmacy faculty & students toward CAM. More than 90% of medical, nursing, & pharmacy faculty believed tt quality conventional & CAM practices should be integrated for care in a clinical setting & & tt CAM includes ideas & methods from wh conventional medicine could benefit. Over 90% of both students & faculty believed tt knowledge regarding CAM was important for practitioners. Only 7% felt tt CAM Txs have no true impact on Tx of Sx, conditions, &/or diseases. 6% stated tt CAM is a threat to public health. Skepticism or disbelief in t efficacy of CAM is strikingly low & demonstrates a shift is currently occurring in t field of medicine. MDs w >22 yrs of practice had t most negative views of CAM. T views of those currently studying medicine are quite t opposite. Educational exposure to CAM was correlated w perceived usefulness. Medical students who had t least amount of education about CAM viewed it as less useful than others. Faculty recognize t contribution tt CAM may offer & are open to having CAM taught w/i t curricula, but, are not highly trained or experienced in use of CAM & have limited knowledge & experience with it. They received little training in CAM & less than half could identify any CAM Tx in wh they had sufficient training to use or to advise Pts regarding use. Faculty did not aspire to gain skills in CAM to personally provide therapy to Pts, but, were interested in acquiring sufficient skill to advise Pts regarding t use of CAM. Faculty & students strongly support t integration of CAM practices into clinical care, inclusion of CAM in their school's curricula, & preparing health professionals to advise Pts about CAM.

Barnes, P M, MA, Powell-Griner E, PhD et al. Complementary and alternative medicine use among adults: United States, 2002, US Depart of Health & Human Services, CDC, Nat'l Center for Health Statistics: 2004. A very large U.S. national survey (31,044 adults) sponsored by the HHS, NCCAM, NIH, & CDC to evaluate the use of CAM among adults in the U.S. Report notes that some of the explanations for t growth of CAM include Pts wanting to be actively involved in health care decisions & dissatisfaction w conventional medicine. T report notes tt dissatisfaction may be related to t inability of conventional medicine to adequately treat many chronic diseases & their Sx such as debilitating pain. A commonality of CAM is treatment of t whole person, addressing physical, mental, & spiritual attributes rather than focusing on a specific pathogenic process as emphasized in conventional medicine. Data from t CAM component of t National Health Information Survey 2002 included

questions on 27 types of CAM including 10 types of providers (DCs, massage therapists, homeopaths, naturopaths, acupuncturists, etc) & 17 other CAM therapies for wh a provider isn't necessary (megavit, herbs, supplements, diets) & mind-body therapies: biofeedback, deep breathing, guided imagery, hypnosis, progressive relaxation, qi gong, tai chi, & yoga, prayer for health purposes. Results: 75% of adults have ever used CAM when prayer for health reasons was included. 62% of adults have used CAM in past 12 mo when prayer was included. W/o prayer 36% of adults in U.S. used CAM in past 12 mo. Reasons for using CAM: Believed CAM combined w conventional med would help: 54%. Thought CAM would be interesting to try: 50.1% believed conventional medicine would not help them: 28%. Because conventional MDs suggested they try it: 26%. Felt tt conventional med was too expensive: 12%. Most people who have ever used CAM have used it in t past 12 mo. Most people use CAM to treat or prevent musculoskeletal conditions or other conditions assoc w chronic or recurring pain. 10 CAM modalities most commonly used in past 12 months: Prayer for one's own health: 43.0%; Prayer by others for one's own health: 24.4%; Natural products (garlic, echinacea, ginseng, ginko biloba, etc): 18.9%; Deep breathing exercises: 11.6%; Participation in prayer group for one's own health: 9.6%; Meditation: 7.6%; Chiropractic: 7.5%; Yoga: 5.1%; Massage: 5.1%; Diet-based therapies: 3.5%.

Most Commonly used Practitioner based CAM Therapy. Ever Used. In past 12 Months.

Chiropractic	19.9%	7.5%
Massage	9.3%	5.0%
Homeopathy	3.6%	1.7%
Acupuncture	4.0%	1.1%
Naturopathy	0.9%	0.2%
Hypnosis	1.8%	0.2%
Biofeedback	1.0%	0.1%

Most Common Reasons to Seek CAM care. Back pain or problem* 16.8%; Head or chest cold 9.5%; Neck pain or problem* 6.6%; Joint pain or stiffness*4.9%; Anxiety/Depression 4.5%; Arthritis, gout, fibromyalgia* 4.9%; Stomach or intestinal ills 3.7%; Severe HA or migraine* 3.1%; Recurring pain* 2.4%; Insomnia or trouble sleeping 2.2%.

Tindle, H. A., MD, MPH, R. B. Davis, ScD, et al. Trends in use of complementary and alternative medicine by US adults: 1997-2002. Altern Ther Health Med 2005; 11(1): 42-9

Comparison of two national surveys in 2002 & 1997 of CAM use by US adults: (1) the Alternative Health/Complementary and Alternative Medicine supplement to the 2002 National Health Interview Survey (NHIS, N = 31,044) & (2) a 1997 national survey (N = 2055), each containing questions about 15 common CAM therapies (chiro, massage, acupuncture, energy healing, hypnosis, biofeedback, chelation, naturopathy, folk medicine, herbal medicine, yoga, high dose vitamins, homeopathy, relaxation techniques, & special diets). Results: T most commonly used CAM modalities in 2002 were Herbal therapy (18.6%, representing over 38 million US

adults); Relaxation techniques (14.2%, representing 29 million US adults); Chiropractic (7.4%, representing 15 million US adults). Among CAM users, 41% used two or more CAM therapies during the prior year. Factors associated with highest rates of CAM use were ages 40-64, female gender, non-black/non-Hispanic race, and annual income of $65,000 or higher. Overall CAM use for the 15 therapies common to both surveys was similar between 1997 and 2002 (36.5%, vs. 35.0%, respectively, each representing about 72 million US adults). The greatest relative increase in CAM use between 1997 and 2002 was seen for herbal medicine (>50% increase from 12.1% vs.18.6%) & yoga (almost 40% from 3.7% vs. 5.1%), while t largest relative decrease occurred for chiropractic (@25% from 9.9% to 7.4%) & massage (6.8% to 4.9%). A downturn in t US economy from 1997-2002 & a recent increase in managed care may have contributed to lower use. Conclusions: The prevalence of CAM use remained stable from 1997 to 2002. Over 1 in 3 respondents used CAM in the past year, representing about 72 million US adults.

The Institute for Alterative Futures. The Future of Chiropractic Revisited: 2005-2015. 2005. Chiropractic Education: Chiropractic colleges have seen a major drop in enrollment in t late 1990s due to: a demographic drop in eligible students; rising tuition costs; increasing burden of student loans; managed care's affect on t profession; A reduction in referrals, recruiting, & encouragement from practicing DCs.

Kallestad, B. FSU chiropractic school fights pits scholars against lawmakers. Marietta Daily Journal. Associated Press 2005; (Monday, January 17). Some FSU professors have been circulating a parody map showing t campus of t future, w a new Bigfoot Institute, a School of Astrology and a Crop Circle Simulation Laboratory. It's a not-so-subtle jab in a growing debate over a proposal to build a chiropractic college on this campus, t first such school at a public university in t nation. More than 500 professors, including t university's two Nobel laureates, have signed a petition opposing t school and a handful have even threatened to resign rather than teach alongside what they consider a "pseudoscience." The dispute is heading to a showdown later this month, pitting FSU faculty & doctors against chiropractors and powerful lawmakers who pushed a $9 million proposal thru t legislature. "There's a small number of faculty who would like it to happen, there is another group of faculty who would like it to die as painful a death as possible. Many faculty and physicians worry tt chiropractic isn't based on real science & tt establishing such a program could hurt t university's academic reputation. T faculty committee tt oversees curriculum voted 22-0 to stop t proposed chiropractic program.

Chapman-Smith, D. Update 2005. The chiro profession in t US is suffering difficult times.
Causes: managed care & competition, internal problems of unity, image, & public trust. Another example FSU Jan 27, 2005 vote 10-3 not to develop t chiro program. Program at FSU would have opened up opportunities for research, increased cultural legitimacy, more diverse range of students, opened door to similar programs in t future. T cancellation of FSU should serve as a wake-up call for t profession to pursue

its unity, coherent communication & enhanced research. T profession must do more to improve legitimacy to public & medicine. New initiative to establish a unified nat'l public relations program, “The Campaign for Chiropractic," w all organizations supporting one program. Led by Kent Greenawalt announced at Parker, Jan 2005. Greenawalt commissioned a new public opinion survey, results communicated at Parker & reveal a strong need for an effective, ongoing, united public relations campaign. T great majority of t public doesn't trust DCs because they are seen as salespersons, not professionals. They ranked just above state senators & well below all other major health professions. T public is prepared to try chiro for persistent pain problems but doesn't want to hear from DCs on wellness or health in general. T broader public has an indifferent or negative attitude to chiro. Very challenging findings. Need to accelerate research, strive for higher standards of practice. Develop greater integration w/i t mainstream healthcare. Engage public thru media & consumer advocacy groups. Create greater intraprofession unity. Develop geriatric chiro: a large growth area & t best in wh chiro can claim a stake in prevention & wellness. Retiring baby boomers will look for altern med to help them remain active & healthy.

Meeker, DC, Haldeman, DC, MD, PhD. Chiropractic: a profession at the crossroads of mainstream & alternative medicine. Ann Int Med 2002;136(3):217-27. Pts use of chiropractic in t US has tripled in past 2 decades (3.6% in 1980 to 11% in 1997 nat'l survey) - estimated 190 million Pt visits in a yr, about 30% of visits to all CAM practitioners. SM & forms of touching care require a level of trust between Pt & DC. Repeated visits allow a relationship to flourish & is used to communicate on social & psychological levels as well as about biological implications of care. To date at least 73 RCTs of SM in English - most published in medical & orthopedic journals; 19 papers in chiro peer-reviewed lit. 43 RCTs of SM for acute, subacute, CLBP are published. 30 favored SM over comparison Txs in at least a subgroup of Pts; 13 found no signif differences. No trial to date has found SM to be statistically or clinically less effective than t comaprison Tx. 11 RCTs of SM for NP published. have been conducted; 4 had positive findings & 7 were equivocal. Meeker, DC, 7 of 9 RCTs of SM for various forms of headache were positive. Most RCTs of SM are for MS pain & t positive effect sizes are clinically & stat signif but not dramatic. T Quebec task force on whiplash associated disorders concluded tt SM had at least "weak cumulative evidence," & recommended tt a short regimen of SM may be used as a therapeutic trial for NP. AHCPR concluded tt SM was safe & effective for ALBP, w a strength of evidence of "B." Their review of all clinical trials at t time found no other Tx to have stronger evidence. T most recent systematic review (Bronfort 1999) concluded tt there was moderately strong evidence of a short term benefit of SM for both acute & CLBP. They found insufficient evidence for or against t effectiveness of SM for sciatica.

Slosberg. Understanding Chiropractic: A Review of the Literature. A Presentation for Medical and other Health Professionals 2004. 140 Slides. Presentation Topics include: Increased Utilization of Chiropractic, Complementary & Alternative Care (CAM) –

Current Trends; Evidence Based Practice Guidelines; Chiropractic Education; Selected Clinical Trials; Cervical Manipulation & Risk of Stroke; Basic Mechanics and Neurology of Spinal Manipulation; Natural History of Musculoskeletal Problems; Chiropractic & Exercise to Improve Patient Outcomes; Patients referral for chiropractic care. For more information contact Dr. Slosberg at (925) 426-1137.

Kaptchuk, OMD, Eisenberg, MD. Chiropractic Origins, Controversies, and Contributions. Arch Intern Med 1998; 158: 2215-2224 (Harvard Med School -funded by NIH grant). It's no secret tt LBP & chronic pain are t Achilles' heel of biomedicine & present an opportunity for alternative care. Many large surveys leave little doubt tt Pts believe chiro works for them. Pts perceive chiro as a valuable component of their health care. Most comparison clinical trails show SM to be better & no trial finds it to be significantly worse than conventional Txs. Chiro adjustments evoke an experience of change so palpable tt t Pt can often hear it in t characteristic "pop" or "crack" indicating tt a state of greater mobility has been achieved. A perception of transformation has been audibly triggered. T chiro approach to healing relies on t opposite of double-blindedness; it enlists t full participation & awareness of both parties. Chiro will undoubtedly be an important & prominent feature of US health care. Part of its strength lies in t art of healing & Pt-Dr relationships. For people w chronic pain & other chronic conditions, t chiro visit itself can be a source of comfort. Tx by a DC can generate a sense of understanding & meaning, an experience of comfort, an expectation of change & a feeling of empowerment. Chiro's combination of innate intelligence & simple mechanical explanation can give a rich vocabulary to just those illnesses conventional med remains poorly equipped to address. Chiro finds its voice exactly where biomedicine becomes inarticulate. Too often, biomedicine fails to affirm a Pt's chronic pain. Pts think their experience is brushed aside by an MD who treats it as unjustified or unfounded, attitudes tt heighten a Pt's anguish & suffering. DCs, by rooting pain in a clear physical cause, validate the Pt's experience. DCs have consistently offered the promise, assurance, & perception of relief. Chiropractic's ultimate lesson may be to reinforce the principle that the Pt-physician relationship is fundamentally about words & deeds of connection & compassion.

ACA. Utilization, Costs, and Effects of Chiropractic Care on Medicare Program Costs. ACA Today 2001:3. Study commissioned by ACA & completed in June 2001 by Muse & Associates is t first study to compare global, per capita Medicare expenditures of chiro Pts receiving care in t Medicare program. Data is from Medicare's Standard Analytical Files for 1999 -(most recent available cost data). T executive summary states: Results strongly suggest tt chiro care signif reduces per beneficiary costs to t Medicare program. Chiro services could play a role in reducing costs of Medicare reform &/or a new prescription drug benefit. The study found: 1. Beneficiaries who received chiro care had lower ave average. 2. Medicare payments for all Medicare services than those who did not: $4,426 vs $8,103. 3. Averaged fewer Medicare claims than those who did not; had lower average Medicare payments per claim than those who did not. Results will be used to bolster legislative efforts to expand t avail-

ability of chiro care in Medicare & expand chiro related services tt Medicare would reimburse to all services tt they are authorized to provide under state law. Chiro Pts' Freedom of Choice Act (H.R. 902)

Nelson, DC, MS. Effects of inclusion of a chiropractic benefit on the utilization of health care resources in a managed care health plan. WFC 2003. A 4 yr study using administrative claims data comparing 700,000 health plan members w chiropractic coverage to 1 million member w/o chiro coverage to evaluate t effects of chiro coverage on total health care costs, rate of utilization of specific high-cost procedures, cost of management of specific NMS conditions, & whether chiropractic care is used as a substitution care or add-on care in a managed care health plan. Results: Members w chiro coverage were younger (mean 33 vs 36) & less likely to have specific comorbid medical conditions (for 6 selected conditions) vs to those w/o chiro coverage. Total health care costs for members w chiro coverage was 12% lower than for those w/o coverage. In health plan members Tx for NMS conditions, total health care costs were 13% lower for those w chiro coverage. Cost of treating episodes of LBP was 28% lower in those w chiro coverage. BP Pts w chiro coverage had fewer inpatient stays (9.3 vs 15.6 stays per 1000 Pts). MRI rate was lower for BP Pts w chiro coverage (43.2 vs 68.9 MRIs per 1000 Pts). Rate of LB surgery was lower (3.3 vs 4.8 per 1000 Pts). BP Pts w chiro coverage received fewer radiographs (17.5 vs 22.7 per 1000). Data also demonstrate tt most chiro care is a substitution for medical care w/i t health plan. Conclusion: Inclusion of a chiro benefit in a managed care plan results in a reduction in overall utilization of health care resources & cost savings. If all 1.7 million members had chiro coverage t plan would have saved $47.5 million over 4 yrs. Cost reduction due to: 1. A favorable selection process; 2. A substitution effect of chiro for medical care; 3. Lower rates of use of high cost procedures; 4. Lower cost management of care episodes by DCs.

Sherman, R. Chiropractic treatment of workers' comp claimants in the state of Texas, MGT of America submitted to the Texas Chiropractic Association. 2003. Texas Chiro Assoc (TCA) funded independent study (by MGT of America) of use & effectiveness of chiro in work comp. Chiro care was assoc w signif lower costs & more rapid recovery in Tx of workers w low back injuries & is not a contributor to t state's rising work comp costs. More than 70 articles/ studies on cost & effectiveness of chiro care. MGT also analyzed data on @ 900,000 work comp claims filed from 1996-2001. Only 14.6% of claimants were Tx by DCs, only 8.5% received >½ of their Tx from DCs. Chiro care accounted for only 12.5% of medical fees & 6.9% of t total work comp costs. Figures don't include pharmaceutical costs (insurers aren't required to provide this), wh if included would reduce t percent of costs from chiro care. DCs Tx about 30% of workers w lower back injuries but were responsible for only 17.5% of t Tx costs & 9.1% of t total costs. T ave claim for a worker w a low back injury was $15,884, but if t worker received at least 75% of care from a DC, t total cost per claimant decreased by nearly one fourth to $12,202. If t DC provided at least 90% of t care, ave cost declined by > 50% to $7,632. "T existing body of research indicates tt chiro is a cost-effective means of Tx for MS injuries & is assoc w lower Tx costs & more rapid recovery in t

overwhelming majority of studies of chiro & work comp costs."

Cherkin, PhD, Mootz, DC. Chiropractic's Identity Crises. Synopsis, research priorities, & policy issues. In Adams, DC et al. Chiropractic in the United States: Training, Practice and Research. AHCPR.1997; Chap XII: 117-130. Some DCs attempt to prevent recurrences of a problem & t development of other illnesses, or to enhance general health. It's important to research if chiro can prevent recurrences of MS problems, prevent illness, or enhance health. Most Pts seek chiro for MS problems, primarily LBP. But chiro has positioned itself not only as an altern source of health care, but as a separate profession w a distinct health care philosophy. This has created an identity crisis w/i chiro. T profession is unclear about whether it is a comprehensive, holistic alternative to med or a clearly defined MS subspecialty. DC practices include characteristics consistent w primary care: They are directly accessed, frequently coordinate care w other providers, obtain special studies, develop continuing relationships w Pts & emphasize prevention strategies. But DCs don't offer a comprehensive array of med Tx strategies. Limitations of clinical training in multidisciplinary settings, scope of practice, & comprehensiveness of services by DCs need to be overcome before those outside t profession will be comfortable w t idea of DCs as PCPs. The MS specialist view of DCs poses a hazard for chiro. Because Tx of MS problems is provided by PTs & OTs by referral from MDs, there's concern tt DCs may be viewed as a duplication of existing medical management options. But, given tt >90% of billable manip is provided by DCs an argument can be made tt they provide a unique service. The chiropractic profession needs to clarify its role & strive to ensure that both training & practice are consistent with that vision. The profession needs to establish a credible & supportable clinical identity. Marketing & patient education should focus on prevention, wellness, rapid resolution of disorders, & self-reliance for common health problems.

Chiropractic and Medical Education

Coulter I, PhD et al. A comparative study of chiropractic and medical education. Alternative therapies 1998;4(5):64-75. Ave GPA for entrance at Med College 3.56, at Chiro 2.90. Ave min of 100.94 semester hrs for Med for Chiro 64.06 hrs. Curriculum of 3 chiro & 3 med schools (CA, TX, IA): Chiro total 4800 hrs, Med total of 4667 hrs, but w additional 3 yrs of graduate ed to meet requirements for practice. Largest difference is in clinical clerkship: Med 3467 hrs, Chiro 1405 hrs. But, chiro students take 1975 hrs in chiro clinical sciences combined w clerkship total 3380. In med, clinical sciences are combined w clinical clerkship totaling 3467. Basic Sciences: DCs taught additional 290 hrs of basic sciences (29% of curriculum) in med (26%). Same basic sciences courses: Same number of hrs of Microbiology (ave: 120 hrs); Chiro teaches more hrs in Pathology (205 vs 162); More anatomy & phys in Chiro : 570 hrs Anatomy (40%), Phys 205 hrs (21%) in Med: 368 hrs Anatomy (31%) & 142 hrs Phys (12%)). Clinical clerkships/internships: 3467 (74%) med vs 1405 (29%) chiro. But 44% to 50% of chiro program is dedicated to chiro clinical sciences wh have no equivalent in med. Combining chiro clin sci w clin clerkships comes to 3380 in chiro school.

Medical students receive twice t no of hrs in clinical experience but 1000 fewer hrs in lectures & labs. Clinical experience doesn't include med residency after grad, if residency is included clin experience becomes 5227 hrs vs 1405 for chiro.

Common Characteristics Shared by Discs and Articular Cartilage. 1) Occur in weight bearing joints and are subjected to repetitive load bearing. 2) Are viscoelastic/deformable structures: a) Deform under loading; b) Exhibit creep deformation in response to sustained loads. 3) Are avascular. Blood vessels would be disrupted under the loads they would be subjected to if they supplied disc & cartilage.

Mooney, Vert, MD. backstrong.com; 2001. Neither the disc's nucleus nor annulus have their own blood supply so all the cells living in this tissue must gain nutrition by diffusion to keep alive. These cells make the collagen and proteoglycans that give tissue resilience. Because there are less cells in the disc compared to tissues anywhere else in the body, it is very slow to repair. Even worse, it is very easy for these relatively few cells to be cut off from their supply of nutrition due to local swelling or barriers for diffusion. That is one of the major reasons why recurrent back pain is so common. Discs cannot repair themselves very well. Because the disc does not have its own blood supply, it's nutrition must be achieved by the disc swelling up with water and having it squeezed out with physical activities - like a sponge that soaks up water which then can be squeezed out. Thus we see that physical activity is really the pump for exchange of fluid in the disc. Important in achieving a healthy back is to provide a mechanism to improve disc hydration. Physical activity which creates a pumping force is the mechanism by which exchange of fluid within the discs occur. This is best achieved by loading and unloading the lumbar spine. Repeated cycling from flexion to extension, and extension to flexion, should achieve the appropriate hydration.

Common Acute Mechanical Back Pain & Soft Tissue Subfailure Injuries

Herzog, PhD. Symons, DC, PhD. The mechanics of neck manipulation with special consideration of the vertebral artery. J Canadian Chiro Assoc 2002; 46(3): 134-6. For mechanical injury to occur, the forces (stresses) in the tissue must exceed the microstructural and macrostructural failure limits of t tissue.

Mooney, MD. J Musculoskeletal Medicine 1995; Oct: 33-39. Common acute BP is due to chemical abnormalities created by a soft tissue tear. The tear represents a mechanical disruption which is usually microscopic. X- rays demonstrate no changes before & after an acute back injury. Soft tissue tears are associated with edema & swelling. Distention of innervated tissue creates pain. **In soft- tissue injuries progressive physical activity evacuates extracellular & extravascular fluid**. This justifies the recommendation of early mobility for injured tissues. **Subfailure Injury.**

Mooney, V. MD. How to have a healthy back. backstrong.com. 2003. With inflammation, swelling of the tissues results & aggravates nerves. Local swelling hurts because tissue is stretched. Thus, the goal of Tx in acute painful situations is to reduce swelling by increasing motion & improving fluid exchange. Connective tissue - fascia, ligaments, tendons - have a high density of fibers because they have to be very strong for their size, so there is very little room for blood vessels. Thus, the problem is limited nutrition to the cells. If connective tissue motion is diminished, fibers begin to glue together with cross-links resulting in stiffer tissue, which is no longer flexible and can tear when sudden overload occurs. To maintain the health of connective tissue, motion is necessary to maintain flexibility & elasticity. Motion can avoid the formation of cross-linking & enhance nutrition to the cells.

DeLeo, PhD, Winnem, PhD. Physiology of Chronic Spinal Pain Syndromes. Spine 2002; 27(22):2526-37. Spinal tissue (disc, muscle, etc) or nerve root injury sets into play the synthesis and release of numerous inflammatory mediators that not only induce inflammation and edema, but also sensitize NCs & recruit new NCs to enhance the pain. Mediators include: bradykinin, substance P, histamine, 5-HT (serotonin), glutamate, Acetylcholine, ATP, cholecystokinin, eicosanoids (PGE2, PG12, LKB4).

Drezner, MD, Herring, MD. Managing LBP. Steps to optimize function and hasten return to activity. Phys & Sports Med 2001; 29(8). Back strains or sprains imply some degree of muscle stretching or microscopic tearing of t muscle fibers &/or ligaments. Pain results from mechanical or chemical irritation of NC nerve fibers. Precise identification of t anatomic pain generator is difficult. Local tenderness & muscle spasm, limited ROM, & normal neuro exam are t usual findings. Radiating pain is unusual, & walking & sitting are generally uncomfortable but not unbearable.

Panjaabi, PhD. Simulation of whiplash trauma using whole cervical spine specimens. Spine 1998; 23(1):17-24. 84% of all neck injuries are classified as low severity soft tissue injuries & result mainly from low velocity impact collisions. Soft tissue whiplash injuries include interspinous lig tears, disc rupture, strains of cervicocapital jt complex, ligament flavum rupture, disruption of facet jts, overstretching of anterior muscles & have been documented during surgery. T majority of whiplash Pts do not undergo surgery & their soft tissue injuries remain undetected. Only severe injuries tt show complete ruptures are documented. Incomplete or **subfailure injuries** of ligs are seldom noted. Soft tissue injuries assoc w whiplash often are not visualized on routine radiographs or CT scans. Even at surgery, t view of t surgeon is limited to t operating field & only soft tissues tt are completely torn/avulsed are documented. Less severe injuries & those away from t site of surgical exposure are not seen. T soft tissue in low velocity impact such as whiplash is seldom torn completely. Most likely it is stretched beyond its elastic limit, resulting in an incomplete injury.

Ito, S.,Ivancic, P. C., Panjabi, M. M., Cunningham, B. W. Soft tissue injury threshold during simulated whiplash: a biomechanical investigation. Spine 2004; 29(9): 979-87. Chronic pain resulting from low-speed collisions may be explained by partial tears of

t soft tissues, including anulus fibers, ligaments, & avascular cartilage. Because of poor blood supply, these tissues may not completely heal following injury, resulting in altered cervical spine kinematics tt can lead to accelerated degenerative changes & clinical instability.

Yoganandan, PhD et al. Whiplash injury determination with conventional spine imaging and cryomicrotomy. Spine 2001; 26(22): 2443-8. Soft tissue injuries to the cervical spine were produced in 4 intact human cadavers that underwent single whiplash acceleration (3.3g or 4.5g) loading via a whole-body sled to replicate injuries from whiplash. Pre & post-test X-ray, CT & cryomicrotomy were used to visualize injuries. Results: X-rays identified the least lesions (1 in 2 specimens). CT identified 3 lesions in 2 specimens, but trauma was not readily apparent to all soft tissues of the cervical spine. Cryomicrotome sections identified 17 structural alterations in 4 specimens to t lower cervical spine including stretch & tear of the ligamentum flavum, anulus disruption, anterior longitudinal ligament rupture, and facet joint compromise w tear of capsular ligaments. Conclusions: Results clearly indicate that whiplash acceleration can induce soft tissue & ligament alterations to the C-spine. Pathologic changes assist in the explanation of pain arising from this injury. CT is better than X-ray, but subtle, clinically relevant injuries may be left undiagnosed w either technique. Cryomicrotomy offers a procedure to understand soft tissue-related injuries to the cervical anatomy due to whiplash. Recognition of these injuries advances the knowledge of the whiplash disorder. In whiplash, often t severity of impact is considered to be of low magnitude & doesn't induce bony damage (Fx & subluxations). Radiographs are routinely assessed as normal. Thus, t injury does not lend itself to objective identification by traditional imaging methods. Cryomicrotomy showed abnormalities in all specimens' anterior & posterior columns - frequently confined to t lower spine, often at C5-6 & attributed to extension injury. A-P sliding of facet jts assoc w pinching, shear & capsular strains may compromise jt integrity. This can be painful because facet jts are rich in NCs wh can be excited by motions exceeding physiologic limits. T study shows evidence for potential neck pain secondary to abnl motions in these soft tissues. T more occult whiplash assoc injuries are less understood than Fx & subluxations. Lack of objective radiographic findings has often led to t dismissal of Pts' Sx. Recent acknowledgment tt whiplash assoc injuries do occur has led to t acceptance of Pts' pain. The study clearly shows tt structural alterations occur to t head-neck complex as a result of whiplash & tt these alterations are not seen on routine X-rays & CT. These findings help define t injuries & potential sources of pain (caused by structural abnormalities) in whiplash. A better understanding of these injuries will allow better Tx.

Uhrenholt, L. DC, Niels Grunnet-Nilsson, DC, MD, PhD, et al. Cervical spine lesions after road traffic accidents. Spine; 2002 27(17): 1934-1941. A literature review to determine if occult pathoanatomical lesions in t C-spine of MVA fatalities exist. Study identified 3 high quality studies wh used cryomicrotomy & a ctl grp. Subtle lesions found exclusively in MVA fatalities & not in t ctl grp included: Minor tears of t AF at t vertebral rim; Disc disruption w herniation; Avulsions & partial separation between t

endplate & vertebrae; Articular cartilage microfractures; Hemarthrosis or capsular swelling or brusing; New vertebral Fxs; Bruising of synovial folds. Conclusions: Occult lesions in cervical discs & facet jts after fatal MVAs exist. Present imaging methods, esp radiography, do not visualize these subtle lesions. Radiologic exam is very insensitive for detecting subtle spinal lesions. Jonsson et al found radiograms identified only 4 of 245 lesions found later at autopsy in 22 MVAs fatalities. Taylor & Twomey found tt none of t lesions found at autopsy were identified at postmortem radiography in 16 Pts. Taylor & Taylor found tt postmortem radiologic exam of 58 Pts failed to detect 199 (64.4%) of 309 lesions visible in sectioned specimens. A total of 93.5% of t minor lesions were missed. Nonlethal injuries in C-spine fatalities indicate what may occur if people are subjected to nonlethal forces. Nonfatal MVAs may result in similar lesions. Negative clinical & radiologic exam do not prove t absence of pathoanatomical lesions.

Sterling, M., Jull, G et al. Development of motor system dysfunction following whiplash injury. Pain;2003 103(1-2): 65-73. Study of motor system function in 66 whiplash Ss w/i 1 mo and 2 & 3 mo F-U for 1) cervical ROM, 2) joint position error (JPE); 3) activity of the superficial neck flexors (SCM EMG) during a cranio-cervical flexion test. At 3 mo Ss were classified using NDI scores as recovered (<8); mild pain & disability (10-28); moderate/severe pain & disability (>30). Motor system function was also measured in 20 ctls. Results: 62% reported ongoing pain at 3 mo. 29% reported persistent moderate or severe Sx. All whiplash grps demonstrated decreased ROM & increased SCM EMG 1 mo after injury. Decreased ROM persisted in the moderate/severe Sx grp, but returned to normal in those who recovered or had mild pain at 3 mo. Only the moderate/severe group showed greater JPE, w/i 1 mo of injury, wh remained unchanged at 3 mo. Increased SCM EMG activity persisted for 3 mo in all whiplash groups. Deficits in t motor system were detected at 1 mo after whiplash injury & persisted not only in those reporting moderate/severe Sx at 3 mo but also in those who recovered or had persistent mild Sx & indicates alterations in patterns of muscle activation & recruitment previously found in both both traumatic & non-traumatic chronic NP Pts. LBP research shows altered muscle recruitment persists despite Pts reporting recovery & may be a factor involved in high rates of recurrence. Acute MS pain is can induce changes in motor system function wh persist over time & may be a consequence of t initial peripheral NC input in t acute stage.

Siegmund, PhD et al. Awareness affects the response of human subjects exposed to a single whiplash-like perturbation. Spine 2003; 28(7): 671-9. Most whiplash injuries occur in rear-end collisions w/o warning, but whiplash studies use Ss aware of an imminent impact. This study looks at how awareness of impending whiplash-like perturbation affects neck muscle response, and head & neck kinematics. 35 women & 31 men underwent a single forward horizontal perturbation while EMG measured SCM & cervical paraspinal muscle activity. Pt randomized into 3 grps: 1) a countdown for Ss alerted to t impact, 2) an impact w/o an alert in Ss who expected it w/I 60 sec. & 3) an unexpected impact for surprised Ss who were deceived. Results:

Muscle & kinematic responses were delayed in surprised Ss. Cervical paraspinal amplitudes were 260% larger & angular head accelerations in flexion were 180% larger in surprised vs alerted men. Surprised women had a 25% larger head retraction than aware women. Conclusions: The larger retractions (rearward horizontal translation of t top relative to t bottom of t C-spine) in surprised women likely produce larger tissue strains & & may increase injury potential. Aware Ss may not replicate muscle & kinematic responses, or injury potential of unprepared occupants in real collisions. Surprised Ss respond differently to a whiplash-like perturbation than Ss aware of impending impact. This calls into question t applicability of muscle, kinematic, & clinical response data of whiplash experiments using aware human Ss. Studies of clinical Sx generated in whiplash experiments may underestimate t risk of injury in real collisions.

Falla, D. PT, BPhty, PhD et al. Patient with chronic neck pain demonstrate altered patterns of muscle activation during performance of a functional upper limb task. Spine 2004;29(13): 1436-1440. Study of neck muscle activation (SCM, ant scalenes, upper trap - EMG activity) during & after repetitive upper limb task between Pts w idiopathic neck pain, whiplash & healthy controls. Results: greatest EMG amplitudes in SCM, ant scalenes, & left upper trap in whiplash Pts, w lowest amplitudes in ctls. In upper traps – greatest amplitude in ctls & lowest in whiplash Pts. Pts w neck pain demonstrated greater activation of accessory neck muscles during a repetitive upper limb task. This may represent an altered pattern of motor control to compensate for reduced activation of painful muscles. Greater activity of t superficial neck muscles in neck pain Pts could be an altered motor strategy for reduced deep muscle activation. Reduced contractile capacity of t deep cervical flexor muscles has been associated w increased activation of superficial cervical flexor muscles.

Ferrari, R. ,A. S. Russell. Survey of general practitioner, family physician, and chiropractor's beliefs regarding the management of acute whiplash patients. Spine 2004; 29(19): 2173-7. Survey of 362 MDs & 88 DCs. >89% of MDs & 76% of DCs believed tt encouraging maintenance of normal activities, even if they hurt, is important in the recovery from whiplash. 91% of MDs & 84% of DCs agreed tt exercise therapy was effective in acute whiplash. MDs are more likely to have negative feelings about treating patients who have whiplash & were more likely to believe there was nothing physically wrong w many patients w chronic whiplash, & agree that NSAIDs & muscle relaxants are effective in acute whiplash. DCs are more likely to agree that traction, TENS, SM, massage, & acupuncture are effective in acute whiplash. Conclusions: MDs & DCs generally hold beliefs that are consistent with the current evidence regarding the most helpful approaches to acute whiplash, although chiropractors were more likely to be supportive of passive therapy methods. NSAIDs are useful: MDs agree: 81.5%; DCs agree: 61.2%;
Massage is useful: MDs agree: 60%; DCs agree: 85.5%; Manipulation is useful: MDs agree: 16.3%; DCs agree: 94.5%.

The Recurrent Nature of Back & Neck Pain

Waddell, MD et al. **Clinical guidelines for the Management of Acute Low Back Pain. Royal College of General Practitioners** 1996: 26. **Red Flags for Possible Serious Spinal Pathology**. Age of onset <20 or >55 yrs; Violent trauma; Constant progressive, non-mechanical pain; Thoracic pain; Past Med Hx of Carcinoma; Systemic Steroids; Drug abuse; HIV; Systemically unwell; Weight Loss; Persisting severe restriction of lumbar flexion; Widespread neurology; Structural Deformity
Simple Backache -Mechanical Origin: Presentation between ages 20 - 55; Lumbosacral region, buttocks & thighs; Pain of mechanical nature; Varies w physical activity; Varies w time; Patient well; Prognosis good: **90% recover from acute attacks in 6 wks**.
Nerve Root Pain: 1. Unilateral leg pain worse than LBP; Pain generally radiates to foot or toes; 2. Numbness & paresthesia in the same distribution; 3. Nerve irritation signs: Reduced SLR wh reproduces leg pain; 4. Motor, sensory or reflex change limited to one nerve root; 5. Prognosis reasonable: 50% recover from acute attack w/i 6 wks.
Risk Factors for Chronicity: Previous Hx of LBP; Total work loss due to LBP in 12 mo; Radiating leg pain; Reduced SLR; Signs of Nerve Root involvement; Reduced trunk muscle strength & endurance; Poor Physical Fitness; Self-rated poor health; Heavy Smoking; Psychological distress & depressive Sx; Disproportionate illness behavior; Low job satisfaction; Personal problems - alcohol, marital, financial; Adversarial medicolegal proceedings.
Cauda Equina Syndrome: Difficulty w micturition, Loss of anal sphincter tone or fecal incontinence, Saddle anesthesia about t anus, perineum or genitals, Widespread or progressive motor weakness in legs or gait disturbance, Sensory level.
Manipulation. Waddell, MD et al. Clinical guidelines for the Management of ALBP. RCGP 1996: 15. There are 36 RCTs of SM for LBP. 19 report positive results & 5 more, positive results in subgroups. There is very little evidence available on SM in Pts w nerve root pain. W/i t first 6 wks of acute or recurrent LBP, SM provides better short-term improv't in pain, activity levels & higher Pt satisfaction than other Txs w wh it has been compared. There is no firm evidence tt it's possible to select wh Pts will respond or what kind of SM is most effective. T evidence is inconclusive as to whether SM for LBP of > 6 wks duration provides clinically signif imporv't in outcomes compared w other Txs. There is conflicting evidence from RCTs & lit reviews on t effectiveness of SM in CLBP. Risks of SM for LBP are very low if carried out by a trained practitioner. SM should not be used in Pts w severe or progressive neuro deficits in view of rare but serious risk of neuro complication.
Recommendation: Consider SM w/i t first 6 wks for Pts who need additional help w pain relief or who are failing to return to nl activities: W/i first 6 wks of onset, SM can provide short-term improv't in pain & activity levels & higher Pt satisfaction. Evidence is inconclusive tt SM produces clinically signif improv't in CLBP. Risks of SM are very low in skilled hands
Back Exercises: Waddell, MD et al. Clinical guidelines for the Managm't of ALBP. RCGP 1996: 15. There are now 28 RCTs of specific back exercises for LBP but many are of poor quality. Based on t evidence it is doubtful tt specific back exercises produce clinically signif improv't in ALBP or tt it is possible to select wh Pts will

respond to wh exercises. McKenzie exercises may produce some short-term Sx improv't in ALBP. There is some evidence tt exercise programs & reconditioning can improve pain & functional levels in Pts w CLBP. There are strong theoretical arguments for exercises & reconditioning by 6 wks rather than later.

Waddell G. MD. The Back Pain Revolution. Churchill Livingstone 1998: 35. One of the main characteristics of BP is that it often runs a fluctuating or recurring course. **An isolated acute attack with no previous history & complete recovery is rare.** Each attack or episode of health care may be against a background of recurrent attacks or persisting minor symtoms. The most important feature of chronic pain is not its duration but its impact on the Pt's life.

The Recurrent Nature of Back Pain

Frank, MD. Brit Med J 1993; April 3: 901-9. Reviews a study in which 373 Ps under 40 yrs old, with their first onset of back pain are followed for 10 yrs. 89% had recurrences & only 33% had no lost time from work from future back problems. **Strategies to manage low back pain must be long term & preventive.**

Waddell, MD. JMPT 1995;18(9):590-596. Traditional teaching is that 90% of LBP attacks recover w/i 6 wks, but recent natural history studies suggest that this is overly optimistic & over-emphasizes RTW. It now seems that 50% of attacks settle w/I 4 wks, but 15-20% have some symptoms for at least 1 yr. 70% of Pts who have ABP. will suffer 3 or more recurrences 20% of Pts w LBP will continue to have some back Sx over long periods of their lives. LB disability affects @ 3-6% of t pop each yr. Back Sx are t most common cause of disability for people under t age of 45. Benefits for LBP in Britain are rising more quickly than for any other cause of chronic incapacity.

McGorry RW, MSBE, PT et al. The relation between pain intensity, disability, and the episodic nature of chronic and recurrent low back pain. Spine 2000;25(7): 834-841. Two thirds of the people who have had back pain in the past can be expected to have some symptoms every year.

Wiesel, MD. Backletter 2002;17(1):1,8-10. The universe of back pain sufferers in t US exceeds 100 million people every year.

Saal JA, MD. Spine 1997;22(14):1545-1552. The major premise used in the MC system for the primary care of LBP is based upon the assumption that 90% of Pts improve in 6 to 12 wks. However, a natural Hx study by Von Korff found tt approx 60% will recur. In a study of BP in primary care, Von Korff & Saunders found tt 60% to 75% improve w/i the first month, 33% report intermittent or persistent pain at one year, & 20% of Pts describe substantial limitations at 1 yr. **The premise for the AHCPR guidelines & MC for BP is not valid**.

Mooney, MD. J Musculoskeletal Med 1995; Oct: 33-39. Most soft tissue injuries heal

spontaneously within 6 wks if there is not total disruption & instability. Failure to heal within 6 wks is probably due to poor blood supply, insufficient stimulus to repair or uncontrolled mechanical stresses exceeding the tolerance of the healing tissues. Tissues which fail to heal over 6 to 8 wks probably will not heal itself & should be considered a chronic injury.

Kannus, MD, PhD. Phys & Sportsmed 2000; 28(3): 55-63. Approximately 6 to 8 wks postinjury, the new collagen fibers can withstand near normal stress, although final maturation of tendon & ligamentous tissue may take as long as 6 to 12 months.

Lawrence, MPH et al (NIH Nat'l Institute of Arthritis & MS & Skins Diseases). Estimates of the prevalence of arthritis and selected musculoskeletal disorders in the United States. Arthritis & Rheumatism 1998; 41(5):778-99. BP is pervasively common, about half of adults have BP in any given yr. T usual course is rapid improv't, but **5-10% develop persistent back Sx. BP tends to relapse - most Pts will experience multiple episodes. T usual natural Hx is one of recurrence.** About 15% report LBP lasting longer than 2 wks in t past yr. Persistent pain, (>3-5 mo) occurred in 5-10% of Pts w BP. Only 1.6% report BP w sciatica of >2 wks at some time in their lives & 1% report being told they had a slipped or ruptured disc in any given yr. Lifetime prevalence of being told a Pt had a ruptured disc was 2.1%. Among working ages (20-64 yrs) >26 million in US have frequent LBP. Ages 65 & older almost 6 million have frequent LBP.

Croft PR, MD et al. BMJ 1998;36:1356-1359. Outcome of low back pain in general practice. 463 Pts saw a general practitioner (GPs) for LBP in a 12 mo period. Pts hadn't seen their GP for LBP in past 3 mo & had a new episode of LBP. 59% of Pts agreed to be followed by nurses & interviewed w/i 1 wk of their first visit, at 3 & 12 mo to determine t outcome of t LBP episode based on pain & disability scales. 59% of 463 Pts saw their GP only once in t 6 mo after 1st visit. 32% of Pts did consult again, but only w/i t first 3 mo & only 8% of Pts had visits for >3 mo. By 3 mo only a minority of LBP Pts recover & there was little increase in t percent who recovered by 12 mo, **emphasizing t recurrent & persistent nature of LBP**. Findings are in sharp contrast to t assumption tt 90% of LBP in primary care resolves w/i 1 mo. Many Pts seeing GPs for t 1st visit for an episode of BP had Sx for 1 mo or more. Although Sx improve, most still have pain or disability 12 mo later but, are no longer seeing their MD. Only 25% have fully recovered 12 mo later. We should stop characterizing LBP as multiple acute problems, & a small number of chronic, long term problems. LBP is a chronic problem with an untidy pattern of Sx & periods of relative freedom from pain & disability interspersed w acute episodes, exacerbations & recurrences. A previous episode of LBP is t strongest risk factor for a new episode. By age of 30 almost half t population have had a substantive episode of LBP. **These figures simply do not fit w claims tt 90% of episodes of LBP end in complete recovery**.

Carey, MD.Spine 2000; 25(1):115-120. Once disabling symptoms are present for 3 months, t majority of Pts will begin a career of impairment tt affects almost all

aspects of their lives says Carey, MD. (presented at Society of Gen Internal Med in SF 1999). Functional disability at 1 month was a strong predictor of chronicity. Lack of functional recovery at 1 mo appeared to be t best early predictor of long-term impairment. More than half of those who were impaired at 4 wks were impaired at 22 months. Pts who had intractable BP for 3 mo had even worse outcomes. 2/3ds of Pts who had continuous Sx at 3 mo had functionally disabling Sx at 22 mo.

Schiottz-Christensen B, et al. Long-term prognosis of ALBP in patients seen in general practice. Family Practice 1999;16(3):223-232. A prospective longitudinal study in Denmark of Pts w ALBP. Pts (18-60 yrs), consulting their GP due to an episode of LBP lasting <2 wks. Pts could have no LBP in previous 6 mo. Outcome (sick leave, pain & functional or complete recovery were measured at 1, 6 & 12 mo. **Functional recovery**: t ability to manage ordinary ADLs; **Complete recovery**: feeling of well-being w regard to LB problems. **Results**: 503 Pts were F-U. 50% of Pts on sick leave RTW w/i 8 days; at 1 yr, only 2% remained on sick leave. At 1 yr, 45% of Pts continued to complain of LBP. Factors most assoc w poor long-term LBP outcome were 1) severity of LBP at inclusion, 2) assm'ts by t GP of susceptibility to develop chronic LBP & 3) a Hx of LBP having caused previous sick leave. **Conclusions**: LBP in general practice has a good prognosis w regard to sick leave, but a high proportion of Pts continue to complain of LBP. Even though nearly all t Pts had RTW at 1 mo, 16% did not consider themselves functionally recovered. This figure declined to 8% at 12 mo. At F-U at 6 & 12 mo, 53% & 46% of t Pts did not consider themselves completely recovered. At yr, about 50% continued to complain of discomfort, indicating tt an acute episode of LBP causing a visit to a GP is followed by a longer period w low-grade disability than previously expected. Although work loss is well-defined & often-used outcome, it is too insensitive for use as a comprehensive single outcome in studies of LBP. @ 15% of Pts were on sick leave between F-Us, indicating a recurrent pain pattern. One reason for t low predictive value of t Hx of t index episode & t traditional PE may be tt this set of Dx procedures was developed mainly in hospitals to identify surgical Pts wlumbar disc herniation. In general practice, however, t vast majority of Pts have unspecified LBP, only 2 Pts of 503 had an operation for lumbar disc herniation in this study. It is therefore not surprising tt t predictive powers of t various test differ between t 2 populations.

van den Hoogen, Koes, PhD et al. On the course of LBP in general practice: a one year follow up study. Ann Rheum Dis;1998 57(1): 13-9. Dutch study investigates the course of LBP in Pts given usual medical Tx in general practice. 269 Pts completed all F-U questionnaires. Results: At 12 wks 35% & at 1 yr 10% of Pts still suffered LBP. Pain & disability diminished quickly after initial visit, & both stabilized at a lower level if LBP didn't completely disappear. Time to recovery for Pts w more chronic LBP (>7 wks) was 4 wks longer than for Pts w more acute LBP. 3 of 4 Pts (76%) endured one or more relapses w/i a year. Median time to a relapse was 7 wks, & its duration was about 6 wks. Pain & disability were less severe during relapses. Conclusions: For most Pts, t clinical course of LBP in general practice clearly is less favorable than expected. It takes more than just a few weeks to recover, & relapses occur w/i a year

in most cases. Relapse rates by far exceeded our expectations. 76% (3 of every 4 Pts) endured one or more relapses. Our review of t lit did not reveal any data on t relapse rates of LBP in general practice. The high relapse rate indicates tt our concept of LBP as an incidental & temporary problem may be false in many cases presented in general practice. LBP in many cases should be viewed as a recurrent illness. This implies tt t Tx of LBP should be changed accordingly. Therapeutic intervention may be highly valid if relapses are prevented.

Ferguson, S. A., W. S. Marras, et al. Longitudinal quantitative measures of the natural course of low back pain recovery. Spine. 2000; 25(15): 1950-6. A study w evaluation every 2 wks for 3 mo to quantify ALBP recovery in 32 LBP Ss w no radicular Sx (16 occupational and 16 nonoccupational) based on 1) work status, 2) Pain, 3) ADLs, 4) Trunk Kinematics (Objective validated functional performance) - measuring ROM, flexion & extension velocity, flexion & extension acceleration from each plane as well as twisting positions at 0 deg, 15 deg, & 30 deg clockwise & counterclockwise. T trunk kinematic provides a quantitative measure of recovery, comparable to t traditional Sx & ADLs, but independent of t subjective impression of t Pt or MD. Results: Most Pts continued to work during t ALBP episode. RTW underestimated the percent of Ss impaired compared to all other outcomes. Pain, ADLs, & trunk kinematics all showed similar patterns of recovery for 0 to 12 weeks. At 14 weeks, functional performance recovery lagged behind. Both pain & ADLs indicated that 80% of the population was recovered, functional performance indicated the figure to be 68%. Conclusion: Use of several outcome measures may lead to a better understanding of LBP recovery or residual impairment & may minimize risk of recurrent injury. Findings indicate tt people continue to work although subjective Sx & objective functional performance measures show them to be impaired. RTW may be a misleading outcome. This study's results clearly denote tt RTW is a misleading indicator of impairment. It's hypothesized tt lost time is a function of psychosocial factors, physical job demands, etc & not of functional performance, Sx, or ADLs. T correlation between work status & t other 3 major outcomes were all weak, indicating tt work status recovery is independent of workers' functional performance, Sx or ADLs.

Wiesel, MD. Fourth International Forum for Primary Care Research on Low Back Pain. Backletter 2000; 15(5): 42, 52, 53, 58. BP as seen in a primary care setting is not the acute, self-limited condition it was once thought to be. It is more typically a recurrent or chronic symptom that erupts periodically over the course of a lifetime. Given t recurrence rate of LBP, the distinctions among acute, subacute, & chronic LBP are becoming increasingly fuzzy. There is scant evidence tt any form of medical Tx can alter the natural history of this condition long-term. The general goal for health care providers is enlightened, cost-effective management & not a heroic cure.

Borkan, PhD, Van Tulder, PhD, et al. Advances in the field of low back pain in primary care. A report from the Fourth International Forum. Spine;2002 27(5): E128-132. LBP is not easily classified as either an acute, self-limited condition or a chronic,

unremitting ailment. It is more typically a recurrent or intermittent syndrome tt erupts periodically over t course of a lifetime. LBP, once thought to afflict people of middle yrs, is extremely common from teenage yrs into old age. Only a small portion of sufferers slide from acute or recurrent Sx to chronic disability & heavy utilization of healthcare. The concept of LBP has undergone a dramatic shift in t dominant paradigm. Until 10 yrs ago, LBP was considered purely biomechanical & involved looking for anatomic damage & finding ways of fixing it. This approach hasn't worked. T inadequacy of this model & management led to a radical shift - from thinking about LBP as a biomedical "injury" to viewing it as a multifactorial biopyschosocial pain syndrome. T shift may be summarized as a change from viewing LBP as a "curable" acute bioanatomic problem to a manageable biopsychosocial recurrent complaint. LBP is a functional disturbance rather than a signal of structural damage. There are doubts tt any form of medical Tx can alter t natural Hx of this condition over t long-term.

Vingard, MD et al. Seeking care for low back pain in the general population: a two-year follow-up study. Spine; 2002 27(19): 2159-65. A 2-year general population F-U study of 17,000 (20-59 yrs) adults to investigate Pts seeking care for a new episode of LBP from all the caregivers in a region of Sweden. 792 (about 5%) sought care because of a new LBP episode (had not sought care in previous 6 mo). 50% of Pts went to MDs & PTs, 50% went to other caregivers (DCs). Some improvements in pain and disability were reported after 3 mo, but at 6 & 24 mo not much more improvement was found. Approximately 70% of Pts had no sick leave during F-U. Few of the care seekers became pain-free during the 2 yr F-U period. This study strengthens the hypothesis that low back pain easily & often becomes chronic even when sick leave is rare.

Hestbaek, DC. Leboeuf-Yde, DC, PhD, et al. The course of LBP in a general population. JMPT 2003; 26(4): 213-9. Study of t 5 yr course of LBP in a general population. 1,370 Ss, representative of the Danish population, were surveyed 3 times over t course of 5 yrs to determine t mean number of days w LBP during t past yr. 813 (59%) were followed t full 5 years. Ss could be divided into 3 groups, those w: 1) no LBP pain, 2) short-term pain, 3) long-lasting/recurring pain. Over time t transitions between groups are common, but mov'ts between no pain & long-lasting/recurring pain are rare. About 1/3 of Ss remain in t same category thru-out all 5 yrs. 20% to 26% of Ss report long-lasting/recurrent LBP at each of t 3 surveys, but only 10% of Ss report long-lasting/recurrent LBP at all 3 surveys. LBP is often a chronic condition characterized by a fluctuating pattern rather than a self-limiting course. 36% to 76% of LBP Pts have recurrences w/i a yr. Previous LBP is an important predictor of future LBP. LBP is characterized by variation & change rather than a disease entity w a well-defined time limitation. LBP rarely seems to be self-limiting but rather presents w periodic remissions. This disagrees w t common notion tt t majority of LBP attacks are benign & self-limiting & therefore can be ignored. Findings indicate tt recommendations in guidelines for managing LBP must be reconsidered. Guidelines tt recommend different Tx regimens on t basis of t duration of t current episode of

LBP alone do not appear to be suitable. LBP should not be dismissed as being transient (and therefore neglected), since t condition rarely seems to be self-limiting but merely presents w periodic attacks & temporary remissions.

Hestbaek L. et al. Low back pain: What is the long-term course? A review of studies of general populations. Euro Spine Journal, 2003; 12: 149-65. Review 36 longitudinal studies (w at least 12 mo F-U) in general Pt populations. Study found no evidence to support t claim tt 80%-90% of BP Pts become pain-free w/i a month. An average of 62% (between 42% & & 75%) still experienced symptoms after 12 mo. Between 42% & 78% experienced relapses w/i 12 mo. Between 26% & 37% of workers w back-related absence, experienced a relapse of work absence. Those w a previous Hx of BP were twice as likely to experience further BP as those w/o a Hx.

Pengel LHM et al. Acute LBP: Systematic review of its prognosis. BMJ, 2003; 327: 323-328. Study of t course of ALBP in general Pt populations. Included prospective 15 studies of Pts w ALBP <3wks. Follow-up: 3 months or more. Specific diseases were excluded: Fx, Ca, Arthritis. In t studies tt provided 12 mo F-U, t risk of recurrence at 1 yr ranged from 66% to 84%. ALBP decreased quickly, (ave of 58% of t initial levels w/i 1 mo). Pain continued to decrease more slowly until 3 mo, but then remained nearly constant from 3 to 12 mo. Ave pain level at 1 mo was 22/100. Ave disability was 24/100.

Skargren E, RPT, PhD et al. 1 year F-U up comparing cost & effectiveness of chiro and PT in management for back pain. Spine 1998; 23(17):1875-1884. A randomized trial of 323 Pts w BP & NP visiting a GP were allocated to chiro or PT to compare outcomes & costs in Sweden. F-U was done at 12 mo. Outcome measures were changes in 1) Oswestry scores, 2) Pain intensity, & 3) General health, 4) Recurrence rates & 5) Direct & indirect costs. Results: No differences were detected in health improv't, costs, or recurrence rate between t 2 grps. According to Oswestry score, chiro was more favorable for Pts w a current pain episode of less than 2 wk & PT for Pts w a current episode of >1 mo. Nearly 60% of Pts in both chiro & PT reported 2 or more recurrences w/i 1 yr. Mean number of Txs sessions was 4.9 for DCs & 6.4 for Pts. Conclusions: Effectiveness & costs of chiro or PT as primary Tx were similar for t total population, but there were some differences in subgroups. Back problems often recurred & additional health care was common. Implications: Tx policy & clinical decisions must consider that BP & NP are often recurrent. Recurrences: nearly 60% of both grps reported 2 or more recurrences & another 12% in t chiro grp & 15% in t PT grp reported continual pain. These rates are in line w those in previous studies: Despite reported improv'ts, a high proportion of Pt still experience pain after 1 yr. The studies suggest tt BP is typically a recurrent condition. T results suggest tt t prognosis of BP over time may be somewhat less favorable than in other reports.

Enthoven, P., RPT, E. Skargren, RPT, PhD, et al. Clincial course in patients seeking primary care for back or neck pain: a prospective 5 year follow up… Spine 2004; 29(21): 258-2465. Study evaluates t 5 yr clinical course for BP or NP in 314 Pts Tx in

primary care & compare results with 1 yr outcome. A previous study showed a decrease in pain & disability after Tx by DCs or PTs, but many reported recurrence or continual pain at 1 yr F-U. Skargren et al. Spine 1998;23(17):1875-84. Nearly 60% of DC & PT Pts reported =/>2 recurrences & another 12% of DC Pts & 15% of PT Pts reported continual pain. Despite improv'ts, many Pts still experience pain after 1 yr. Studies suggest tt BP is typically a recurrent condition. At 5 yr F-U a questionnaire was sent asking about pain, disability (ODI), general health, recurrences, & health care utilization. Results: 34% reported no pain (=/<10) or disability (=/<10 on ODI) at 1 & 5 yr F-U. 45% reported pain & disability at 1 yr & 52% at 5 yr F-U. 84% of Ss reporting pain & disability at 1 yr also reported pain & disability at 5 yrs. Ss w both pain & disability at 5 yr F-U reported a mean pain of 44 on VAS & ODI of 28. There was an increase in t proportion of Ss w recurrence or continual pain between 1 yr & 5 yr F-U. For all Pts pain, disability & general health became somewhat worse between 1 & 5 yr F-U. No outcomes became better. At 5 yrs 63% reported 2 or more recurrences or continual pain in previous 6 mo. This was higher than at 1 yr. 57% of Ss who reported a duration of<1wk at baseline reported pain &/or disability at t 5 yr F-U. 75% of those who reported continual pain at 1 yr also reported continual pain at 5 yr F-U. About 1/3 reported health care utilization during previous 6 mo at both 1 & 5 yr F-U. A previous Hx of BP has been found to be an important factor regarding future back or neck pain. Findings indicate tt Pts seeking care BP or NP should be considered a high risk for further BP or NP. This is consistent w Vingard's findings tt although there was improvement during t first 3 mo, few Pts seeking care for LBP were pain free after 2 yrs.

Leboeuf-Yde, DC, MPH, PhD ,et. al. The Nordic Back Pain subpopulation program: a 1 year prospective multicenter study of outcomes of persistent LBP in chiropractic Pts. JMPT 2005; 28(2): 90-96. Each of 115 Norwegians DCs recruited 10 consecutive LBP Pts (>/=2 wks & a minimum of 30 days altogether w/i t preceding yr). Tx included SM & supportive modalities (exercise & advice). Pts were evaluated at at baseline (875 Pts), at 4th visit (799 Pts), at 3 mo (598 Pts) & at 1 yr (512 Pts) F-U. 92% received at least 4 Txs. At 1 yr F-U, 69% of Pts sought additional LBP care. T mean number of Txs was 9.5 & median was 8 w a range of 2 to 28. 14% received some form of maintenance care. Pts were very satisfied (46%) or quite satisfied (36%) w chiro care. Only 4% were dissatisfied. Results: Considerable improv't was noted between baseline & t 4th visit (VAS dropped from 4.5 to 2.9 & ODI improved from 35.1 to 24.1). Most of the improv't took place between t 1st & 4th visits w only a little further improv't at 3 mo. At 12 mo, no additional improv't was noted. However, t number of pain free Pts increased sharply until 3 mo from 2% at baseline to 15% at 4th visit & 28% at 3 mo. Pain free Pts stagnated at 12 mo (30%). At all F-U times <1% were classified as worse than baseline. At 12 mo, 62% stated they had again experienced LBP for at least 30 days in t previous yr & 80% reported tt they had recurrent LBP over t 12 mo F-U. T DCs, however reported at 12 mo only 26% of Pts had relapses. Episodes of LBP do not necessarily have a self-limiting course as previously thought. A high percent of Pts continue to complain of LBP. Persistent LBP is costly & generally agreed to be largely therapy-resistant. Many relapses among LBP Pts have

been documented in previous studies including a Nyiendo study w a 1 yr relapse rate of @ 90% in Pts Tx by DCs. This is hardly surprising when taking into account t recent insights into LBP, wh point to it being a cyclic/persistent condition rather than an occasional well-defined event. LBP is a disorder tt likely reacts quickly to Tx but is of a cyclic/recurring nature. Pts improve early in t course of Tx. About 2/3ds improve by t 4 th visit & almost 1/3d can be classified as LBP-free at 3 mo. During t ensuing yr most Pts have relapses often unbeknownst to t DC.

Axen I, DC, et al. The Nordic Back Pain Subpopulation Program: validation and improvement of a predictive model for treatment outcome in LBP Pts receiving chiropractic Tx. JMPT 2005; 28(6): 381-5. A multicenter study in 58 Swedish chiropractic practices each recruiting a max of 30 LBP Pts in order to identify predictors of improv't or lack of improv't for Tx in LBP Pts receiving DC care based on clinical information collected at baseline & at 2nd visit. 1057 Pt questionnaires were useable, evaluating rating self-reported "definite improv't" at the 4th visit. Results: 3 factors were best at predicting the absence of improv't by the 4th visit & could correctly classify 79% of Pts: 1) No definite overall improvement by the 2nd Tx; 2) Presence of leg pain; 3) Minimum total duration of pain over the last 12 months being 30 days. Conclusion: It is possible to predict short-term outcome in LBP Pts who receive chiro care before Tx commences & at t latest by t 2nd visit. LBP Pts who also have leg pain occurring sufficiently frequently or lasting sufficiently long to add up to at least 30 days in t past yr & who don't report improv't by t 2nd visit are not obvious candidates for short-term recovery (recovery by t 4th visit). Continued care should be monitored carefully because short-term outcome is a predictor for long-term outcome at both 3 & 12 mo. What Pts expect from their DC is not only tt Tx can help improve their condition but also tt DCs refrain from Tx Pts w little or no hope of getting better.

Wiesel S, MD (ed). Predictors of treatment failure elusive. Backletter 2005;20:144. Mannion A, Elfering E. Euro Spine J 2005; 15:491-505. A short list of characteristics associated w poor surgical outcomes: Long duration of symptoms; Comorbidity; Pyschological distress; Family reinforcement of pain; Smoking; Job dissatisfaction; Having a workers comp claim; Long-term sick leave & work disability; Severity of pathology.

McKenzie, R. The Myth of Short term Acute Low Back Pain. NZFP 2005; 32(2): 125-6. The chance of having a recurrence of BP after a first episode is >50%. Many recurrences are common & >1/3 of t BP population have a long-term problem. The message is that, in any one year, recurrences, exacerbations & persistence dominate t experience of LBP in t community. An individual's experience of BP may well encompass their life history. T high rate of recurrences, episodes & persistence of symptoms seriously questions t myth of an acute/chronic dichotomy. BP should be seen from t perspective of t sufferer's lifetime - & given such a perspective t logic of self-management is over-whelming. Yet, t Accident Compensation Corporation has repeatedly advised t public & health care providers tt acute BP is short term. All that is required is to remain active, remain at work & maintain a positive outlook for early

recovery. This advice denies t opportunity for Pts to learn, in t early stages of their problem, self-management protocols known to assist in early resolution.

McGill, S, PhD. Low Back Disorders Evidence-Based Prevention and Rehabilitation. Human Kinetics 2002: 130-1. 72 workers were followed for 261 wks (>5 yrs): 26 Ss w Hx LBP & lost time from work; 24 Ss w Hx LBP but no lost time; 20 w no Hx of LBP or lost work time. Ss were extensively evaluated: multiple questionnaires & 4 hrs of lab testing for: Fitness parameters (BMI, strength, flexibility, VO2 max). Large inventory of spine specific parameters (strength, muscle endurance, 3D coupled motion, muscle usage during tasks requiring static balance, unexpected loading, anticipatory reaction, challenged breathing, unrestricted lifting from floor, etc). Throughout all tests all Ss were connected to instruments to document 3D lumbar spine motion & torso muscle activity (14 channel sEMG). Results: A Hx of LB troubles was associated with: Larger waist girth; Greater chronicity potential - predicted from psychosocial questions; Reduced extensor to flexor ratio; Lack of muscle endurance, esp a balance of endurance among torso muscle grps. Ss w Hx of LB troubles had wide variety of motor control deficits, more difficulty balancing, & altered response to surprise loading. Ss who missed work due to LB troubles were followed for 261 wks (over 5 yrs) after their last disabling episode: Findings: Multiple deficits appear to remain for very lengthy periods. Having a Hx of LB troubles, even when substantial amounts of time has elapsed, is associated w a variety of lingering deficits. Whether these deficits were a cause of trouble existing prior to Sx or a consequence remains to be seen.

Deyo, R. MD, Weinstein, DO. Low back pain. NEJM. 2001; 344(5): 363-369. Cross-sectional studies of nonspecific LBP, which best reflect primary care, suggest tt 1/3 of Pts are substantially improved at 1 wk & 2/3ds at 7 wks. Recurrences are common, affecting 40% of Pts w/i 6 mo. Most recurrences are not disabling, but t emerging picture is tt of a chronic problem w intermittent exacerbations, analogous to asthma, rather than an acute disease tt can be cured.

Haas, M., DC, E. Groupp, PhD, et al. Dose-response for chiropractic care of chronic low back pain. Spine J 2004; 4(5): 574-83. Several large recent studies findings call into question t characterization of BP as a self-limiting condition. Many studies used RTW or discontinued seeking care as an index of recovery. However, a different picture emerged when pain & disability were t primary outcomes. One large population-based study showed tt only 21% of Pts were pain free at 3 mo & 25% were pain free at 12 mo. T majority of Pts reported significant pain & disability at 12 mo. A large prospective study found tt both acute & chronic LBP Ss were still experiencing pain & disability 3 & 4 yrs after presentation. Other studies have corroborated these findings & have led to t more accurate characterization of LBP as a chronic condition.

Hill, J., MSc, Lewis, PhD, et al. Predicting persistent neck pain: a 1-year follow-up of a population cohort. Spine 2004; 29(15): 1648-54. 1/5 of adults report a new episode of NP in past yr, 2/3ds experience NP at some point in their lives. Neck Pts frequently

return to consult for recurring episodes of pain. A general population survey was conducted among 7,669 adults, (18 to 75 yrs) in UK. Those w NP w/i t previous month were F-U at 12 mo to determine t persistence of NP. The term "persistent neck pain" may reflect chronic, recurrent, or continuous pain. Results: 1,359 (31%) neck pain responders at baseline. At 1 yr F-U 48% reported neck pain lasting >1 day in t previous month. Baseline haracteristics which predicted persistent NP were: age (45-59 yrs), being off work, comorbid LBP, & cycling as a regular activity. A previous US study found 1 wk prevalence of 20% & 1 yr of 34%. Neck exercises have been shown to be helpful & are encouraged & frequently used for NP. Conclusion: Among the general population, neck pain persists at 12 months in around half (48%). An increased risk of persistent neck pain was associated with age 45 to 59 years, LBP, & w cycling. Risk Factors for Neck Pain Onset: Female; Number of Children; Psychological Distress; Previous LBP; Previous Neck Injury. Risk Factors for Persisting Neck Pain: Older age (45-59 yrs); Being off work; LBP; Cycling.

Cote, P. DC, PhD, Cassidy, D, PhD et al. The annual incidence and course of neck pain in the general population: a population-based cohort study. Pain 2004; 112(3): 267-73. During any 6 mo period, 54% of adults suffer from NP & 4.6% experience important activity limitations due to NP. Very little is known about t natural Hx of NP. Clinicians generally accept tt t course of NP is favorable - most recover & few develop CNP & disability. However, a recent large study found tt only 6.3% of NP Ss report tt their pain was non-recurrent, suggesting tt NP may be similar to LBP & follow an episodic course marked by periods of remission & exacerbations. Prevalence of NP increases w age & is higher in women. A population-based study of 1100 randomly selected Saskatchewan adults to determine the annual incidence of NP & describe its course. Ss were surveyed at baseline & F-U at 6 mo & 12 mo using the Chronic Pain Questionnaire. Results: 513 Ss were free from NP for past 6 mo at baseline. 587 (54%) Ss had NP in t 6 mo period before t survey at baseline. T annual incidence of NP is 14.6%. Most new episodes were mild. 0.6% developed disabling NP. Incidence of new episode was higher in women who also more likely to experience persistent Sx & less likely to report complete resolution. Of 587 Ss w NP at baseline, 36.6% reported resolution, 32.7% reported improv't. Persistent NP reported by 37.3% & 9.9% reported aggravation. 22.8% reported a recurrent episode of NP. Neck pain is a disabling condition with a course marked by periods of remission and exacerbation. Contrary to prior belief, most individuals with neck pain do not experience complete resolution of their symptoms and disability. Findings contradict t commonly held view tt NP is a benign disorder, w a highly favorable prognosis. Rather, NP is a chronic episodic condition characterized by episode of persistent, recurrent or fluctuating pain & disability. Current evidence suggests tt NP & LBP run similar courses. T course of LBP is also characterized by periods of remissions & exacerbations. These observations & reports of strong associations between NP & LBP support t hypothesis tt they represent components of a large chronic pain syndrome. NP is related to signif activity limitations for an important proportion of t population. NP follows an episodic course tt can lead to significant disability. Although a signif proportion improve, most Ss w NP do not experience complete resolution of their pain

& disability. NP represents an important chronic health condition.

Chiu, T., PhD, T.-H. Lam, MD, et al. A randomized controlled trial on the efficacy of exercise for patients with chronic neck pain. Spine 2005; 30: E1-7. Neck pain (NP) had lifetime prevalence of 66.7%. Neck pain had a point prevalence of 22.2%.

Wiesel, MD. The complexity of CBP. Backletter 2005; 20(4): 37, 44, 45. Are back pain & neck pain part of a broader pain syndrome? Chronic spinal pain (CSP) is typically assoc w other chronic pain conditions, chronic diseases, & psychological disorders wh affect t function, health care use, work loss, & quality of life. "We can't continue to view BP as an isolated acute event rather than one element of a broader syndrome." A study by Von Korff (CSP & physical mental comorbidity in t US. Pain 2005; 113:331-9) surveyed 5692 adults for CSP, other chronic pain conditions, mood disorders, anxiety, substance abuse. Results: almost 20% suffered from CSP over past 12 mo. 30% had suffered chronic spinal pain over their lifetime. Recurrent chronic pain is typical across pain conditions. Almost 9 of 10 Ss w CSP, reported at least one other comorbid illness. 2/3 had another chronic pain condition. >1/2 had another chronic disease. T prevalence of CSP was >3X as high among Ss w other pain conditions. CSP was nearly 2X higher in Ss w a mental disorder. Roger Webb (Spine 2003;28:1195-1202) found 1 mo prevalence of SP was 29% of wh half was chronic, 40% was disabling, 20% was intense, disabling & chronic. 75% of Ss w BP & 89% w NP reported pain at other sites. Severe disabling SP was assoc w numerous other pains, bodily complaints, & psychological distress. "Of Americans awarded social security disability in 1996 for BP, 40% also had neck pain & 25% had mental health Dx." (Waddell. T Back Pain Revolution. Churchill Livingstone; 2004: 76-7). Hestbaek concluded in 2003 tt BP often appears to be part of a larger picture of ill health. T lit leaves no doubt tt diseases cluster in some individuals. LBP is part of this pattern & therefore cannot be regarded as a separate entity. BP & comorbidities could have a common origin. These illnesses interact & impact t lives of chronic pain sufferers. Croft found tt t strongest predictor for developing persistent disability at t initial consultation of 180 BP Pts was t presence of pain elsewhere. Those who reported widespread pain at baseline had >6X increased risk of developing CBP. Psychological distress, poor health, & dissatisfaction w work all predicted progression to chronicity. Baseline factors tt predicted a new episode of CBP 4 yrs later (1996 & 2000) in 2184 adults included previous chronic pain elsewhere & poor physical health.

Gues M, et al. Chronic low back pain in individuals with chronic neck pain of traumatic or non-traumatic origin. A population based study. Acta Orthopaedica 2006;77:132-7. Study of prevalence of CLBP in Ss w chronic neck pain (CNP) of traumatic or nontraumatic origin. 4,415 Ss 25-64 yrs were randomly selected from an area in Sweden. Results: T prevalences of CLBP & CNP were 16% & 17% respectively. 51% of Ss had both BP & NP. In NP Pts, 1/4 had a Hx of neck injury, almost ½ were WAD. T prevalence of CLBP in Ss w nontraumatic CNP was 53% & 48% in those w CNP & a Hx of neck trauma. There's no difference in t prevalence of CLBP between

whiplash injury & other types of neck trauma. Ss w CNP after WAD had t same prevalence of CLBP as those w/o neck injury.
Ss w persistent regional pain are more prone to report persistent pain elsewhere, as well as several other Sx. Chronic muscular pain at one site of t body may induce pain at other sites. Conclusions: Independently of traumatic or nontraumatic origin, t prevalence of CLBP is 3X higher in Ss w CNP than in t general population.

Johansen MD, et al. Generalized muscular hyperalgesia in chronic whiplash syndrome. Pain 1999;83:229-234. In 11 chronic whiplash Pts & 11 matched ctls t sensitivity over t infraspinatus, brachioradial & anterior tibialis muscles was assessed. Infusion of hypertonic saline into t infraspinatus & anterior tibialis was done to assess muscular sensibility & referred pain pattern. Results: Pressure pain thresholds were signif lower in Pts vs ctls in t infraspinatus; brachioradial & anterior tibialis. Infusion of hypertonic saline caused higher pain scores & larger patterns of referred pain in chronic whiplash Pts both w/i & outside t traumatized area. Conclusions: Findings suggest a generalized central hyperexcitability in Pts w chronic whiplash. This pain may be a neurogenic type of pain. Findings of muscular hyperalgesia to painful muscle stim not only in t neck & shoulder but also in t distant areas not assoc w whiplash injury may be a manifestation of a generalized central hyperexcitability & support t hypothesis tt central mechanisms are involved in chronic whiplash syndrome. Similar findings of widespread muscular hyperalgesia are reported in fibromyalgia (FMS) & indicates a role of central hyperexcitability in FMS.

Hagen EM, PhD et al. Comorbid subjective health complaints in low back pain. Spine 2006;31:1491-5. Study compares subjective health complaints/comorbidities in subacute 457 LBP Pts sick-listed 8 to 12 wks vs a Norwegian normal population. Results: LBP Pts had signif more LBP, neck pain, upper back pain, pain in the feet during exercise, headache, migraine, sleep problems, flushes/heat sensations, anxiety, & sadness/depression. Prevalence of pain in arms, shoulders, & tiredness was also high, but not signif higher than normal Ss. Conclusions: Findings indicate LBP Pts suffer from a "syndrome," consisting of muscle pain located to the whole spine, legs, head, sleep problems, anxiety, & sadness/depression. These comorbidities may signal tt LBP is part of a more general, nonspecific condition. W longer duration of complaints, t chance of sensitization & chronification increases. To avoid development of a vicious cycle & to help Pts understand & respond it is crucial to understand these pain perception mechanisms & to intervene at an early stage. Research suggests sensitization is t factor for generalized muscle pain & high levels of subjective health complaints. Repeated use of synapses may lead to long-lasting changes in synaptic efficiency & increased reactivity to stimuli caused by repeated use. Widespread pain in t entire spine, legs, & head may also be connected w muscular dysfunction starting in t lumbars & via t thoracolumbar fascia wh covers back muscles from sacrum thru t ligamentum nuchae playing an integrating role in load transfer may affect muscles along t pelvis, spine, shoulders, & neck playing an integrating role in load transfer & stability. Only 7 Pts (1.6%) reported pain solely

localized to lumbars.

Waddell G. MD. The Back Pain Revolution 2nd Ed. Churchill Livingstone 2004: 119-120. Back pain is a recurrent problem, so it's not surprising tt t best predictor of future progress is t previous Hx. Low back pain should be viewed as a chronic problem w periods of relative freedom from pain & disability interspersed w acute episode, exacerbations, & recurrences. The paradox is tt from a pathologic point of view most minor low back injuries should recover quite quickly, but t clinical reality is tt many attacks do not.

Waddell G, MD. The Back Pain Revolution. Churchill Livingstone 1998: 232. Excess or repetitive mechanical force causes tissue damage which results in pain, discomfort, and swelling. This leads to avoiding activity out of fear and Loss of motion, muscle changes: spasm, inhibition & weakness. These changes result in decreased activity, immobilization & disuse which lead to loss of function. Muscle weakness, atrophy, loss of coordination and disturbed motor programs result. In addition, joint stiffness, decreased ROM, and scarring occur. Loss of cardiopulmonary and cardiovascular function also occur. All of these changes lead to Chronic, painful musculoskeletal dysfunction, increased risk of reinjury & chronic problems.

Mikheev, MD. (orthopedist & chief medical officer for WHO). The Chiropractic Report 1993; July:1-6. Traditional medical management based on rest and passive care has been unsuccessful, actually promoting disability. CLBP is not an injury but a result of a downward spiral of inactivity leading to reduced functional capacity, increased risk of reinjury and chronicity.

Waddell G. MD. The Back Pain Revolution. Churchill Livingstone 1998: 151-151. One of the common criticisms of the diagnosis of soft tissue sprain or strain is that such an injury is normally followed by healing. Symptoms should settle over the expected tissue healing time. However, if the problem is dysfunction, then symptoms can persist for as long as dysfunction continues. Dysfunction may be self-sustaining, so symptoms may persist indefinitely. Another important implication: Because dysfunction does not involve any permanent change,it is always reversible. Even if dysfunction & symptoms may persist indefinitely, there is always the potential for recovery by restoring normal function.

Waddell G, MD. The Back Pain Revolution. Churchill Livingstone 1998: 145. Musculoskeletal Dysfunction. Abnormalities of Posture; Abnormalities of joint movement: Limited movement; Hypermobility; Abnormal Patterns of Movement; Acute joint locking. Muscle: Fatigue; Weakness; Tension, stress/anxiety; Shortening, stretching; Reflex muscle spasm. Connective Tissue (fascia, ligs, jt capsule, muscle): Adhesions, scarring; Trigger points; Fibrositis. Musculoskeletal Dysfunction: Neuromuscular Incoordination: Muscle imbalance; Abnormal patterns of movement; Altered proprioceptor and nociceptor input and neurophysiologic processing.

Mooney, V. MD. How to have a healthy back. backstrong.com 2003. Lower back pain is the most common musculoskeletal disorder. Following heart disease and cancer, back pain represents the most costly medical problem in every industrialized society. No one dies of LBP & most people get over it. Unfortunately, most people do not stay over it. The reoccurrence of back pain is almost guaranteed.

Mayer TG, MD. Neurologic clinics of North America 1999;17(1):131-147. The majority of injuries to the low back involve soft tissues or discs with sprains and strains of musculoligamentous tissues, which have a relatively brief healing period. **When healing is temporally complete, but biomechanically imperfect, leading to permanent impairment of supporting elements, chronic disability may follow.**

Chronic Musculoskeletal Dysfunction

Haas, M., DC, E. Groupp, PhD, et al. Dose-response for chiropractic care of chronic low back pain. Spine J 2004; 4(5): 574-83. Several large recent studies findings call into question t characterization of BP as a self-limiting condition. Many studies used RTW or discontinued seeking care as an index of recovery. However, a different picture emerged when pain & disability were t primary outcomes. One large population-based study showed tt only 21% of Pts were pain free at 3 mo & 25% were pain free at 12 mo. T majority of Pts reported significant pain & disability at 12 mo. A large prospective study found tt both acute & chronic LBP Ss were still experiencing pain & disability 3 & 4 yrs after presentation. Other studies have corroborated these findings & have led to t more accurate characterization of LBP as a chronic condition.

Kannus, MD, PhD. Immobilization or early mobilization after an acute soft tissue injury? Phys & Sportsmed 2000; 28(3): 55-63. Inflammation and pain result in voluntary inhibition of muscle activity across the affected joint.

Review of Chiropractic for Treating LBP

National Center for Complementary and Alternative Medicine. (NCCAM). About chiropractic & its use in treating LBP. Research Report. 2004: 1-15. Key Points: 1. Chiropractic is used most often to Tx MS conditions. 2. Research studies of chiropractic Tx for LBP have been of uneven quality & insufficient to allow firm conclusions. Nonetheless, the overall sense of the data is tt for LBP, chiro Tx & conventional medical Txs are about equally helpful. It is harder to draw conclusions about t relative value of chiro for other clinical conditions. 3. T risk of experiencing complications from chiro adjustments of t low back appears to be very low. However, t risk appears to be higher for adjustment of t neck. 4. It's important to inform all of your health care providers about any Tx, including chiro. Most DCs use other Txs in addition to adjustments, (mobilization, massage, heat/ice, ultrasound, electrical stim, rehabilitative exercise, counseling about diet, weight loss, lifesytle factors, homeopathy, acupuncture). Side effects: temporary discomfort, HA, tiredness. These effects tend to be minor & to resolve w/i 1 to 2 days. Serious complications. No prospective studies, but t risk appears to be very low. It appears to be higher for cervical spine, (eg stroke). A rare complication of low back adjustment is cauda

equina syndrome, estimated to occur once per millions of Txs (t number of millions varies; one study placed it at 100 million). Insurance coverage is extensive. As of 2002, > 50% of HMOs, & >75% of private health plans & all state workers comp systems cover chiro. Can bill Medicare. Scientific research about chiro for LBP: 7 controlled clinical trials & one observational study of chiro Tx for LBP (1994 thru June 2003). Summary of findings: all studies found at least some benefit form chiro Tx. However, in 6 of 8 studies, chiro & conventional Txs were found to be similar in effectiveness. One trial found greater improvement in t chiro grp than in those getting either sham manip or back school. Another found Tx at a chiro clinic to be more effective than outPt hospital Tx. Reviews of the literature & meta-analyses: 3 reviews of clinical trials on chiro Tx for BP between 1996-June 2003. Summary of findings: Overall, evidence seen as weak & less than convincing for t effectiveness of chiro for BP. T 1996 review reported tt there were major quality problems in t studies analyzed. T review concludes data did not provide convincing evidence for t effectiveness of chiropractic. The 2003 general review states tt since 1996 systematic review, emerging data "have not tended to be encouraging...The effectiveness of chiro SM for BP is thus at best uncertain." The 2003 meta-analysis found SM to be more effective than sham but no more or less effective than other Txs. Keep in mind: many trials of chiropractic analyze t effects of chiro SM alone, but DCs practice includes more than SM. Results of trials performed in one setting (MCOs) may not apply in other settings. Scientific controversies assoc w chiropractic? Within t profession (use pf PT, wh techniques best for wh conditions, concept of subluxation). Outside: questions of effectiveness, scientific basis, potential risks. Research on chiro is ongoing.

Stano, PhD, et al. Chiropractic and medical care costs of low back care: results from a practice-based observational study. Am J Managed Care; 2002 8: 802-09. Study of 111 MDs & 60 DCs compares 1 yr cost for 2263 ALBP & CLBP Pts Tx by MDs & DCs. Data included billing, charts, provider & Pt questionnaires, Pt health status, pain, disability, & socioeconomic characteristics. Medical Pts prescription drug costs were included. Results: Direct office costs for 1920 DC Pts & 952 MD Pts over a 1 yr period were relatively small. 43% of chiro Pts & 57% of med Pts incurred costs of <$100. T mean costs for chiro Pts ($214) were signif higher than for med Pts ($123), especially compared to nonreferred med Pts ($103). Chiro Pts had slightly lower baseline pain & disability than nonreferred med Pts, but t 2 grps were similar on most characteristics. There were no signif difference in improvements in pain (VAS) & disability (Oswestry) between Pt grps measured at 1, 3, 5, 9 mos & at 1 yr. Conclusion: Results indicate tt Pts Tx in chiro clinics incur higher costs over a 1 yr period, but have about t same degree of relief as nonreferred Pts Tx in medical clinics.

Assendelft, MD, PhD et al. Spinal manipulative therapy for low back pain. Ann Intern Med; 2003 138(11): 898-906. Study evaluates effectiveness of SM for ALBP & CLBP in terms of pain & function, comparing SM w other therapies, including recent high-quality RCTs & previous systematic reviews of t literature. 39 RCTs were identified w a total of 5486 Pts. Comparison Txs divided into 5 groups: 1) Sham, 2) Conventional

GP & analgesics, 3) PT & exercise, 4) Ineffective Txs: Traction, corset, bed rest, topical gel, home care, no Tx, diathermy, minimal massage, 5) Back school. Previous reviews pooled Txs to wh SM was compared w/o distinction among passive & active Txs. For ALBP Pts SM was superior only to sham or ineffective Txs. SM had no signif advantage over GP/analgesics, PT, exercises, or back school. Results for CLBP Pts were similar. Radiation of pain, study quality, profession of manipulator, & use of manip alone or in combination w other therapies did not affect these results. SM had clinically & statistically significant benefits only when compared w sham manp or ineffective Txs. Compared w other advocated therapies (analgesics, PT, exercises, or back school), SM had no significant benefits. SM is probably more effective than placebo, but effectiveness compared w other advocated therapies is substantially less than previous reviews suggested. We conclude there's no evidence for increased effectiveness of SM compared w other advocated therapies for ALBP or CLBP. Previous reviews wh pooled results found SM significantly favorable, but when SM was compared w specific alternative therapies, this benefit was consistent for only sham & ineffective Txs. SM is very unlikely to be a particularly effective therapy for any group of BP Pts. Our findings tt SM is substantially less effective than previously estimated should temper enthusiasm for this Tx as "the" recommended therapy for LBP Pts. We found no evidence tt SM is superior to other advocated therapies. Neither did we find evidence tt these therapies are superior to SM. We conclude tt SM is one of several options of only modest effectiveness for LBP Pts. There is no evidence tt SM is superior to other standard Txs for Pts w ALBP or CLBP.

ACA. New Study is Further Support for Safe Alternatives to Drugs. For Immediate Release: June 2, 2003. A new study showing that SM is just as effective as traditional medical care for BP should come as welcome news to Pts looking for safe, drug-free alternatives to medical Tx, according to the American Chiropractic Assoc (ACA). June 3 study in Ann Intern Med proves what the chiropractic profession has known for decades -- that SM, or chiropractic adjustment, is an effective alternative to drugs and surgery for BP. "Our society has become more and more health-conscious in recent years. People are making better food choices, exercising more, and beginning to question the number of potentially harmful drugs they might be taking," said Daryl D. Wills, DC, President of the ACA. "This study indicates that consumers can avoid taking drugs for BP in favor of a safer form of care, w/o sacrificing any of the benefit. Nowhere does the study indicate that analgesics or any other treatment is more effective than chiropractic care." Because of the increased attention BP in recent years, MDs have been referring Pts to DCs more than ever before. For years, DCs have advised their Pts on prevention of BP thru exercise, proper ergonomics & other active solutions.

Cherkin, PhD et al. A review of the evidence for the effectiveness, safety, & cost of acupuncture, massage therapy, & spinal manipulation for back pain. Ann Intern Med; 2003; 138(11): 898-906. Study to provide a rigorous & balanced summary of best available evidence of effectiveness, safety, & costs of SM, massage & acupuncture for LBP based on systematic reviews of RCTs published since 1995 & RCTs published

since t reviews were conducted. Acupuncture: because quality of t 20 RCTs tt evaluated acupuncture was generally poor, t effectiveness of acupuncture for Tx ABP or CBP is unclear. Massage: evaluated in 3 RCTs have report tt massage is effective for subacute & CBP. SM: analysis of t results of 26 RCTs for ABP & CBP report tt SM was superior to sham therapies & ineffective Txs but was not superior to effective conventional Txs. Conclusions: Massage was found to be effective for persistent BP. SM has small clinical benefits tt are equivalent to those of other commonly used therapies. Effectiveness of acupuncture remains unclear. All of these Txs seem to be relatively safe. Preliminary evidence suggests tt massage, but not acupuncture or SM, may reduce t costs of care after an initial course of therapy.

Ferrari R, MD, Russell, Cassidy D, DC, PhD et al. A re-examination of the whiplash associated disorders (WAD) as a systemic illness. Ann Rheum Dis 2005; 64: 1337-42. All Ss who submitted a claim or were Tx for WAD after a MVA in Saskatchewan, Canada during 18 mo were examined. 7462 Ss met t criteria for WAD. 45% completed t SF-36, as well as, demographic & pre-injury health info, collision data, & symptoms (Sx) an average of 1 mo post-collision. For most Ss neck pain was only one of many diffuse & intense Sx often including LBP. T range of Sx included fatigue, dizziness, paraesthesia, HA, spinal pain, nausea, & jaw pain could be interpreted as a systemic disorder. SF-36 scores showed low physical & mental functioning 1 month post-collision. Conclusions: WAD is best appreciated as a syndrome extending well beyond a neck injury. More research is needed for a better understanding of t underlying mechanisms involved so tt Tx can be directed at t broad spectrum of illness rather than focusing on finding a focal neck injury. Findings underscore t wide range of Sx present after WAD & emphasize t need to adopt a broader concept of post-collision sequelae. We propose tt rather than trying to view whiplash as a specific, anatomically definable injury, this diverse cluster of post-whiplash Sx be reconceptualized as forming a "general illness," w widespread Sx presentation - an illness in wh Sx arise from & are modulated by pathology, psychological responses, & social context. Data indicate tt beyond neck pain, Sx such as LBP, dizziness, nausea, both upper & lower limb numbness & tingling, tinnitus, & cognitive problems are common after whiplash. It is clear tt in t acute stages after injury, persons w whiplash present w a broad range of systemic physical & mental Sx tt cannot be explained by a single anatomical region of injury.

van Tulder, M., A. D. Furlan, et al. Complementary and alternative therapies for LBP. Best Practices & Research Clinical Rheumatology 2005; 19(4): 639-654. Results of systematic reviews conducted according to methodological recommendations by t Chocrane Back Review Grp were used; t recently published reviews on massage, neuroreflexology, SM, t updated review on acupuncture, & preliminary results from a Cochrane review on botanical medicine tt has been submitted for publication. Hypotheses for t working mechanism of SM are: 1) release for entrapped synovial folds; 2) relaxation of hypertonic muscle; 3) disruption of articular or periarticular adhesions; 4) unbuckling of motion segments tt have undergone disproportionate displacement; 5) reduction of disc bulge; 6) repositioning of miniscule structures w/i articular surfacel; 7) mechanical stimulation of nociceptive jt fibers; 8) reduction of

muscle spasm. Results are a summary of t Cochrane review: Effectiveness of SM for ALBP: SM vs sham: 2 trials. Pts receiving SM had stat signif & clinically signif short term improv't in pain vs sham therapy. Improv'ts in function were clinically relevant but not stat signif. SM vs other therapies: 12 trials. SM resulted in stat signif short-term pain relief vs other therapies judged ineffective or possibly even harmful. However, t clinical signif of this finding is questionable. Improv't in short-term function w SM vs ineffective therapies was clinically signif but not stat signif. There was no differences in effectiveness between Pts Tx w SM & those Tx w any of t conventionally advocated therapies. Effectiveness of SM for CLBP: SM vs sham SM: 3 trials. SM was signif more effective than sham on short-term & long-term pain relief. SM was signif more effectives on short-term improv't of function on t Roland-Morris. SM vs other therapies: 8 trials. SM was stat more effective vs t group of therapies judged to be ineffective or perhaps harmful on sort-term pain relief & function. No differences in short & long-term effectiveness vs other conventionally advocated therapies, such as general practice care, physical or exercise therapy, & back school. Adverse effects: For personnel trained to perform SM t risk of serious complications was low. As estimate of t risk of SM causing a clinically worsenend disc herniation or cauda equina syndrome in Pts w lumbar disc herniation is <1 in 3.7 million.

Ernst E, Canter PH. A systematic review of systematic reviews of spinal manipulation. J R Soc Med 2006;99:192-6. A systematic evaluation of t evidence from recent systematic reviews of clinical trials of spinal manipulation. Literature searches of 4 electric databases for all systematic reviews of t effectiveness of SM for any indication, published between 2000 & May 2005. Results: 16 papers relating to these conditions: LBP (n=3), NP (n=2), lower back pain & NP (n=1), headache (n=3), non-spinal pain (n=1), dysmenorrhea (n=1), infantile colic (n=1), asthma (n=1), allergy (n=1), cervicogenic dizziness (n=1), & any medical problem (n=1). T conclusions of these reviews were largely negative, except for BP were SM was considered superior to sham but not better than conventional Txs. Conclusions: Collectively, data do not demonstrate tt SM is an effective intervention for any condition. Given t possibility of adverse effects, this review does not suggest tt SM is a recommendable Tx.

Hurwitz EL, DC, PhD, et al. A randomized trial of chiropractic and medical care for patients with low back pain: eighteen-month follow-up outcomes from the UCLA low back pain study. Spine 2006;31:611-21. Study compares the long-term (18 mo) effectiveness of medical & chiro care for LBP in managed care & assesses effectiveness of physical therapy & modalities in Pts receiving medical or chiropractic care. Evidence comparing long-term relative effectiveness of common treatment strategies offered for LBP in managed care is lacking. 681 LBP Pts were randomized to chiro w or w/o physical modalities, or medical care w or w/o PT, & 610 (89.6%) were F-U for 18 mo. Outcomes: low back pain, disability, complete remission, Pts perception of improvement in symptoms. Results: Pts assigned to either chiro grp or PT grp had almost 2X as many visits (5.4 vs 3.9) as Pts assigned to MD Tx alone. Of Pts not receiving PT or modalities, improv'ts in pain, disability & likelihood of complete remission were a little greater w chiro than w medical Tx (remission =

1.29); In medical grp changes in pain, disability & remission were > in Pts also getting PT (1.69). In Pts getting chiro & modalities there was no > improv't or remission than w/o modalities than chiro alone. Compared w medical Tx only, chiropractic & PT Pts were much more likely to perceive improvement in their LB Sx. However, <20% of all Pts were pain-free at 18 mo. Conclusions: Differences in outcomes between medical & chiropractic care w/o PT or modalities are not clinically meaningful, although chiropractic may result in a greater likelihood of perceived improvement, perhaps reflecting satisfaction or lack of blinding. PT may be more effective than medical care alone for some Pts, but physical modalities appear to have no benefit in chiropractic care.

Gotlib A, BSc, DC, Rupert Ron, MS, DC. Assessing the evidence for the use of chiropractic manipulation in paediatric health conditions: A systematic review. Paediatr Child Health 2005;10(3): 157-161. A review of 9 pediatric RCTs of 590 children on asthma, enuresis, infantile colic, chronic otitis media, jet lag, radial head subluxation, one observational study, & 141 descriptive studies (mostly case studies) of 2245 children. Most of the evidence is rated at low levels on the scale of evidence. DCs have had successful outcomes on a single case basis but conclusions arrived at may be premature. Yet, some practitioners are quick to generalize premature conclusions to a larger population – a position not well grounded in science. Health claims made by practitioners with respect to the application of SM for pediatric health conditions are supported by low levels of scientific evidence primarily based on clinical experience, many descriptive case studies & a few RCTs. There is the need for more rigorous scientific inquiry to examine the value of SM for pediatric conditions. The clinical encounter needs to better grounded on scientific evidence of much higher quality.

Haneline, M.T., DC, MPH. Chiropractic manipulation and acute neck pain: a review of the evidence. JMPT 2005; 28(7): 520-25. A review of t chiropractic & medical literature (1996-2003) to determine t extent of current evidence supporting t use of chiropractic manipulation for Tx of acute neck pain (ANP). Of 267 citations most didn't deal w Tx of acute NP. Less than 10 articles marginally dealt w Tx of ANP w cervical SM. There has only been one RCT in English tt specifically dealt w Tx of ANP by SM. Other studies involved NP Pts w subacute or chronic NP or Tx w mobilization rather than SM. Conclusion: There is scant investigative research into t Tx of ANP w chiro SM. More data are needed.

Leboeuf-Yde, C., DC, MPH, PhD et al. Self-reported nonmusculoskeletal responses to chiropractic intervention: a multination survey. JMPT 2005; 28(5): 294-302. An international study to F-U a Swedish study (Leboeuf-Yde, C et al. The types and frequencies of improved nonmusculoskeletal symptoms reported after chiropractic SMT. JMPT 1999; 22(9): 559-64) of positive nonmusculoskeletal responses (N-MRs) to chiropractic care. Questionnaires given to 385 DCs & 5607 of their Pts on a return visit w/i 2 wks of previous Tx by DCs in Canada, USA, Mexico, Hong-Kong, Japan, Australia, & South Africa. SM w or w/o additional therapy was provided by DCs.

Outcomes: self-reported improved N-MSRs w/i t past 2 wks for allergy, asthma, breathing, circulation, digestion, hearing, heart function, ringing in ears, sinus problems, urination, vision & others. Results: Most common reasons for Tx were LBP (60%) & neck problem (51%). Least common reasons: Non-MS/organic & dizziness (each 8%). Most common non-MS complaints: digestion, circulation, allergy. 4% to 25% of Pts reported improv't only 0.5 to 3% reported worsening. Patterns of N-MSRs were similar across countries. More common for women to report N-MSRs than men but no differences in terms of age, education, work status. In relation to number of visits in past 3 mo, there was an increase in number of Pts reporting at least 1 N-MRs going from 14% for 1 Tx, 22% for 2-3 Txs, 26% for 4-11 Txs to 31% for at least 12 Txs. T upper C-spine was most often assoc w specific N-MSRs followed by upper thoracic, lower thoracic & pelvis/sacrum. Both this & Swedish study reported improved digestion (8 & 10%) & breathing (7 & 6%). In Swedish study there was a positive relationship between t number of spinal areas Tx, but not in this study. This study did find a relation to t number of visits over t past 3 mo. Thus, some type of dose-response was found in both studies. T type of Tx (SM, mobilization, soft tissue) didn't matter in terms N-MRs. T previous study's results were largely reproduced. Positive reactions were reported by 2% to 10% of all patients and by 3% to 27% of those who reported N-MS problem in their Hx. Most common improv'ts were breathing (27%), digestion (26%), & circulation (21%). It appears tt chiro care for N-MS conditions is only weakly to moderately successful but rarely harmful. Weakness of study: 1) Pt's ability to recall. 2) N-MRs may be missed if they require more than 2 wks to manifest. 3) Absence of a control grp. It is not possible to establish whether Pts improved because of Tx, despite Tx, or regardless of Tx. Conclusion: A minority of Pts w self-reported N-MS Sx report definite improvement after chiropractic care, & very few report definite worsening.

Budgell, B., DC, MS. Invited Commentary: Self-Reported Nonmusculoskeletal Responses to Chiropractic Intervention: A Multination Survey by Leboeuf-Yde et al. JMPT 2005; 28(5): 365-66. SM to manage Pts w visceral disorders is a highly politicized, emotive issue. Few original data articles address N-MS responses to chiro. A comprehensive survey of original data articles reported papers describing t use of SM in Tx 39 visceral disorders. In 27 of 39, t use of SM to Tx a particular visceral disorder was supported by a single paper. 15 of these 27 papers referred to a single Pt. For 15 of t 39 disorders cited in t lit, t use of SM was supported by t experience w a single Pt. T majority of articles were in support of only 6 complaints: visual deficits, chronic pelvic pain & dysmenorrhea, asthma, enuresis, & PMS. Currently very little primary data are available concerning clinical outcomes, & t studies tt do exist are generally of poor quality. At this point, it would be difficult to advocate, based on evidence alone, anything beyond t experimental use of SM in Tx of perhaps 1 or 2 N-MS complaints. Whereas chiro management of N-MS complaints may have been an important component of chiro practice in t past, it is a trivial portion of modern practice & represents no more than a few % of new Pt presentations. It is reasonable to question whether it is currently rational & economically justifiable to conduct clinical trials. Digestive & respiratory difficulties

might provide more fertile ground for study. Leboeuf-Yde's study indicates an association between Tx & changes in Sx, but this study was not designed to determine nor is there any implication of cause & effect. It is fair to describe t current approach to study of chiro management of visceral disorders as "backward." This applies not just to clinical studies but also to t neglect of basic physiological investigations. Would it harm chiro to aask honest Qs about what we know instead of trying to prove what we think we know?

Haas M, DC, Goldberg B, MD et al. A practice-based study of patients with acute & chronic LBP attending primary care & chiropractic physicians: 2 wk to 48 mo follow-up. JMPT 2004; 27: 160-9. Large, multidisciplinary, multicenter, prospective, practice-based observational study of 2780 self-referring acute & chronic Pts Tx by 60 DCs (1855 Pts) & 111 MDs (925 Pts) F-U up to 4 yrs (2 wks, 1, 3, 6, 12, 24, 36 & 48 mos) using VAS & Oswestry, SF-12. A modest advantage is seen for DC over MD care of chronic Pts in first 12 mos. For acute Pts there was only a small advantage for DC care. There were no differences between DC & MD Pts from 24 to 48 mos. Data suggest a potentially clinically important advantage for DC care in chronic Pts w pain radiating below t knee. T majority of relief was achieved by 3 mos followed by a plateau thru 12 mo. This was followed by a clinically important aggravation at 24 mos w a subsequent second plateau to 4 yrs. An advantage for DC care was notable for chronic Pts. The relative benefit appears to be sustained in t long-term to 12 mos. T advantage for DC over MD care for acute Pts was small & not clinically important. Perhaps t greatest potential for DC care is in Tx of LBP w concomitant pain radiating below t knee. Adjusted mean differences ranged from 18.2 to 21.7 on t VAS – about 20% better in the first year & 9.7 to 13.9 (ave of 10% – 14%) on Oswestry over 3 yrs for disability. Our findings support t contention tt most Pts, acute or chronic, have recurrent back problems. LBP persists for many Pts far longer than previously believed. Chiropractic demonstrated an advantage over medical care for chronic Pts in t first yr, particularly for those w leg pain radiating below t knee. Most of t relief was achieved w/i 3 mo & sustained for 12 mos.

Haas, M., DC, MS, Sharma, R, PhD et al. Cost-effectiveness of medical & chiropractic care for acute & chronic low back pain. JMPT 2005; 28(8): 555-63. Study to identify relative provider costs, clinical outcomes, & Pt satisfaction for Tx of mechanical LBP in a practice-based, nonrandomized, comparative study of 2780 Pts self-referring to 60 DCs & 111 MDs over a 2-year period. Outcomes were office costs, office costs plus referral costs for office-based care & advanced imaging, pain, functional disability, Pt satisfaction, physical health, & mental health evaluated at 3 & 12 mo. For chronic LBP, MD Pts had greater disability, poorer physical health, & >pain radiating below t knee. Results: DC office visit costs were higher for both acute & chronic Pts at both 3 & 12 mo. When referrals were included for PT care (25% of MD Pts were referred for PT)& advanced imaging, there were no signif differences in costs between provider types. Acute & chronic DC Pts experienced better outcomes in pain, functional disability, & Pt satisfaction ($P < .01$). Clinically important differences in pain & disability were found for chronic DC Pts only. Pt satisfaction favored DC care for

acute & chronic Pts. Study to identify relative provider costs, clinical outcomes, & Pt satisfaction for Tx of mechanical LBP in a practice-based, nonrandomized, comparative study of 2780 Pts self-referring to 60 DCs & 111 MDs over a 2-year period. Outcomes were office costs, office costs plus referral costs for office-based care & advanced imaging, pain, functional disability, Pt satisfaction, physical health, & mental health evaluated at 3 & 12 mo. For chronic LBP, MD Pts had greater disability, poorer physical health, & >pain radiating below t knee. Results: DC office visit costs were higher for both acute & chronic Pts at both 3 & 12 mo. When referrals were included for PT care (25% of MD Pts were referred for PT)& advanced imaging, there were no signif differences in costs between provider types. Acute & chronic DC Pts experienced better outcomes in pain, functional disability, & Pt satisfaction ($P < .01$). Clinically important differences in pain & disability were found for chronic DC Pts only. Pt satisfaction favored DC care for acute & chronic Pts. Conclusions: Office costs alone are not appropriate outcomes to compare MD & DC care. MD office costs don't include PT, whereas physical modalities are usually performed in DC offices. Costs for referral for PT care, advanced imaging & other provider care appear to equalize MD & DC care costs. Hospitalization/surgical costs were not included in t analysis. Because there is a greater referral rate of surgical eval & hospitalization from MDs, it is likely tt inclusion of hospitalization/surgery would have increased medical costs disproportionately. DC care appeared relatively cost-effective for Tx CLBP. Our findings are consistent w t review findings tt SM-based therapy is at least as good as &, in some cases, better than other Txs for LBP. DC CLBP Pts showed an advantage over MD Pts in pain, disability, & satisfaction w/o additional costs. Chronic pain & disability outcomes were clinically important at 3 mo & to a lesser degree at 12 mo. Satisfaction w chiro care was considerably greater for both acute & chronic Pts at both 3 & 12 mo.

Bronfort, PhD, DC, Haas, DC, MA, et al. Efficacy of SM & mobilization for LBP & neck pain: a systematic review & best evidence synthesis. The Spine Journal 2004; 4:335-356. A review of 43 RCT trials on t efficacy of SM & MO (mobilization) for t management of LBP & NP using stringent methodological criteria isolating t effect of SM & MO. RCTs in English, Danish, Swedish, Norweigan & Dutch thru 2002 using Pt oriented outcomes (pain, disability, global improv't, & recovery time). Results: Acute LBP: Moderate evidence SM provides more short-term pain relief than MO & detuned diathermy, limited evidence of faster recovery than a commonly used PT Tx strategy. Chronic LBP: Moderate evidence SM's effect is similar to an efficacious Rx NSAID. SM/MO is effective in t short term compared to placebo & GP care, and in t long term compared to PT. Limited to moderate evidence tt SM is better than PT & home back exercise in both t short & long term. Limited evidence tt SM is superior to sham in t short term & to chemonucleolysis for disc herniation in t short term. Limited evidence tt MO is inferior to back exercise after disc herniation surgery. Mix of acute & chronic LBP: SM/MO provides similar or better pain outcomes in t short & long term compared w placebo & other Txs (McKenzie, medical care, PT management, soft tissue Tx, & back school). Acute NP: Few studies & t evidence is currently inconclusive. Chronic NP: Moderate evidence tt SM/MO is superior to GP care for

short term pain reduction, but tt SM offers at most similar pain relief to high-tech rehab exercise in t short & long term. Mix of acute & chronic NP: Overall evidence isn't clear. Moderate evidence tt MO is superior to PT & PCP care & similar to SM in both t short & long term. There is limited evidence tt SM, in both short & long term is inferior to PT. Conclusions: Data synthesis suggests tt recommendations can be made w some confidence regarding t use of SM &/or MO as a viable option for t Tx of both LBP & NP.

Chapman-Smith, D, LLB. Review of the Literature 2004; July 31. It is clear from the evidence generally, including Bronfort's other publications in recent years, that a combination of manipulation or mobilization and exercise is best for most Pts with chronic back or neck pain.

Haas, M., DC, E. Groupp, PhD, et al. Dose-response for chiropractic care of chronic low back pain. Spine J 2004; 4(5): 574-83. There have been no trials of optimal chiropractic care in terms of number of office visits for spinal manipulation and other therapeutic modalities. This RCT evaluates t effects of number of chiropractic visits for SM w & w/o physical modalities (PM) on CLBP & disability in 72 CLBP (=/>3 mo) of mechanical origin using pain & disability scales to measure outcomes. Pts were randomized to receive 1, 2, 3 or 4 visits/week of SM, that is, a total of 3, 6, 9, or 12 visits over 3 wks. Half of Pts in each grp also received PM on each visit (heat/ice, ultrasound, electrotherapy, manual soft tissue massage). Results: Pain intensity - At 4 wks, there was a substantial linear effect of visits favoring a larger number of visits: 5.7 points improvement on pain scale per each additional 3 visits. PM did not improve pain relief. At 12 wk F-U, there was a similar effect of visits on patients receiving SM & PM but not SM by itself. Functional disability: At 4 weeks, a visits effect was noted w 5 points more improv't per additional 3 visits. No significant grp differences at 12 wks. Conclusions: There was a positive, clinically important effect of the number of chiropractic treatments for CLBP pain intensity & disability at 4 weeks. Relief was substantial for patients receiving care 3 to 4X/wk for 3 weeks. This is t first RCT to study t dose-response relationship between number of visits to a DC & outcomes. 23 to 28 of 100 points better pain relief for Ss receiving 9 & 12 Txs is clinically important. Inclusion of PM at each visit had no signif effect on pain improv't. T dose-response for pain intensity suggests tt more chiro Tx may be required to reach t optimal benefit. Our data support t study of a larger number of visits in future trials. Disability outcomes further support a larger number of visits in future trials. There was a positive clinically important effect of t number of Txs on CLBP at 4 wks. Relief was substantial for Pts receiving care 3 to 4 times/wk for 3 wks. T sustainability of relief patterns to 12 wks was not clear. A concentrated course of chiro care of up to 12 visits in 3 weeks appears appropriate for t Tx of CLBP.

Haas, M, DC et al. Dose response for chiropractic care of chronic cervicogenic headache and associated neck pain. A randomized pilot study. JMPT 2004; 27(9): 547–553. A preliminary/pilot study of 24 Pts w chronic cervicogenic headache (HA) (=/>5 HA/mo for a minimum of 3 mo) to evaluate t relationship between HA

outcomes and the number of DC visits. Pts were randomized into 3 grps to receive: 1 visit/wk for 3 wks for total of 3 visits; 3 visits/wk for 3 wks for total of 9 visits; 4 visits/wks for 3 wks for a total of 12 visits. 3 DCs provided HVLA SM & up to 2 PT modalities (heat, soft tissue therapy including massage, & trigger point therapy) per visit. Outcomes: Primary outcome: Headache (HA) pain. Secondary outcomes: HA disability, Neck pain (NP) & disability, Number of HA. Results: For HA pain, substantial differences were found between Ss getting 1X/wk & those receiving either 3 or 4 Tx/wk. Improvement was substantial in magnitude compared w baseline for t higher dose grps. Comparable differences between grps were found for HA disability at 12 wks. There was also a considerable reduction in t number of HA vs baseline. T advantage of t higher dose grps over t lowest Tx was 4 to 6 HA/mo. Neck pain & assoc disability magnitude appeared to parallel HA outcomes. T data suggest support for a dose-response relationship between cervicogenic HA pain/disability & t number of chiro Txs. Larger numbers of visits produced greater benefit. This implies tt more Txs may be required to achieve maximum benefit & saturation of t dose-response curve. Findings suggest t benefit of 9 to 12 visits over 3 wks for Tx of HA/neck pain & disability. A larger number of visits than 12 in 3 wks may be required for maximum relief & durability of outcomes.

Descarreaux, M, et al. Efficacy of preventive spinal manipulation for chronic low back pain and related disabilities. JMPT 2004; 27(8): 509-514. Study investigates maintenance SM. Can it help reduce overall pain & disability assoc w CLBP after an initial phase of intensive chiro care? 30 Pts (ave 42.1 yrs, 24 M, 6 F) w chronic non-specific low back pain (=/> 6mo; ave was 68 -74 mo [5-6 yrs]) were randomized into 2 grps. Grp 1: received 12 Txs (3X/wk of side posture to lumbars & S-I jts - no complementary Tx or Pt education was given) in an intensive 1 mo period but received no Tx in a subsequent 9 mo period. A 4 wk period preceding t initial phase of Tx was used as a control period to examine t sole effect of time on pain & disability. Grp 2 received 12 Txs in an intensive 1 mo period & maintenance SM every 3 wks for a 9 mo F-U period. Pain (VAS) & disability (modified Oswestry) were evaluated at 1 mo & every 3 mo. Ice bags were used when Pts had pain >50. External consultations & t total number of sick days due to LBP were tracked. Results: Control period of 1 mo did not modify t pain & disability levels. For both grps t initial intensive phase of Tx yielded a signif reduction pain (21 mm on VAS scale) & on t Oswestry (9.1). For t maintenance grp, t disability scores were signif lower after 10 mo than before t initial phase of Tx. For t no maintenance grp, t disability score returned to t preTx level between 3 to 6 mo after t initial phase of Tx. For both grps, pain remained signif lower than t preTx levels. Results suggest tt maintenance SM helped maintain t disability scores at levels obtained after intensive SM care. In F-U period, t maintenance grp used t ice bag less often. Ave use was used 17X in no maintenance grp & 8 X in maintenance grp during 9 mo F-U period. Conclusion: Study confirms tt LBP & disability are reduced after SM. It shows positive effects of preventive chiro Tx in maintaining functional capacities & reducing t number & intensity of pain episodes after an acute phase of Tx.

Edwards, J. DC. ACN: The first shot in a long war. Dyn Chiro 2005; 23(22): 20-1. (retiring ACA chairman & 1st chairman of t new Nat'l Chiro Legal Action Fund (NCLAF) responsible for building a war chest so t profession can respond when attacked). The NCLF is monitoring inappropriate actions & abuses of chiro managed care networks (Landmark, ACN, ASHN). An example: a letter to the NY State Department of Health Sept 2005: T department is reviewing a proposed arrangement between Oxford Health Plans & ACN tt would permit ACN to manage Oxford's chiro benefits. We want to provide important information bearing on t delivery of quality chiro services. ACA has received an increasing number of complaints from DCs about t practices & policies of ACN. NYCC reviewed & analyzed t criteria used by ACN. "If NYCC were to use ACNs material as a cornerstone for our educational process, we would expect a signif decline in positive Pt outcomes...Our review reveals a disturbing pattern of various methods of withholding benefits purchased by t Pt & employer but, in fact, restricted under t guise of medical necessity. Insurers have t duty to review claims for medical necessity. Organizations such as NCQA & URAC exist to accredit MCOs & certify tt, among quality measures, no abusive restrictions of benefit payments or care authorizations tt would jeopardize Pt care can occur. Edwards, J. DC. ACN: The first shot in a long war. Dyn Chiro 2005; 23(22): 20-1. The AMA determined there was a need for formal Principles & Guidelines to ensure fair access to quality Pt care & to serve as a standard for ethical operations. Some MCOs w oversight over chiro care are in violation of these AMA principles. Authorization of care is denied for arbitrary reasons without review of t Pt's medical record, including: Pt is not improving quickly enough so care is deemed ineffective, or t Pt is improving, therefore care is no longer deemed necessary. Although some networks show extensive research & algorithms to ensure there is consistent process behind authorizations, actual claims evidence shows a huge disparity between company written policy & actual utilization management decisions. The ACA is very concerned tt some of these denial decisions may jeopardize t health & well being of Pts. T effects of such include: 1) the Pt is misled to think tt t benefit stated in their Summary Plan Description is available for use at t discretion of their doctor & t Pt's own determination tt they need to see a doctor. 2) t fact tt a benefit is represented to a Pt or employer who then expects access to t value it is stated to provide in terms of care - this becomes deceptive & represents an illusory benefit. T goal of chiro is efficient care, t best possible clinical outcomes in t most cost-effective manner. When care is restricted & results in poor outcomes, efficient care is not achieved. We simply have restricted care. An analysis of ACN summary data by Jeffrey Simonoff, PhD, (professor at NYU) states: "the ACN summary statistics certainly suggest tt such cost & visit limiting controls could be affecting practice by truncating t number of visits." T analysis supports our contention tt services are artificially being reduced by ACN's statistical maneuvering & benefits are being denied tt have otherwise been promoted & paid for by employers to t detriment of t Pt's health. It appears tt those organizations doing utilization review should have a Quality Assurance Program in place to assess t program's effectiveness. ACN states tt it is not hearing of any complaints from DCs, yet t ACA has had hundreds of complaints. We specifically request tt your department commence a formal inquiry into t effects of ACN policies & limitations on Pt care.

Banic, B. et al. Evidence of spinal cord hypersensitivity in chronic pain after whiplash & in fibromyalgia. Pain 2004; 107: 7-15. In 3 groups: whiplash Pts (n=27), fibromyalgia Pts (n=22) & healthy ctls (n=29) transcutaneous electrical stim of t sural nerve was applied & EMG recordings from t biceps femoris muscle were recorded. Results indicate evidence of spinal cord hyperexcitability in Pts w chronic pain after whiplash & in fibromyalgia. This can cause exaggerated pain following low intensity NC or innocuous peripheral stimulation. Spinal hypersensitivity may explain, in part, pain in t absence of detectable tissue damage. Absence of evidence tissue damage does not necessarily mean tt there is no tissue damage. Facet jts have been identified as a frequent source of pain after whiplash, even when clinical & radiological investigations do not show specific lesions. Tissue damage recognized or not by t available diagnostic methods, induces persistent hyperexcitabiltiy of spinal cord neurons in persistent pain complaints. In addition, peripheral inflammation induces a gene expression in t DRG resulting in an increased synthesis of peripheral receptors. This mediates primary hyperalgesia whereby a reduced threshold for eliciting pain w/i t injured area can be detected. T underlying mechanism may be either a sustained central facilitation by NC input from an unrecognized peripheral focus or spinal cord plasticity changes tt persist after resolution of tissue damage.

Giesecke, T, MD, et al. Evidence of augmented central pain processing in idiopathic CLBP. Arthritis & Rheumatism 2004; 50(2): 613-23. In chronic pain studies identified t occurrence of generalized increased pain sensitivity & altered brain processing, suggesting central augmentation of pain processing. Study compares sensory testing (pressure-pain threshold on thumbnail) & fMRI for neuronal activation in pain-related cortical areas w stimuli of equal pressure in CLBP Pts (pain =/>12 mo unexplained by MRI/radiographic changes), fibromyalgia Pts, & healthy ctls. Results: There is hyperalgesia in CLBP & fibromyalgia. When equal amounts of pressure were applied fMRI detected 5 regions of neuronal activation in pain-related cortical areas in CLBP & fibromyalgia grps (contralateral primary& secondary cortices, inferior parietal lobule, cerebellum & ipsilateral S2) vs only a single activation in ctls (contralat S2). Conclusions: CLBP & fibromyalgia Pts experienced more pain & showed more extensive patterns of neuronal activation in pain-related cortical areas. Findings are consistent w t occurrence of augmented central pain processing in CLBP & fibromyalgia Pts.

Multifidi, Back Stabilizers and CLBP

Lee J-H, et al. Trunk muscle imbalance as a risk factor of the incidence of low back pain: a 5 year prospective study. JNMS 1999;7(3):97-101. 5 yr study finds trunk muscle weakness is a risk factor in t incidence of LBP. 140 asymp Ss (ages 13 to 49) who had never been Tx for LBP had trunk muscle strength measured isokinetically to evaluate peak torque of ext, flex, right rot & left rot & agonist/antagonist ratios (E/F & L/R) ratios. Ss were followed 5 yrs. LBP Ss: M (32%) & F (40%). There were no differences between t non-LBP & LBP grps in age, height & weight, peak torque values & L/R ratios. However, **E/F ratio of t LBP grp showed signif lower value than t non-LBP grp. Lower extensor than flexor muscle strength may be a risk**

factor in t incidence of LBP.

Cohen, MD, Rainville, MD. Aggressive Exercise as Treatment for Chronic Low Back Pain. Sports Med; 2002; 32(1): 75-82. Studies show that CLBP Pts have deficits in trunk strength. The loss of extensor strength is much greater than that of flexor strength. The normal extensor to flexor strength ratio is 1.2 to 1.5, & in CLBP Pts it has been documented to be less than 1.0.

McGill S, PhD. Ultimate Back Fitness and Performance. Waterloo, Canada, Wabuno Publishers; 2004: Neither isometric nor dynamic trunk strength predicted t development of LB problems over a 10 yr F-U. Studies demonstrate reduced isometric trunk extensor endurance times in LBP but found no differences in isometric flexion or extension strengths. While isometric strength was not assoc w t onset of back troubles, poor static back endurance scores are. Strength appears to have little or a very weak relationship w LBT. In contrast, muscle endurance, when separated from strength, appears to be linked w better back health. T back muscles are designed for endurance capacity. A stable spine requires endurable muscles not necessarily strong muscles. A Hx of LBP is assoc w extensors having less endurance & flexors having more endurance. Graduated, progressive exercise programs (of longer duration & lower effort) should emphasize endurance first, then progress to strengthening exercises. More repetitions of less demanding exercises will enhance endurance & strength. LB exercises need not emphasize strength w high load, low repetition tasks. Given tt endurance has more protective value than strength, strength gains should not be overemphasized at t expense of endurance. For t injured back, spine flexibility should not be emphasized until t spine has stabilized & has undergone strength & endurance conditioning. T most successful rehab programs emphasize trunk stabilization thru exercise w a neutral spine while stressing mobility at t hips & knees.

Osborne, N, DC, FRSH, FCC, Cook J, DC. Global muscle stabilization training - isotonic protocols. In Liebenson C ed. Rehabilitation of the Spine 2nd Edition: Lippincott, Williams & Wilkins, 2007:667-87. Many studies identify t link between spinal pain & reduced strength, esp endurance of spinal stabilizers. There is a strong correlation between extensor weakness (reduced endurance) & t development of t first onset BP. Good isotonic endurance protects against occupationally related BP. A large study also noted flexor/extensor weakness in CNP & showed a strong correlation between chronic NP & neck weakness. Restoring or improving strength & endurance in NP or BP has a signif impact on chronic pain, function & disability. Endurance training is an initial goal in rehab. Endurance loading maximizes blood flow/perfusion & healing. Emphasis is on improv'ts in tonic holding capacity (endurance) of spinal stabilizers. Endurance is trained in deconditioned Pts w loading at 30-40% MVC in 3 sets of 12-14 repetitions. Spinal musculature endurance levels increase by 100-150% w/i 8 wks typically in deconditioned Pts. For Pt athletes or heavy laborers, additional protection to t spine is provided thru strength training w loads of 70-80% MVC performing 1-2 sets of 8-12 reps. Maximal strength gains occur after 8 wks of 25-40%. Development of strength is usually a secondary

consideration. The focus needs to be address endurance, muscle imbalances & core stability. Compliance: training should be in a supervised setting to improve form, accountability & document progression. A study by Reilly & Lovejoy observed 91% compliance w supervision vs 31% w/o supervision in an identical program. At 6 mo supervised grp had > improv't in aerobics, strength, & pain.

Leggett SM, Mooney VM, et al. Restorative exercise for clinical low back pain. Spine 1999;24(9):889-898. Tx of 412 patients with CLBP at 2 centers using the same Tx protocols. Outcomes: specific strength testing, SF-36, & self-appraisal of improvement at intake, discharge, and 1-year follow-up, & reuse of health care services after discharge. Results: Response during t program and at 1-year follow-up was similar at t 2 centers. Because of t extreme **reuse of t health care system for CLBP**, t authors believe reuse is t most important evaluation of efficacy. T most important finding from t study is t low reuse of t health care system by Pts who'd completed t progressive strengthening program: **reuse rate of 10% & 12% at 1 yr** at t 2 centers. Results were as effective in worker's comp as in private insurance cases. A study 1995 on 269 Pts w CLBP >3 mo found t **reuse of health care system was 73.1% & 10.4% of t Pts had undergone surgery**. Another study found at F-U tt 55% had need for med care. This study found tt a program designed to restore functional deficits rather than manage pain has an excellent opportunity to provide effective care unrelated to med Dx. In CLBP, **lumbar extensors** are likely to be deficient. **Multifidi** are t muscles most used in lumbar extension. A study noted tt **fatty infiltration in t lumbar extensors** of Pts w CLBP was higher than tt in healthy Ss. T same findings were noted by others using CT who found **t more severe t BP, t greater t atrophy in t lumbar extensor muscles.** EMGs demonstrated tt t amplitude of EMG signals in t extensors is considerably less than nl in CLBP. Lumbar flexors function normally in w Pts w LBP, but t extensors do not. **There's considerable evidence to focus t recovery program for CLBP specifically at lumbar extensors w equipment tt isolates this musculature & provides progressive, restorative strengthening exercise.**

Sweeney, HL, PhD. Gene Doping. Scientific American 2004; 291(1): 62-69. In aging muscles the rate of damage may be normal but t repair mechanisms may become less responsive. As a result, muscle fibers die & are replaced by infiltrating fibrous tissue & fat. In Pts immobilized by disability there is severe skeletal muscle loss caused by a total shutdown of muscles' repair & growth mechanism at t same time apoptosis (programmed cell death) speeds up. This is known as *disuse atrophy*. Skeletal muscle is metabolically expensive to maintain, so keeping a tight relation between muscle size & activity saves energy. Skeletal muscle is exquisitely tuned to changing functional demands. Just as it withers w disuse, it hypertrophies in response to repeated exertions.

Liebenson C. DC. Functional Stability Training. In Liebenson C ed. Rehabilitation of the Spine. A Practitioners Manual. 2nd Edition. Philadelphia: Lippincott, Williams, &

Wilkins, 2007:612-62. Muscle strength is lost at t rate of 3% to 7% per day of rest. Muscle strength improves 0.5% to 1% per day w training.

Richardson, PhD, BPhty, Jull, BPhty, GradDipManipTher, et al. Therapuetic Exercise for Spinal Segmental Stablization in Low Back Pain. 2nd Ed. Edinburgh, Churchill Livingstone 2004: 59-73. The multifidus (MF) is the most medial lumbar muscle. The muscle has 5 separate bands wh stem from SPs & laminae of lumbars. The deepest & shortest fascicle arises from t vertebral lamina (laminar fibers) & inserts into t mamillary processes of t vert 2 levels below w L5 fibers inserting onto t sacrum. T other fascicles arise from t SP & are longer. Some of t deepest MF fibers attach to t capsules of t facet jts. The MF has a unique segmental arrangement & t capacity for fine control of movements of individual lumbar vert. The MF is segmentally innervated by t medial branch of t dorsal ramus. Each nerve innervates only t fascicles tt arise from tt vert indicating a direct relationship between a segment & its MF. T segmental MF can control a segment to match t applied load. MF muscle bulk increases caudally from L2 to S1. The MF is t largest muscle spanning t lumbosacral junction. In contrast, t cross-sectional area of t lumbar longissimus & iliocostalis decreases on progression caudally. T large size of t MF at t lumbosacral jct compared w t lumbar erector spinae suggests tt t MF is t most capable of providing support at this level. It is t L4-5, L5-S1 segments tt have t highest incidence of pathology in LBP. T MF has a close relationship to t facet jts & by controlling t sliding movement of t facets, controls t distribution of stresses & loading on t vertebral jts. The MF is t only muscle tt's primary function is to protect t vertebral jts.

Bogduk, MD, PhD. Clinical anatomy of the lumbar spine & sacrum. NY, Churchill Livingstone 1997: 105-8. The MF, t largest & most medial of t lumbar back muscles, consists of a repeating series of 5 overlapping fascicles wh stem from t laminae & spinous process (SP) of each lumbar vertebrae. T key feature of t MF is tt its fascicles are arranged segmentally. Each lumbar vert is endowed w a group of fascicles tt radiate from its SP anchoring it below to mamillary processes, t iliac crest & t sacrum. MF fibers are arranged so their principal action is focused on individual vertebrae. They act in concert on a single SP. All fascicles arising from t SP of a vertebrae are innervated by t medial branch of t dorsal ramus tt issues from below tt vertebrae. Thus, t muscles tt directly act on a particular vertebral segment are innervated by t nerve of tt segment.

Akuthota, MD, Nadler, DO. Focused Review: Core Strengthening. Arch Phys Med Rehabil 2004; 85,(Suppl 1): S86-S93. The spinal ligaments provide little stability in the neutral zone. Their more important role may be to provide afferent proprioception of the lumbar spine segments.

Bogduk, MD, PhD. Clinical anatomy of the lumbar spine & sacrum. NY, Churchill Livingstone 1997. 104-5. The intertransversarii & interspinales muscles act as large, PR transducers. Their value lies not in t force they can exert, but in t muscle spindles they contain. Placed close to t lumbar vertebral column, they can monitor

movements of t column & provide feedback tt influences t action of t surrounding muscles. Such a role has been suggested for t cervical intertransversarii, wh contain a high density of muscle spindles. All unisegmental muscles of t vertebral column have 2 to 6 times t density of muscle spindles found in t longer, polysegmental muscles. This underscores t PR function of all short, small muscles of t body.

Richardson, BPhty, PhD, Hodges, BPhty, MD, PhD, et al. Therapeutic Exercise for Lumbopelvic Stabilization. A motor control approach for the treatment & prevention of LBP. Edinburgh, Churchill Livingstone. 2004: 59. The intertransversarii & interspinales are small segmental muscles connecting t transverse & spinous processes of two adjacent lumbar vertebrae. They have a segmental nerve supply & are highly rich in muscle spindles. McGill (2002) proposed tt these muscles are actually length transducers & position sensors. Bogduk proposed tt these muscles have a prominent PR role. As such, they could influence kinesthetic sense in t lumbar region & affect patterns of muscle activity.

Hodges, PhD, Richardson, PhD. Arch Phys Med Rehab 1999; 80 (Sept): 1005-1012. Study of trunk muscle coordination in Ss w & w/o a Hx of LBP (mean duration of 8.3 yrs). All Ss were pain free at t time of testing. Results: LBP Ss failed to recruit transverse abdominus (TrA) or internal obliques (IO) in advance of fast limb mov't & no abdominal muscle activity was recorded in most intermediate speed trials. Findings indicate tt preparatory spinal control is altered w LBP. LBP Ss have altered recruitment of trunk muscles wh may provide inadequate protection of spinal structures from injury. Precise recruitment of t trunk muscles is essential to protect t spine. In t neutral position minimal restraint is provided by passive structures (ligaments & jt capsules) & stability is dependent on t contraction of surrounding muscles. Changes in muscular control of t trunk w a Hx of LBP may expose spinal structures to increased risk of microtrauma & injury. Increased stress on t passive structures may result from decreased muscular stabilization. Results provide evidence tt coordination of t trunk muscles is altered in Ss w a Hx of LBP even w/o pain so they may be at greater risk of reinjury due to inadequate muscular stabilization of t spine.

Marshall PP, Murphy BD, PhD. The effect of sacroiliac joint manipulation on feed-forward activation times of the deep abdominal musculature. J Manipulative Physiol Ther 2006;29:196-202. Study determines the incidence of delayed feed-forward activation (FFA) times of their deep abdominal muscles (TrA & OI) in relation to rapid upper limb movements in 90 healthy young males & retests those who showed delayed FFA after 6 months to determine reliability of the measure & to determine the effect of SI manipulation on delayed FFA times. Results: 17 of 90 Ss met the criteria of impaired FFA: failure of deep abdominal activation within 50 milliseconds of deltoid activation. 13 were remeasured at 6-mo F-U. There was significant improvement (38.4%) in FFA times for this group when remeasured immediately after the sacroiliac joint manipulation. Conclusions: Delayed FFA is a highly reproducible measure at long-term F-U. This technique appears to be a sensitive marker of the

neural effects of sacroiliac joint manipulation. Future prospective studies are needed to determine if delayed FFA times are a marker for those at risk for developing back pain.

Ebenbichler, et al. Sensory-motor control of the lower back: implications for rehabilitation. Med Sci Sports Exerc 2001; 33(11): 1889-98. Stabilizing function of t trunk muscles is esp important in t Neutral Zone where t spine is least stiff - range of displacement around t mid position of t segment/jt, where little resistance is offered by passive spinal restraints. MF contributes nearly 70% of t stiffness resulting from muscle contraction in t neutral zone of t lumbar spine. Any injury or dysfunction of t MF will directly affect lumbar segmental stability.

Hodges, PW., PhD Core stability exercise in chronic low back pain. Orthop Clin N Am;2003 43: 245-54. In CLBP, there is consistent delayed activity of transverse abdominus (TrA) in association w rapid limb mov'ts even when in remission of pain. In CLBP, during functional tasks, there's reduced amplitude of activity of t multifidus (MF). Studies also show changes in muscle composition: Increased fatigability, Reduced cross-sectional area in as little as 24 hrs of unilateral LBP, Fatty infiltration.

Hungerford, PhD, Gilleard, PhD, Hodges, PhD. Evidence of Altered Lumbopelvic Muscle Recruitment in the Presence of Sacroiliac Joint Pain. Spine;2003 28(14): 1593-1600. EMG study of 7 trunk & hip muscles in 14 Ss w a Dx of sacroiliac joint pain (SIJtP) & ctls to determine whether muscle activation of the supporting leg was different during hip flexion in standing. Activation of the trunk & gluteal muscles stabilize the pelvis for load transference; but, t temporal pattern of muscle activation & effects SIJtP on tt patterns haven't been investigated.Results: Onsets of internal obliques & MF occurred before initiation of weight transfer in ctls but were delayed on the symptomatic side in SIJtP Ss, as was t gluteus maximus. EMG onsets were different between symptomatic & asymptomatic sides in SIJtP Ss. Delayed onset of internal obliques, MF & gluteus maximus EMG activity of the supporting leg during hip flexion in Ss w SIJtP suggests an altered strategy for lumbopelvic stabilization tt may disrupt load transference through t pelvis. The contribution of muscle force to control of intrapelvic motion is dependent on optimal control of the nervous system. Stability of intersegmental lumbar motion is maintained by strategies controlled by the CNS wh modulates timing & pattern of muscle recruitment according to the demands placed on the lumbar spine. Deep trunk muscles, including TrA, MF, lower fibers of internal obliques, & t diaphragm, activate before limb or trunk motion & exhibit patterns of co-contraction to increase spinal stiffness & limit intersegmental motion.

Liebenson, C. DC. What's All the Buzz About Spinal Stability? Part One: Biomechanics and Neurophysiology. Dyn Chiro 2004; 22(12): 34, 35, 46. Spine stability is greatly enhanced by co-contraction of antagonistic trunk muscles (abdominal & extensor muscles). Co-contractions increase spinal compressive load, as much as 12% to 18%, or 440N, but they increase spinal stability even more by 36% to 64%, or

2,925N. But when load is at a minimum, such as when the body is relaxed or a task is trivial, the motor control system is often "caught off guard" and injuries are precipitated. Inappropriate muscle activation sequences during seemingly trivial tasks, such as bending over to pick up a pencil, can compromise spine stability and potentiate buckling of the passive ligamentous restraints. Motor control skill has also been shown to be compromised under challenging aerobic circumstances. Spinal instability potentiates joint disorders. Spine stability requires that the central nervous, joint, and muscle systems all work together.
The joints are primarily passive, while the muscles are the active components that execute the commands of the nervous system.

Kader, MD et al. Correlation between the MRI changes in the lumbar multifidus muscles and leg pain. Clinical Radiology 2000;55:145-149. MRIs of 78 BP Pts (17-72 yrs) w or w/o leg pain were analyzed for lumbar multifidus (MF) atrophy, disc degen & N root compression. **MF atrophy was present in 80% of Pts w LBP & was bilateral in most cases** & at L4/L5 & L5/S1 levels together. Muscle atrophy was more common in older Pts & females. T correlation between MF atrophy & leg pain was signif. Atrophy of MF may explain referred leg pain in t absence of other MR abnormalities & should be assessed in MRIs of lumbar spine. **MF are innervated unisegmentally by t medial branch of t dorsal ramus.** MF wasting may be caused by t **Lumbar Dorsal Ramus Syndrome**:LBP w referred leg pain induced by irritation to structures innervated by t dorsal ramus nerve, (facet jts, MFs, interspinous ligs, or by myofascial injury) due to acute or chronic trauma wh initiates myofascial pain, spasm & ischemia. This triggers a self-sustained vicious cycle tt promotes muscle atrophy.

Structures innervated by the medial branch of the posterior primary division (AKA dorsal ramus) of the spinal nerves: MF, facet jt capsule, interspinales, medial intertransversarii, superspinous & interspinous ligs, & ligamentum flavum.

Bogduk, MD. PhD. Clinical anatomy of the lumbar spine and sacrum. New York, Churchill Livingstone 1997: 133. T lumbar dorsal rami divide into a medial branch, a lateral branch & a variable intermediate branch. T lateral branches are distributed to t iliocostalis muscle, but can also be cutaneous. T intermediate branches have only a muscular distribution, to t longissimus muscle. T medial branches tt are most relevant because they supply t facet jts. Each divides into multiple branches to supply t multifidus, t interspinous muscle & ligament & two facet jts. Each medial branch supplies t facet jts above & below its course. T muscular distribution of t medial branches to t MF is very specific. Each medial branch supplies only those muscles tt arise from t lamina & spinous process of t vertebra w t same segmental number as t nerve. T principal muscles tt move a segment are innervated by t nerve of t segment.

Polus, BI. Muscle spindles & spinal proprioception. In Principles and Practice of Chiropractic 3d edition. 2005. Haldeman S, McGraw Hill: 249-288. PRs serve as t

afferent limb of reflex pathways resulting in local muscle contractions tt stiffen a joint & minimize mechanical disturbances to t natural alignment of a spinal joint. Neural connections exist between MRs of IVD, facet jts, & local fascicles of t MF. Panjabi proposed tt lumbar instabililty may be a result of a loss of control & excessive movement in t neutral zone of t spinal segment due to injury of spinal tissues, degenerative changes, disease or muscle weakness. W/i t neutral zone spinal motion is produced w a minimum of internal resistance, where t overall stresses in t spinal column & t muscular effort required to maintain joint alignment are minimal. The MF plays a signif role in maintaining stability of lumbar spine segments w/i t neutral zone. This muscle undergoes pathological change after episodes of ALBP, including atrophy tt does not recover after resolution of Sx. This lack of recovery of local musculature is presumed to lead to an increased vulnerability of t lumbar spine to further injury & risk of recurrence of acute episodes of LBP.

Hides JA, PhD, et al. Long-term effects of specific stabilizing exercises for first-episode low back pain. Spine 2001;26:E243-8. A RCT w 1-yr & 3-yr F-U to evaluate a short-term exercise program's long-term effect on recurrences in acute, first-episode LBP Pts. An initial episode of ALBP is known to resolve spontaneously in the short-term in the majority of cases. However, the recurrence rate is staggeringly high ranging from 60% to 86% in various studies. 39 acute, first-episode LBP Pts (<3 wks) were medically managed (bedrest, absence from work, medications & advice to resume activity as tolerated) & allocated to a ctl grp or specific exercise group (4 wks of exercises to rehabilitate t MF in co-contraction w t transversus abdominis). Pain (by McGill Pain Q & VAS), disability (by Roland), ROM, activity levels, & muscle cross-sectional area (CSA) (using Dx ultrasound) were evaluated to determine recurrences at 1 & 3 yr F-U. Results: All Pts had asymmetry of MF w diminished size - cross sectional area on t side of pain decreased an average of 22% for ctl grp & 26% for specific exercise grp. At 4 wks & 10 wks F-U t MF recovery was not spontaneous on remission of pain in ctl grp. CSA at t most affected level remained 16.8% less at 4 wks & 14% less at 10 wks. Muscle recovery was more rapid & complete in exercise grp. MF CSA was only 0.7% less at 4 wks & 0.2% less at 10 wks. At 1 yr F-U, additional Tx was sought by 42% of ctl grp & 15% of exercise grp. For 2-3 yrs, 25% of ctl grp sought Tx vs 20% of exercise grps. Outcomes of disability & physical function were similar for both grps at 4 wk (pain resolved in 90% of Pts). Although they resumed nl activity levels, Pts in t ctl grp had signif decreased MF size at 10 wks F-U. At 1 yr F-U, Pts in ctl grp were 12.4 times more likely to experience recurrences of LBP than Pts in t specific exercise grp & 9X more likely to experience LBP in 2 to 3 yrs. Recurrent episodes were rated as severe & disabling as t original episode in 56% t ctl grp, but in only 33% in exercise grp. Conclusion: Specific exercise in addition to medical care & resumption of activity may be more effective in reducing low back pain recurrences than medical management & activity alone. After acute LB injury, a deficit in t MF may leave t injured segment susceptible to further injury & recurrence. Specific exercise therapy may be required to restore nl muscle function. Deficient stabilization of lumbar segments caused by a deficient MF may explain LBP recurrence w minimal or no predisposing incidents.

Kang, Y.-M., PhD et. al. Electrophysiologic evidence for an intersegmental reflex pathway between lumbar paraspinal tissues. Spine 2002; 27: E56-63. Sensory (afferent) impulses conveyed by t medial branch of t dorsal ramus reflexly alter motor (efferent) activity of medial branches at least one to two vertebral segments away. This provides evidence tt t medial branch of t dorsal ramus underlies reports tt mechanical stimuli [like SM] initiate reflex interactions between lumbar medial paraspinal tissues. T presence of reflex pathways between adjacent lumbar segments probably helps contribute to segmental coordination during movement & may provide t neural substrate proposed to understand t effects of SM. Sensory stimuli from t most medial paraspinal tissues may reflexly alter motor (efferent) activity to an adjacent lumbar segment & could contribute to biomechanical changes associated w CLBP & lumbar muscle spasm.

Fryer, G. BAppSc (Osteo), Morris, PhD, Gibbons, MD, BS, DO. Paraspinal muscles & intervertebral dysfunction: part 2. JMPT 2004; 348-57. The deep lumbar MF &TrA appear to be controlled independently from t motor commands of t more superficial trunk muscles. These deep muscles are recruited prior to limb or trunk movement, are not influenced by t direction of movement, maintain contraction throughout the entire motion, and are proposed to have a major role in controlling intersegmental motion & spinal stability. Contraction of these deep stabilizing muscles is delayed or absent in Pts w LBP. Evidence suggests tt pain delays & inhibits t deep stabilizing musculature but does not affect t control of t more superficial muscles. Atrophy of MF appears to occur rapidly & specifically to t side & vertebral level of pain & injury. In t lumbars this process appears to be specific to MF & indicates reflex inhibition of MF activity. Because spinal pain appears to suppress the activation of the deep musculature, it is possible tt t CNS may attempt to compensate for this deficiency of strength & stability by exaggerating t activity of t more superficial muscles. Such an attempt to increase spinal stability w/o recruitment of the deeper muscles may explain t non-voluntary guarding behavior observed in LBP Ss. Electrical & mechanical stimulation of deep spinal structures (IVDs, facet jts, supraspinous ligs) produce reflex activation – not inhibition of MF.

Solomonow, PhD, MD et al. Spine 1998;23(23):2552-2562. Spinal ligaments are endowed w sensory receptors & are situated in key locations sensitive to relative motion of t vertebrae in various planes, so their receptors can monitor movement & activate muscles via spinal neurons & maintain or restore stability. Stimulation of t receptors elicit reflex activity in t paraspinal muscles & contribute to maintaining spinal stability when subjected to various internal & external disturbances. A reflex arc exists in t human spine from MRs in spinal ligs, discs & facet jts to t multifidi & possibly other muscles. Such a reflex is triggered at low to moderate loads tt cause relative motion of 2 vertebrae, causing multifidi to become active. When conditions tt challenge spinal stability are detected, t control unit activates appropriate muscles to protect, restore or avoid instability. Strong muscular activity is seen when loads tt can cause permanent damage to t ligament are applied, indicating tt spastic muscle

activity & pain can be caused by ligament overloading. Ligs have only a minor mechanical role in maintaining spine stability. Muscular co-contraction of anterior & posterior muscles are t major stabilizing mechanism of t spine. Workers requiring sustained activity of paraspinal muscles at their jobs are subject to muscle fatigue & diminished ability of t muscles to stabilize t spine & there is a signif risk of injury. Muscle conditioning programs are highly effective in prevention & rehabilitating Pts w spinal injuries. As muscles become conditioned & less prone to fatigue, t stability of t spine can be preserved for longer periods of time w/o exposure to injury.

Barr KP, MD, Griggs M, MD, PT, Cadby T, MS, P. Lumbar stabilization: core concepts and current literature, Part 1. Am J Phys Med Rehabil 2005;84:473-80. Stability is dynamic including static position & controlled mov't, as well as, alignment in sustained postures & mov't patterns tt reduce tissue strain, avoid trauma & allow efficient muscle action. Stability & mov't patterns may be altered by tissue damage, insufficient muscular strength or endurance, poor neuromuscular control, fatigue, or a combination of such problems and may result tissue damage, decreased stability, increased challenge to already inefficient muscles, & a degenerative cascade. Passive restraints (bones, ligaments, jt capsules) provide t most stability toward t end of ROM. They don't provide much support in t neutral position; muscles provide t support & stiffness. Very modest levels of muscle activity can create sufficiently still & stable jts. In usual situations only about 10% of maximal contraction is needed to provide segmental stability. In a segment damaged by ligament laxity or disc disease slightly more may be needed. Therefore, **endurance is much more important than absolute muscle strength in most Pts**, although a strength reserve is needed for unpredictable activities such as a fall, sudden load, or quick mov'ts. T neural control system coordinates muscle activity to respond to expected & unexpected forces. T system must activate t correct muscles at t right time by t right amount to protect t spine from injury & allow t desired mov't. Stiffness is achieved w specific patterns of muscle activity wh differ depending on jt postion & load. **T spine is more easily injured in full flexion because of excess straining of t passive system**. Spinal stability may be compromised by motor control errors or poor muscular endurance wh allows overloading of passive tissues. Too much stiffness causes unnecessary energy expenditure & increased loading of spinal segments. Deep muscles are responsible for control of stiffness of vertebrae. Global muscles generate spinal motion & handle external loads. MF control vert mov't during posture & mov't to protect t joints, disc, & ligs from excessive strains & injury. TrA stiffens t by spine increasing intra-abdominal pressure. **In Pt s w LBP t deep stabilizing system is often very dysfunctional**. Deep fibers of t MF & TrA are t first muscles to become active when a limb is moved & are independent of mov't direction. These fibers contribute t most to spinal stabilization & are active in quiet standing & postural tasks such as neck flexion. Studies in wh surface EMG is used to measure activity are flawed by an inability to measure MF activation. MF in CLBP Pts demonstrate atrophy. In postop Pts w unilat LBP paraspinals were 10-30% smaller on affected side. Ultrasound found 31% difference side to side in CLBP vs 3% in ctls. Atrophy is unilat. **MF changes do not seem to resolve spontaneously w/o specific Tx even when pain is abated. Specific exercise training has evidence tt MF atrophy can be reversed**. In LBP there is poor stabilization due to

delayed TrA activity & a decreased ability to contract in Pts w recurrent LBP even when pain free. Other stabilizers: quadratus, pelvic floor, diaphragm, iliopsoas, rectus abdominis, obliques contribute to intraabdominal pressure & stabilization before t initiation of large limb mov'ts. T local deep muscles (MF, TrA) provide a general increase in intervertebral stiffness. T activity of t superficial muscles may also become dysfunctional in LBP when there's dysfunction in t passive stabilizing system, global muscles may try to compensate by coactivation wh increases spine stability & stiffness but comes at t price of increasing compressive load & spinal pain. Global muscles can't provide control over individual vertebrae & have limited ability to control shear forces unlike t deep stabilizers. They also restrict spinal motion & spinal function. They may not be able to perform other intended motion & functions if they are used to try to achieve spinal stability & may compromise respiratory function. LBP Pts have weaker back extensors, decreased endurance, abnl flexor to extensor strength ratios. Weak extensors are a risk factor for development of LBP. Postural control is altered in CLBP & is thought to be due to impaired neuromuscular feedback & delayed muscle reaction times. LBP Pts have more trouble w unexpected balance challenges, trunk perturbation, slower muscular reaction times. But in a 2 wk rehab program consisting of trunk extensor strengthening, Pts developed reaction times similar to ctls. In spinal segments w structural damage, proper muscular function seems to be able to compensate for structural deficits. That is why **exercise training is t mainstay of Tx to improve stabilization**. Exercise can increase muscle mass, strength & endurance. Research supports t theory tt stability exercises prevent recurrences. Exercises should use low loads to t spine so it is better tolerated & t risk of injury is low & compliance is increased.

Liebenson C. Functional Stability Training. In Liebenson C ed. Rehabilitation of the Spine. A Practitioners Manual. 2nd Edition. Philadelphia: Lippincott, Williams, & Wilkins, 2007:612-62. Endurance training of agonist & antagonist co-contraction ability about a jt has been shown to improve jt stability by enhancing muscle stiffness. This doesn't require a very strong muscular effort. Researchers have shown tt efforts of just 25% of maximum voluntary contraction (MVC) provided maximal jt stiffness. A prolonged tonic holding contraction at low MVC is ideally suited to selectively train type 1 tonic muscle fiber function. Tonic fibers only operate at levels <30% to 40% of MVC. Isometric holds should be no more than 7 - 8 sec based on recent studies indicating rapid loss of available oxygen in muscles contacting at mild to moderate levels of intensity (<50% of MVC).

Danneels LA et al. CT imaging of trunk muscles in CLBP Pts & healthy control subjects. Eur Spine J 2000;9:266-72. A study of 32 CLBP Pts (ave 9.16 yrs) & 23 ctls. Muscle cross-sectional size (CSA) was evaluated from CT images. Only CSA of MF at t lower end-plate of L4 was found to be statistically smaller in LBP Pts. After onset of pain, a combination of reflex inhibition & substitution patterns of other trunk muscles may work together & cause selective atrophy of t MF. Since t MF is important for lumbar segmental stability, t MF atrophy may permit spinal instability & be a reason for t high recurrence rate of in chronic LBP. The selective atrophy of t MF in CLBP Pts

was unilateral & isolated to one level. This suggests tt wasting was not generalized disuse atrophy but spinal reflex inhibition. MF recovery didn't occur spontaneously on remission of pain. In subacute & chronic stages a combination of reflex inhibition & changes in coordination of trunk muscles work together to produce atrophy. Many studies highlight t importance of t MF to provide dynamic control. Wasting of t MF may permit lumbar segmental instability, predisposing to further damage. This may explain t progressive nature of Sx & disability exhibited by many CLBP Pts. Results suggest tt a selective training of t stabilizing muscular system could be meaningful in t prevention & rehab of CLBP.

Mooney, V. MD. How to have a healthy back. backstrong. com. 2003. There are small muscles in the low back tt function in a unique manner to maintain lumbar lordosis. With pain, these small back muscles rapidly atrophy. Scientific studies confirm that they atrophy more quickly than any other muscle group when there is back injury. T muscle atrophy can remain after recovery from t LBP episode. When one has a back injury with recurrent pain, t nervous system inhibits muscle function. The inhibition may be greater than it needs to be, especially when pain is assoc w anxiety & fear of re-injury. Inhibition can be diminished by aggressive physical training best accomplished when the muscles to be facilitated are isolated in someway so there is no substitution by other muscles.

Kristjansson, E. Reliability of ultrasonography for the cervical multifidus muscle in asymptomatic and symptomatic subjects. Man Ther. 2004; 9(2):83-8. Study to assess the reliability of ultrasonography to depict the size of the cervical multifidus muscle (MF) in asymptomatic & symptomatic Ss. 10 asymptomatic women (19-48 years) & 10 women w chronic WAD, grade II, (19-49 years) were imaged by ultrasonography. T cross-sectional area (CSA) of t MF & the transverse versus the anterior-posterior dimensions at the C4 level were measured. T size of the MF was significantly reduced in the symptomatic group. Results indicate that loss of clarity of the fascial layer between the semispinalis cervicis & t cervical MF may be a Dx sign of muscle atrophy. Ultrasonography can be used to precisely measure the size of the cervical multifidus muscle.

Strengthening Multifidi & Reducing Future Back Pain

Danneels et al. Effects of 3 different training modalities on the cross sectional area of the lumbar multifidus muscle in patients with chronic low back pain. Br J Sports Med 2001; 35(3):186-91. To determine whether MF atrophy can be reversed & the effect of different exercise programs on the cross sectional area (CSA) of the lumbar multifidus (MF) in 59 CLBP Pts. Pts were randomly assigned to one of 3 programs: Group 1 (19 Ss) 10 wks of stabilization training; Group 2 (20 Ss) 10 wks of stabilization combined w dynamic resistance training; Group 3 (20 Ss) 10 wks of stabilization combined w dynamic-static resistance training. Before and after 10 wks of training, MF CSAs were measured from CT images at 3 different levels (upper end plate of L3 and L4, and lower end plate of L4). Results: The CSA of the multifidus muscle was significantly increased at all levels after training in group 3. In contrast, no

significant differences were found in groups 1 and 2. General stabilization & dynamic intensive lumbar resistance training have no significant effect on the CSA of the lumbar MF in CLBP Pts. The static holding component between the concentric and eccentric phase was found to be critical in inducing muscle hypertrophy. Tx consisting of stabilization training combined with an intensive lumbar dynamic-static strengthening program seems the most appropriate method of restoring the size of the multifidus muscle. Eccentric muscle contractions seem to be essential to obtain optimal hypertrophy in response to resistance training & a combined dynamic-static training mode has been recommended in order to recruit as many motor units as possible. To increase muscle mass, an intensive strengthening program is necessary in addition to stabilization training. In CLBP, recovery of MF may be hampered by changed recruitment patterns, so tt other muscles are active & substitute. People w sedentary lifestyles do not expose their back muscles to work loads high enough to stimulate type II fibers. Type II fibers (fast twitch) of MF recover as a result of intensive exercise. Training w maximal & submaximal effort may reverse t selective atrophy of type II fibers in t MF.

Keller, MD, et al. Trunk Muscle Strength, Cross-sectional Area, and Density in Patients w CLBP Randomized to Lumbar Fusion or Cognitive Intervention and Exercises. Spine; 2004 29(1): 3-8. 1 yr F-U study in a 51 yr old woman w postlaminectomy syndrome randomized to lumbar fusion showed the cross-sectional area was unchanged & density decreased by 3%. IN a 45 yr old woman w postlaminectomy syndrome randomized to cognitive intervention & exercise at 1 yr F-U t cross-sectional area increased by 12% & density by 16%. 1 yr F-U study to compare muscle strength, cross-sectional area, & density of the back muscles in 124 CLBP Pts (8-9 yrs) (w or w/o previous laminectomy) randomized to either lumbar fusion or cognitive intervention & exercises (combined supervised & home based). Results: Exercise grp performed signif better in muscle strength than fusion group, (>184 Nm, a 30% increase) & Biering-Sorensen Test: 21 seconds. The density at L3-L4 decreased in the lumbar fusion grp but remained unchanged in the exercise group. The cross-sectional area was unchanged in both groups. Strength & density increased at T12-L1 in t exercise grp. Conclusions: CLBP Pts who had cognitive intervention & exercise improved signif in strength & muscle density remained stabile at 1 yr F-U vs Pts who had lumbar fusion. Their muscle strength & density decreased. T effect of an exercise program first leads to gains in muscle strength because of neural drive, then to increased density because of hypertrophy of the muscle fibers, and lastly to an increase in the cross-sectional area.

Reasons to perform exercises to strengthen & improve endurance of **multifidi** on a gym ball: 1. Can start in lumbar flexion & move to lumbar neutral
2. Requires balance & stimulates MR input to produce spinal motor reflex programs tt protect & stabilize spinal jts.
3. Provides pelvic stabilization, prevents substitution of gluteals & hamstrings for multifidi

San Juan JG, Yaggie J, Levy S, et al. Effects of pelvic stabilization on lumbar muscle activity during dynamic exercise. J Strength Cond Res 2005;19:903-7. Trunk extension is a compound movement involving simultaneous rotation of t lumbar spine, pelvis, & hips. Together they result in @ 180 degrees of trunk extension w 72 degrees in t lumbars & 108 degrees in t hip & pelvis. It's been suggested tt in order to effectively assess & train t lumbar extensor muscles, t pelvis needs to be stabilized during trunk extension to minimize t involvement of t hip & lower extremity muscles & to isolate t lumbar extensors. If t pelvis is free to move during trunk extension, contraction of t gluteals & hamstrings causes t pelvis & hip to rotate & only a small portion of t total trunk extension force production is due to motion of t lumbar spine via contraction of t lumbar extensors. Study examines t effect of pelvic stabilization on t activity of t lumbar & hip extensor muscles during dynamic back extension exercise in 15 healthy Ss performing dynamic extension exercise on a lumbar extension machine w & w/o pelvic stabilization. Surface EMG activity was recorded. Results: T activity of t multifidus was 51% greater during t stabilized condition. Pelvic stabilization enhances lumbar muscle recruitment during dynamic exercise on machines.

Mooney. Backstrong.com. Variable Angle Resistance Roman Chair (VARRC)

Jull, PT, PhD, Richardson, PT, PhD. Motor control problems in patients with spinal pain. JMPT 2000;23(2):115-117. Traditional exercise programs focus on strength, endurance, & functional capacity - beneficial in deconditioned Pts, increasing general muscular support of t spine. However, recent research suggests motor control is a key impairment rather than loss of strength. Links are emerging between LBP & motor control deficits in t local muscle system - transverse abdominis (TrA) & multifidus (MF). These muscles lose their nl anticipatory function in LBP Pts, exhibiting delays in activation & loss of their nl preprogrammed function for support. MF reacts by inhibition at a segmental level in acute episodes of LBP. Segmental stabilization training is aimed at controlling pain, protecting & supporting t spinal segment from reinjury by re-establishing & enhancing muscle control - to improve motor control & restore nl synergistic function between local & global muscle systems. T focus is on retraining co-contraction of t TrA & MF. During retraining, these muscles are activated cognitively, as independently as possible from global muscles. Contractions are practiced repeatedly w t aim of restoring t muscles automatic stabilization function.

Akuthota, V. M. and S. F. D. Nadler Core Strengthening. Arch Phys Med Rehabil 2004; 85,(Suppl 1): S86-S93. The "core" is described as a box with the abdominal muscles in front, paraspinals & gluteals in back, the diaphragm as the roof, & the pelvic floor & hip girdle musculature as the bottom. The core serves as a muscular corset that works as a unit to stabilize the body & spine. The core serves as the center of the functional kinetic chain & has been referred to as the "powerhouse," the foundation or engine of all limb movement. Stability & movement are critically dependent on the coordination of all t muscles surrounding the lumbar spine. Recent research emphasizes the importance of TrA & MF but all core muscles are needed for

optimal stabilization & performance. To acquire this cocontraction, **precise neural input & output (referred to as proprioceptive neuromuscular facilitiation)** are needed.

Instructions for **Abdominal Hollowing** exercises to learn control and strengthen transverse abdominus (begin in 4 point stance - kneeling on hands & knees):
1. Suck belly in. Bring your belly button up toward your spine. Suck your stomach away from you belt.
2. Hold your stomach sucked in & continue to breathe
3. Hold stomach sucked in, continue to breathe & do cross extensions of arm & opposite leg. Add hold.

McGill, S., PhD. Correspondence 2006. In the "birddog" t gluts generate t hip extensor torque & may possibly add some lumbar extension w some minor passive tissue splinting tt is transferred up t spine, but the "birddog" results in much better stabilization patterns with abdominal integration than roman chair exercises. The gluts must support the extended and cantilevered leg, but so do t spine extensors (and all other torso muscles to some degree) for torque & stability about all 3 axes. This creates a wonderful stabilization environment, training both motion and motor patterns including abdominal coactivation, neutral spine, and motion about t hips not t spine.

Liebenson C. Functional Stability Training. In Liebenson C ed. Rehabilitation of the Spine. A Practitioners Manual. 2nd Edition. Philadelphia: Lippincott, Williams, & Wilkins, 2007:612-62.
Safe Exercises: Quad single leg raise = 2000 to 2300 N; Quad: Opposite arm/leg raise (birddog) = 3000N; Side bridge on knees <2000N; on ankles = 2600 N; Curl-up = 2000 N. Unsafe exercises: Sit-ups, bent knee = 3500N; Sit-ups, straight knee = 3350 N; Curl-up on ball = 4000N; Prone Superman = 4300N.

McGill S, PhD. Ultimate Back Fitness and Performance. Waterloo, Canada, Wabuno Publishers; 2004: 274-9. T method to activate extensors w minimal spine loading is to use t single leg extension hold wh results in acceptable spine loading & activates one side of extensors to @ 18% of MVC. Simultaneous leg extension w contralateral arm raised "birddog" increases unilateral extensor muscle challenge @27% of MVC on side of lumbar extensors & 45% MVC on t other side of thoracic extensors but increases lumbar compression to over 3000N. Emphasize abdominal bracing & a neutral spine. Goal is to hold t limbs parallel to t floor for @ 6-8 sec. Good form includes a neutral spine & abdominal bracing.

McGill S, PhD. Ultimate Back Fitness and Performance. Waterloo, Canada, Wabuno Publishers; 2004: 274-9. **Beginner's program for Stabilization**: 1) Begin w flexion/extension cycles (cat/camel motion) to reduce spine viscosity. This is a motion exercise not a stretch: 5-6 cycles. 2) Slow lunges w an upright braced torso (sparing t spine) while improving hip & knee endurance & mobility. 3) Anterior abdominal exercises - Curl-Ups. 4) Lateral musculature exercises - Side Bridges for lats &

abdominal wall muscles for optimal stability. 5) Extensor program consists of Leg Extensions & t Birddog.

McGill S, PhD. Ultimate Back Fitness and Performance. Waterloo, Canada, Wabuno Publishers; 2004: 274-9. Endurance is built first w repeated sets & then for some t progression continues w longer holds. Early endurance progression begins w isometric holds performed in curl-up, bridges, & birddog & held no longer than 7 or 8 sec. T duration is based on recent evidence tt rapid loss of available oxygen in torso muscles contracting at these levels. Short relaxation of t muscle restores oxygen. Endurance objectives are achieved by building up repetitions of t exertions rather than by increasing t duration of each hold.

Liebenson C. Functional Stability Training. In Liebenson C ed. Rehabilitation of the Spine. A Practitioners Manual. 2nd Edition. Philadelphia: Lippincott, Williams, & Wilkins, 2007:612-62. Variables by which to progress Pts: Unloaded to loaded. Simple to complex (uniplaner to triplaner or isometric to concentric to eccentric.) Slow to fast. Endurance to strength to power. Increasing resistance. Stable to labile (decreased points of support or use of unstable surfaces like ball or board). Always have t Pt demonstrate t exercise on t next office visit to correct any errors tt they may have adopted. Stability Training Variables: Intensity: submaximal <50% of single repetition maximum (1 RM). Sets & repetitions: start w 1 set of @ 6 reps. Progress to 1 set of 12 reps. Further progress after t reverse pyramid approach of adding a second set of 8 reps, & then a third set of 4 reps. Hold times: emphasize endurance by holding for 1 to 2 breaths (6 to 8 sec). Form: movem'ts should be performed slowly w appropriate form for motor control training & injury prevention. Frequency: daily or twice daily to improve motor control. Duration: up to 3 mo required to re-educate movement patterns in a Pt w chronic pain.

Graves, PhD et al. Arch Phys Med Rehab 1994; 75: 210-15. Training w/o pelvic stabilization resulted in no improv't in strength of lumbar extensors. Training w pelvic stabilization showed signif improv't in lumbar extensor strength. T magnitude of improv't in t fully extended ROM was 120% at full extension to 42% at full flexion. This demonstrates t unique potential of t lumbar muscles to adapt to specific resistive exercise. Research suggests tt large strength increases in t isolated lumbar extensor muscles are due to t fact tt these muscles are initially very weak. Because lumbar extensors are rarely isolated during normal daily activities, they seldom encounter an overload stimulus required to gain strength. These muscles are weak before training because they exist in a state of chronic disuse. Trained lumbar extensors have a greater strength & would be able to handle greater external loads & be more resistant to fatigue.

Nourbaksh, PT, PhD, Arab, PT MSc. Relationship between mechanical factors and the incidence of LBP. JOSPT 2002;32(9):447-460. Study investigates the association among mechanical factors & occurrence of LBP. 600 Ss categorized in 4 grps 1) asymp men; 2) asymp women; 3) men w LBP; 4) women w LBP. (each: #150, 43 yrs).

Measured 17 physical characteristics & t assoc w LBP: Back extensor endurance & length; Length of ilioposas, abdominal muscle, hip adductor, hip flexor, hamstrings, gastrosoleus; Strength of hip flexor, extensor, abductor, adductor, abdominal muscle; pelvic tilt, foot arch. Results: Endurance of back extensor muscles had t highest assoc w LBP of all factors. Length of back extensor muscles, strength of hip flexors, hip adductors, & abdominal muscles also had a signif assoc w LBP. Conclusion: Endurance of back extensor muscles has t highest assoc w LBP. Other studies also show a decrease in back extensor muscle endurance in CLBP Pts. Factors including size of lumbar lordosis, pelvic tilt, leg length discrepancy, & length of abdominal, hamstrings, & iliopsoas muscles are not assoc w LBP. EMG studies indicate paraspinal muscles in LBP Pts have a faster fatigue rate. Fatigued muscles have longer response times & decreased ability to tolerate sudden loads. Excessive, uncontrolled loads may induce strain on t facet jts & other passive structures resulting in LBP. Studies show tt improvement of erector spinae endurance is important in preventing & Tx LBP. Improved Sx may be due to enhanced muscle endurance & coordination between t trunk flexor & extensor muscles.

Moseley, G. L. Impaired trunk muscle function in sub-acute neck pain: etiologic in the subsequent development of low back pain? Man Ther 2004; 9(3): 157-63. 54 neck pain (NP) Pts (>4 mo to 1yr) w no LBP for at least 2 yrs & 52 healthy ctls assessed on an abdominal drawing-in task (ADIT) – abdominal hollowing. T maximum pressure change sustained for 2 sec rated: >/= 4 mmHg: nl; 2-4 mmHg: uncertain; <2 mmHg: abnl. Ss from each group were contacted at 2 yrs & asked if they had experienced persistent or recurrent LBP (>4 episodes) in tt time. Results: Mean ADIT score for NP Pts was signif lower: 1.8 mmHg vs 5.2 mmHg in ctls. 75% of NP Pts & 15% of ctls had an abnl response. Reduced ADIT in NP Pts & in ctls is assoc w increased risk of developing LBP. 80% of NP Pts indicated they still had NP at 2 yrs. 74% of Pts who had an abnormal response on ADIT reported persistent or recurrent LBP at 2 yrs - 3X more than for uncertain & nl response grps. Of ctls who had an abnl response on ADIT, 75% went on to develop persistent or recurrent LBP in t next 2 yrs - 6X tt for t for uncertain & nl response. Ss w subacute NP have a reduced capacity to perform ADIT. Reduced performance on ADIT is assoc w increased risk of LBP over t next 2 yrs in both NP Pts & ctls. Spinal pain impacts on trunk muscle control regardless of t spinal level at wh pain is experienced. Altered trunk muscle function assoc w NP may be etiologic in t subsequent development of LBP. Altered trunk muscle function in otherwise asymptomatic Ss may also be etiologic in t development of LBP. Results imply tt maintenance of nl voluntary trunk muscle function may be important in preventing LBP in Pts w subacute NP

Strengthening Abdominal Muscles

Vera-Garcia, Phys Ther 2000; 80(6): 564-9. Performing curl-up exercises on labile surfaces increased abdominal muscle activity. 8 men w no Hx of LBP performed curl-up exercises - on a stable surface & 3 on labile surfaces. EMGs were recorded from abdominal sites & normalized to maximal voluntary contraction (MVC) amplitudes. Curl-ups on labile surfaces increased abdominal muscle activity.

Curl-ups on stable bench: in percent of MVC: 21% upper rectus abdominis; 20% lower rectus abdominis; 4.7% external obliques; 11% internal obliques. Curl-up on gym ball: in percent of MVC: 46.6% upper rectus abdominis; 54% lower rectus abdominis; 21% external obliques
19.5% internal obliques. Curl ups on a gym ball doubled activity in t recutus abdominis & activity in t external oblique increased approximately four fold. Curl-ups on labile surfaces change both the level of muscle activity and the way that the muscles coactivate to stabilize the spine & t body. This suggests a much higher demand on the motor control system, which may be desirable for a rehabilitation program.

Strey, K. Ab-solutely no other way. San Diego Magazine; 2001:35. Study sponsored by the American Council on Exercise (ACE), from the Biomechanics Lab at SDSU, monitored muscle activity using EMG to compare 13 of the most common abdominal exercises & ranked them from most to least effective. According to Peter Francis, PhD (director of t Biomechanics Lab at SDSU) the 1st ranked was t bicycle maneuver, 2nd was t captain's chair, 3d was crunches on exercise ball. Even though the use of the exercise ball came in third, Francis highly recommended using an exercise ball because it requires balance and continuouse of muscles.

U.S. Department of Labor: Bureau of Labor Statistics. 2003 National Occupational Employment & Wage Estimates. Chiropractic - Mean income: $83,230. Median income ($50^{th}$ percentile): $66,610

Use of Fitballs to Enhance Balance, Proprioception, Endurance & Motor Control.
Posner-Mayer J, PT, editor. Orthopedic, Sports Medicine, & Fitness Exercises using the Swiss Ball; 1995. Excellent resource for prescribing exercises utilizing the Swiss (Gym) Ball.

Functional Layers of the Spine
Jemmett, R., PT. Spinal Stabilization. The New Science of Back Pain. Halifax, Canada, RMJ Fitness & Rehabilitation Consultants. 2003. **The Deep Layer** consists of vertebrae, discs, ligaments, & a series of muscles wh run from one vertebrae to t next. Deep layer performs 2 functions: 1) Helping to stabilize t spinal column. Ligs serve to limit t size of t bending & rotating motions and limit motion only at t end ROM. Ligs prevent t vert from moving too far in any direction. 2) providing t CNS w information about t exact position of every jt & vertebrae in t spine. Discs, small muscles (intertransversarii & interspinales) ligs of t deep layer are well innervated & have t ability to sense changes in t position of t many jts of t spine & send this postural information to t CNS. T CNS is extremely dependent on this postural information when attempting to effectively organize & use t various muscles wh make the spine work. CNS needs a steady stream of accurate info about t relative position of all our jts if it is going to successfully coordinate parapsinal muscles. We are beginning to understand t significance of t position-sensing function of t deep layer. T body uses muscles to control t small coupled & translation motions. To

control them, t nervous system needs to know what motions are occurring. Discs, ligs, & small muscles of t spine contain receptors wh send this positional information to t nervous system. Every split second, discs, ligs, small muscles at every jt send this positional information to t nervous system so it can know where t different parts of t body are relative to each other. W this info, t nervous system can activate t correct muscles to create a certain movement or prevent excess movement. When t small coupled and translations of t spine are not kept under precise control, injury may occur. Therefore, developing a highly tuned positional sense is a first step to rehabilitation or prevention. Stabilization training requires t use of position & movement sense much more than standard exercises. Previous exercise approaches for BP & sports conditioning ignored position sense training.

Hodges, PW., PhD Core stability exercise in chronic low back pain. Orthop Clin N Am;2003 43: 245-54. Accurate motor control is dependent not only on muscles, but on the sensory system which provides information about stability, perturbation, & a dynamic model of t body. In CLBP there is impairment of the sensorimotor system including reduced acuity & impaired repositioning tasks. Motor control is dependent on sensory input.

Jemmett, R., PT. Spinal Stabilization. The New Science of Back Pain. Halifax, Canada, RMJ Fitness & Rehabilitation **Consultants. 2003. The Middle Layer** consists of four key muscles tt provide t bulk of stability required to keep t lower back working effectively. Two are back muscles: multifidus & t quadratus lumborum & two are abdominal muscles: internal oblique & transversus abdominis. These muscle provide dynamic stabilization of t spine, preventing excessive motion at spinal jts. Until recently we failed to appreciate t importance of t middle layer muscles in this activity, thinking tt t ligs did all t work of stabilizing t spine. We now know tt t ligs only provide stability at t extreme end ROM. It is t middle layer muscles wh are responsible for t majority of t stabilization required to keep t back functioning properly. A complicated set of muscle activations must take place in order to maintain spinal stability while we use our extremities. T body preactivates t middle layer muscles before virtually any form of movement. This braces or stabilizes t spine so tt movements of t limbs occurs efficiently & w/o disturbing t overall sense of balance. If this core is unstable, t arms & legs will have to work harder to accomplish a given task. T trunk, functioning as t foundation from wh our arms & legs operate must be stable to allow t limbs to work at optimal efficiency. If t spine is not well stabilized some part of t body may eventually become injured. Rehab has been going about stabilization training t wrong way. T focus on t large power muscles of t trunk has left many Pts & athletes physically unprepared. **The Outer Layer** of large, thick, long muscles can create large amounts of power & creat bodily movements. They are collectively known as t erector spinae muscles (iliocostalis, longisiumus, spinalis). Two abdominal muscles, t external oblique & t rectus abdominis are also components. T primary reason old style back exercise programs failed was because they focused on training these large muscles, neglecting those wh stabilize spinal jts. When we train t spine's jt position sense, we fine tune t nervous system's ability

to detect & react to t shear, translations & rotations occurring throughout t spine. A finely tuned movement detection sense allows for t correct use of t stabilizing muscles to protect t spine from injury.

Edelman, MD, PhD, Tononi, MD, PhD. A Universe of Consciousness. Basic Books 2000: 57-59. In t initial stages of learning a new skill, conscious control has to be exerted at every step, about every detail, in a process tt is slow, laborious, & prone to error. But with practice, conscious control becomes superfluous & disappears. Our performance becomes automatic & fades from consciousness. With practice, new & specialized circuits may augment those already present (long-term changes in synaptic strength) in t areas involved, & performance becomes automatic, fast, easy, accurate & largely unconscious. Automatization suggests tt conscious control is exerted only at critical junctures, when a definite choice or a plan has to be made. In between, unconscious routines are continuously triggered & executed, so tt consciousness can float free of all those details & proceed to plan & make sense of t grand scheme of things.

Carter, R. Mapping the Mind. Univ California Press, Berkeley 1998: 196. PET scans: areas in the prefrontal & temporal cortex are lit up when subject is concerned with making decisions & focusing attentionin learning a word task. When the person has practiced the task & it has become routine these areas remained switched off. When the person is choosing new words the activity returns.

Kandel E, MD. Cellular mechanisms of learning and the biological basis of individuality. In: Kandel E, editor. Principles of Neuroscience. 4th ed: McGraw Hill; 2000. p. 1247-1279. T molecular mechanisms of memory storage change t connectivity of neurons in the brain. Learning changes t effectiveness of t synaptic connections tt make up t pathway mediating t behavior. Learning can lead to increases in synaptic strength & structural changes in sensory & motor neurons. At synapses involved in learning & memory storage, a relatively small amount of training can produce large & enduring changes in synaptic strength. Long-term changes require new protein synthesis wh involves: 1) gene activation & expression, 2) new protein synthesis, & 3) growth of synaptic connections. T number of presynaptic terminals in t sensory neurons increases & may become twice as great in t long-term sensitization. Changes also occur in motor neurons - their dendrites grow to accommodate additional synaptic input. Long-term sensitization also involves facilitation of transmitter release at synapses. Long-term sensitization involves t synthesis of new proteins & leads to t growth of new synaptic connections . Specific enzymes translocate to t nucleus activating certain genes tt encode proteins important for t growth of new synaptic connections. Connections of afferent & efferent pathways in t cortex can expand or retract depending on activity. Organizational changes probably occur throughout t somatic afferent pathways as well. All brains are uniquely modified by experience. Learning produces changes in the effectiveness of neural connections.

LeDoux, J. PhD. Synaptic Self. How our brains become who we are. Viking 2002: 78-81

Neural activity drives t formation of new synapses & axon branches, as well as, provides cues tt act to select & stabilize existing ones. Active axons branch & sprout new connections. Plasticity is accompanied by axon branching & new synapse formation following learning. Once this occurs, an action potential (AP) will be more effective in firing t postsynaptic cell because it activates more synapses on tt cell. An important set of molecules are neurtrophins, which promote t survival & growth of neurons. When an AP occurs in a postsynaptic cell, neurtrophins are released from t cell & diffuse backward across t synapse, where they are taken up by presynaptic terminals. Under t influence of neurotrophins, axon terminals branch & sprout new synaptic connections. Since only the presynaptic cells tt were just active take up t molecules, only they sprout new connections. Activity thus induces growth, & t growth is restricted to t active terminals. Cell death is prevented if a presynaptic terminal receives a life-sustaining shot of neurotrophins from its postsynaptic partner.

Hodges, PW., PhD. Core stability exercise in chronic low back pain. Orthop Clin N Am;2003 43: 245-54. In CLBP, CNS motor programs changes impair activity of t deep muscle system (delayed, phasic instead tonic, no longer independent of t superficial muscles) often in assoc w over-activity of one or more superficial muscles. Core stability exercise, unlike general exercise, restores coordination between trunk muscles & improves integration of deep & superficial systems. A key strategy is to retrain motor function practicing "parts" of mov'ts rather than t whole mov't. When a skill is trained in parts, t attention demand is reduced to allow attention to be focused on a single element. T task is divided into smaller parts practiced independently & then t practiced elements are integrated together to practice t complete skill. T component of mov't tt is impaired is t activity of t deep muscle system. Focus of t initial stage of rehab is to train this component independently from t superficial muscles.

Motor learning (relearning) occurs in 3 phases:

1) Cognitive - elements practiced consciously w attention to feedback, mov't sequence, performance, & instruction thru repetition & practice. Initially t goal is to contract t deep muscles cognitively to increase t precision & skill of t contraction of t local muscles. Then t goal shifts to increased number of repetitions & holding time & decreased feedback.

2) Associative phase: basic skills have been acquired & cognitive demand reduced. Focus moves from simple elements of task performance to consistency, success & refinement. Many repetitions are required in a variety of contexts to reduce cognitive demand of t task. Involves task performance in increasingly challenging positions & integration of deep & superficial muscle function, PNF, & postural challenges.

3) Autonomous phase: task becomes habitual & automatic & conscious intervention is reduced. Training in this manner can result in a change in t automatic control of t spine & peripheral jts

Standard Sizes for Fitballs

Patient Height	Size – CM	Size - Inches
5' – 5'7"	55cm	22"
5'8 – 6'2"	65cm	26"
6'3" – 6'9"	75cm	30"

McPartland, DO , Brodeur, DC, PhD, Hallgren, PhD. JMPT 1997;20(1):24-29. Study of relationship between Chronic Neck Pain (CNP >3 mo); Somatic dysfunction (Tender, Asymmetry, Restriction, Tissue Texture); Suboccipital muscle atrophy on MRI in 7 Pts vs 7 normal Ss (ave age 39). MRI showed atrophy of rectus capitus posterior major & minor muscles including **fatty infiltration**. **Conclusions:** Findings suggests a relationship between CNP, somatic dysfunction, muscle atrophy & standing balance. Propose a cycle of chronic somatic dysfunction, resulting in muscle atrophy, which reduces PR output from atrophied muscles. The lack of PR inhibition of pain in the dorsal horn results in chronic pain & a loss of balance.

Ylinen, MD et al. Active neck muscle training in the treatment of chronic neck pain in women. JAMA; 2003 289(19): 2509-16. Study evaluates efficacy of 1) intensive isometric neck strength training, 2) lighter endurance training of neck muscles on pain & disability or a 3) control grp (included stretching & aerobic exercise) in 180 women (25-53 yrs) w nonspecific chronic neck pain (CNP) ave 8-9 yrs in a blinded RCT in Finland. Training initially supervised, then home based. Endurance training: dynamic neck exercises included lifting head up from t supine & prone positions. Strength training: high-intensity(80%) of maximum isometric neck strengthening & stabilization exercises w an elastic band. Both training grps performed dynamic exercises for shoulders & upper extremities w dumbells. All grps were advised to do aerobic & stretching exercises regularly 3X/wk. Outcomes: Neck pain & disability via VAS, Neck /Shoulder Pain & Disability index & Neck Disability Index. Mood assessed on short depression inventory. Max isometric neck strength & ROM. Compliance: Kept exercise year long diaries: Average per week: 2X for endurance training; 1.7X for strength training, & 2X for stretching/aerobic exercises. Results: At 12 mo F-U, both NP & disability had decreased in both training grps vs ctls. Max isometric neck strength improved in strength grp more than in endurance grp. ROM had improved signif in both training grps vs ctl in rotation, but only t strength training grp had signif improv'ts in lat flex, flex & extension. Conclusions: Both strength & endurance training for 12 months were effective for decreasing pain & disability in women w nonspecific CNP. Stretching & aerobic exercise alone proved to be much less effective than strength training.

Ylinen JJ, MD et al. Effects of neck muscle training in women with chronic neck pain: one-year follow-up study. J Strength Cond Res 2006;20:6-13. In both exercise groups the greatest gains in neck strength, decrease in neck pain & disability were achieved during the first 2 mo, but improvements continued up to 12 months. The control grp showed only minor changes, significant differences were found in favor of the training groups in all measures. Neck and shoulder muscle training is an effective therapy for

chronic neck pain, resulting in early improvement in both the strength & pain measures. Results can be maintained and even improved with long-term training.

Hodges, P, PT, PhD,MD, Jull, G, PT, PhD. Spinal segmental stabilization training. In Liebenson, C (ed). Rehabilitation of the Spine 2nd Ed. Lippincot, Williams, & Wilkins 2007: 585-611. It is estimated the osteoligamentous system contributes approximately 20% to the mechanical stability of the cervical spine whereas 80% is provided by the surrounding neck musculature. The primary goal of rehab is to retrain control rather than increase t strength & endurance of trunk muscles thru motor relearning, skill acquisition, & training cognitive control. Goals for movement disorders include improvement of motor performance (increased precision, decreased error), improved performance consistency (decreased variability), persistence of improvement over time leading to permanent improvement & adaptability of t skill to a variety of environments (novel contexts, decreased feedback, etc).

Falla, Jull, et al. Patients with neck pain demonstrate reduced electromyographic activity of the deep cervical flexor muscles during performance of the craniocervical flexion test. Spine 2004; 29(19): 2108-14. Study compares activity of deep & superficial cervical flexor muscles & ROM during a craniocervical flexion test in 10 Pts w chronic neck pain (CNP) & 10 ctls. Deep cervical flexor (longus colli & longus cervicis) EMG activity was recorded by electrodes inserted via t nose on to t posterior mucosa of t oropharynx. Surface electrodes were placed over the superficial neck muscles (SCM & ant scalene). EMG amplitude & craniocervical flexion ROM was measured during 5 levels of supine craniocervical flexion. Results: Amplitude of deep cervical flexor EMG activity was signif less for CNP Ss than ctls. There was a strong trend for greater SCM & ant scalene EMG activity for CNP Ss. Conclusions: Findings confirm tt reduced performance of the craniocervical flexion test is assoc w dysfunction of the deep cervical flexor muscles & support the validity of this test for Pts w NP. Previous research found inferior performance on craniocervical flexion test in idiopathic NP & NP after whiplash. EMG amplitude of superficial flexors was signif higher in NP Pts than ctls and is thought to be related to impaired performance of deep cervical flexors & may indicate a strategy to compensate for dysfunction of t deep cervical flexor muscles. The changes in deep & superficial neck muscles are consistent w findings for other body regions. Increasing data indicates tt activity of deep lumbar muscles (TrA & MF) is impaired in LBP Pts. Many studies suggest tt LBP Pts have increased activity of superficial muscles (erector spinae) under various conditions. This may be a strategy to restrict motion of the spine. Testing and retraining the cervical flexor synergy as part of a specific active stabilization program is widely used in practice. This specific exercise approach in Pts w cervicogenic HA led to reduced NP, frequency & intensity of HAs & was assoc improved performance on the craniocervical flexion test.

The Interactive Spine - Chiropractic Edition by Primal Pictures (primalpictures.com): CD-ROM of anatomical illustrations, cadaver sections, pathology, MRI, examination, conditions, with explanations and videos of treatment, rehabilitation, neurological &

orthopedic evaluation. Also offer CD-ROMs of Hand & Wrist, Foot & Ankle, Shoulder & Elbow, Hip, Knee. For more information call (925) 426-1137.

Manipulation and Exercise

Morton, PT, M Hth Sc. Manipulation in the treatment of acute low back pain. J Manual & Manip Ther 1999;7(4):182-189. Prospective study of 29 Pts w ALBP (4 wks or less) randomized to 2 Tx grps: Grp 1) 15 Ss receive SM & stabilization exercises (to contract multifidi & improve co-contractions between multifidi & abdominal muscles); 2) 14 Ss receive stabilization exercise program alone. Pts got SM 2X/wk for total of 8 Tx. Post-Tx assm't performed weekly for 4 wks, then w/o further SM but continuing exercise program at 2 mo & 3 mo. Outcomes: ROM, Roland, VAS taken at initial visit, at t end of each wk, at 2 & 3 mo. Results: Signif differences between grps appears at 1 wk for pain & ROM & at 4 wks for disability. All 3 outcomes increase further w time. ALBP Pts who receive SM + exercise program improve to a greater extent than Pts who receive t exercise program alone. At 3 mos, Grp 1 (SM & exercise grp) had a mean disability score on t Roland 90.3% less than exercise alone grp. 11 of 15 Pts in Grp 1 had no disability at 3 mo vs only 1 in 14 in Grp II (exercise alone). At 3 mo Grp 1 had a mean pain score 100% less than Grp II. None of t 15 Pts in grp 1 had pain at t end of 3 mo, vs 13 of 14 in grp still had pain. At 3 mo, Grp 1 had mean ROM 46.44% more than grp II. Conclusions: Pts who receive SM + exercise for ALBP will improve more & faster than Pts who receive exercises alone. T difference between t grps appears early. SM also appears to be cost-effective.

Bronfort DC, PhD et al. A randomized clinical trial of exercise and spinal manipulation for patients with chronic neck pain. Spine 2001;26:788-99. After a 1-week baseline, 191 Pts w chronic mechanical neck pain were randomized to 11 wks of Tx w F-U at 5 wks, 11wks, 3, 6 &12 mo to compare efficacy of 20 one hour sessions of SM alone, SM + low tech exercise, or MedX (high-tech exercise). Pts randomized to receive: **1) SM only**: by 1 of 9 DCs, HVLA to Cervical & Thoracic spine & light soft tissue massage & then 45 min of detuned microcurrent after SM to control for similar time per visit. **2) SM + Exercise**: SM by 1 of 9 DCs to Cervical & Thoracic spine + light soft tissue massage & low tech exercise: 45 min supervised sessions of progressive strengthening for neck & upper body proceeded by short aerobic warm up & light stretch. Upper body strengthening includes push-ups, dumbbell weights of 2 to 10 lbs. Cervical strengthening exercises w weight attachments to headgear (1.25-10 lbs). **3) MedX Exercise**: one on one supervision by PT. Sessions begin w stretching, upper body strengthening, & 15-20 min aerobic stationary bike. Dynamic progressive resistence exercises on MedX cervical extension & rotation machines to isolate C-rotators & extensors. All Pts in all grps were instructed to use a home exercise program of resistive extension, flexion & rotation exercises w rubber tubing device. Outcomes: Pt rated neck pain, disability, functional health status (SF-36), global improvement, satisfaction w care, & medication use. ROM, muscle strength, & endurance assessed by examiners blinded to patients' treatment assignment. Results: After 11 wks: Pt rated outcomes: all 3 grps improved. No signif differences between grps in terms of pain, neck disability, general health, improv't, except for

satisfaction w care wh was signif higher for SM + exercise than for SM alone. In terms of neck performance at least twice as much improv't in SM/exercise as in SM on all measures including ROM. SM/exercise showed greater improv't in flex endurance & flex strength than MedX. MedX showed higher gains than SM in most measures w flex t exception. Long term outcomes: Tendency in short term for t 2 exercise grps to perform better continued thru-out 1 F-U yr & resulted in signif grp differences of medium effect size & are clinically important, esp between t SM /exercise vs SM grp. SM/exercise Pt satisfaction was superior to both MedX & SM. SM/exercise was superior to SM alone in terms of pain, satisfaction & improv't & MedX was superior to SM in terms of pain. Conclusion: w exception of Pt satisfaction for wh SM/exercise was superior to SM alone, no clinically important grp differences were observed at 11 wks. During t F-U yr, there was a cumulative advantage for both SM/exercise & MedX exercise compared to SM. Both exercise grps showed very similar improv'ts in all outcomes, but SM/exercise reported greater satisfaction w care. T use of strengthening exercise whether in combination w SM or in t form of high-tech MedX program appears to be more beneficial to Pts w chronic neck pain than SM alone. SM/exercise patient satisfaction was superior to both MedX & SM. SM/exercise was superior to SM alone in terms of pain, satisfaction & overall improv't & MedX was superior to SM in terms of pain.

Evans, DC, MS, Bronfort, DC, PhD, et al. 2 yr F-U of a randomized clinical trial of SM & two types of exercise for Pts with chronic neck pain. Spine;2002 27(21): 2383-9. 145 chronic neck pain Pts were evaluated at all F-Us over two yrs (3, 6, 12 & 24 mos) after Tx. A signif difference in pain was observed in favor of the 2 exercise grps. SM + exercise was superior to both Med & SM in terms of Pt satisfaction. No signif differences were found for neck disability, general health status, improvement, & OTC medication use, although the trend favored the two exercise groups. Results demonstrate an advantage of SM + low tech rehab exercise & MedX rehab exercise vs SM alone over 2 yrs in terms of pain reduction & are similar to those at 1 yr F-U. Results suggest Tx including supervised rehab exercise should be considered for chronic neck pain.

Aure, PT, Nilsen, PT, Vasseljen, PhD. Manual & exercise therapy in CLBP Pts. Spine 2003; 28(6): 525-31. RCT w 1-yr F-U in Norway compares effects of manual therapy (MT) to exercise therapy (ET) in 49 CLBP Pts on 100% sick-leave (>8 wks but <6 mo) w or w/o radicular pain. 27 Pts got MT & 22 ET. All Pts given 16 Txs (45 min each) in 8 wks. Manual Therapy (MT): 1/3 of each Tx devoted to jt manip & mobilization & 2/3ds to exercise: 5 general exercises for spine, abdomen, lower limbs, & 6 specific, localized exercises for spinal segments & t pelvic girdle to normalize function. Exercise Therapy (ET): 10 min warm-up on exercise bike. Exercises individually prescribed to strengthen, stretch, mobilize, coordinate & stabilize abdominal, back, pelvic, & lower limb muscles. Outcomes: Pain, disability (Oswestry), general health (COOP charts), & RTW before, after, & 4 wks, 6 mos, & 12 mos F-U. Spinal ROM (Schober test) measured only before & immediately after Tx. Results: Improv'ts noted in both groups, but MT grp showed significantly larger improv'ts than ET grp on all

outcome variables at all F-U times (post Tx, 4 wks, 6 mo, 1 yr). Effects gained from Txs were stable in the 1-year posttreatment period in both groups. Conclusions: MT showed significantly greater improv't than ET. Differences were signif on all outcome measures, both on short and long-term F-U.

UK BEAM trial team. United Kingdom back pain exercise and manipulation randomized trial: effectiveness of physical treatments for back pain in primary care. BMJ 2004; 329(Dec 11): 1377. Randomized trial to evaluate t effect of adding SM (6wks), exercise classes (general exercise) for 6 wks, or SM followed by exercise classes to "best care" (advice to keep active + back care book) in general practice for 1334 LBP Pts. Outcomes: Roland Morris at 3 & 12 mo. Results: All groups improved. Exercise improved disability at 3mo months by 1.4 more than "best care." For SM additional improv't was 1.6 at 3 mo & 1.0 at 12 mo. For SM followed by exercise additional improv't was 1.9 at 3 mo & 1.3 at 12 mo. No serious adverse events occurred. Conclusions: Relative to "best care" in general practice, SM followed by exercise achieved a moderate benefit at 3 mo & a small benefit at 12 mo. SM achieved a small to moderate benefit at 3 mo & a small benefit at 12 mo. Exercise achieved a small benefit at 3 mo not at 12 months.

UK BEAM trial team. United Kingdom back pain exercise and manipulation randomised trial: cost effectiveness of physical treatments for back pain in primary care. UK BEAM Trial Team. 2004; 1381. Study assesses cost effectiveness of adding SM (6 wks), exercise classes (6 wks) or SM followed by exercise classes (combined treatment) to "best care" general practice for 1287 LBP Pts. Outcomes: Healthcare costs, quality adjusted life years (QALYs), & cost per QALY over 12 mo. Results: Over 1 yr, SM is a cost effective addition to "best care" for back pain in general practice. SM probably gives better value for money than SM followed by exercise. This is the first study to show convincingly tt both SM alone & SM followed by exercise provide cost effective additions to care in "best care" general practice.

Drezner, MD, Herring, MD. Managing LBP. Steps to optimize function and hasten return to activity. Phys & Sports Med 2001; 29(8). SM should always be used with other appropriate rehab components. Protracted passive Tx places t Pt in a dependent role & becomes counter productive to establishing functional independence. The high recurrence rate & functional changes tt occur in CLBP warrant attempts to maximize rehabilitation. T overall goal is to restore nl function & promote safe & independent return to activity. Implementing a long-term maintenance program is important in preventing recurrence. Thus rehab should continue beyond t resolution of Sx & return to sport.

Preventive Exercise

O'Sullivan. Evaluation of specific stabilizing exercise in the treatment of CLBP with radiologic diagnosis of spondylolysis or spondylolisthesis. Spine;1997 22(24): 2959-67.RCT of 42 CLBP Pts w lumbar instability (spondylolysis or spondylolisthesis) to determine t efficacy of a 10 wk supervised specific stabilizing exercise program w

daily home exercises. Pts were F-U at 3, 6 & 30 mo. Outcomes: McGill, Oswestry, lumbar & hip ROM, abdominal muscle recruitment patterns. Exercise grp: 10 wk exercise program specifically training deep abdominal muscles (TA, IO), w co-activation of MF. Control Grp: 10 wk supervised by MDs - regular weekly general exercise: swimming, walking, gym work. 8 Pts also supervised exercise & local pain relief via heat massage, ultrasound. 9 Ss did trunk curls regularly. Results: Specific exercise grp showed a significant reduction in pain intensity & functional disability, wh was maintained at a 30 mo F-U. Control grp showed no significant changes. A "specific exercise" Tx approach appears more effective than other commonly prescribed conservative Tx in CLBP Pts w spondylolysis or spondylolisthesis.

Shaughnessy M, Caulfield. A pilot study to investigate the effect of lumbar stabilisation exercise training on functional ability & quality of life in patients with CLBP. Internat'l J Rehab Research. 2004; 27(4):297-301. Dysfunction in t TrA & MF leads to segmental instability & is implicated in the causation of CLBP. Exercise programs to enhance strength & re-educate these muscles to provide spinal stability have been proposed as a key component in managing CLBP. Evidence indicates tt specific exercises targeting TrA & MF is effective in: Enhancing segmental stability; Reducing LBP; Enhancing functional ability; Reducing recurrence rates. This study examines t effectiveness of a lumbar stabilization exercise program in improving quality of life (QoF) & functional outcomes (Oswestry & Roland) in 41 CLBP Pts (=/>12 wks) randomly assigned to a 10 wk supervised Tx (n=20) or a control grp (n=21). Tx was 10 sessions over 10 wks (2 - 1hr sessions in wk 1, 2 - 30 min sessions wk 2, 1 - 30 min per wk during wks 3-6, 1 - 30 min in wk 8 & 10). Training Program: 1. Ss trained how to activate TrA & MF. Facilitation strategies included visualization techniques, verbal instruction, palpation, education w illustrations. Strength of contractions measured using pressure biofeedback unit. 2. Training began in low-load non-functional position (prone lying, 4 point stance, supine lying w flexed knees). 3. Holding time for exercises was gradually increased to point where Ss could perform 10 contractions w 10 sec holds. 4. Once Ss could perform sustained contractions in low load postures, regime progressed by adding leverage thru limb mov't. 5. Ss performed daily maintenance exercise program at home between exercise sessions w t PT. Written material was provided to facilitate home exercise program. Results: No differences in baseline scores between grps on any of t 3 measures. Oswestery, Roland, & 7 of 8 measures on SF-36 (exception: general health) signif improved following Tx. Control grp scores stayed t same or were signif worse. Both functionality & quality of life improved in Tx grp. Exercise training of t deep stabilizing muscles (TrA & MF) is capable of bringing signif improv't in functional ability & QoF in CLBP Pts. Roland improved an ave of 50% & Oswestry 25%. These clinically important improv'ts in functional status were mirrored by signif increases in self-perceived health status. Results clearly demonstrate t effectiveness of a program aimed at enhancing function of t muscles stabilizing t lumbar spine.

Linton, PhD, van Tulder, PhD. Preventive interventions for back and neck pain problems: what is the evidence? Spine 2001;26:778-87. A literature review of

controlled trials to determine interventions used to prevent back & neck pain & the evidence for their utility. The literature was searched to identify studies of preventive intervention in randomized or nonrandomized controlled trials using subjects not seeking treatment. Outcome of reported pain, report of injury, dysfunction, time off work, health- care utilization, and cost were used. 27 investigations met the criteria for 1) back school & educational efforts, 2) lumbar supports, 3) exercises, 4) ergonomics, and 5) risk factor modification. There is strong evidence that back schools and lumbar supports are not effective in prevention. There were no properly controlled trials for ergonomic interventions or risk factor modification, therefore there was not good evidence available to draw a conclusion. Exercises, on the other hand, showed strong evidence from multiple RCTs of positive results for utility in prevention. There is consistent evidence tt exercise may be effective in preventing neck & back pain. Only exercises provided sufficient evidence to conclude that they are an effective preventive intervention. The mechanisms by wh exercises may prevent LBP are believed to be 1) they strengthen t back muscles & increase trunk flexibility; 2) the increase blood supply to t spine muscles & jts & IVDs, minimizinginjury & enhancing repair; 3) they improve mood & thereby alter t perception of pain.

Vuori, I. M.. Dose-response of physical activity & LBP, osteoarthritis, & osteoporosis. Med & Sci in Sports & Exerc 2001; 33(6, Suppl): S551-S586. Risk factors for LBP include inactivity or immobilization wh can lead to reduced muscle strength & endurance in back, abdominal, & thigh muscles. Higher strength of t muscles of t back & trunk can protect t back from injury or minimize effects of injurious events. Higher endurance of trunk muscles helps maintain motor control because of less fatigue, thus decreasing t risk of high loading of spine structures. Better flexibility & good motor skills decrease t risk of injury. Good general or aerobic endurance counter acts fatigue, improves circulation to back structures & improves mood. There is convincing evidence tt exercise training can be effective & is currently t only effective tested modality for prevention of LBP.

Bogduk, MD, PhD, McGuirk. Medical Management of Acute and Chronic Low Back Pain. An Evidence-Based Approach. Amsterdam, Elsevier 2002: 143-161. Results of controlled trials & systematic reviews paint a disappointing picture of t efficacy of single therapies for CLBP. No data from controlled trials support any efficacy for surgery, spinal cord stimulation, epidural steroids, & intraspinal opiods. T best quality studies have denied or failed to show any efficacy greater than tt of placebo for acupuncture, injection of tender points, traction, epidurolysis, & back school. Other therapies for CLBP achieve only limited reductions in pain, some for only short periods. These include analgesics, NSAIDs, opiods, manipulative therapy, massage, behavioral therapy, & conventional exercises. There is no evidence tt submitting Pts to multiple single therapies, simultaneously or serially, achieves better outcomes. The only Tx shown in a controlled trial to have produced substantial & lasting reductions in CLBP are special exercises designed to coactivate abdominal & MF muscles. Of all single therapies, only special exercises designed to coactivate t

abdominal muscles & MF hold t promise of substantial & sustained reductions in BP. According to t best available data, therefore, if exercises are to used for CLBP, they should focus on coactivation of abdominal & MF muscles.

Gross, MSc, Hoving, PhD, et al. A Cochrane review of manipulation and mobilization for mechanical neck disorders. Spine 2004, 29(14): 1541-8. Multimodal care: SM & MO - 6 trials. When SM & MO compared to placebo, there was no evidence of difference. When compared to no Tx, results showed a tendency toward short-term & long-term benefit for chronic neck disorder for pain relief, function improv't, global perceived effect. MO vs PT, GP care, exercise there were conflicting results. Multimodal care: SM or MO plus other physical agents vs placebo. 6 trials. There's moderate evidence showing no difference in benefit for pain relief, function, global perceived effect. Multimodal care: MO & MN plus exercise (EX) focus. 15 trials w both short & long term F-U for chronic MND, neck w HA, w or w/o radicular Sx or HA. When compared to wait list control there was strong evidence of maintained long-term benefit favoring multimodal care. Common elements in this care strategy in all studies was MO or SM plus exercise. Pt were more satisfied w SM plus EX over SM or EX alone. But when MO & SM plus exercise was compared against exercise there was moderate evidence of no difference for pain relief or improv't in function. There was moderate evidence favoring reduced costs for SM or MO + Ex for acute, subacute, & chronic MND w or w/o HA or radicular findings. Recent trials add further support to SM/MO & exercise in achieving clinically important pain reduction, global perceived effect, & Pt satisfaction in acute & chronic neck disorder w or w/o HA. We continue not to find evidence in support of SM or MO as solo Txs. Conclusions: Multimodal care, including SM &/or MO + EX is beneficial for pain relief, functional improv't, & global perceived effect for subacute/chronic MND w or w/o HA. Evidence did not favor SM &/or MO done alone or in combination w various other types of Txs. There was insufficient evidence available to draw conclusions for neck disorder w radicular findings. Systematic review of 33 trials did not favor MO &/or MN done alone or combined w other Txs like heat for relieving acute or persistent pain & improving function when compared to no Tx. SM &/or MO when used w exercise are effective for alleviating persistent neck pain & improving function. When compared to one another, neither SM nor MO was superior.

Sarigiovannis, P. ,B. Hollins. Effectiveness of manual therapy in the treatment of non-specific neck pain: a review. Phys Ther Reviews 2005; 10: 35-50. A systematic review identified 12 RCTs to assess t evidence for t effectiveness of cervical spine manipulation & mobilization (spinal manual therapy – SMT)in t Tx of nonspecific neck pain. Scores for methodolgical quality ranged from 25 to 67 of a possible 100 points. Only 4 trials were above 50. 2 of these reached positive conclusions about t effectiveness of manual therapy in Tx of nonspecific neck pain & 2 a negative conclusion. T effectiveness of SMT on non-specific NP remains inconclusive. T available evidence favored SMT when used in conjunction w exercise, particularly in in t Tx of Pts w chronic nonspecific NP. Further, well-designed RCTs are needed to

draw valid conclusions about t effectiveness of SMT on non-specific NP. Studies raise t proposition tt SMT should be delivered together w exercises in t Tx of chronic NP.

Goldby LJ, PhD, et al. A randomized controlled trial investigating the efficiency of musculoskeletal physiotherapy on chronic low back disorder. Spine 2006;31:1083-93. RCT to evaluate t efficacy of manual therapy & spinal stabilization exercises to rehabilitate chronic low back disorder (CLBD). 346 LBP Pts received manual therapy (manipulation + mobilization: max of 10 sessions in 10 wks), or a 10 wk spinal stabilization rehab program (1 hr class/wk), or a minimal intervention (an educational booklet). Pts F-U at 3, 6, 12, 24 mos. Outcomes: Pain, disability/Oswestry, handicap, medication, & quality of life. Results: Signif improvements in favor of spinal stabilization grp at 6-mos stage in pain & dysfunction, & at 12 mos in medication (34.3% less), dysfunction & disability (15.71 on Oswestry). Conclusions: Spinal stabilization is more effective than manual therapy or an education booklet in treating CLBD in terms of reducing pain, disability, dysfunction, medication intake, & improving quality of life. Both manual therapy & spinal stabilization are effective in pain reduction. Although manual therapy is adept at relieving pain, it failed to show any consistent improvement in disability, handicap, or impairment. This reinforces t need for LBP Pts to be viewed in terms of the low back disorder & not simply in terms of their LBP. Clinical emphasis should move away from focusing on pain. Manual therapy is appropriate for these Pts at reducing pain, but results suggest tt it should not be used as an isolated modality because it doesn't concomitantly reduce disability, handicap, or improve quality of life.

Institute for Alternative Futures. The Future of Chiropractic Revisited: 2005-2015. www.altfutures.com, Institute for Alternative Futures. Jan 2005. As t population ages there will be increasing demand for therapies tt improve a Pt's quality of life. This includes Tx for BP & NP but also many health & wellness activities. One of t largest growth areas in health care will be geriatrics. Retiring baby boomers will look for alternative med tt can help them remain active & healthy. Developing better evidence for geriatric chiro & more in depth post-graduate programs in geriatric chiro will help chiro expand. “Healthy Life Doctors"

Wiesel, MD, Is back pain preventable? European Guidelines offer a fresh view of the evidence. (European Guidelines for Prevention in Low Back Pain. Sponsored by t European Commission, Research Directorate-General. Department of Policy, Co-ordination & Strategy; 2004). Backletter 2005; 20(3): 25-31. A "best evidence synthesis review" using an objective evidence-rating system grading each recommendation according to t strength of evidence. The panel found high quality evidence to support physical exercise for t prevention of LBP among workers, back pain recurrences, & recurrent sick leave. Exercise programs for workers have modest effects in most studies. While exercise is a promising intervention, it is not a panacea. T guidelines recommended physical exercise & activity as means of preventing sick leave due to BP & as methods of decreasing t occurrence of further episodes but could find no evidence to support any particular type or intensity of exercise. T new guideline also

recommended against t use of back schools. It did not find evidence to support t use of back belts. They also found inadequate evidence to recommend t use of any particular chair or mattress, nor could they find evidence to support the use of shoe insoles in prevention. Multidimensional & multidisciplinary interventions have reported positive results offering a variable mixture of education, exercise, training, pain management, work redesign, but t panel noted it was impossible to determine wh aspects of these programs should be recommended. The guidelines panel did not find sufficient evidence to recommend physical ergonomic interventions.

Herzog, PhD et al. Electromyographic responses of back & limb muscles associated with spinal manipulative therapy. Spine 1999;24(2):146-153. 10 asymp Ss underwent 11 different high-speed, low amplitude SMs in t cervicals, throacics, lumbars, & SI jts to determine reflex responses elicited by SM as measured by using 16 pairs of surface electrodes placed on t back & proximal limb muscles. Results: Each SM produced consistent reflex responses (w/i 50 -200 msec after t onset of t thrust & lasting @ 100-400 msec) in a target-specific area. Responses were probably of multireceptor origin (& may include facet jt capsule MRs, pain & cutaneous receptors, & PRs of skeletal muscles). SM provided a repeatable & systematic EMG response tt extended beyond t immediate area of force application. SM in upper & midthoracic areas elicited EMG responses in upper limb muscles (deltoids) on t side of SM. EMG responses in t lower limb muscles (glut max) were systematically recorded for all Txs in t lower thoracic & lumbar levels & SI joint. The EMG responses may be beneficial by inhibiting hypertonic muscles. The authors observed in symptomatic Pts tt local muscle hypertonicity was largely abolished immediately after t SM induced EMG response, supporting t idea tt **SM reduces hyperactivation of muscles in areas of BP.** This study is t first to show t existence of EMG responses in SMs & t first to show reflex activation of upper & lower limb muscles during spinal & SI jt manipulation. High speed, low amplitude SMs elicit clear, measurable & repeatable EMG responses in distinct areas specific to t SM. In another study, t authors showed tt a SM force of similar magnitude as in this study, but applied at a much slower rate didn't produce t reflex responses found in this study. **T reflex response appears to depend on t rate of change in force & deformation rather than on t force or stretch magnitude itself.** Because t reflex pathways are evoked systematically during SM, there is a distinct possibility tt these responses may cause some of t clinically observed benefits, such as reduction in pain & a decrease in hypertonicity of muscles.

Herzog, PhD. Clinical Biomechanics of Spinal Manipulation. Churchill Livingstone 2000. Before Tx muscle shows high EMG activity & was found to be stiff based on motion palpation. During Tx EMG activity increased presumably because of reflex activation produced as a result of t Tx. Following Tx EMG was silent & the muscle was found to be relaxed & soft based on motion palpation. The EMG responses may be beneficial by inhibiting hypertonic muscles. In symptomatic Pts local muscle hypertonicity was largely abolished immediately after t SM induced EMG response, supporting t idea tt SM reduces hyperactivation of muscles in areas of BP.

Herzog, PhD, et al. The effective forces transmitted by high-speed, low-amplitude thoracic manipulation. Spine; 2001 26(19): 2105-10. 20 asymp Ss received 3 HVLA SM to the transverse process of the thoracic spine. Total force, local force, contact area, peak pressure, & average pressure at the contact interface between clinician & subject were measured by use of a flexible pressure pad. Results: Average peak total force was 238.2 N. The average peak local force over a target area of 25 mm2 was 5 N, indicating tt global measures of loading vastly overestimate the local effective forces at the target site. T effective loading of specific target sites is much smaller than the global measures might suggest because as SM forces increase, so does the contact area; therefore, much of the total force is taken up by non-target-specific tissues. Chiro techniques require tt Tx forces be applied on a specific target location in a defined direction. For this reason adjusting instruments, such as Activator & t Integrator devices were developed & are in widespread use. These devices have a stylus w a contact tip of about 127mm2. Force application is exactly along t axis of instrument. Therefore, t point of force application & t direction of force application are local & well defined. These instruments have criticized for their low peak force production. However, t local forces applied w these instrument normalized to a 25 mm2 area (5 N) are t same, on average, as those observed here for manual SM. One might be tempted to say tt t Tx effects of SM & those of Activator/Integrator instruments should be similar.

Kool, J. et al. Exercise reduces sick leave in patients with non-acute non-specific low back pain: a meta-analysis. J Rebail Med; 2004 36: 49-2. A meta-analysis of 14 RCT trials evaluating whether exercise alone or as a part of a multidisciplinary Tx reduces sick leave in Pts w non-specific, non-acute (=/> 4 wks) LBP. Studies compared usual care with exercise. Results: Qualitative & quantitative analysis showed strong evidence tt exercise reduces sick days during t first yr of follow-up an average of 24%. In a subgroup of studies on t Tx of severely disabled (>90 sick days under usual care) t effect size was greater: 30% reduction. Findings provide strong evidence tt exercise significantly reduces sick days during t first F-U yr.

Tveito TH, Hysing M, et al. Low back pain interventions at the workplace: a systematic literature review. Occup Med (Lond) 2004; 54(1): 3-13. The rising costs of employees w LBP have resulted in an abundance of interventions to prevent & treat the problem, but little is known of the effect of the different interventions. A literature review to assess the effects of interventions in the workplace on LBP looking at outcomes on sick leave; costs; new episodes of LBP; & pain. Results: 31 publications from 28 interventions were found. Exercise interventions to prevent & treat LBP in employees have a documented effect on sick leave, costs and new episodes of LBP. Multidisciplinary interventions have an effect on levels of pain. Conclusions: Of all the workplace interventions only exercise & comprehensive multidisciplinary interventions have a documented effect on LBP.

Christensen, K., DC, DACBR, CCSP, CSCS. Determining the Ideal Location for Rehab Exercising. Dyn Chiro;2004 22(2): 12. Home or independent gym based exercise have

benefits - but also drawbacks. Supervised office or rehab facility exercise can bring about tremendous gains, but are expensive. 4 areas of concern: 1)compliance; 2) complexity of exercise program; 3) communication/instruction; 4) cost. Compliance is a challenge: Pts have to do exercise to benefit. The only way to ensure compliance is for Pts to perform exercise w supervision. A study found tt LBP Pts were much more likely to perform rehab exercises at a gym when a trainer was assigned to accompany them at their sessions. A rehab program tt provided free home-exercise equipment achieved minimal results, because most Pts didn't do t exercises. Because of poor compliance, researchers concluded, "Unsupervised home exercise programs may benefit few patients." Complexity of exercise program: Pts are easily overwhelmed w exercise instructions. Under supervision Pts can tolerate more complicated exercise routines & learn to use complex rehab equipment by repeatedly reviewing the exercises & correcting errors. With home exercises, Pts have difficulty remembering & correctly performing exercises, unless t number of exercises is kept low. A study found tt Pts over 65 yrs were unable to perform more than 2 exercises properly when tested a week later. Multiple sets, weekly schedules, & exercises for several body regions adds complexity, making it more difficult for Pts. Doctor/Patient Communication: W supervised exercise there is t opportunity for multiple levels of communication. Verbal instructions are insufficient to get Pts to exercise; at a minimum, written directions with diagrams must be provided. Better still are good visuals: photographs or videos of the exercises. Best of all, Pts see the doctor or therapist perform the exercises, & are encouraged to ask questions. Cost: If resources were unlimited, everyone could do supervised exercise. But t cost of t doctor's time - & t additional space & equipment - make supervised exercise expensive. Both Pts & third party payors are interested in keeping costs down. A compromise: a home-based program w a few (or several) supervised exercise sessions in t office. This works for many Pts & achieves most of the benefits of a supervised office based program, yet keep costs down. Since DCs see Pts frequently, we can monitor Pts closely & review compliance & performance regularly. Pts on a home exercise program should be asked weekly to demonstrate their exercises. Knowing their DC will be checking on them motivates Pts to exercise regularly. Initially, show Pts only a few exercises to be performed daily. As consistency is established, additional or more complex exercises (with increased resistance) can be implemented. Keeping t hurdles low in the beginning avoids discouragement. It's also a good way to minimize the sense of effort, pain and soreness. Simple instructions. Avoid multiple sets & other complex exercise methods - at least in the beginning. For most patients a single set of 10-12 repetitions of each exercise is effective. Single-set programs are less time-consuming. This translates into improved compliance. It's also good to have Pts do t exercises every day. This establishes regularity & avoids complexity of a weekly schedule. Use an exercise diary. Have Pts fill out a diary & bring it in w each visit. This motivates them to do exercise, since they will want to show you their diary & get some praise & recognition. By having to record each home exercise session, Pts realize this is a necessary part of their Tx. To be sure Pts know t exercises to do & how to do them correctly demonstrate t exercise, watch t Ot do the exercise, & correct mistakes. When Pts are weak or have poor motor control they won't be able

to do some exercises properly, and will substitute, improvise or cheat. Exercises performed incorrectly may even be detrimental. A cost-effective rehab program is achievable with a monitored home exercise program. A few patients may need to be enrolled in an office-based program due to poor compliance, a complicated case, or risk of injury. For most Pts, a closely monitored home exercise program enables the DC to provide cost-efficient, effective rehab to improve spinal function, decrease Sx, & prevents disability.

Liddle, SD et al. Exercise and chronic low back pain: what works? Pain; 2004 107(1-2): 176-90. (Rehabilitation Sciences Research Group, Univ of Ulster). Supervised exercise group displayed better exercise compliance & long-term results than t home exercise group. 15 of 16 trials included supervised (11) or partially supervised (4), of wh 5 maintained their positive results at short-term & 5 at long-term F-U. It appears from these results tt fully or partially supervised programs might contribute to t maintenance of exercise benefits. Supervision is thought to play a part in enhancing exercise compliance.

Surgery & Denervation Atrophy

Sihvonen T et al. Local denervation atrophy of paraspinal muscles in postoperative failed back syndrome. Spine 1993;18(5):575-581. 13 of 15 Pts suffering from severe postoperative failed back syndrome (FBS) after laminectomies had dorsal ramus lesions in one or more segments & local paraspinal muscle atrophy. Disturbed back muscle innervation & loss of muscular support leads to disability & increased biomechanical strain & may be an important cause of failed back syndrome. Operative techniques can cause iatrogenic lesions of dorsal rami & innervation failure of LB muscles. Striking denervation atrophy of LB muscles can occur leading **to loss of functional muscle support & to disturbed segmental mobility & further increased biomechanical strain & disability**. In addition, muscles in unoperated levels seemed more atrophied probably due to disuse. LB surgery can cause severe lesions (slight partial denervation may be much more general) to back muscle innervation & denervation atrophy in back muscles.

Hee, H T, MD, et al. The Effect of Previous Low Back Surgery on General Health Status. Spine 2004; 29(17): 1931-37. BP Pts enrolled in the National Spine Network (NSN) database from Jan 1998 to April 2000 were given the SF-36 on their initial visit to examine the effects of previous low back surgery on general health status. Of t 18,325 Pts enrolled, 3,632 had previous back surgeries. Results: Pts who had previous lumbar surgeries fared significantly more poorly in all 10 scores of t SF-36 health survey, even after controlling for confounding factors. Pts who had received decompression surgery achieved signif better scores for general health, role-physical, & mental component summary scales compared to those who had other surgeries. Conclusions: Previous back surgery is associated w significantly worse general health status than those w/o surgery. Among Pts who had previous surgeries, decompression seems to exert better effects on SF-36 health status.

Fairbank, J, et al. RCT to compare surgical stabilisation of the lumbar spine with an intensive rehab programme for Pts w CLBP: the MRC stabilization trial. BMJ 2005. (May 23)(download). RCT at 15 orthopedic & rehab centers in the UK of 349 Ss w CLBP (>1 yr) all who were candidates for spinal fusion to assess t clinical effectiveness of surgical stabilization (implant, interbody cage, bone graft material) compared w intensive rehab program based on principles of cognitive behavior therapy. Outcomes: Oswestry, t shuttle walking test, SF-36, Zung depression index, somatic perception Q at baseline & at 2 yr F-U. 284 were F-U at 24 mo. Oswestry changed favorably for surgery grp from ave 46.5 to 34 & in rehab grp from 44.8 to 36.1. There was a slight advantage for t surgery grp. No signif differences between Tx grps was found in t walking test or any other outcomes. Conclusions: Both grps reported reductions in disability during 2 yr F-U. T difference between grps in t Oswestry was marginal, barely reaching t predefined clinical difference. T potential risk & additional cost of surgery also need to be considered. No clear evidence emerged tt spinal fusion was any more beneficial than intensive rehab. Intensive rehab program: Ave 75 hrs of intervention (5 days/wk for 3 wks) w one day F-U sessions at 1, 3, 6, or 12 mo. Exercises were individually tailored w increased repetitions & duration. Included stretching, spinal flexibility exercises, general muscle strengthening, spine stabilization exercises, cardiovascular endurance exercises. Also cognitive behavior therapy to identify & overcome fears & unhelpful beliefs.

Rivero-Arias, O. et al. Surgical stabilisation of the spine compared with a programme of intensive rehabilitation for the management of patients with chronic low back pain; cost analysis based on a RCT. BMJ 2005; May 23, 2005. To determine whether surgical stabilization of the spine is cost effective when compared w an intensive rehab program in CLBP Pts all who were surgical candidates, an economic evaluation on 349 Pts randomized to surgery (176) or an intensive rehab program (173) in 15 centers across the UK. Outcomes: costs related to BP incurred by the NHS & Pts up to 24 mo after randomization. Return to paid employment & total hrs worked. Results: At 2 yrs, 38 Pts in rehab (of 173) had surgery whereas just 7 (of 176) of Pts assigned to surgery had rehab. T mean total cost per Pts was 7830 pounds in surgery grp & 4526 pounds in rehab grp, a signif difference of 3305 pounds. Conclusion: 2 yr F-U data show tt surgical stabilization of t spine may not be a cost effective use of healthcare resources.

Deyo, R. M. and J. D. Weinstein. Low back pain. NEJM. 2001; 344(5): 363-369. There is no evidence from clinical trials or cohort studies tt surgery is effective for Pts who have LBP unless they have sciatica, pseudoclaudication, or spondylolisthesis. In t absence of cauda equina syndrome or progressive neurologic deficit, Pts w suspected herniated disc should be Tx nonsurgically for at least a month. Multiple surgical procedures are rarely helpful.

Gejo R, MD et al. Serial changes in trunk muscle performance after posterior lumbar surgery. Spine 1999; 24(10):1023-1028. Study to evaluate t influence of surgically-

related back muscle injury on postop trunk muscle performance & LBP. Pts divided into: 1) Short retraction time (<80min) & 2) Long (>80 min): evaluated before surg at 3 & 6 mo F-U post surg. Injury was estimated by MRI & trunk muscle strength.Results: Back muscle injury was directly related to t muscle retraction time during surg. T damage to t multifidi was more severe & recovery of extensor muscle strength was delayed in t long-retraction time grp. In addition, t incidence of postop LBP was higher in t long-retraction time grp. Conclusions: Postop trunk muscle performance is dependent on muscle retraction time. It is beneficial to shorten t retraction time to minimize back muscle injury & subsequent postop LBP.

Loupasis, MD. Seven to 20 year outcome of lumbar discectomy. Spine 1999;24(22):2313-2317. A retrospective study to assess t effects surgery for lumbar disc herniation over an extended period of time. 109 Pts w surgically documented herniated lumbar disc were F-U at a mean of 12.2 yrs by a mailed self-report questionnaire wh asked about pain relief, satisfaction w results, analgesics, activity level, work capacity, & reoperations. **Results:** T long-term results were satisfactory in 64% of Pts. Of t 101 Pts, 28% still complained of signif BP or leg pain. Reoperation rate was 7.3% (8 Pts). **Conclusions: The long-term results of standard lumbar discectomy are not very satisfying. More than 1/3 of Pts had unsatisfactory results & more than one quarter complained of signif residual pain.** Female gender was predictive of a poor outcome. About 50% of women had an unsatisfactory result w only 25% of t men w unfavorable outcome. Jobs requiring signif physical strenuousness predispose to an unfavorable outcome. Hence, only Pts w light occupational activity fare best. Only 19% of these had unsatisfactory results compared w 64% of those who did heavy manual work.

Dreyfuss, MD, et al. Efficacy and validity of radiofrequency neurotomy for chronic lumbar zygapophysial joint pain. . Spine 2000;25(10):1270-1277. 15 CLBP Pts whose pain was relieved by diagnostic medial branch blocks of t lumbar facet jts, underwent lumbar medial branch radiofrequency neurotomy to coagulate t nerve along 8-10 mm of its length. Pts were eval before & at 6 wks, 3, 6 & 12 mo after surgery. Results: 60% of Pts had at least 90% relief of pain at 12 mo, & 87% had at least 60% relief. Relief was assoc w denervation of t multifidus (MF) in those segments in wh t medial branches had been coagulated. Conclusions: Lumbar medial branch neurotomy is effective in reducing pain in Pts selected on t bases of controlled Dx blocks. Denervation was achieved in all Pts, all of whom obtained some degree of relief. In 11 of 15 Ss, based on EMG there was denervation in every segmental MF muscle tt pertained to t targeted nerves. T relief of pain is concordant w t demonstration of postoperative denervation in t respective bands of MF.

Chiropractic, Chronic Whiplash, Reduced Range of Motion, and Headaches
(Cervicogenic, Tension-type, Migraine)
Dall'Alba, BPhty et al. Cervical Range of Motion Discriminates Between Asymptomatic Persons and Those With Whiplash. Spine 2001; 26(19): 2090-94A comparative study of cervical ROM in 89 asymptomatic Ss & 114 chronic whiplash

Pts (3 mo - 2 yrs). ROM was measured in 3D w a computerized, electromagnetic, motion-tracking device. Results. ROM was reduced in all primary movements in Pts w persistent whiplash-associated disorder. Sagittal plane movements were proportionally the most affected. On the basis of ROM, age, and gender, 90.3% of study participants could be correctly categorized as asymptomatic or as having whiplash. ROM was capable of discriminating between asymptomatic persons and those with persistent whiplash-associated disorders.

Sjaastad, MD, PhD et al (On behalf of The Cervicogenic Headache International Study Group). Cervicogenic headache: Diagnostic Criteria. Headache 1998;38:442-445. Major Criteria of Cervicogenic HA (in order of importance): Neck involvement a) Precipitation of head pain occurring by 1) neck mov't &/or sustained awkward head positioning &/or 2) external pressure over t upper cervical or occipital region on t Sx side b) Restriction of ROM in t neck c) Ipsilateral neck, shoulder, or arm pain of vague nonradicular nature, or occasionally radicular- type arm pain. Confirmed by Dx anesthetic blockades (scientific works) Unilateral head pain, w/o sideshift (w severe pain it may cross t midline). Moderate-severe, nonthrobbing, & nonlancinating pain, fluctuating or continuous pain usually starting in t neck. Not infrequent occurrence of head or indirect neck trauma by Hx, usually of only medium severity.

Sjaastad, MD, PhD, Fredriksen, MD, PhD. Cervicogenic headache: Criteria, Classification & Epidem. Clin Exper Rheum. 2000; 2(Suppl 19):S3-6. Particularly unfortunate may be a non-tolerated position of the head/neck during sleep. When the Pt finally wakes up, the triggering event may already have passed the point of no return, since the Pt has been unable to notice the initial warning during sleep. These are uni-lateral HAs (not strictly one-sided, but the pain dominates on one side) starting in the neck & "spreading" forwards. There are signs pertaining to the neck, such as reduced cervical ROM, mechanical precipitation mechanisms & ipsilateral should/arm sensation or pain.

Whittingham, DC, PhD, Nilsson, DC, MD, PhD. Active range of motion in the cervical spine increases after spinal manipulation (toggle recoil). JMPT 2001; 24(9): 552-5. Blinded RCT of t changes in active cervical ROM after cervical SM in 105 Pts w cervicogenic HA. After 3 wk baseline observation period (phase 1), Ss randomized into 2 grps. Phase 2 - Grp 2 received SM (toggle recoil), Grp 1 received a sham SM. Phase 3, Grp 1 received toggle & Grp 2 - no Tx. Phase 4, Grp 2 received sham SM & Grp 1 received no Tx. After each phase, active cervical ROM was measured w a strap on head goniometer by 2 blinded examiners. Results: After receiving SM, active cervical ROM increased signif in Grp 2 vs Grp 1. T difference between t Tx grps disappeared after Grp 1received SM. Conclusion: Cervical SM increases active ROM.

McCrory, MD, MHSc et al. Evidence Report: Behavioral and Physical Treatments for Tension-type and Cervicogenic Headache. 2001 (Exec Summary at www.fcer.org). Duke University Evidence-based Practice Center Center for Clinical Health Policy Research. A systematic review by expert epidemiologists & clinicians affiliated w a

very respected research center of behavioral & physical interventions for Tx of HA: Behavioral: 1) relaxation training, 2) biofeedback training & 3) cognitive-behavioral (or stress-management). Physical Txs: acupuncture, cervical SM & PT. These Txs are primarily aimed at HA prevention rather than alleviation of Sx once an attack has begun. A recent population study, using Dx criteria of the International Headache Society (IHS), found that 17.8% of subjects w frequent HA (5 days per month) had t criteria for cervicogenic HA, equivalent to a prevalence of 2.5% in the general population. Cervical SM was associated with improvement in HA outcomes in 2 trials involving Pts w neck pain &/or neck dysfunction & HA. SM appeared to result in immediate improvement in HA severity when used to Tx episodes of cervicogenic HA compared w a placebo grp. When compared to soft-tissue therapies (massage), SM resulted in sustained improvement in HA frequency & severity. However, in Pts w/o a neck pain/dysfunction component to their HA — Pts w episodic or chronic tension-type headache — the effectiveness of cervical SM was less clear. No placebo or no-Tx control studies of SM have been done in these populations. In a trial among Pts w episodic tension-type HA, SM conferred no extra benefit when added to a soft-tissue therapy (deep friction massage). In another trial of Pts w tension-type HA, amitriptyline was significantly better than SM at reducing HA severity during 6-week Tx period; there was no significant difference between the 2 Txs for HA frequency during the same period. Interpretation of results is difficult because all Pts received the same relatively low dose of amitriptyline (30 mg). Despite t same dose of amitriptyline adverse effects were much more common with amitriptyline (82% of patients) than with manipulation (4%). During the 4-week period after Txs ceased, Pts who had SM were significantly better than those who took amitriptyline for both HA frequency & severity. The return to near-baseline values for headache outcomes in t amitriptyline group contrasts w a sustained reduction in HA frequency & severity in those who received SM.

Nilsson, DC, MD et al. JMPT 1997;20(5): 326-330.Study of t effect SM on cervicogenic HA (CH) in a prospective, RCT in 53 Pts w frequent HA criteria for cervicogneic HA. All Ss were age 20 to 60; had >/= 5 days/mo of HA for at least 3 mo; no prior SM of C-spine; no effect w migraine meds, occipital HA location; Pts could identify neck mov'ts or postures tt precipitate /aggravate HA; Pts exhibited decrease passive ROM; Pts kept a HA diary for 1 wk before Tx. 28 Pts received SM 2X/wk for 3 wk. 25 Ps received low-level laser in t upper C-sp (placebo) & deep friction massage (including trigger pts) in t lower cervical/upper thoracic region 2X/wk for 3 wks. **Results**: 1. Use of analgesics decreased by 36% in SM grp but was unchanged in t soft-tissue grp. 2. Number of HA hrs/day decreased by 69% in SM grp compared w 37% in soft tissue grp 3. HA intensity per episode decreased by 36% in SM grp vs 17%. Conclusion: SM has a signif positive effect in cases of cervicogenic HA. CH accounts for some 15-20% of all recurrent HA.

Nelson CF, DC et al. JMPT 1998;21(8): 511-519. Study of t relative efficacy of amitriptyline, SM & a combination of both therapies for t prophylaxis of migraine HA in a prospective, randomized trial of 218 Pts w t Dx of migraine HA. After 4 wk

baseline period, Pts were assigned to 8 wks of Tx & a 4 wk F-U. Results: Improv't was observed in both primary & secondary outcomes in all 3 study grps. T reduction in HA scores during Tx compared w baseline was 49% for amitriptyline, 40% for SM & 41% for t combined grp. During F-U, t reduction from baseline was 24% for amitriptyline, 42% for SM & 25% for t combined grp. **Conclusion:** There's no advantage to combining amitriptyline & SM for Tx of migraine HA. SM was as effective as a well-established & efficacious Tx (amitriptyline), & on t basis of a benign side effects profile, it should be considered a Tx option for Pts w frequent migraine Has.

Tuchin P, DC. et al. A randomized controlled trial of chiropractic spinal manipulative therapy for migraine. JMPT 2000; 23(2): 91-95. Assesses efficacy of chiro SM in Tx of 127 chronic migraine Pts (ave age 38; ave duration 18.1 yrs) in a 6 mo RCT in 3 stages: 2 mo pre-Tx; 2 mo of Tx (diversified, max of 16 Txs or a placebo grp getting detuned interferential current), & 2 mo post-Tx. **Results:** Mean number of migraines reduced from 7.6 to 4.1/mo in th SM grp (46% reduction in frequency). Greatest improv't was in med use (54% reduction). Also 36% reduction in duration 7 34% reduction in disability. A signif number of Pts reduce their med use to zero by t end of t 6 mo trial. T ave response of t SM grp showed signif improv't in migraine frequency, duration, disability, & meds use. 22% of Ss reported >90% reduction of migraines as a consequence of t 2 mo SM. Another 49% more Ss reported signif improv't in t morbidity of each episode. 59% of SM Tx Pts reported no NP after 2 mo of SM. 22% reported sl pain, 13% mild & 8% moderate pain. Highest responses were signif reduction in photo phobia (90%), nausea (89%) & needing a quiet, dark area in reaction to pain (83%), lowest responses were reduction in aura (33%) & vomiting (52%). **Conclusion:** Results support previous findings showing tt some people report signif improv't in migraines after chiro SM.

Vernon, DC. JMPT 1995;18(9):611-617. The sustained benefit with SM may indicate a correction of some underlying disorder responsible for the headaches. Given that amitriptyline is a standard therapy for chronic tension HAs the finding tt SM provides comparable relief should compel everyone's attention. It is now indisputable tt afferent connections from the upper cervical jts have an enormous capacity to create referred head & facial pain as well as muscle dysfunction in the cranio-vertebral region.

Hoving, PhD, Koes, PhD, et al. Manual Therapy, Physical Therapy, or Continued Care by a General Practitioner for Patients with Neck Pain. Ann Intern Med. 2002;136(10):713-722. 183 Pts w =/>2 wks of nonspecific neck pain randomized to receive: 1) Manual therapy (MT) x 6 wks (specific mobilization techniques) 1x/ wk; 2) PT(exercise therapy) 2x/wk; or 3) continued care by a GP (analgesics, counseling, and education). Outcomes (3 & 7 wks): Tx successful if Pt reported "completely recovered" or "much improved" on a 6 point scale. Physical dysfunction, pain intensity, & disability also measured. Results: At 7 wks, success rates were 68.3% for MT, 50.8% for PT, & 35.9% for continued care. Differences favored MT > PT & PT >

GP. Success rate at 7 wks was twice as high for MT vs continued care. ROM improved more for MT or PT than continued care. General health perception showed signif difference in favor of MT vs continued care or PT. MT Pts had fewer absences from work than PT or GP Pts. There were signif differences in pain intensity w MT vs continued care or PT. Disability scores also favored MT. PT scored better than continued GP care on some outcomes but differences were small. In everyday practice, for every 3 Pts referred for MT & every 7 for PT, 1 additional Pt will completely recover w/i 7 wks than would have recovered after continued GP care. **Conclusion: MT is favorable Tx option for NP Pts vs PT or continued GP care**. **Manual Therapy (MT)**: included techniques by Cyriax, Kaltenborn, Maitland, Mennel: use of passive mov'ts to help restore nl spinal function: "hands-on" muscular mobilization to improve soft tissue function, specific jt mobilization techniques (low-velocity passive mov'ts w/i or at t limit of jt ROM. HVLA SM was <u>not</u> included) to improve overall jt function & decrease restrictions, & coordination or stabilziation techniques to improve postural control, coordination, & mov't patterns by using t stabilizing cervical musculature. Sessions: 1 per wk for max of 6 wks. **Physical Therapy (PT)**: combined Txs but active exercises was t strategy to improve strength, ROM, postural exercises, stretching, relaxation exercises, & functional exercises. Manual traction, stretching, massage, interferential current or heat could precede exercise, but specific manual mobilization techniques not included. 30 min Tx sessions, 2X/wk w a max of 12 Txs. **Continued care by GP** - including advice on prognosis, self-care, advice on ergonomics (size of pillow, work position) & encouragement to await further recovery. Also an educational booklet w advice & exercises. Meds: paracetamol or NSAIDs. 10 min F-U visits scheduled every 2 wks were optional.

<u>Jull</u>, PT, PhD, et al. RCT of Exercise & Manipulative Therapy for Cervicogenic Headache. Spine;2002 27(17): 1835-1843. RCT for cervicogenic headache (CHA) in 200 Pts w F-U at 7wks, 3, 6, & 12 mo to determine effectiveness of manipulative therapy (MT) (Maitland type includes low-velocity cervical joint mobilization [passive, rhythmical jt movements] & high-velocity manip), exercise therapy (ExT) emphasizing motor control rather than strength (low-load endurance exercises to train muscle control of the cervicoscapular region) or a combination of both (MT+ExT) vs a ctl group. Pts received 8 to 12 visits over 6 wks. Outcomes: HA frequency, intensity, duration, Northwick Park Neck Pain Index, medication use, Pt satisfaction, pain on neck mov't, upper cervical joint tenderness, craniocervical flexion muscle test, & posture measures. Results: Both MT & ExT signif reduced CHA frequency, intensity, neck pain & benefits were maintained at 12-mo F-U. Effect sizes were at least moderate & clinically relevant. 72% of Pts in MT, ExT or Combined grps achieved reductions of 50% or more in HA frequency at 12 mo F-U, w 42% reporting 80% to 100% relief at 12 mo, indicating clinically relevant results. Combined MT+ExT were not superior to either Tx alone except for duration of HA, but 10% more Pts gained relief wh is clinically significant. Thus, it could be argued that MT & ExT should be used in combination for CHA to ensure optimal effects are gained across all outcomes over the long term.

Giles, DC, PhD; Muller, PhD. Chronic Spinal Pain: A RCT Comparing Medication, Acupuncture, and Spinal Manipulation. Spine;2003 28(14): 1490-1502. 9 wk RCT of 115 chronic spinal pain Pts (>13 wks) at a hospital's multidisciplinary spinal pain unit to compare efficacy of medication, acupuncture, & SM. 3 Tx Protocols: 1) Meds not previously tried by t Pts (Celebrex, Vioxx, Paracetamol), 2) Acupuncture (2X/wk), 3) Chiropractic SM (2X/wk). Pts assessed before Tx by a sports physician for exclusion criteria & given an Oswestry , NDI, SF-36, Pain, VAS & ROM at baseline & 2, 5, & 9 wks after beginning Tx. Results: The highest proportion of early recovery (asymptomatic status) was found for SM (27.3%), followed by acupuncture (9.4%) & medication (5%). SM achieved best overall results, w improv't s of 50% on the Oswestry, 38% on the NDI, 47% on the SF-36, & 50% on the VAS for BP, 38% for lumbar standing flexion, 20% for lumbar sitting flexion, 25% for cervical sitting flexion, & 18% for cervical sitting extension. On the VAS for neck pain, acupuncture showed a better result than manipulation (50% vs 42%). Consistency of results provides evidence tt in chronic spinal pain, SM results in greater short-term improv't than acupuncture or meds. Results need confirmation from future larger studies. Results: SM may be superior to acupuncture or meds for successful Tx of Pts w chronic spinal pain syndrome, except for those w NP. For NP, acupuncture achieved a better result than SM. Pts in this study experienced chronic spinal pain syndrome for an ave of 4.5 yrs in meds grp, 6.4 yrs in acupuncture grp, & 8.3 yrs in SM grp. SM, during a maximum Tx duration of 9 wks, achieved asymp status for every 4th Pt (27%). This result is superior to t percents for acupuncture (9.4%), & meds (5%) for short-term outcomes. For chronic spinal pain syndromes, SM provided t best overall short-term results, despite t fact tt t SM grp had experienced t longest pre-Tx duration of pain. SM appears to provide t best short-term benefit for some Pts w chronic spinal pain syndrome. Acupuncture appeared to be more efficacious for NP on t VAS. All 3 forms of Tx showed some positive response according to t SF-36.

Muller, PhD, Giles, DC, PhD. Long-term Follow up of a RCT assessing the efficacy of medication, acupuncture, & SM for chronic mechanical spinal pain syndromes. JMPT 2005; 28(1):3-11. 1 yr F-U of RCT conducted at t multidisciplinary spinal pain unit of Townsville's general Hospital of 115 chronic mechanical spinal pain (>13 wks) Pts randomized to receive meds (Celebrex, Vioxx, paracetamol) (n=43), acupuncture (n=36) (2X/wk for 9 wks), SM (n=36) (2x/wk for 9 wks). 69 completed t 9 wk Tx period & were exclusively Tx w t allocated Tx. 62 (90%) Pts were assessed at baseline & at 1 year F-U w Oswestry, NDI, pain frequency scores, SF-36, & VAS. Main analysis was restricted to 40 Pts who had received exclusively the randomly allocated Tx (compliers only analysis) for the whole observation 1 yr F-U period. Results: Only SM demonstrated broad-based long-term benefit: 5 of the 7 main outcome measures showed signif improv'ts vs only 1 item in each of acupuncture & medication groups. Conclusions: In chronic spinal pain Pts, SM may be the only Tx of t assessed regimens that provides broad & significant long-term benefit.

Grunnesjo, DN, Bogefeldt, MD et al. A Randomized Controlled Clinical Trial of Stay-

Active Care Versus Manual Therapy in Addition to Stay-Active Care: Functional Variables and Pain. JMPT 2004; 27(7): 431-441. A RCT compares effects of stay-active concept only (encouraging Pts to take part in physical activities to stay fit) versus stay-active concept & manual therapy (specific mobilization, MET in 160 Swedish acute or subacute (</=3 mo) LBP Pts. Pain & disability rating index were outcomes at F-U of 5 & 10 wks. Results: At baseline, t experimental group had somewhat more pain, a higher disability rating index, & more herniated disks than t reference group. At 5 & 10 wks, the experimental group had less pain & lower disability than ctls. Conclusions: Manual therapy in LBP Pts appears to reduce pain & disability better than t traditional stay-active concept.

Muller, PhD, Giles, DC, PhD. Long-term Follow up of a RCT assessing the efficacy of medication, acupuncture, & SM for chronic mechanical spinal pain syndromes. JMPT 2005; 28(1):3-11. 1 yr F-U of RCT conducted at t multidisciplinary spinal pain unit of Townsville's general Hospital of 115 chronic mechanical spinal pain (>13 wks) Pts randomized to receive meds (Celebrex, Vioxx, paracetamol) (n=43), acupuncture (n=36) (2X/wk for 9 wks), SM (n=36) (2x/wk for 9 wks). 69 completed t 9 wk Tx period & were exclusively Tx w t allocated Tx. 62 (90%) Pts were assessed at baseline & at 1 year F-U w Oswestry, NDI, pain frequency scores, SF-36, & VAS. Main analysis was restricted to 40 Pts who had received exclusively the randomly allocated Tx (compliers only analysis) for the whole observation 1 yr F-U period. Results: Only SM demonstrated broad-based long-term benefit: 5 of the 7 main outcome measures showed signif improv'ts vs only 1 item in each of acupuncture & medication groups. Conclusions: In chronic spinal pain Pts, SM may be the only Tx of t assessed regimens that provides broad & significant long-term benefit.

Legorreta, AP, MD, MPH, Mez D, DC, Nelson, CF, DC, MS et al. Comparative analysis of individuals w & w/o chiropractic coverage. Arch Intern Med 2004; 164(Oct 11):1985-1992. Despite t evidence for safety, effectiveness, & growing public demand, health insurance coverage for chiro continues to remain restricted, particularly in t managed care sector. Chiropractic coverage is often limited in terms of referral restrictions, conditions covered, number of visits, maximum annual dollar benefit, requirement for MD referral, & amount paid per visit. Health plan designs may impede appropriate access to chiropractic clinical care. A comprehensive overview of t literature reveals tt it is essentially unanimous in reporting tt chiropractic care is associated with significantly higher Pt satisfaction compared w Pts who receive conventional treatments.A 4 yr study using administrative claims data comparing 707,690 health plan members w chiropractic coverage (ASHP) to 1,001,995 member w/o chiro coverage to evaluate t effects of chiro coverage on: Total health care costs; Cost of management of specific NMS conditions; Rate of utilization of specific high-cost procedures; Is chiropractic care used as a substitution care or add-on care in a MCO. Results: Members w chiro coverage were younger (mean 33 vs 36) & had less specific comorbid medical conditions (HBP, heart failure, DM, arrhythmias) vs to those w/o chiro coverage. Total health care costs for members w chiro coverage was 12% lower annually than for those w/o coverage. Adjusted for differences in age &

comorbidities total costs were 1.6% lower w chiro care. Analysis did not include P.T. & prescription costs. Cost for Tx of Pts w NMS conditions: (141,616 w chiro coverage vs 189,923) costs were 13% lower annually for those w chiro coverage. Hospital costs for NMS Pts w chiro coverage was 15% lower. Ambulatory costs for NMS Pts w chiro coverage was 12% lower. Cost of providing care for LBP per episode of LBP was 28% lower w chiro coverage. BP Pts w chiro coverage had fewer inpatient stays (9.3 vs 15.6 stays per 1000 Pts); had fewer MRIs (43.2 vs 68.9 per 1000 Pts); had fewer LB surgeries (3.3 vs 4.8 per 1000 Pts); had fewer radiographs (17.5 vs 22.7 per 1000) even though the percent of complicated cases was only marginally higher (2%) in those managed by MDs. Data also demonstrate tt most chiro care is a substitution for medical care & not an add on cost. Conclusion: Inclusion of a chiro benefit in a managed care plan results in a reduction in overall utilization of health care resources & cost savings. We estimate an annual reduction of $16 million in Pts w chiro coverage as a result of lower utilization of high cost items. This is a conservative estimate. Despite t evidence for safety, effectiveness, & growing public demand, health insurance coverage for chiro continues to remain restricted, particularly in t managed care sector.

Ness J, MD, Nisley N, MD. Cracking the Problem of Back Pain. Is Chiropractic the Answer? Arch Intern Med 2004, 164 (Oct11): 1953-4. In this 4 yr retrospective claims data analysis of >1 million members of a health care plan, access to chiropractic care was correlated w a reduction in t cost of caring for NMS complaints & BP & was associated w lower utilization of radiography, MRI, back surgery, & hospitalization. The study raises t intriguing possibility tt chiro may in fact be t more economic approach to t management of t complex, ill-defined, recurrent & often refractory symptom of BP. The study is one of t largest analyses ever performed on t economic impact of chiropractic. Chiropractic manipulation may prove to be a safe alternative when compared w t use of NSAIDs or opiates in frail Pts who are highly susceptible to t development of devastating medication adverse effects. T study offers a tantalizing glimpse into possible large-scale economic benefits obtained thru access to chiro coverage by large groups of insured Pts.

Nelson, C. F. DC, MS, Metz, D, DC, et al. Effects of a managed chiropractic benefit on the use of specific diagnostic and therapeutic procedures in the treatment of low back and neck pain. JMPT 2005; 28(8): 564-9. Study to measure t effects of a managed chiropractic benefit on the rates of Dx & Tx of BP & neck pain (NP) in a retrospective analysis of claims data from a managed-care health plan over 4 yrs. Use rates of CT/MRI, surgery, inpatient care, & radiographs were compared between employer groups w & w/o a chiropractic benefit. Results: For LBP Pts, use rates of all 4 studied procedures were lower in the group w DC coverage. On a per-episode basis, the rates in the group with coverage were reduced by Surgery: -32.1%; CT/MRI: -37.2%; plain-film radiography -23.1%; inpatient care -40.1%. On a per-patient basis, the rates were reduced by: Surgery: -13.7%; CT/MRI: -20.3%; Radiography: -2.2%; Inpatient care: -24.8%. For NP Pts, the use rates were reduced per episode in the group w chiropractic coverage: Surgery: -49.4%; CT/MRI: -45.6%; Radiography: -36.0%; Inpatient care: -49.5%. Per patient, the rates were

Surgery: -31.1%; CT/MRI: -25.7%; Radiography: -12.5%; Inpatient care: 31.1%. All group differences were statistically significant. Conclusion: In all study categories, there were signif reductions in t rates of surgery, CT/MRI, inpatient care, & radiographs. Chiro was used almost entirely as a substitution for medical care for both BP & NP. Chiro care is far less likely to lead to t use of these invasive procedures. For Tx of LBP & NP, inclusion of a chiropractic benefit resulted in a reduction in the rates of surgery, advanced imaging, inpatient care, & plain-film radiographs.

Sarnat, R. L., MD, Winterstein, J. DC. Clinical and cost outcomes of an integrative medicine IPA. J Manipulative Physiol Ther 2004; 27(5): 336-47. 4 yrs of data were collected from claims from an integrative medicine IPA (Alternative Medicine Inc - AMI) in which, for the first time, DCs function as PCPs specializing in a nonpharmaceutical /nonsurgical approach w/i a classical gatekeeper HMO. PCP-DCs were organized into a well defined integrated health care system along w conventional MDs encompassing both CAM & conventional modern medicine w/i a single gatekeeper HMO format. T intention of AMI was to provide members w t best Tx tt both PCP-DCs, using a variety of CAM techniques & conventional medicine had to offer. All PCP-DCs passed credentialing by an HMO Review Committee composed exclusively of MDs. AMI began January, 1999 w 16 PCP-DCs. In Dec 2002, AMI had 30 PCP-DCs. Pts enrollment was offered to t total 600,000 members of t HMO. In Dec 2002 there were 649 members. 21,743 member months (mm) of data were analyzed. PCP-DCs focused on risk factors including diet/nutrition, exercise, postural/structural problems, behavioral/emotional problems, physiological disease, & stress management. All exams & Txs were at t discretion of t PCP-DCs & didn't require approval from t IPA MD directors. All ancillary testing & Tx outside t personal office of t PCP-DCs was subject to MD medical director approval. If acute life threatening or advanced disease management required inpatient status or conventional modern medicine, t PCP-DCs delegated authority to t attending MD consulted. PCP-DCs, by design, initially saw Pts frequently (ave of 2X/mo) to correct structural dysfunctions & provide re-education in lifestyle choices in contrast to medical IPAs wherein most Pts saw PCPs on a "crisis only" basis. PCP-DCs also utilized nonphysician CAM providers licensed or credentialed in CAM therapies: massage, acupuncture, cranial sacral therapy, stress management including meditation, yoga, energy balancing, cognitive therapy. PCP-DCs in this study utilized all t modalities noted & not just chiro SM as a sole therapeutic intervention. AMI cost savings (below predicted budget) were 66.7%, 88.1%, 57.1%, 69.3% for 1999-2002. AMI's members/Pts included a broader spectrum of disease states than commonly seen in a typical DC office. When Dx necessitated Tx tt required use of pharmaceuticals or surgery, then referral was made to an MD. Results: 4 yrs (1999-2002) & 21,743 mm. Findings illustrate AMI's superior clinical outcomes vs conventional IPA based on actual claims data. PCP-DC referral patterns to MDs resulted in comanagement in only 40% of members. 60% of Pts were managed solely by PCP-DCs. AMI referrals: 1 per 33 Pt visits vs 1 per 3 visits in conventional medicine IPAs. This is consistent w t prediction tt an increase in CAM oriented PCP encounters initially would result in less utilization of conventional medicine downstream. Pt satisfaction surveys had scores of 100%, 89%,

91%, & 90% for yrs 1999-2002. AMI members consistently rated their experience above t HMO network normative average. Audits of utilization management adherence (UM) & utilization review (UR) by onsite nurse auditors were between 97 & 100% in each category. Reliance on a conventional medical model in wh drugs & surgery represent first line Tx, may not provide t best care to our Pts. AMI model seems to demonstrate t potential superiority of an integrated health system in wh chiro & CAM play a signif primary care role. Conventional health care systems excel in acute care & crisis disease state management, yet this accounts for only a small percent of total medical care. T greater health care burden is t prevention & Tx of t multiple chronic disorders tt account for t majority of health care expenditures. Studies suggest tt 50% of deaths & 70% of diseases in t US are caused by unhealthy lifestyle habits (smoking, alcohol abuse, improper diet). Our nation now faces a behavior induced epidemic of chronic illness. Lifestyle re-education emphasizing prevention & wellness may be best addressed by PCPs w an unconventional orientation vs conventional MDs educated to focus primarily on disease management. Findings indicate tt a nonpharmaceutical/nonsurgical orientation can reduce overall health care costs signif & yet deliver high-quality care. Results have been achieved not by decreasing or denying access to care but rather by increasing t frequency of PCP prevention-oriented encounters. It may be time to rethink our current medical model w its overall reliance on pharmaceuticals as a first line option. This model is replicable on a much larger scale. AMI is currently implementing different programs in PPO, PO, & work comp systems.

Licht, P. MD, PhD. Vertebral artery blood flow during chiropractic treatment of the cervical column. PhD Thesis. Odense University, Denmark 2000: 67. Cervical manipulation had a modest effect on vertebral artery volume blood flow, median maximal increase of 20%, in pigs wh increased for 20 -40 sec & then returned to baseline values. We measured flow velocity & volume blood flow in t human vertebral artery by non-invasive color-duplex technique before & after SM & found no change. A short lived effect similar to these experimental findings could have passed undetected in t human study because we measured flow velocity only twice, immediately before & 3 minutes after SM. However, we assumed tt flow changes of similar magnitude as in t pig study would not be of clinical relevance.

Kelly DD, Murphy DC, PhD, Backhouse DC. JMPT 2000;23(4):246-251. Study uses a mental rotation reaction time test to measure SM effects on cortical processing to see if cortical processing, measured by response time is altered by SM. Mental rotation reaction time tests require Ss to judge if an object is in its normal orientation or its mirror image. T task is complex when images are presented at varied angles. Reaction time increases as t angular disparity increases, suggesting tt Ss mentally rotate t object into its normal position before responding. This requires more cortical processing than a simple recognition test & has a longer central processing component. Rotation reaction time may demonstrate t effects of interventions tt affect cortical processing vs peripheral neuromuscular changes tt affect mov't time. 36 chiro students w upper cervical subluxation (based on static & motion palpation)

were randomized. 18 Ss in (experimental grp) received a toggle recoil upper cervical adjustment & 18 ctls rested for 2 minutes & then were retested. Ss responded "N" for normal or "B" for backward when presented w t capital letter "R" in either normal or mirror-reversed orientation, both randomly presented at angles of 0 deg, 45 deg, 90 deg, 135 deg, 225 deg, 270 deg, & 315 deg for 80 stimulus presentations. T reaction time was compared to evaluate t change in cognitive processing. Results: T average decrease in reaction times in t experimental grp was 98 ms, a 14.9% improv't,, whereas t ave decrease in th ctl rp was 58 ms, a 8.0% improv't. Results demonstrate a signif improv't for both grps. T reaction time improv't of t experimental grp was signif greater than tt of t control grp. A decrease in reaction time occurred in both grps, but t significantly greater improv't in reaction time for t experimental grp suggests tt t upper cervical adj may have resulted in an effect on cognitive function beyond tt of a learning effect alone. Conclusion: Study demonstrates a signif improv't in cognitive function, as measured by an improved reaction time to a mental rotation task after upper cervical adjustments. More research is needed to investigate t mechanism of these effects.

Hides JA, PhD et al. Multifidus muscle recovery is not automatic after resolution of acute, first-episdoe low back pain. Spine 1996;21(23):2763-2769. 39 Pts w first episode unilateral ALBP & unilat, segmental inhibition of t multifidus muscle (identified by diagnostic ultrasound) were randomized to 1) a control (pain meds) or 2) Tx grp (meds & exercise) to eval t effectiveness of localized exercise to improve multifidi's stabilizing role. Inhibition of multifidus occurs w acute, first episode LBP & pathologic changes in this muscle are linked w poor outcome & recurrence of Sx. Results: Multifidi muscle recovery was not spontaneous on remission of painful Sx in ctl grp (pain meds only). Muscle recovery was more rapid & more complete in Pts in exercise grp muscular. Conclusions: Lack of localized, muscle support may be a reason for t high recurrence rate of LBP following an inital episode. Pts w ALBP in this study whose pain had resolved had resumed a normal level of activity, but it is possible tt they did so w a predispostion to further injury & recurrence of LBP. Multifidus recovery from inhibition assoc w first episode LBP doesn't occur automatically w resolution of pain & disability. Even when functional levels of activity returned to nl (at 10 wks F-U), muscle size did not return to nl. This may be one factor tt contributes to the high recurrence rate of LBP after an episode of LBP -a high proportion of Pts may have a deficit in their lumbar muscular stabilizing capacity despite their lack of pain.

Richardson, PhD, BPhyt et al. Therapeutic Exercise for Spinal Stablization in Low Back Pain. Scientific Basis and Clinical Approach. Churchill Livingstone 1999: 74. Despite relief of pain & return to ADLs, Pts in ctl grp displayed decreased MF wh persisted to t 10 wk F-U. Persistence of segmental MF inhibition, still evident at 10 wk F-U in t ctl grp, exposed t injured segment to decreased muscle support & a predisposition to further injury. **1 yr results showed only 30% of Ss who performed exercises suffered recurrences of LBP vs 80% of Ss in t ctl grp**. The rapidity of onset & localized distribution of t decrease in muscle size suggest tt disuse atrophy was

not t cause. T most likely mechanism is reflex inhibition wh was was still seen after resolution of pain in t ctl grp Pts. Possible mechanism for t selective inhibition of t MF at t affected level - it is sensory innervation of t injured jt or structure wh is t crucial element in reflex inhibition. It has been suggested tt input from t jt is processed & modulated in t spinal cord to produce an effect in specific muscles wh act on t jt in question. T parts of MF crossing t affected segmental level seem to be t specific parts of t muscle wh are affected by reflex inhibition.

Somatic Referred Pain

Cramer, DC, PhD, Darby, PhD. Top Clin Chiro 1996;3(3):1-8. **Somatic Referred Pain**: Pain of somatic origin felt distant to the structure generating it. It is poorly localized. Why?

Pain input is dispersed by ascending & descending several segments within fibers that make up the tract of Lissauer before synapsing with interneurons. Pain input entering from several different spinal cord segments converges on the same interneurons receiving input from different somatic regions. Dispersal of afferents onto different second order neurons in combination with the convergence of several different afferents onto a single second order neuron decrease the ability of the CNS to localize nociception. This type of dispersal & convergence is also found at the 2nd synapse along the pain pathway in the thalamus which transmits impulses to the postcentral gyrus of the cerebral cortex. The region of the back is represented on a small area of the Sensory Homonculus of the cortex. This may also contribute to poor localization of pain of spinal origin. In addition, the same ascending pain pathways carry pain input from cutaneous areas. Therefore, when these tracts are stimulated, the cerebral cortex may interpret impulses as originating from a cutaneous region.

Cramer GD, DC, PhD. Anatomy of the cervical spine with respect to head pain. Top Clin Chiro 1998;5(1):1-10. The region of t sensory homunculus related to t neck is very small & is very closely related to t posterior region of t head (suboccipital & occipital regions). There is a great deal of overlap which helps explain t broad referral of neck pain to t posterior head.

Somatovisceral Connections

Patterson, PhD. J Canadian Chiro Assoc 1992;36(2) June:107-8. With inflam t number of active jt receptors increases dramatically, perhaps by a factor of 10. There are potent effects of such a dramatic increase in input to t cord & higher centers of t CNS in terms of spinal reflex function & long-term excitability, as well as t interactions between somatic sensory inputs & autonomic outflows from t cord. **Up to 80% of spinal interneurons wh receive input from somatic afferents also receive input from visceral afferents.** Thus a tremendous increase in somatic input could not help but disrupt normal autonomic outflow patterns, disrupting nl body function & homeostasis.

Nansel, PhD. Somatic-Visceral Mimicry Syndromes. JMPT 1995; 18(62):379-397.

Nociceptive afferents from deep somatic structures converge on t same central neuronal pools as do t afferent fibers transmitting noxious stimulation from regionally related visceral structures. Both of these afferent inputs can result in S&S tt may be indistinguishable w respect to their somatic vs visceral etiologies. Somatic dysfunction can often mimic Sx of visceral disease & be mistaken for it, & is supported by an impressive amount of both experimental & clinical data.

Nansel, PhD, Szlazak, DC. JMPT 1997; 20(3): 219-224. There isn't any scientific evidence for the existence of a segmental, neuronally mediated somatovisceral disease mechanism. The evidence doesn't support the view tt autonomic nerves have the capability for inducing tissue pathology in any of their innervated organs. Nor, is there t slightest clinical evidence tt Pts w broken necks or broken backs or Pts w entire hips or shoulders blown apart by shotgun blasts or Pts w mechanical neck or low back dysfunction go on to develop higher incidences of any segmentally or regionally related internal organ disease. We fail to comprehend t evolutionary advantage of an "innate" neuronal reflex mechanism by wh an inflamed facet jt or a subluxated L5 vert would initiate a set of maladaptive, segmentally directed reflex responses tt would orchestrate various disease processes in t prostate, appendix or colon. Overwhelming evidence leaves little doubt tt dysfunction involving deep somatic structures can often produce signs & symps wh mimic (rather than cause) internal organ disease.Whether or not SM is an effective strategy for managing any internal organ disease, t phenomenon of somatic visceral simulation is a separate issue to be dealt w clinically. What is at issue is for how much longer, t chiro profession will continue to embrace its "nerve interference" theories in spite of t glaring inconsistencies they impose on t current scientific knowledge base.

Leboeuf-Yde DC, PhD, et al. The types and frequencies of improved nonmusculoskeletal symptoms reported after chiropractic spinal manipulative therapy. JMPT 1999;22(9):559-564. Retrospective study of t frequency & types of improved nonmusculoskeletal Sx reported after chiro SM obtained thru standardized interviews of 1504 chiro Pts on return visit w/i 2 wks of previous Tx. Study done in private practices of 87 Swedish DCs.Outcome: Self-reported improved nonmusculoskeletal (non-MS) Sx. Results: At least 1 improved non-MS Sx was reported after t previous Tx (342 of 1504) in 23% of cases. 26% were related to airway passages (usually: easier to breathe); 25% were related to t digestive system (improved function); 14% were under eyes/vision (usually improved vision), & 14% under heart/circulation. T number of spinal areas Tx was assoc w t number of reactions. Pts Tx in only 1 area, 15% reported a non-MS response; 2 areas- 22%, 3 areas - 32%, 4 areas - 35%. None of t Pts had sought care primarily for non-MS conditions & Swedish DCs do not emphasize non-MS benefits of care. All benefits are reported by Pts & none have objective verification to confirm their veracity. Whether t link between Tx & reaction is causal or not cannot be shown. T occurrence of reported reactions increased w t number of areas Tx w about twice as many in those Tx in 4 areas than in only 1. Findings warrant further investigation.

Bigos, MD. ALBP in Adults. AHCPR, Dec 1994: 8. Different clinical disciplines use a variety of Dx tt suggest a cause for LBP. However, these labels are often unreliable for categorizing causes of ALBP. **Even after an extensive workup, only @ 15% of Pts can be given a definitive Dx.**

T panel classified LBP into 3 descriptive clinical categories:

1. Potentially serious conditions: A) spinal tumors, B) infection, C) fracture, D) cauda equina syndrome
2. Sciatica: back-related lower limb symps suggesting nerve root compromise
3. Nonspecific back symptoms: symps occurring primarily in t back tt suggest neither nerve root compromise nor serious underlying condition

Iinitial assessment for ALBP focuses on t detection of "**Red Flags**:" indicators of serious spinal or nonspinal pathology: **A)** For **Fracture**: Major trauma, minor trauma in older or potentially osteoporotic Pts; **B)** Possible **Tumor** or **Infection**: age over 50 or under 20, Hx of Cancer, Symps: recent fever or chills or unexplained weight loss. Risk factors for spinal infection: IV drug use, recent bacterial infection, immunosuppression. Pain worsens when supine, severe nighttime pain. **C)** Possible **Cauda Equina Syndrome**: saddle anesthesia, recent onset of bladder or bowel dysfunction, severe or progressive neuro deficit in lower limb; on PE: laxity of anal sphincter, perianal/perineal sensory loss, major motor weakness of quads, ankle plantar flexors, evertors & dorsiflexors

The Benetfits of Adjustments: .Once DCs rule out serious pathologies such as fractures, infections, tumors & cauda equina syndrome (as the federal guidelines suggest), we know the Pt is in good hands becuase all the mechanical tissues of the back including: Muscles, Ligaments, Joint Capsules, & Discs -Respond to & heal well if we adjust them.Because adjusting restores motion & overcomes abnormal restrictive barriers. This helps: 1. Restore motion - both symmetry & ROM; 2. Normalize biomechanics & load distribution; 3. Pump out waste products & edematous fluid; 4. Improves nutrition to discs & articular cartilage; 5. Relax tight muscles; 6. Normalize proprioception - position sense & kinesthesia; 7. Stimulate sensory-motor reflexes which improve dynamic muscular stabilization of joints; 8. Accelerate healing - because movement: A. Increases metabolic rate; B. Increases collagen & protein production; 9. Improves the alignment of new connective tissue

Recent & Important Clinical Studies:

Meade, MD. Br Med J 1990; June 2:1431-37. Long term benefit (6 wk, 6 mo, 1 & 2 yrs) of short term care (10 visits maximum) DC vs MD for LBP in terms of reduction of disability. Chiro more effectively reduced disability. Percent of DC Ps who had time loss from work in the 2nd yr of study: 21%; MD Ps: 35%

Meade, MD. Br Med J 1995; 311:349-351. 3 yr follow-up of 741 patients with LBP randomized to receive either DC or hospital based outpatient care. RESULTS: Mean Oswestry scores at 3 yrs represents a 29% greater improvement in patients Tx by DCs. The absolute improv't was 14.1 in DCs & 10.9 in hospital patients. Patientss with short current episodes, a previous Hx of BP, & initial high Oswesetry scores

derived the most benefit from DCs. The proportion of patients at 3 yrs who thought their allocated trial Tx had helped their BP was higher among Ps referred to DCs. The substantial benefit of DC Tx in terms of pain is evident early on & then persists thru-out the trial.

Shekelle, MD, PhD. The Backletter 1994;9 (6):61,62,68: The evidence on spinal manipulation is much better than for most other back treatments. I think of the treatments that have been tested for acute low back pain, spinal manipulation has probably done the best. There are new treatments that need to be tested and they need it against spinal manipulation to see if they perform better. Spinal manipulation, based on its performance in studies to date, deserves a prominent role in future research on back pain treatment.

The North American Spine Society. Spine 1991; 16(10):1161-67. Chiropractic given their highest rating: Procedure Category 1: Generally accepted, well established, widely used. Recommended for up to 3-4 months, with a 1 month optimum. Reinstitution is warranted if there is a flare-up. Also states tt prolonged bed rest is detrimental to recovery.

Twomey, PhD, PT. Spine 1995; 20(5):615-619. Bed rest & analgesics remain the Tx prescribed most by MDs for LBP despite lack of evidence. Prolonged rest or avoidance of exercise are assoc w an increase in the duration & severity of BP. All elements of the musculoskeletal system (MS) react adversely to inactivity, resulting in weakness & loss of tissue. Prolonged inactivity leads to a loss of muscle bulk, reduction of bone density, reduced ROM, strength, & endurance. The MS system including the spine demands the loading & stress of exercise & movement.

Waddell, MD et al. Bed Rest. In Clinical Guidelines for the Management of Acute Low Back Pain 1996: 12, 22. There are now 9 RCTs of bed rest for acute or recurrent LBP with or without leg pain. These show consistently that bed rest is not effective. Some Pts may initially be confined to bed as a consequence of their pain but this should not be considered as a treatment. Short periods of bed rest are used to treat disc prolapse, but there is little evidence that this is effective. For ALBP bed rest for 2-7 days is worse than placebo or ordinary activity. Prolonged bed rest may lead to debilitation, chronic disability & increasing difficulty in rehab.

Koes, PhD, **Assendelft**, MD. Spine 1996; 21(24): 2860-2873 An updated review of RCTs of SM for LBP. Update of 1991 review of RCTs of SM for LBP. 8 new RCTs since 1990. Each study's methodological quality was assessed & scored. Outcomes were noted for acute (<6 wks), chronic (>6 wks) or mixed groups of Pts. **Results**: 36 RCTs reviewed. In general, studies are of poor quality. 19 trials (53%) report better results for SM than reference Tx (SWD, massage, exercises, analgesics, or placebo). 5 trials report better results in subgroups only. In 10 trials SM did no better than reference Tx. Only 16 studies include outcomes of =/> 3 mo. 6 report long-term benefits of SM. 10 did not. **Acute LBP**: (<6 wks) 12 Trials of SM alone or in combination w other Txs

vs reference Txs. 5 had positive results, 4 negative, 3 had positive in a subgroup only. **Chronic LBP**: (>6 wks) 8 trials - 5 had positive results, 2 negative, 1 had no conclusion. **Mixed Populations**: 12 trials - 8 reported positive results, 1 negative, & in 1 no conclusion. **Placebo Comparisons**: 11 trials of SM vs a placebo Tx (detuned SWD, sham SM). 7 had positive results, 1 positive only in a subgroup & 3 negative studies. Included acute & chronic conditions. **SM is t most frequently studied intervention in RCTs for LBP**. Results indicate tt SM is not consistently better than other therapeutic approaches. Most trials report only short-term effects. Long-term effects (>3 mo) are seldom reported. 2 of 8 trials since 1990 report long-term results. 10 of 16 trials reporting long-term had negative results -indicates tt long-term efficacy remains doubtful. **Conclusion**: Efficacy of SM for ALBP has not been convincingly demonstrated w sound RCTs. There's at least as much evidence in favor of SM for CLBP. However, efficacy of SM has not been established for either. There are indications tt SM might be effective in some subgroups but we're unable to identify which Pts might benefit most..

Meeker, DC, MPH. Spine 1996;21(24):2873. Koes & Assendelft are too cautious. In all t studies on SM, not once has the comparison Tx done better. 3 meta-analyses reached different conclusions. 2 government practice parameters consensus methods came to different conclusions. The grading scheme implies better trials are routine in medicine but such is not t case. The article doesn't note tt data on all other Txs for BP are poorer or even nonexistent. No other Tx for BP has been evaluated in more clinical trials than SM. If estimates from meta- analyses are close, SM has @ a 30% advantage over Txs w wh it has been compared. NSAIDs, another Tx recommend by AHCPR have about t same effect size, but have greater health risks.

Assendelft, MD, PhD, Koes, PhD et al. The effectiveness for chiropractic for treatment of low back pain. JMPT 1996; 19(8):499-507 To determine t effectiveness of chiro Tx for Pts w LBP, a systematic review of t lit to identify RCTs on chiro was done & methodological quality was assessed independently by 2 reviewers. Results: 8 RCTs were identified. All RCTs had serious flaws in their design, execution & reporting. The review did not provide convincing evidence for the effectiveness of chiro for acute or chronic LBP. Conclusions: There is a need for correctly executed trials. Guidelines for uniform execution & reporting of RCTs should be established.

Cherkin, PhD et al. A comparison of PT, chiro manip, & an educational booklet for Tx of Pts with LBP. NEJM 1998;339(15):1021-1029. Randomly assigned 321 adults w LBP persisting 7 days or more after a primary care visit to: 1) McKenzie method of PT, 2) chiro SM, or 3) educational booklet. Pts w sciatica were excluded. PT or SM for 1 mo (number of visits determined by t provider, limited to a max of 9 visits); F-U at 1 wk, 1 mo, 1 & 2 yrs. Bothersomeness of Sx & dysfunction were measured.Results: Chiro grp (ave 6.9 Adj) had less severe Sx than t booklet grp at 4 wks (P=0.02) & there was a trend toward less severe Sx in t PT grp (ave 4.5 visits). But, the differences were small & not significant after adjustments for their non-normal distribution. Differences in dysfunction among grps were small & approached signif only at 1 yr,

w greater dysfunction in t booklet grp than in t other 2 grps. For all outcomes, there were no signif differences between the PT & chiro grps & no signif differences among t grps in 1) t number of days of reduced activity, 2) missed work or 3) in recurrences of BP. 75% of Ss in PT & chiro grps rated their care as very good or excellent, as compared w 30% of Ss in t booklet grp. Over 2 yrs, t mean costs of care were $437 for t PT grp, $429 for t chiro grp, & $153 for t booklet grp. Approximately 60% of Pts had >2 previous episodes of BP@ 50% at 1 yr & 70% in 2nd yr of all groups had recurrences. Conclusions: For Pts w LBP, t McKenzie method & chiro SM had similar effects & costs, & Pts receiving these Txs had only marginally better outcomes than Pts who got an educational booklet. Whether t limited benefits of these Txs are worth t additional costs is open to question.

Balon J, Aker PD, et al. A comparison of active and simulated chiro manip as adjunctive Tx of **childhood asthma**. NEJM 1998;339(15):1013-1020. Randomized trial of chiro SM for children w mild/mod asthma. After 3 wk baseline, 91 kids w Sx of asthma despite usual meds were randomized to active or simulated chiro SM for 4 months. None had previously received chiro care. Each child was Tx by 1 of 11 DCs. Primary outcome: change in peak expiratory flow (PEF), in t morning, before t use of a bronchodilator, at 2 & 4 mo. Adj received: 20 to 36. Results: 80 children's outcomes (38 in active-Tx & 42 in simulated-Tx grp) were evaluated. There were small increases (7 to 12 liters per minute) in PEF in both Tx grps, w no signif differences between grps. Sx of asthma & use of beta-agonists decreased & t quality of life increased in both grps, w no signif differences between grps. There were no signif changes in spirometric measures or airway responsiveness. Conclusions: In children with mild/moderate asthma, the addition of chiropractic SM to usual medical care provided no benefit.

Shekelle P, MD, PhD. What role for chiropractic in health care? NEJM 1998;339(15): Chiro is becoming more mainstream. SM is t Tx tt is used most often & is the method most identified w chiro. Chiro often includes advice about exercise, nutrition & lifestyle. That SM is a somewhat effective Sx therapy for some Pts w ALBP is, I believe, no longer in dispute. Cherkin's new study confirms this: LBP Pts assigned to chiro SM had a small, marginally signif improv't in Sx at 4 wks as compared an educational booklet. What's in dispute is t efficacy of SM in relation to other therapies. Cherkin found no appreciable difference in outcomes between chiro SM & McKenzie method. Cost-effectiveness of chiro relative to other care is also controversial. Cherkin found chiro & McKenzie Pts incurred about $280 more in costs over 2 yrs than Pts who got an educational booklet. Indirect costs, are unlikely to differ since 1) t numbers of days of reduced activity, 2) days in bed, & 3) days of work lost were similar in all 3 grps. T recurrence rate & t percent of Pts who sought care for BP were similar among grps, casting doubt on t hypothesis tt either chiro or McKenzie method saves money by reducing t rate of relapse. I conclude tt chiro for LBP, costs more than t usual supportive med care delivered by HMOs. Whether t small Sx benefit & t enhanced Pt satisfaction are worth this cost is debatable. Before we judge too harshly, remember tt many med interventions paid for by insurance

companies provide equally small benefits or even none at all. There is evidence from randomized trials tt SM may be effective for some Pts w NP. But, efficacy & cost effectiveness of SM relative to other therapies has not been established. MDs generally oppose SM for Tx of non-MS disorders such as hypertension, asthma, OM, despite numerous case reports of improv't, there is a paucity of data from RCTs. Balon concluded tt t addition of chiro SM to med Tx had no effect on t control of childhood asthma. Pts who seek chiro for asthma or other non-MS conditions accounts for less than 1% of all Pts visits to DCs. There is little evidence to support t value of SM for non-MS conditions. It is currently inappropriate to consider chiro as a broad-based alternative to traditional medical care. But, for some MS conditions, chiro does provide some benefit to some Pts. The challenge is to demonstrate tt DCs can achieve this benefit at a cost tt Pts or health insurers are willing to bear.

Tye, L. Reports rekindle medical debate. MDs challenging alternative care. Boston Globe 1998; Oct 11: A01. Chiropractic may have been t immediate target of last week's stinging critiques in t NEJM, but its t broader empire of alt med tt t journal & its allies in mainstream med really are after. Such a campaign wouldn't have been surprising when mainstream & alt med were openly at war. But this comes in what seemed an era of detent, in wh "complementary" practitioners practice along side of traditional MDs. Last week's articles make clear tt t cease-fire has ceased as t journal, for t 2nd time in a month, attacked altern med for allegedly failing to back its claims of healing power. The intense reaction suggests tt rather than embracing an alliance between mainstream & alt approaches, many MDs had bottled up their grievances & were waiting for t right moment to vent them. "We've been giving alt med a free ride," says Dr. Marcia Angell, NEJM exec editor." MDs were leaning over backwards not to alienate their Pts. But they won't alienate Pts by leveling w them, by telling them t truth tt there's very little scientific proof tt supports altern med." Dr James Gordon, former chair of t advisory council to OAM at NIH views it differently: "The editors of NEJM seem to see themselves functioning not as scientists but as guardians of orthodoxy." T relationship between mainstream & alt med has been mostly distrustful. MDs saw altern healers as peddling unproven arts tt unfairly raised Pts' hopes & raided their pocketbooks. Alt providers saw MDs as promoting toxic & expensive conventional Txs & unwilling to consider remedies used for centuries in other parts of t world. Since Eisenberg's study there's been a slow building of bridges. But not everyone bought t new alliance. Many MDs complained, generally in private for fear of alienating their Pts. Some strident responses stem partly from legitimate concerns by MDs over t lack of evidence tt alt Txs work. "You're seeing scientific methods applied to evaluating therapies, many of wh are basically t placebo effect, & those methods demonstrate tt it is t placebo effect," says Tom Delbanco, MD, coauthor on t 1993 Eisenberg study. Some medical backlash is self-interest. Squeezed by MC, MDs worry tt more dollars are going to altern providers. There is journalistic competition between t NEJM & its archrival, JAMA. NEJM's recent focus on alt med was motivated partly by a desire to upstage JAMA wh announced plans a yr ago to make alt med t centerpiece of an issue due next in Nov 1998. NEJM critiques of alt med are almost certain to continue because they bring

into t open simmering issues w/i t med community. Angell says t recent articles generated a record response in letters & t recent studies on alt Txs are "The tip of t iceberg...Finally t scientific community is beginning to mobilize themselves & conduct rigorous studies on these issues." John Eisenberg, MD, head of AHCPR notes, "T alt med grp have to recognize t rules of evidence used in science to establish what ought to be done for Pts. The traditional scientific community must understand there are outcomes & processes of care that Pts value. We are starting to measure what Pts see as important rather than what laboratory tests show. "

Bove G, DC, PhD, Nilsson N, DC, MD, PhD. Spinal manipulation in the treatment of episodic tension-type headache. JAMA 1998; 280:1576-1579. 19 week RCT to determine effects of SM on adults w episodic tension-type HA. 26 M & 49 W (20-59 yrs) w t Dx of episodic tension-type HA were randomized into 2 groups, Grp 1) received soft tissue therapy & SM. Grp 2) received soft tissue therapy & a placebo laser Tx (ctl grp). All Ss got 8 Txs over 4 wks performed by t same DC. Outcomes: 1) Daily hrs of HA, 2) pain intensity per episode, 3) daily analgesic use (recorded in diaries). Results: No signif differences between SM & ctl grps in any of t 3 outcomes. By wk 7, both grp had signif reductions in 1) Mean daily HA hrs (SM: from 2.8 to 1.5 hrs); (ctl grp: from 3.4 to 1.9 hrs); 2) Number of analgesics per day (SM: from 0.66 to 0.38); (ctl grp: from 0.82 to 0.59). Changes were maintained through t observation period. HA pain intensity was unchanged for t duration of t trial. Conclusion: As an isolated intervention, SM doesn't seem to have a positive effect on episodic tension-type HA.

AHCPR Guideline #14: Acute Low Back Problems in Adults. Dec 8, 1994. Spinal manipulation: manual therapy for symptomatic relief and functional improvement of the back. Relief of discomfort can be accomplished most safely with nonprescription medication and/or spinal manipulation.

Spitzer, MD, MPH. Spine 1995; 20(8S):1S-73S. Quebec Task Force on Whiplash-associated Disorders (WAD). Task Force Consensus: The short-term use of NSAIDs & analgesics, spinal manipulation & mobilization by trained persons & active exercises are useful in Grade II & III WAD, but prolonged use of C-collars, rest or inactivity probably prolongs disability. Early return to usual activities should be encouraged.

van Tulder, PhD et al. Spine 1997; 22(18):2128-2156. SM for ALBP (<6wks): 16 RCTs on SM, only 2 were of high quality. 12 trials including t 2 high quality RCTs reported positive results & 4 trials negative results. There is limited evidence tt SM is more effective than a placebo Tx for ALBP. There is no evidence tt SM is more effective than other physiotherapeutic applications (massage, SWD, exercises) or drug therapy (analgesics, NSAIDs) for ALBP because of contradictory results. Conservative treatment of acute and nonspecific low back pain. A review of RCTs of common interventions. SM for CLBP: (>12 wks): 2 high quality & 7 low quality RCTs. 6 trials including t 2 high quality RCTs reported postivie results, 2 trials reported negative results & in one trial, no clear conclusion was drawn. There is strong evidence tt SM

is more effective than a placebo Tx for CLBP. There is moderate evidence tt SM is more effective for CLBP than usual care by a GP, bed rest, analgesics & massage.

Cherkin, PhD. Presentation at the 4th International forum for Primary Care Research on LBP. Backletter 2000; 15 (5): 50, 57. There have been 40 randomized trials on SM for LBP & even more literature reviews. There is a consensus, based on research, that lumbar SM is a reasonably safe procedure for LBP & has a modestly beneficial effect, at least on pain. There is still controversy as to whether these effects are greater for Pts w acute or chronic pain. There is little evidence tt SM alters long-term BP outcomes. The effects tend to be short term. There is no strong evidence of any subsequent decrease in medical utilization or cost. I don't think there is any need for further studies on SM for LBP. However, there have not been any major studies of SM for sciatica.

Giles, DC, PhD, Muller, PhD. JMPT 1999; 22(6):376-381. Study of 77 Pts at a specialized spinal pain syndrome outpatient unit at Townsville Gen Hospital, Queensland, Australia. compares 1) acupuncture (6 Tx in 3-4 wk period, 2) NSAIDs: Tenoxicam w Rantiidine (3-4 wks) & 3) SM (6Tx in 3-4 wk period) for managing chronic (>13 wks duration) spinal pain syndromes (low back, thoracics, neck) in a prospective, randomized assessed clinical pilot trial. Outcomes: changes in measures at 4 wks vs initial visit in scores of 1) Oswestry, 2) NDI, 3) VAS of local pain intensity. **Results**: After a median of 30 days, consistently, over all outcomes, SM was t only intervention wh achieved stat signif improv'ts: a reduction of 30.7% on t Oswestry scale; 2) an improv't of 25% on t NDI, & 3) reductions on t VAS of 50% for LBP & 46% for upper BP & 33% for NP (all signif). Neither of t other interventions showed any signif improv't on any of t outcome measures. **Conclusions**: SM results in greater improv't than acupuncture & medicine. T most remarkable feature of t results is t absolute consistency; over all outcome measures, t manip grp displayed t most substantial improv'ts tt were uniformly found to be signif. In t 2 other intervention grps, not a single signif improv't could be found in any of t outcome measures.

Breen DC et al. Communication between general and manipulative practitioners. Complementary Therapies in Medicine 2000;8:8-14. A survey of 86 MDs in England found that GPs preferred referring to PTs for manipulation rather than DCs or DOs because they felt they had a better understanding of t Tx involved. Chiro & osteopathy terminologies were considered more confusing than PT terminology. 60% of the MDs surveyed thought that Fixation was a confusing term; 67% thought Adjustment was confusing; & 42% thought Subluxation was confusing. The use of professional jargon can be a barrier to effective communication. Terms wh can be misunderstood due to differences in interpretation are damaging to good communication. T medical definition of subluxation is a partial dislocation of a jt. This is quite different from t chiro meaning wh frequently is referring to abnl motion of a jt. Findings reinforce t message tt all jargon should be avoided in correspondence. A number of MDs commented tt t biggest problem was knowing whether they meant t same thing as t manipulative practitioner when interpreting these words.

Del Mar C, MD et al. BMJ 1997;314:526-9. A lit search for RCTs using antibiotics to Tx acute otitis media (OM) found only 6 studies of children. T number of RCTs is small for such a common condition. There is a deficiency of research on this subject. Findings: 60% of children Tx w placebo were pain free w/i 24 hrs of presentation. Only 14% of children in control group still had pain 2-7 days after presentation. In these children initial use of antibiotics will reduce pain & contralat OM by a reduction of about 40%. This is equivalent to an absolute benefit of 5.6% fewer children experiencing pain by 2 to 7 days after presentation. Thus, 17 children must be Tx at first presentation to prevent one child experiencing pain after 2 to 7 days. Conclusions: Many MDs may be disinclined to use antibiotics at first presentation of OM for so little benefit. Antibiotics had no influence on subsequent attacks of OM or deafness at 1 mo. Antibiotics were assoc w a near doubling of t risk of vomiting, diarrhea or rashes. Sx of OM consist mainly of pain & systemic illness. In 80% of children this is limited to 24 hrs duration.

Tulberg T, MD, PhD et al. Spine 1998;23(10):1124-28.What are we doing? A rotengen stereophotogrammetric analysis (RSA) was performed before & after manip in 10 standing Pts w SI jt dysfunction to see if manip can influence t position between t ilium & sacrum & if positional SI jt tests are valid. Many manual therapists claim good clinical results are a result of a **reduction of subluxation**. Pts had 12 SI tests (positional tests, functional tests, pain provocation tests). 3 clinicians had to agree tt at least 10 of t 12 tests were positive to have t Dx of SI jt dysfunction. T positive tests must be normalized after manip.RSA is a well documented method for demonstrating minor 3-D mov'ts calculated by computerized mathematical algorithms. It uses two 40 degree angulated roentgen tubes, a reference plate & a calibration device w indicators at known positions are placed between t Pt & t film plate. By computed data processing, 3-D translations & rotations of t ilium in relation to t sacrum induced by manip were calculated. Manip: high velocity, low amplitude thrust on t inferior lat angle of t apex of t sacrum followed by mobilization, muscle energy technique, & another high velocity thrust. Results: In none of t 10 Pts did manip alter t position of t sacrum in relation to t ilium on RSA, although positional test results changed from positive before manip to nl after. Conclusion: Manip of t SI jt normalized different types of clinical tests but there was no altered position of t SI jt according to RSA. Therefore, t positional test results were not valid & didn't provide a valid description of SI position. Results neither disprove nor prove possible beneficial clinical effects of manip of t SI jt. Because t positive effects are not a result of a reduction of subluxation, further studies of t effects of manip should focus on t soft tissue response.

Cassidy JD, DC, PhD. Point of view. Spine 1998;23(10):1129. Tulberg's study shows no evidence tt manip alters t position of t SI jt. There is no credible evidence tt small displacements (subluxations) of t SI jt are responsible for LBP, yet, t tradition of SI displacement as a cause of LBP remains strong in some professional circles. SM providers often claim exact specificity in t direction of their corrective thrusts applied

to displaced SI jts. Yet, there is no evidence tt t SI jt can be repositioned. There is a plethora of proposed mechanisms for how manip exerts it effect but little convincing research to support them. It seems unlikely tt t reduction of subluxations occurs after manip. This study adds evidence to refute this hypothesis. Most providers of manip now believe tt manip exerts its effect through reflex mechanisms on pain, muscle tension & jt mobility. There is some basic science research support, yet we have no definitive answers yet.

Boline, DC. JMPT 1995;18(3):148-15. Randomized trial compares effectiveness of SM & amitriptyline for chronic tension-type headache (HA) using 2 grps. Study has 2 wk baseline period, 6 wk Tx period & 4 wk post-Tx F-U period. 150 Ps between 18 - 70 yrs w Dx of tension-type HA of at least 3 mo at a frequency of at least 1X/wk. RESULTS: During t 6 wk Tx period, both grps improved at very similar rates in all primary outcomes. In relation to baseline values at 4 wks after cessation of Tx, t SM grp showed a reduction of 32% in HA intensity, 42% in HA frequency, 30% in over-t-counter med usage & an improv't of 16% in functional health status (SF-36). The amitriptyline gruop showed no improv't or a slight worsening from baseline values in t same major 4 outcome measures. All grp differences at 4 wks after cessation of Tx were stat signif. SIDE EFFECTS: Of t Ps who finished t study 46 (82.1%) in amitriptyline grp reported side effects including drowsiness, dry mouth, & weight gain. In t SM grp 3 Ps (4.3%) reported neck soreness & stiffness. CONCLUSIONS: SM is an effective Tx for tension HA. Amitriptyline was slightly more effective in reducing pain at t end of t Tx period but was assoc w more side effects. 4 wks after cessation of Tx, Ps who got SM had sustained their therapeutic benefit in all major outcomes. T Ps who got amitriptyline reverted to baseline values. T sustained benefit assoc w SM seemed to result in a decreased need for over -t-counter meds.

Gibbons, DO, DM-SMed, et al.. Short-term effects of cervical manipulation on edge light pupil cycle time: a pilot study. JMPT 2000;23(7):465-469. Edge light pupil cycle time (ELPCT) is a light reflex of t eyes tthas been shown to be a measurable constant, unaffected by visual acuity, refractive error, eye color, pupil size, or sex. The reflex is controlled thru the autonomic nervous system (ANS). Study investigates t effects of a C1-2 HVLA SM on ELPCT in a randomized pilot study w/o a ctl grp in 13 men w/o eye disease or central or ANS pathology. Ss had ELPCT measured before & after a HVLA rotary thrust to t C1-2 jt on t left (N=6) & right (N=7). Results: SM of t C1-2 jt can produce a signif measureable difference between manip before & after ELPCT, w ELPCT becoming signif faster after SM. Although there is not agreement among researchers in t balance of t parasymp & symp activity tt control t ELPCT, there is agreement tt alterations in ELPCT do reflect changes w/i t ANS. T study found t HVLA thrust applied to C1-2 produced a signif effect on t autonomically mediated ELPCT (P=.002). Results suggest there may be an interrelation between somatic & autonomic function & tt autonomic function might be altered by manual intervention. This is a preliminary study w a small sample & no control grp. Caution should be exercised in interpretation/extrapolation of t results.

Moore KL, MD, Noble SL, Pharm D. Drug treatment of migraine: Part 1. Acute therapy & drug-rebound headache. Am Fam Physician 1997; 56(8)Nov 15:2039-2048. Release of vasoactive substances (sub P, CGRP, neurokinin A) from trigeminal nerve fibers induce a sterile inflammatory reaction around t blood vessels of t dura & pia. This "neurogenic inflammation" may be accompanied by vasodilation & is triggered by impulses originating in t caudal trigeminal nucleus.Abortive agents for migraine such as sumatriptan (Imitrex), dihydroergotamine (DHE 45) & ergotamine can reverse neurogenic inflammation by interactions w specific serotonin receptors. Stimulation of inhibitory (5-HT 1) serotonin receptors can turn off neurogenic inflammation, whereas activation of t excitatory (5-HT 2) serotonin receptors lead to migraine. Many meds used for migraine prophylaxis work by blocking 5-HT2 receptors.

Lu J, MD, MS, Ebraheim NA, MD. Spine 1998;23(6):649-652. Anatomic considerations of C2 Nerve root ganglion. Dissection of dorsal root ganglion (DRG) of C2 nerve root found tt t DRG are all proximally placed & occupy most of t foramen & may render t C2 DRG vulnerable to entrapment. C2 ganglia occupy 76% of t foramen height. All C2 DRGs are confined w/i foramens between t arch of atlas & t lamina of axis. Trauma w extreme rotation/extension (ie whiplash) at t C1-2 jt has t potential to crush t C2 ganglion between t arch of atlas & t lamina of axis & may be implicated in cervicogenic HA.Many Pts w cerviocgenic HA have a Hx of MVAs & head or neck trauma typical whiplash. C1- 2 arthrosis may directly irritate t C2 N root & ganglion causing occipital neuralgia. Cervicogenic HA may occur as t result of displacement, abnl mov'ts or arthritic changes in t C1-2 jt compromising t C2 ganglion & N root. During combined rotation w extension (whiplash) t post arch of atlas & t superior articular process of axis approximate & contact t C2 ganglion. Histologic studies of C2 ganglion show morphologic changes: proliferation of connective tissue in t endoneurium & t ganglion itself, signs of myelin damage & axonal degeneration. Compression or entrapment of t C2 ganglion involves fibers tt contribute to t greater occipital nerve.

Hack GD, DDS et al. 1998 Medical and Health Annual. Encyclopedia Britannica, Inc. Chicago 1997: 18-29. In 1995, Hack et al found tt t RCPM (rectus capitis posterior minor) muscle extends from t occiput to t posterior arch of atlas & connects via a bridge of connective tissue to t spinal dura.This connection may resist inward folding of t dura wh may compromise CSF flow when t neck is extended. Can abnormal tension in t RCPM result in increased tension in t dura & play a role in HA? T dura is extremely sensitive & tension on it during surgery is felt as HA. T muscle-dura connection may transmit forces from neck muscles to t pain sensitive dura. Researchers postulate HA pain may be produced by neck structures. This is accepted by DCs, & DOs who perform SM in t C-spine. A recent literature relates HAs to injury or pathology of t neck. Studies suggest tt SM, massage & biofeedback directed at t neck are valuable for managing tension HAs. SM for HA is based on dysfunction in neck muscles contributing to head pain. In t US more than 90% of SM are performed by DCs. T muscle-dura connection may represent an anatomic basis for t effectiveness of SM wh may decrease muscle tension & reduce pain by reducing t

forces exerted on t dura via t RCPM. Hack et al have now identified another muscle-dura connection between C1 & C2 involving - t Rectus Capitis Posterior Major & Oblique Capitis Inferior muscles. A role in HA pain is hypothesized as t mechanics of these 2 anatomic structures appear to be similar.

McPartland, DO, MS, Brodeur, DC, PHD. J Bodywork & Movement Therapies. 1999; Jan 30-35. RCPM dysfunction causes reflex muscles activity in other cervical & jaw muscles & may also cause indirect irritation to the pain sensitive dura resulting in chronic Has. Dural tension & irritation may ascend directly into the posterior cranial fossa via t falx cerebelli or involve the spinal cord via the second denticulate lig. Chronic dysfunction of t RCPM may lead to persistent mechanical irritation to t dura & chronic reflexive activity of other cervical & jaw muscles. Injury to t RCPM may irritatie t C1 nerve. Chronic C1 irritation may refer pain to t neck & face via C1 connections to C2 & CN 5.

Whiplash, Chronicity and Chiropractic Care

Murphy D, DC, DABCO. Whiplash biomechanics update. Am J Clin Chiro 1999;9(3):24-25. During rear end collision t head remains stationary due to its inertia. Since t occupant's upper back is in contact w t vehicle's seat, as t vehicle moves forward during t collision t C-spine begins to extend from t lower C-sp. T upper C-sp & occiput are t last to extend. Because of t time lag to extend t upper C- sp during rear-end collision, t C-sp will initially form an "S" configuration w t upper spine in flexion while t lower spine extends. In whiplash, t neck initially forms an S-shaped curvature w lower C-hyperextension & upper flexion wh they identify as t injury stage for lower C-jts. T lower cevical extension is actually signif icant segmental hyperextension consistently exceeding t physiologic limits of rotation in extension. T soft tissue, in low velocity impact like whiplash is seldom torn completely. More likely, it is stretched beyond its elastic limit, resulting in incomplete injury. Many whiplash victims subjected to less severe injury, have incomplete soft tissue injuries not readily visualized even by MRI. These Pts don't undergo go surgery, so, these soft tissue injuries go under detected & unidentified. Whiplash Pts suffer pain, disability & degenerative changes for many yrs. Panjabi et al in 1998 speculate tt Sx, especially long-term Sx, may be due to incomplete soft tissue injuries tt may not easily heal. In these sub-failure injuries, soft tissues are not completely torn, but become stretched beyond their elastic limit & constitutes functional injury to t spine. T results will help clinicians direct their attention to t soft tissue injuries in whiplash Pts. T results point to lower levels of t C-sp as potential injury sites, esp for low energy rear-end impacts. At higher impact, t upper levels of t C-spine are also prone to injury.

Bogduk N, MD, PhD, DSc. Point of view. Spine 1999;24(8):770. Studies show tt facet injuries are common in fatal MVAs. They also show tt these injuries are undetectable on plain radiographs. Studies also show tt facet jt pain is very common in Pts w chronic whiplash & tt t assoc psychologic distress disappears when pain is relieved & provides t missing biomechanical link between Sx & mechanism of injury. This is t

most significant advance in t biomechanics of whiplash since t pioneering studies of 1955. As a result, we no longer rely on inference or speculation; we have a direct demonstration of the mechanism of injury in whiplash. T study demonstrates in live human volunteers tt in whiplash t lower cervical segments undergo sagittal rotation about an abnormally high IAR. As a result, there is no translation; there is only rotation. As t vertebra spins, its anterior elements separate from, while t posterior elements crunch into, t vert below. This mechanism predicts tt t resultant lesions should be tears of t anterior anulus & Fx of t facet apophysial jts or contusions of their menisocids. These are t very lesions seen at postmortem. This & previous studies indicate t threshold for Sx injury is approximately 8 kmph (4.96 mph). When subjected to such impact volunteers develop Sx, but they last a day or two to less than a wk. It seems reasonable to expect tt Pts subject to impacts 4 & 8 times as great could develop lasting injuries & Sx.

Croft DC, MS, MPH, Whiplash Injury: the current model. JACA 2000;37(7):32-42. In CAD - cervical acceleration/deceleration injury, t occupant's head rises above head restraint during impact -ramping - due to a gliding up t seat back (as much as 3.5") & a temporary straightening of t thoracic & cervical spine. T restraint then acts as a fulcrum intensifying t injury. Hyperextension of t lower cervical segments occurs w/i t first 200 msec & may occur before t head contacts t head restraint. Backset - t distance between t head & t head restraint at t moment of impact. More than 2 inches renders even a well positioned restraint nearly useless. T model of CAD has changed: 1) global (regional) hyperextension is neither necessary as an injury mechanism, nor is it common. Intersegmental hyperextension is more likely a key factor. Early in t crash, w/i 100 msec after impact, t spine takes on an s-shape w t lower segments in t range of hyperextension, while t upper segments are flexed. This is t point of maximal injury potential. In no cases did global (regional) hyperextension occur. T global neck motion never exceeds t nl ROM, thus gross hyperextension does not occur. Injury can, & often does occur well w/i t nl ROM. Even t most severe lesions seen at autopsy are often not visible on plain film or MRI.

Woodward, MD et al. Injury 1996;27(9):643-645. T literature suggests 43% of whiplash Pts suffer long-term Sx. If Pts are Sx after 3 mo then there's almost a 90% chance they will remain so. No conventional Tx has proven effective in chronic cases. Methods: 28 Pts randomly selected from chiro referrals for chronic whiplash. T severity of Pts' Sx before & after Tx was assessed independently by a DC & an orthopedist in a structured phone interview. Pts were divided into 4 grps: Grp A: Sx free; Grp B: mild nuisance Sx , no pain-killers or interference w work or leisure; Grp C: intrusive Sx tt handicapp work & leisure & caused frequent analgesic use. Grp D severely disabled, had lost jobs, repeatedly sought med advice & continually used analgesics. Chiro care included SM, PNF & cryotherapy. 28 Sx whiplash Pts (mean 39 yrs) all had medical care but remained Sx. Txs included anti-inflammatories, soft collars & PT. Pts referred for chiro Tx at an ave of 15.5 mo after injury. 22 (79%) were referred by their solicitors, others by friends, relatives or self-referrals - none was referred by an MD. Sx included neck pain, stiffness, HA, shoulder, arm & BP. At t time of referral 27 of 28

Ps were Grp C or Grp D. **Results**: Following chiro Tx 26 (93%) of Pts had improved; 16 by one Sx grp & 10 by 2 Sx grps. This improv't was independent of whether assessed by orthopod or DC. In t grp tt had improved, 17 had stopped Tx at time of assessm't; Sx had recurred to a minor degree in 4 (24%) of these Pts. Results of this retrospective study suggest tt benefits w chiro care can occur in over 90% of Ps undergoing chiro Tx for chronic whiplash. T encouraging results from this retropsective study merit a prospective RCT to compared conventional Tx w Chiro in chronic whiplash injury.

Khan, Cook, Gargan, Bannister. J Orthop Med 1999;21(1): 22-25. Retrospective review by phone interviews of 93 consecutive Pts seen in a chiro clinic. Pts were referred after a mean of 12.7 mo from injury. Pts underwent a mean of 19.3 Tx over a period of 4.1 mo. The were 3 categories of Pts: Grp 1 - Pts w isolated NP assoc w restricted neck ROM. Grp 2 - Pts w neuro Sx or signs assoc w a restricted ROM. Grp 3 - Pts who described severe NP but had full ROM of t neck. Pts in this grp often described an unusual grp of Sx w a bizarre, non-dermatomal pain distribution. Gargan & Bannister classification of whiplash Sx: Grade A - absent ; Grade B - nuisance; Grade C - intrusive; Grade D - disabling. Grps 1 & 2 both improved following chiro manip, but Grp 3 showed no signif improv't.. Conclusion: Results provide further evidence tt chiro is effective for chronic whiplash Sx. However, t identification of a grp of Pts who fail to respond highlights t need for a careful Hx & PE before beginning Tx. Chiro is the only proven effective Tx in chronic cases.

Spitzer, MD, MPH. Quebec Task Force on Whiplash-associated Disorders (WAD). 1995; 20(8S):1S-73S. A review of original research & consensus recommendations: C-strain can occur w forces as low as 2.7-3.6 MPH. **Grade O**: No neck complaints, No physical signs; **Grade I**: Neck pain, stiffness or tenderness, no physical signs; **Grade II**: Neck complaints & musculoskeletal signs (decreased ROM, point tenderness); **Grade III**: Neck complaints & neurological signs (decreased DTR, weakness, sensory deficits); **Grade IV**: Neck complaints & fx or dislocation.

Tx of WAD: Most Tx currently used haven't been evaluated in a scientifically rigorous manner & are unproven. This includes: C-pillows, postural alignment training, acupuncture, spray & stretch, TENS, ultrasound, laser, diathermy, heat, ice, massage, epidural or intrathecal injections, muscle relaxants, & psychosocial interventions. Txs evaluated in scientifically rigorous manner show little or no evidence of efficacy. This includes C-soft collars, steroid injec of facet jts, pulsed electromagnetic Tx, magnetic necklace, & subcutaneous water inejc. Use of soft C-collar beyond 72 hrs probably prolongs disability in WAD.

Promotion of Activity Interventions such as mobilization, manipulation & exercise in combination w analgesics or NSAIDs are effective on a time-limited bases PRESCRIBED REST is seldom indicated & should always be limited to short duration. **Task Force consensus:** is tt use of NSAIDs & analgesics, short-term manip & mobilization by trained persons & active exercises are useful in Grade II & III WAD, but prolonged use of C-collars, rest or inactivity probably prolongs disability. .Early return to usual activities should be encouraged.

Chiropractic & Infantile Colic

Wiberg DC, Nordsteen, DC, Nilsson DC, MD, PhD. The short-term effect of spinal manipulation in the treatment of infantile colic: a randomized controlled clinical trial with a blinded observer JMPT 1999;22(8):517 -522. Definition of Infantile Colic: unexplainable & uncontrollabe crying in babies from 0 to 3 mo, >3 hrs/day, >3 days/wk for 3 wks or more, usually in t afternoon & evening hours.50 infants seen by t health visitor nurses, who fulfilled t Dx criteria for infantile colic in Denmark. One grp (#25) received SM for 2 wks (3 to 5 sessions) based on restricted mov't, manipulated w specific light pressure w fingertips until nl mobility was found in t involved segments. T other grp (#25) Tx w t drug dimethicone for 2 wks. Outcome: Changes in daily hours of crying as registered in a colic diary. Parents kept a 1 wk baseline diary. Kids then randomly assigned. At end of 1 wk & at end of 2 wks, blinded visiting nurses admdinistered t infantile colic behavior profile. Parents continued w t diary for t 2 wks of care.The short-term effect of spinal manipulation in the treatment of infantile colic: a randomized controlled clinical trial with a blinded observer. Results: By trial days 4 to 7, hours of crying were reduced by 1 hour in t dimethicone grp compared w 2.4 hrs in t SM grp. On days 8 thru 11, crying was reduced by 1 hour for t dimethicone rp, and by 2.7 hrs in t SM grp. From trial day 5 onward, t SM grp did significantly better than t dimethicone grp. Conclusions: SM is effective in relieving infantile colic. When results were compared w those of t only other trial on SM for infantile colic (Klougart et al. JMPT 1989;21(4):281-8) we see t results were virtually identical. In t previous trial, mean daily hrs w colic was reduced by 66% on day 12 of t trail, & in this trial there was a reduction of 67% on day 12, whereas t dimeticone grp only had a reduction in daily hrs w colic of 38% on day 12. These similarities strengthen the conlcuison that a positive effect of SM exists in the treatment of infantile colic.

Wiberg et al. Compared with dimethicone, 2 weeks of spinal manipulation reduced infantile colic behavior at 4 -11 days after initial treatment. Evidence-Based Nursing 2000;3(2):12. A new review notes tt there were no dropouts in t SM grp but 9 in t dimethicone grp. The reason for all 9 dropouts was worsening of t infants' Sx. By excluding data on these more severe cases, t colic behavior in t dimethicone grp appears better than it actually was. Despite this bias, t SM grp still scored significantly better. Tx of infantile colic is important because it can lead to serious consequences such as abuse & family disruption. Preliminary evidence indicates a potential benefit of SM in t Tx of infantile colic.

Lee, BSE, Li, MD, Kemper MD, MPH. Chiro care for children. Arch Ped & Adoles Med 2000;154(April):401-407. Survey of 150 DCs in Boston area to evaluate pediatric care. 90 (60%) of DCs responded (65% M, 35% F). Technique use: diversified 62%, activator (40%), SOT (37%). DCs averaged 122 visits/wk &13 (11%) were children/adolescents. For kids, 30% of Dcs actively recommend immunizations, 7% recommend against them, 63% make no recommendations. Number of children visiting DCs is increasing. In 1997, ACA reported tt kids were 10% of chiro Pts. This amounts to @ 20 million ped chiro visits annually. An estimated 410,000 ped chiro visits in Boston area in

1997. Extrapolating to US, approx 30 million ped visits were made in US in 1997 - a 50% increase in ped visit over 4 yrs, reflecting growth in number of DCs. T expected doubling of DCs in next 10 yrs is likely to lead to additional ped visits to DCs. Considering t fees & frequency of visits, t costs, our estimate is tt @ $1 billion was spent on ped chiro in 1998, $510 million paid out-of-pocket.

Bronfort. DC et al.. JMPT 1996; 19(9): 570-582. RCT w 1 yr follow-up in 174 CLBP Pts (age 20-60) compared t efficacy of 5 wks of 1) SM combined w trunk strengthening exercise (TSE); 2) SM combined w trunk stretching exercises; 3) NSAID w TSE, all followed by 6 wks of supervised exercise alone. OUTCOMES: Pt-rated LBP, disability, & functional health status at 5 & 11 wks. RESULTS: Outcomes at 5 & 11 wks revealed no signif group differences. Continuance of exercise during t F-U yr, regardless of type was assoc w a better outcome. CONCLUSION: All 3 Tx regimens was assoc w similar & clinically important improv't over time tt was considered superior to t expected natural Hx of long-standing CLBP. For managm't of CLBP, trunk exercise in combination w SM or NSAIDs seem beneficial & worthwhile.

Carey, MD, MPH. Costs & Outcomes of ALBP in North Carolina. New Eng J Med 1995;Oct.5:913-917. Study of 1633 ALBP Pts (Sx <10 wks) treated by Primary Care MDs, DCs, Orthopods, Managed Care. Pts in all groups had similar degrees of pain & loss of function (Roland- Morris) at onset. Pts re-evaluated at 2,4,8,12, & 24 wks. Most Pts improved rapidly with a median improvement of 8 & a mean of 16 days. Only 5% hadn't functionally recovered at 6 mo. No significant differences in recovery rates among the Pts Tx by different provider types. Cost of outpatient care were highest for Orthopods & DCs. DCs had the most visits. Pts who saw DCs had a much higher satisfaction rating.

Wiesel MD. Backletter 1997;12(6):63. Carey examined t impact, over 12 months, of a 2 day intensive training on manual therapy skills on a group of 30 family physicians & internists. Confidence in t ability to Tx BP increased substantially. 15% of MDs felt well prepared to Tx LBP prior to t course & 67% at 1 yr. 90% felt comfortable explaining t rationale of SM to their Pts. The MDs didn't perform many SMs as a result of t course -treating roughly one new Pt per month w SM. T program seemed to build bridges between MDs & DCs. Prior to training 17% of MDs said they frequently or occasionally suggested referral to DCs. 47% did so at 1 yr after training.

Johnson, MSc., Bootman, PhD.. Drug-related morbidity and mortality. A cost-of-illness model. Arch Intern Med 1995; 155(Oct 9):1949- 1956. Drug-related morbidity & mortality was estimated to cost $76.6 billion in the ambulatory setting in U.S. The largest cost was drug-related hospitalizations: 8.76 million admissions at a cost $47.4 billion/yr - 62% of total cost. This represents 28.2% of the total 31.1 million admissions in 1993. Admissions to long-term care facilities is the 2nd largest cost with 3.15 million admissions at a cost of $14.4 billion. Visits to Drs. for drug related problems exceeds 115 million costing @ $7.5 billion. This is 17.3% of all physician office visits of the almost 670 million annually. Drug-related morbidity and mortality. A cost-of-illness

model. An additional 76.3 million prescriptions is needed to resolve Tx failures & drug related problems at a cost of $1.93 billion. & is 8.2% of all Tx in 1992. A total of 930.5 million prescriptions/yr. Emergency room visits due to drug-related problems is 18.9% of @ 89.8 million visits in 1992. CONCLUSIONS: the cost of drug-related problems in ambulatory care in U.S. is considerable & should be considered in health policy decisions with regard to pharmaceutical benefits.

Bates, MD et al. JAMA 1997;277(4):307-311. The costs of adverse drug events in hospitalized patients. Study of resource utilization assoc w adverse drug events (ADE) in a sample of 4108 admissions to 11 medical & surgical units in 2 hospitals over 6 mo. Results: there were 190 ADEs of wh 60 were preventable. T estimated post- event costs attributable to an ADE were $2595 for all ADEs & $4685 for preventable ADEs. These estimates are conservative & don't include t costs of injuries to Pts or malpractice costs. If ADEs & assoc costs are representative of t nation's hosptials, t total hospital costs of ADEs occurring during hospitalization would be

Phillips DP et al. Increase in US medication-error deaths between 1983 & 1993. The Lancet 1998;351(Feb 28):643-644. Between 1983 & 1993 t number of Americans who died from Medication Errors (ME) rose sharply & t trend appears to be continuing. From t most recent data, fatal ME increased 260% overall, but among outPts, t jump in such deaths was 850%."Deaths officially ascribed to med errors may represent only t tip of t iceberg," said Phillips of t Univ of California at San Diego because many such fatalities probably are not listed tt way on death certificates. During t decade evaluated, t number of outPt encounters jumped 75% while t number of days Amercians spent in hospitals fell 21%. T largest jump in outPt ME involved deaths due to anesthesia drugs, suggesting tt t tremendous growth in outPt surg may be one part of t problem. OutPt fatalities from ME jumped from 172 in 1983 to 1,459 in 1993, a nearly 9-fold increase. T increase in medication related deaths can't be explained by t number of drugs prescribed wh has risen only 39% in t decade while med fatalities jumped 257%.

Carey, MD, MPH.. Spine 1996; 21(3):339-344. In more than 4,445 households: 11.5% of adults had severe LBP in 1 year (functionally disabling). 7.6% had acute severe LBP (<3 mo.). Symptoms were more common in younger Pts than in those >60 yrs (8.5% vs 5%). 39% of Pts sought health care. More prolonged pain, severe pain & sciatica were assoc with seeking care. 13% saw DCs, 24% MDs, 2% other providers. Pts viewing DC Tx as helpful vs MD Tx: 99% vs 80%. Pts satisfied with DC Tx vs MD Tx: 96% vs 84%. DC vs MD Pts who sought Tx from another provider: 14% vs 27%. **Use of DCs is so common that one hesitates to use the terms alternative or nonstandard**

Shekelle, MD, PhD. Med Care 1995;33(8):842-850. Evidence continues to accumulate that DCs are more popular than MDs with their BP Pts. Of 1020 episodes of BP care made by 686 Pts encompassing 8825 visits, DCs were the primary providers for 40% of episodes. DCs were the first provider in 1/3d of all Ps who sought BP care & @ 10%

of Pts initially seeing other providers switch to a DC to receive the majority of their BP care. DCs retain a greater percent of their Pts who have a subsequent episode of BP care than do other providers. DCs retained 92% of their Pts for a second episode. GPs retained 75%. DOs retained 75%. Orthopedists retained 50%. Internists retained 22%. Other professions retained 40%. The new message in this study is the degree to wh DCs retain their Pts. With a 92% retention rate, DCs seem to be extremely popular with their Pts. This is compatible with previous research @ Pt satisfaction with DCs.

Carey Benedict. Back Magic. Health 1998; May/June:108-112. DCs were once dismissed as crackpots. Now even MDs call them your back's best hope. DCs have not only shaken t carnival barker stereotype, in recent yrs they have transcended mere acceptability to become as much a part of mainstream medicine as tongue depressors. DCs are being added to hospitals, HMOs, are widely reimbursed by Medicare & Medicaid. work comp & private insurers. This embrace is partly a matter of economics. Ave costs for a BP Pt to see a DC are @ 1/10 of t costs for seeing an MD. "I courted Jay Triano longer than I courted my wife," says founder of t Texas Back Institue, Ralph Rashbaum. Last yr some 20 million BP sufferers visited a DC - a throng tt by 2010 is expected to double in size. In t first wks of pain chiro quickens recovery. But if pain hasn't diminished in a month, more adjustments don't seem to help. Then it's probably time to give an MD a shot at t problem. In other words, t surgeons at TBI are still very busy handling accident victims & chronic spinal pain or fractures. But, in striking change, they see themselves as doctors of last resort. Back crackers, like John Triano, are emerging as the bearers of conservative care. "T wonderful thing is that you get a response right away. If it works, great. If there's no improv't after 2 or 3 visits, well, at least you know it's not working. And t risk is almost zero. We have wonderful surgeons at TBI & we're certainly not going to lose any of them. But we've just hired 2 more DCs. I think tt tells you wh direction we're headed."

Saal JA, MD. Spine 1997;22(14):1545-1552. Analysis of spine care delivery system in the US reveals two parallel systems. The first is the traditional medical model, serving 60% of t market. This model has relied upon bed rest, hospitalization, drugs & surgery. The second is the chiropractic model servicing approx 40% of t spine market.

Wiesel, MD. Chiropractic continues to grow. Backletter 1997;12(5):60. The chiropractic profession continues to grow in popularity worldwide. It is now the third largest primary health care profession in the western world after medicine & dentistry. There are approx 50,000 DCs in US, 10,000 in Japan, 5000 in Canada, 2500 in Australia, 1000 in UK, 100 to 500 in Belgium, Denmark, France, Italy, Norway, Sweden, Switzerland, NZ, So Africa & the Netherlands. There are smaller numbers in other European countries, Asia, Africa, the Middle East, & So America.

Mosley, Cohen,DC, Arnold, MD. Am J Man Care 1996;2:280-282. Retrospective study of Pts at an independent physician model HMO in Louisiana evaluating cost of care for back acute (BP) or neck pain (NP) for Pts who sought chiro care (N=121) or other

Tx (n=1,838). Also looked at surgical rates, use of Dx imaging (MR & CT) & Pt satisfaction on claims paid Oct 1, 1994 - Oct 1, 1995. **Results**: cost of care for BP & NP was substantially lower for DC Pts than non-DC Pts ($539 vs $774). Use of prescription drugs & Dx imaging (4.9% vs 16.5%)were signif greater in non-DC group whereas surgical rates & Pt satisfaction were nearly identical. (94% satisfaction in both groups). **Conclusion:** DC care has outcomes are equal to those of non-DC care at substantially lower costs. MD Pts got 2X as many prescriptions. Study demonstrates that DC services were well integrated in an HMO & have proven satisfactory to Pts & providers as well as cost-effective for BP & NP. The system offered self-referral for DC services. If half of the Pts Tx by traditional care received DC care, annual savings would have exceeded $215,000. We believe that managed DC care is an extremely promising method of Tx acute BP & NP. We recommend its wider application by the managed care industry & physician community.

Triano, DC, MA. Spine 1995;20(8):948-955. Randomized trial of Pts w untreated LBP lasting >7 wks. Groups: 1) SM - side posture, 2) SM sham, 3) back education program (BEP). PRIMARY OUTCOMES: Self-report pain (VAS) & activity tolerance (Oswestry). Ps assessed at enrollment, at 2 wks of Tx & 2 wks w/o Tx. RESULTS: 170 Ps completed study w a mean of 10.5 visits. Greater improvement was noted in pain & activity tolerance in SM group. Immediate benefit from pain relief continued to accrue after SM even for the last encounter at the end of the 2-wk Tx interval. CONCLUSION: There appears to be clinical value to Tx according to a defined plan using SM even in LBP >7 wks.

Heigh, MD. Postgraduate Med 1994;96(6):63-6. The prevalence of ulcers in Pts taking NSAIDs ranges from 10% to 30%. In the Aspirin for Myocardial Infarction Trial risk of hospital admission for duodenal ulcer was 10.7X > in aspirin vs placebo Pts. Gastric ulcers develop in 26% of Ps who take aspirin regularly. Pts who take NSAIDs for a total of 30 or fewer days had the highest risk. Most gastroduodenal injury occurs during the first several wks of Tx.

Tamblyn R, PhD et al. Ann Intern Med 1997;127:429-438. 70 million prescriptions for NSAIDs per yr in t US. Use of NSAIDs accounts for an about 7,600 deaths & 76,000 hospitalizations in t US. Almost all deaths from NSAID related GI side effects occur in t elderly. **In t 1980s, MDs were advised to avoid prescribing NSAIDs to elderly. In 1990, however, an estimated 58% of women & 53% of men 65 yrs of age or older in Quebec were prescribed NSAIDs! Surveys in t US & Britian indicate tt 4% to 42% of MDs are unaware of t side effects of these drugs.** Pts 60 to 69 have a 3 fold increase in relative risk for serious GI side effects relative to those 25 to 49. Those w a Hx of peptic ulcer dis have a 6 fold increase in risk. Low doses are recommend because t relative risk for serious GI side effects incrases from 2.8 w half t standard dose to 8.0 w t highest dose.

Manga P, PhD. Angus D, PhD. Univ of Ottawa 1998. Enhanced chiropractic coverage under OHIP as a means of reducing health care costs, attaining better health

outcomes & improving the public's access to cost-effective health services. There is considerable empirical support for the cost-effectiveness & safety of chiro management of MS disorders. Doubling t proportion of t Ontario public from 10% to 20% will lead to direct annual savings of $348 million to t Ontario health care system, indiect saving of $1.85 billion per year through sharply reduce levels of short & long-term disability & compensation. T only 2 studies tt do not show significantly better cost-effectiveness for chiro services (by Shekelle & Carey) are by medical researchers not economists & have significant design problems.

Smith M, DC, PhD(c), Stano M, PhD. JMPT 1997;20(1):5-12. Analysis of payments & outcomes for recurrent episodes for 9 common lumbar & low back conditions Tx by DCs vs MDs from 2 yrs of Ins claims data. 7077 Pts w 9314 episodes of care. 8018 episodes of care initiated by DCs or MDs. 1215 Pts had recurrent episodes. Total Ins payments were 1.6 times greater for MD Tx episodes. For recurrent episodes DCs retain more Pts. Pts who cross over between provider types for multiple episodes are more likely to return to DCs suggesting tt chronic, recurrent low back cases may gravitate to DCs over time. Chronic LBP Pts tend to shift over time to DCs. In Pts who had 3 episodes of BP, MD Pts exposed to a DC in an intervening episode were 23 times more likely not to return to a MD than a MD Pt not exposed to a DC.

Coulter, PhD et al. The Appropriateness of Manipulation & Mobilization of the Cervical Spine. RAND 1996: Table 6, page 36 Complications resulting from Treatments of the Cervical Spine per million applications 1)SM - CVA & other complications: 1.46, Major impairment: 0.639, Death 0.268. 2) Cervical spinal surgery - Neurologic complications 15,600, Death 6,900; 3) NSAIDs - Serious GI complications 3,200>65 yrs, 390<65yrs, 1000 all ages.

Shekelle P, MD, PhD, Coulter, PhD. J Spinal Disorders 1997; 10(3):223-228. After LBP, neck pain & HA are t next most common reasons for providing SM, accounting for @ 20% of all visits to Dcs. T complications of cervical SM are rare. T most serious are related to VBA compromise. Limited data preclude an exact estimate of frequency. Evidence suggests tt t risk is higher for SM involving rotation plus extension. Our best estimate based on data available of t incidence of VBA compromise related to C-SM is tt it occurs one time in 1 to 3 million manipulations. We found cervical SM for NP & HA to be t second most common use of SM. Limited evidence supports t use of C-SM for these 2 indications.

Wiesel, MD. 1997;12(8):87. NSAIDs use & risks in senior citizens. New survey by t National Council on Aging found tt 20% of seniors >age 60 regularly take meds for chronic pain (arthritis & LBP).
NSAIDs are more widely used by seniors than any other type of prescription meds. An alarming 13% using NSAIDs also reported an ulcer. 25% taking prescription NSAIDs reported side effects. 60% using NSAIDs said they took them for 6 mo or more, in spite of warnings tt risk for serious GI complications increases 4 fold after 6 mo of use. Seniors taking non-prescription NSAIDs used them daily for an ave of 5 yrs

despite labels cautioning against >10 days of use. "T serious side effects of NSAIDs result in 200,000 hospitalizations & 20,000 deaths annually, " says Thomas Schnitzer, MD, rheumatologist & geriatrician at Northwestern U. Tx cost for NSAID induced side effects is $3 billion/yr.

Senstad, DC, Leboeuf-Yde, DC, MPH, PhD, Borchgrevink, MD. Spine 1997;22(4): 435-440. Unpleasant Side Effects after SM. Prospective survey of the frequency & characteristics of unpleasant side effects after SM . Based on data from 4712 Txs of 1058 new Pts by 102 Norweigian DCs. 55% of Pts had an unpleasant effect w/i the first 6 visits. 1/4 of all Txs over the first 7 visits will result in at least one reaction. Less than 1/5th of reactions arise w/i 10 min of Tx, suggesting tt t SM itself is rarely painful. Reactions are short, w Sx usually disappearing on t day of their appearance. Radiating discomfort is reported significantly most-often to be severe & to last t longest. 89% of Ps didn't curtail their ADLs. Common & benign reactions follow a distinct pattern & can be considered "normal."

Hurwitz, DC, PhD et al. Spine 1996;21(15):1746-1760. Scientific Paper of RAND study of Appropriateness of SM & Mobilization (MO) of the Cervical Spine. Of 1457 articles identified only 67 were used. Much more high quality research is needed before more definitive recommendations can be made. **Conclusions**: 1) MO is probably of at least short-term benefit for Pts w acute NP; 2) SM is probably slightly more effective than MO or PT for some Pts w subacute or chronic NP. All three Txs are probably superior to usual medical care; 3) SM &/or MO may be beneficial for muscle tension HAs; 4) MO results in fewer complications than does SM.

Baker B. Family Practice News 1996; June 1: 14. SM vs Acetominophen for Chronic Neck Pain.
Study at University of Colorado of Pts w chronic NP of minimum of 12 wks and an ave of 10 yrs. 35 Pts in SM group saw a DC 12 visits over 6 wks. 34 Pts in Med group got Acetominophen 4X/daily & saw a nurse 12 visits over 6 wks to control for personal attention. Both groups told to exercise & use a heating pad. At end of 6 wks Pts in SM group reported signif improvement in NP & function, and showed trends toward better ROM & strength. Pts in med group showed no real change. Long-term follow-up is underway.

Bigos, MD et al. Acute Low Back Problems in Adults. Clinical Practice Guidelines No. 14. AHCPR, December 1994. (800)358-9295. **AHCPR** (The Agency for Health Care Policy and Research) was established to enhance the quality, appropriateness, & effectiveness of health care services Within AHCPR, The guidelines were developed by an independent multidisciplinary panel of 23 clinicians and experts using extensive literature searches and critical reviews to evaluate empirical evidence & outcomes. The recommendations are based on the scientific lit. When the lit is incomplete or inconsistent, recommendations based on t judgement of panel members and consultants was used.

Intent: to change t paradigm of focusing care exclusively on t pain of LBP to

one of helping Ps improve their activity tolerance. **Goal** is to help Ps recover normal activity tolerance & avoid t development of low back disability.

Spinal Manipulation: manual therapy for symptomatic relief & functional improvement of the back

Abstract

Assessment & treatment of adults with **Acute Low Back Problems (ALBP)**: activity limitations due to symptoms in the low back &/or back-related leg symptoms of less than 3 months. In the absence of red flags neither routine nor special testing is required in the first month of symptoms for either sciatica or nonspecific back pain. Most of these patients will recover spontaneously from their activity limitations within 1 month. The principal conclusions:

1) T initial assessment for ALBP focuses on t detection of "**Red Flags**" indicators of serious spinal or nonspinal pathology:
   A) For Fracture: Major trauma, minor trauma in older or potentially osteoporotic Ps;
   B) Possible Tumor or Infection: age over 50 or under 20, Hx of Cancer, Symps: recent fever or chills or unexplained weight loss. Risk factors for spinal infection: IV drug use, recent bacterial infection, immunosuppression. Pain worsens when supine, severe nighttime pain
   C) Possible Cauda Equina Syndrome: saddle anesthesia, recent onset of bladder or bowel dysfunction, severe or progressive neuro deficit in lower limb; on PE: laxity of anal sphincter, perianal/perineal sensory loss, major motor weakness of quads, ankle plantar flexors, evertors & dorsiflexors
2) In t absence of red flags, imaging studies & further testing of Ps are not usually helpful during the first 4 wks of LBP
3) Relief of discomfort can be accomplished most safely with nonprescription medication &/or spinal manipulation
4) While some activity modification may be necessary during t acute phase, bed rest >4 days is not helpful & may further debilitate t P
5) Low-stress aerobic activities can be safely started in t first 2 wks of symps to help avoid debilitation; exercises to condition trunk muscles are delayed at least 2 wks.
6) Ps recovering from ALBP are encouraged to RTW or normal daily activities as soon as possible
7) If LBP persist, further evaluation may be indicated
8) Pts w sciatica may recover more slowly, but further evaluation can also be safely delayed
9) W/i t first 3 mo of LBP only Ps w evidence of serious spinal pathology or severe, debilitating symps of sciatica & physiologic evidence of specific nerve root compromise corroborated on imaging studies can be expected to benefit from surgery
10) With or without surgery, 80% of Ps w sciatica recover eventually
11) Nonphysical factors (psychological or socioeconomic problems) may be addressed in t context of discussing reasonable expectations for recovery

T panel found no evidence of benefit from t application of physical agents & modalities such as ice, heat, massage, traction, ultrasound, cutaneous laser Tx, TENS, & biofeedback. Self-application of heat or cold may be taught to Ps who choose such options to provide temporary relief of symps. Evidence doesn't support t use of trigger point, ligamentous & facet jt injections, needle acupuncture, or dry needling as Tx for ABP.

Chapman-Smith, JD. Chiro Report 1996;10(4)July:1,6. AHCPR's annual budget of $163 million has been slashed to $3 million. This is the price for offending the big boys. When the ABP. guidelines recommended against many common medical Tx & in favor of SM, those whose incomes & positions were threatened (orthopods & equipment suppliers) lobbied to prevent publication. Pharmaceutical manufacturers were in disbelief seeing recommendations against the use of prescription drugs for most Pts. Opponents caused a 12 mo delay. The AHCPR HA panel has completed its final draft, but recommendations the use of prescription drugs be tempered & non-drug management like SM for HAs from the C-spine is appropriate for many Ps has caused the pharmaceutical world to be too uncomfortable. The result, its HA guideline - even though in final draft form after yrs of work - will not be published. - the HA project is dead.

Hillyer, DC. Manipulation in the Curricula of Chiropractic, Osteopathic, Physical Therapy
& Medical Schools. FCER 1995:1-14. RAND: 94% of SM done by DCs. Remainder is by GPs, Orthopedic Surgeons, PTs. What are the educational qualifications of each? Reviewed the catalogs of at least 10 schools from each category to determine class hours of training to learn manipulation. Chiro colleges average more than 500 Hrs of class time devoted to SM. DO colleges have @ 128 hrs, Med schools & Physical Therapy have none.

The Role of Exercise in Chiropractic Management; **(see also pages 66-68)**
Ameis, MD.. Can Fam Physician 1986;32(Sept):1871-76. As time passes the rehabilitative program should become progressively more active. Physicians can help by being directive & specific in allowing resumption of activity. Excessive rest & precaution within the first 4 wks is counter-productive & assures a passive attitude toward recovery. There is little justification for a formal physiotherapy program extending beyond the 4th month. Attendance is mostly for pain control. The effectiveness of the modalities does not extend more than a few hours post Tx. The risk of dependency increases markedly. Patients invariably expect Tx to result in pain-free status. Instead, it should be stressed that recovery of function is the primary goal. Unfortunately, in chiropractic the goals often fail to include restoration of specific & general fitness, a failing which may foster passivity & dependence. More progressive DCs emphasize recovery of activity, diet & exercise while tapering the attendance in keeping with the improving clinical picture. Drs should provide steady pressure on the patient to maximize the recovery by actively & aggressively responding to & managing the pain impairments & secondary inactivity related

weight gain & deconditioning.

Cady, MD. J Occupat Med 1979;21(4):269-272. Prospective study of 1652 fire fighters. Initial evaluation of endurance, strength, flexibility, timing, coordination. Divided into 3 fitness groups & followed for 3 yrs. Who developed back injuries: least fit group: 7.1%, mid-fit group: 3.2%; most fit group: 0.8%. Conclusion: physical fitness & conditioning are preventive of back injuries. T passive structures of t back are most likely to be injured when exposed to forces beyond muscular control.

Bigos, MD. et al. Acute Low Back Problems in Adults. Clinical Practice Guidelines. December 1994:57. **Early Goals of Exercise Program in Patients w ALBP**

1. Prevent debilitation due to inactivity
2. Improve activity tolerance
3. Return Ps to their highest level of functioning as soon as possible

Bigos, MD. Acute Low Back Problems in Adults. Clinical Practice Guidelines. Quick Reference Guide Number 14. December 1994:22

Improving Physical Conditioning through an incrementally increased **Exercise Program**.

1. Goal is to build activity tolerance & overcome individual limitations due to back symptoms.
2. **At this point in Tx, symp control methods are only an adjunct to making prescribed exercises more tolerable**.
3. Begin w low stress aerobic activities to improve general stamina (walking, biking, swimming, & eventually jogging)
4. Exercises to condition specific trunk muscles can be added a few wks after [onset]. T back muscles may need to be in better condition than before t problem occurred. Otherwise t back may continue to be painful & easily irritated by even mild activity.
5. Finally, specific training to perform activities required at home or work can begin. T objective of this program is to increase t P's tolerance in carrying out actual daily duties.

AHCPR Guidelines: 152-3: T goal is to try to prevent back problems from returning, or if they do return, being severe. Success will depend on 2 factors: 1) T condition of your protective muscles, 2) T activities you ask your back to tolerate. Ignoring either of these factors usually means more back problems. Out-of-condition protective muscle tires easily. Regular activity is essential to obtain t conditioning effect to protect your back. Both your level of physical conditioning & t stresses you put on your back will determine how often you will have problems & how severe they become.

Cherkin, PhD. West J Med 1989; 150(3):351-355. Patients' response to management of LBP by MD vs DC: Much greater patient satisfaction w DCs: 66% vs 22%. Much greater satisfaction w the information provided by DCs. Less days of disability: DC Patients 10.8, MD's 39.7

Finestone, MD, Conter, PhD. Lancet 1994; Sept 17: 801-2. USA Today 1994; Sept 16-18:1A. Acting classes should be taught in med school, so MDs can at least pretend that they are concerned about their Ps.

Cherkin, PhD. West J Med 1988; 149(4):475-80. Beliefs of MDs & DCs about managing LBP: MDs more frustrated by back patients, less well trained, don't think they can do much to stop acute from becoming chronic

Cherkin, PhD. Am J Pub health 1989;79(5):636-7. MDs attitude toward DCs: the more they know about chiro the more likely they will view it positively. Younger MDs are more open than older ones.

Cherkin, PhD. J Fam Practice 1992;35(5): 505-6: DCs well trained, effective & safe for LBP. MDs should get to know DCs in their area & consider referral of Ps w LBP.

Borkan, MD. Referrals for alternative therapies. J Family Practice 1994; 39(6):545-550. MD referrals were most often based on: 1. Ps' request for referral to alternative Tx, 2. Pts' cultural beliefs; 3. Failure of conventional Tx (P's lack of response). 4. T belief tt Ps have nonorganic or psychological disease. **Primary Care MDs referred 2.33 times more often than other medical specialties**. T most common referral is for SM.

Callahan, MA. The chiropractor as a primary care health provider in rural, health professional shortage areas of the USA. FCER 1994: Types of health care providers referring patients to DCs:
Family practitioners: 69.2%; orthopedists 18.8%, neurologists: 11.2%

Hart, PhD. Spine 1995; 20(1):11-19. LBP is t 5th most common reason for MD office visits: 1) hypertension, 2) pregnancy care & complications, 3) general med exam, 4) acute upper respiratory infec, 5) LBP. Market share by specialty of back problem visits: MD family practice or general practice: 30.4%; General internal med: 14.1%; DO family or general practice: 11.1%. Total seen by generalists=55.6%; Orthopods: 24.9%.

Cherkin. PhD. Spine 1995;20(1)1-10. Physician perceptions of t effectiveness of nonsurgical Txs for ABP.: Physical therapy: 81%; Strict bed rest for >3 days: 72 %; SM: 36%. For CLBP: Physical therapy: 93%; multidisciplinary pain program 75%, TENS 74%; SM: 35%. **Less than 3% of MDs would have recommended SM for any of their ABP., Sciatic, of CLBP**.

Published Recommendations for Referral for Chiropractic Care
Curtis, MD, Bove, DC, PhD . T J Family Practice 1992; 35(5):551-555. Guidelines for identifying a competent chiropractor: **1)** Txs mainly M-S disorders w SM; **2)** Doesn't do routine X-rays on every Pt; 3**)** Doesn't extend duration of Tx unnecessarily; 4) Writes a response to a referral & outlines evaluation & therapy; **5)** Doesn't charge "front end" lump sum for whole Tx program; **6)** Graduated from CCE accredited

school; **7)** Willing to have MD visit office to observe Tx; **8)** Good feedback from Ps on care given. **CLINICAL PROFILES APPROPRIATE FOR MANIP**

PROBLEM	DURATION OF Tx
Acute LBP (<3 wks)	3-5 Tx, max of 10 before re-eval
Subacute LBP (3-12 wks)	Unclear
CLBP (>3 months)	3 Txs/wk for up to 8 wks before re-eval

Summary: In terms of return to normal function & Pt satisfaction Chiro seems to be of value.. A favorable response to SM is good sign tt Tx may help again. Article supported in part by AHCPR

Shekelle, MD, PhD. Spine 1994; 19(7):858-86:1Clinical Characteristics of Patients most likely to benefit from Spinal Manipulation: 1. **Acute Low Back Pain** (<3 wks duration): **a)** No risk factors for contraindications or no contraindications on lumbo-sacral films; **b)** Minor or no lower limb neurological deficits; **c)** No sciatic nerve irritation; 2. **Subacute Low Back Pain** (3-13 wks duration): **a)** No contraindications on lumbosacral radiographs; **b)** No lower limb neurologic findings; **c)** No sciatic nerve irritation; 3. **Chronic Low Back Pain** (>3 mo duration): **a)** No contraindications on L-S radiographs & CT/MRI; **b)** No lower limb neurologic findings; **c)** No sciatic nerve irritation; **d)** No ongoing biomechanical or psychosocial stress

REFERRAL FOR SM? For patients particularly with uncomplicated acute low back pain with symptoms prolonged >1 or 2 wks or poorly controlled with mild analgesics, a therapeutic trial of SM may be suggested. Over 90% of all claims for reimbursement are by DCs. Best method of referral is to contact the doctor & ask him to explain the approach to diagnosis & treatment of patients w LBP. Select a clinician who has reasonable judgement & practices within the boundaries of acceptable care. Be wary of doctors who make extravagant claims of efficacy or encourage prolonged courses of SM.

Ebrall, DC, PhD (c). **Workers Compensation studies**: Chiro J Australia 1992; 22(2):47-53. Only ½ the injured workers treated by DCs required comp days and of those who needed comp days, they required only 1/3 as many as patients treated by MDs. There was 6 times less progression to chronicity with DC vs MD care in this match sample of 1996 subjects. See also: Johnson-Iowa, Wolk-Fla, Nyiendo-Oregon, Greenwood-W.Va, Jarvis-Utah

Yates, DC. JMPT 1988;11(6):484-488. Chiro decreased Blood Pressure: systole 14.7mmHg, Diastole 13mmHg, 5 min post adjustment

Brennan, PhD. JMPT 1991; 14(7):399-408; 1992;15(2):83-9. Adjustment increases in respiratory burst in phagocytes in order to engulf and destroy invasive organisms. Chiro influences the immune system, a somatovisceral effect.

Yeomans, DC. JMPT 1992;15(2):106-114. Chiro increases intersegmental motion of restricted cervical jts & reduces excess motion of adjacent hypermobile jts

Schifrin, PhD; Dean, PhD & Schmidt, PhD. Studies in Virginia. Order from FCER 1(800) 622-6309. Cost of DC care accounts for only 1% of all insurance billings. It is cost effective with high patient satisfaction. Reviews all clinical trials.

Stano, PhD. ACA J Chiro; March; 41-5; J Am Health Policy 1992; Nov/Dec: 39-45; JMPT 1993; 16(5):291-9; JNMS 1993;1(2):64-8. chiropractic care is a substitute for more expensive medical, particularly a substitute for inpatient hospitalization, surgery, medications. Average cost of care for NMS Dx if just have MD care averaged $1138 higher (30% higher). Has data base of 360,000 patients including 91,000 who have received DC care

Manga, PhD. Report for the Ontario Ministry of Health: Order from FCER 1(800) 622-6309. Potential savings of many hundreds of dollars annually if there is a in switch management of back care from MDs to DCs. DC care is safer, more effective, reduces both disability and chronicity. Chiro reduces the spiraling of health care costs which occurs in the medical system. For every dollar paid to a DC there is an additional 25 cents generated in additional costs. For every dollar paid to a the primary MD there are an additional $4-5 generated.

Kokjohn, DC.. JMPT 1992;15(5):279-285. Chiro reduces back pain, abdominal pain & menstrual distress & may be a safe non-pharmacological alternative to management of primary dysmenorrhea

Pikalov MD, PhD, Kharin, MD. Use of spinal manipulative therapy in the treatment of duodenal ulcer; a pilot study. JMPT 1994; 17(5): 310-313: SMT achieved clinical remission with full epithelialization or cicatrization in all 11 subjects in the SMT group. Under the same conditions of patient age and size of defect, the SMT group had pain relief after 1-9 (average of 3.8) days & clinical remission an average of 10 days earlier than traditional medical care. This was statistically significant at $p<.001$. Patients with the same dimensions of ulcerous defect were relieved sooner with SMT. The data suggest that SMT is adequate to ameliorate the pathogenesis & to reduce the clinical symptoms of ulcer with greater success than traditional medical care.

Pick, DC. JMPT 1994; 17(3):168-173**:** In a 42 yr old asymptomatic male, an MRI was done, first, without manipulative pressure. A second MRI was performed while firm pressure was applied through the contacts toward the opposing contact point. Results from the second MRI demonstrated that the pressure affects the structure of the brain & supports the theory of suture mobility. There were changes on the second MRI in the shape of the corpus callosum, fornix, the lateral ventricle, angular surface of the central lobule & inferior colliculi. Structural alterations deep within the brain can be produced to a gross visual level by the application of external cranial manipulative force. This suggests that altering the volume of flow of CSF & blood through cranial manipulation may lead to alteration of neuron function.

Chiropractic Management and Ear Infections

Froehle , DC. JMPT 1996; 19(3):169-177. Chiropractic & Ear Infections in Children: Retrospective study of 46 children all 5 or less yrs old with S&S of ear discomfort/ear infection. **Treatment**: All children Tx by a single DC using Activator w some SOT blocking & modified AK for 3X/wk for 1 wk, 2X/wk for 1 wk, then 1X/wk. Regimen ended with improv't. Tx focused primarily on C-sp & occiput. **OUTCOMES**: based on parental observation: child has no fever, no signs of ear pain, is asymp or child seemed asymp to DC or parent stated tt child's MD judged t child improved. **RESULTS:** 93% of all episodes improved, 75% in 10 days or less; 43% w only 1 or 2 Txs. Young age, no Hx of antibiotic use, initial episode (vs recurrent) & designation of an episode as discomfort rather than infection were assoc w improv't w fewest Txs. **LIMITS OF STUDY** 1) retrospective, 2) small sample size, 3) little data available on t natural Hx, 4) lack of objective Dx criteria, 5) lack of objective outcome measures, 6) lack of control grp. **CONCLUSION**: limitation of medical intervention (antibiotics or tympanostomy tubes) & t addition of chiro care may decrease t Sx of ear infection in young children

Fysh, DC. Chronic recurrent otitis media. J Clin Chiro Ped 1996;1(2): 66-78. Restricted lymphatic drainage from the middle ear plays a major part in the establishment of chronic recurrent infections. Lymphatic drainage depends on its flow on adequate muscle activity/contractions, arterial pulsations & external compression of body tissues. If a child has a subluxation the misalignment or fixation may cause nerve irritation sufficient to cause hypertonicity of neck muscles which can restrict lymph drainage from the head thru the deep cervical lymph ducts. Most children with chronic suppurative otitis media have been Tx with at least several courses of antibiotics so fluid in the middle ear is likely sterile. The presence of this sterile serous fluid in the middle ear cavity at a temp of 98.6 deg F provides an ideal medium for the proliferation of bacterial or viral organisms which make their way up the eustachian tube. If organisms are able to proliferate in the residual middle ear fluid then acute suppurative otitis media results.

Peet, DC. Chiro Pediatrics 1996; 2(2): 8-10. Research suggest that otitis media may be caused by improper drainage of the deep cervical lymphatics. Reduced drainage causes a reduction in the lymphatic outflow from the eustachian tubes so fluid builds up in the inner ear making it an inviting environment for bacteria & viruses. Improper drainage may be caused by increased muscle tone or spasm coupled with a child's already small drainage system. The drainage system must pass under the cervical musculature before emptying into the superior vena cava. Physical motion due to muscular contractions, arterial pulsations & passive mov't pumps the lymph thru the system. Increased motion increases t lymph flow, whereas lack of mov't restricts the flow of lymph. Subluxations may produce muscle spasms wh constrict & pool the lymphatic drainage.

Fallon Joan M, DC. The role of the chiropractic adjustment in the care and treatment of 332 children with otitis media. J Clin Chiro Ped 1997;2(2):167-183

Del Mar C, MD et al. BMJ 1997;314:526-9. A lit search for RCTs using antibiotics to Tx acute otitis media (OM) found only 6 studies of children. T number of RCTs is small for such a common condition. There is a deficiency of research on this subject. Findings: 60% of children Tx w placebo were pain free w/i 24 hrs of presentation. Only 14% of children in control group still had pain 2-7 days after presentation. In these children initial use of antibiotics will reduce pain & contralat OM by a reduction of about 40%. This is equivalent to an absolute benefit of 5.6% fewer children experiencing pain by 2 to 7 days after presentation. Thus, 17 children must be Tx at first presentation to prevent one child experiencing pain after 2 to 7 days. Conclusions: Many MDs may be disinclined to use antibiotics at first presentation of OM for so little benefit. Antibiotics had no influence on subsequent attacks of OM or deafness at 1 mo. Antibiotics were assoc w a near doubling of t risk of vomiting, diarrhea or rashes. Sx of OM consist mainly of pain & systemic illness. In 80% of children this is limited to 24 hrs duration.

Froom J et al. BMJ 1997; 315:98-102. Antimicrobials for actue otitis media? A review. A multinational review of antimicrobials found tt otitis media is t most common reason for outpatient antimicrobial use in t US. About 30% of children under age 3 receive microbial Tx for acute ear ache each yr. No study found large differences between placebo & antimicrobials groups & concluded tt t benefit of routine antimicrobials for otitis media is unproved. Little evidence exists tt routine Tx is effective for preventing mastoiditis & meningitis. In t 9 country study, antimicrobials did not improve outcome at 2 mo & no differences in rates of recovery were found for either 1) type of antimicrobial or 2) duration.We conclude tt existing research offers no compelling evidence tt children w acute otitis media routinely given antimicrobials have shorter duration of Sx, fewer recurrences, or better long-term outcomes than those who do not receive them. Antimicrobial use in children w otitis media results in t emergence of resistant organisms tt cause otitis media. More than 80% of children w acute otitis media recover w/o antimicrobials. Clinicians should immediately reconsider routine use of antimicrobials for children w otitis media & consider treating Sx w analgesics & observation for lack of improv't. Increasing worldwide resistance of bacteria to antimicrobial drugs is causing a crises manifested by higher morbidity, mortality & costs.

Winters et al. BMJ 1997;314 (May 3):1320-1325. Compares efficacy of PT, manip, & corticosteroid injec for Tx Pts w shoulder complaints in a randomized single blind study in t Netherlands. 172 divided into 2 Dx grps: 1) synovial grp (n=114) & 2) shoulder girdle grp (N=58). Pts in shoulder girdle grp were randomized to manip or PT. Pts in synovial grp were randomized to corticosteroid injec, manip or PT. Main outcomes were duration of shoulder c/o. **Results**: In shoulder girdle grp duration of c/o was signif shorter after manip than PT. T number of Pts reporting failure was less w manip. In synovial grp duration of c/o was shortest after corticosteroid injec. Drop out due to Tx failure was low in injec grp (17%) & high in manip (59%) & PT (51%) grps. Conclusions: For shoulder girdle disorders manip seems to be t preferred Tx. for

synovial disorders, corticosteroid injec seem t best Tx.

Vicenzino B et al. Pain 1996;68:69-74. Effects of cervical SM on the pain and dysfunction of lateral epicondylitis. 15 Pts w lateral epicondylitis (LE) & elbow pain for a mean of 8 mo had a reduction of 53.4% in t neurodynamic test; 35.3% in pain-free grip strength, 43.1% in pressure pain threshold at baseline as compared to their unaffected side. T Pts had a high prevalence of hypomobility in t lower C-spine. Each Pts received one of t 3 interventions per day (SM , placebo or control) & all 3 in a randomized sequence over 3 days. Both Pts & assessors were blinded. Outcome measures were determined immediately before & after each inervention. Pain (VAS) was also assessed at 24 hrs . Pts & assessors were blinded as to wh grp Pts were in. SM was a Contralateral lateral glide (CLG) at C5-6 w t affected arm maintained in a position predetermined at t initial exam involving combinations of shoulder abduction, internal rotation & occasionally elbow extension. One had of t therapist depressed t scapula while t other cradled t occiput & neck above C5,6. a grade III passive lateral glide mov't was applied by t hand cradling t neck & occiput. **Results:** : A signif effect was found for Uppler limb Tension Test (ULTT), Pain-free Grip (PFG) & Pressure Pain threshold (PPT) & 24 hr pain scores. **The study demonstrates a clear & immediate hypoalgesic effect of SM (CLG) in Pts w LE at a site removed from t site of Tx application.**

Nansel, PhD. JMPT 1989;12(6):419-27. RCT indicates cervical adjustment improved symmetry & ROM in asymptomatic subjects with cervical lat flexion differences >10 deg.

Seemann, PhD. Chiro Res J. 1993;2(3):33-38. Post adjustment improvement in symmetry of load distribution as measured by dual scales after 12 wks of care: 12.84 lbs to 3.67 lbs

Herzog, PhD. JMPT 1991;14(2): 104-9. Post-adjustment improvement in the biomechanics of walking. Chiropractic quantitatively improved the symmetry of load distribution so that patients were indistinguishable from a normal population.

Cassidy, DC, PhD. JMPT 1992; 15(9): 570-75. Adjustments increased cervical ROM & reduced pain more effectively than did mobilization. The mechanism by which SM works is not certain. There is no evidence that it reduces subluxation or that minor positional misalignments are of clinical significance. It is more likely that SM exerts a reflex effect on pain & muscle tension. Mechanical stimulation of joint capsule proprioceptors & muscle spindles can result in reflex inhibition of pain, reflex muscle relaxation & improved mobility.

Chiropractic and Neurology

Swinkels Annette, MSc, Dolan Patricia, PhD. Spine 1998;23(5):590-597. Proprioception (PR) describes sensations generated within t body tt contribute to awareness of t relative orientation of body parts, at rest & in motion and are fundamental to control

of human movement. Recent work suggests tt **position & mov't sense may be impaired in t presence of joint disease**. Consequently, an improv't in PR is considered by many as an essential part of rehabilitation.

Swinkels MSc, Dolan PhD. Spine 2000;25(1):98-105. PR has 2 components: position sense (awareness of t relative orientation of body parts in space & movement sense (kinesthesia) - t perception of velocity & acceleration. Afferent inputs from jt tissues, muscles, skin, eyes, & vestibular apparatus all contribute to PR. Ligamentous & capsular afferents are most active at t limits of jt mov't, input from muscle spindles provides t primary source of jt position sense over most of t physiologic range. **Position sense in healthy Ss is accurate to w/i a few degrees, but may be impaired by pathology**. Mov't of one vertebra relative to another will produce t most strain in small intersegmental muscles (richly endowed with muscles spindles) & ligaments.

Seaman, DC, MS, DABCN. JMPT 1997;20(4):279-284 Proprioception is a conscious processing of mechanoreceptive input. Proprioception refers to conscious awareness of body position & body movement. Proprioception is a conscious cortical experience & not a peirpheral sensory phenomenon. It can not occur if cortical centers are not intact.

Lephart, PhD et al. Am J Sports Med 1997;25(2):130-137. Articular structures like ligaments not only provide mechanical restraint but also provide neurologic feedback that directly mediates reflex muscular stabilization about the joint, providing dynamic joint stability.

Jiang, MB, PhD et al. Spine 1997;22(1):17-25. Jt receptors contribute to 1) the coordination of muscle tone around jts & 2) provide neurologic feedback to enhance jt stability. Spinal ligaments, like those around knee jts, are richly innervated, responsive to mechanical stimulation & provide PR feedback tt mediates reflex muscular stabilization about the joint, providing dynamic joint stability - part of a neurologic protective mechanism. Stretching ligs stimulates MRs & the production of Fos protein. Synaptic transmisssion to interneurons & neural nuclei activates production of Fos protein & can be used to trace sensory & functional pathways in t CNS. In chickens, a transverse lig at T3-4 was repeatedly stim by a mechanical load. Fos production was assessed using a fluoresence microscope. RESULTS: Mechanical stim of a transverse lig led to a widespread barrage of neuronal activity in sensory areas of t CNS. **Results strongly support tt spinal ligs contribute to muscle coordination around jts increasing jt stability.** Stretching a spinal lig resulted in massive & widespread neuro input from several levels of t spinal cord & suggest a reflex response to muscles designed to maintain adjacent vertebrae in close alignment & prevent t jts from being damaged. The involvement of higher brain centers suggests a central involvement of reflex activity in response to t sensory information to maintain general balance & an upright posture. Scoliosis may be related to misperception of info assoc w local motor reflex activity of t spinal cord or central reflex activity in t brain. Evidence suggests a primary defect of posture, PR,

or equilibrium control is responsible for production of t spinal curvature in scoliosis.

Lephart PhD, ATC et al. Am J Sports Med 1997;25(2):130-137. Proprioceptive neuromuscular control influences 3 levels of motor activation in the CNS. 1) Spinal Reflexes provide reflex muscular stabilization of joints -Dynamic Stabilization. 2) Brainstem Motor control integrates input from jt MRs, vestibular centers & visual input to maintain posture & balance. 3) Highest levels of CNS function - provides cognitive awareness of body position & kinesthesia needed for control of voluntary mov'ts. **Encouraging maximum afferent discharge to these levels of the CNS must be the goal in stimulating jt & muscle receptors**. The abnormal sequencing of muscle firing can cause asynchronous neuromuscular activation patterns that may predispose articulations to overuse trauma. Loss of normal synchronization of firing patterns can alter joint kinematics resulting in repetitive microtrauma.

Hodges, PhD, Richardson, PhD. Arch Phys Med Rehab 1999; 80 (Sept): 1005-1012. Study of trunk muscle coordination (abdominal & back extensors) in Ss w & w/o a Hx of LBP w of upper limb mov't. Ss w a Hx of LBP had Hx of an insidious onset of at least 18 mo duration for wh they had sought care & lost a minimum of 3 work days. Ss had at least 1 episode of BP per yr or semi-continuous BP. Mean duration of Sx was 8.3 yrs. Ss were pain free at t time of testing. Results: early activation of transverse abdominals (TrA) & internal obliques (IO) occurred in t majority of trials in t ctl grp w mov't. Ss w Hx of LBP failed to recruit TrA or IO in advance of limb mov't w fast mov't, & no activity of t abdominal muscles was recorded in t majority of intermediate speed trials. Findings indicate tt t mechanism of preparatory spinal control is altered in people w LBP for mov't. Ss w a Hx of LBP have altered recruitment of trunk muscles in response to voluntary tasks. Because of t instability of t spine, these changes in recruitment may indicate inadequate protection of spinal structures from injury. Precise temporal & spatial recruitment of t trunk muscles is essential to protect t spine. In t neutral position minimal restraint is provided by passive structures & stability of spinal segments is dependent on t contraction of surrounding muscles. Changes in muscular control of t trunk in Ss w a Hx of LBP may potentially expose spinal structures to increased risk of microtrauma & injury. Increased stress on t passive structures may result from decreased muscle system spinal stabilization. Results provide evidence tt coordination of t trunk muscles is altered in Ss w a Hx of LBP when they are without pain. A person w a Hx of LBP without current Sx may be at greater risk of reinjury because of inadequate muscular stabilization of t spine.

Ghez C. The Control of Movement. In Kandel ER, Schwartz JH, Jessell TM (eds). Principles of Neural Science 3d edition. NY. Elsevier 1991; Chap 35:534-547. Local interneurons main branches are confined to t same or adjacent spinal segments & in t medial intermediate zone project bilaterally to motor nuclei tt control axial muscles. Propriospinal neurons main axon branches terminate in distant spinal segments, running up & down t cord, terminating on interneurons & on motor nuclei located several segments away. Axon of medial propriospinal neurons are longer & may

extend t entire length of t spinal cord. This pattern of organization allows t axial muscles, innervated by many spinal segments to be coordinated.

Kandel, Schwartz, Jessell. Principles of Neural Science; 4th Ed, 2000:667-8. Axons of the propriospinal neurons course up & down t white matter of t spinal cord & terminate on interneurons & motor neurons located several segments away. Axons of medial propriospinal neurons run have long axons tt branch extensively, some axons extend t entire length of t spinal cord to coordinate movements of the neck & pelvis. This organization allows axial muscles, innervated from many spinal segments, to be coordinated easily during postural adjustments.

Guyton, MD. Medical Physiology 1991: 591. Propriospinal Tracts: More than half of all nerve fibers ascending & descending in the spinal cord are propriospinal fibers which run from one segment to another providing pathways for multisegmental reflexes.

Ghez C. In Kandel ER, Schwartz JH, Jessell TM (eds). Principles of Neural Science 3d edition. NY. Elsevier 1991; Chap 35:596-607. Postural responses are triggered by 3 types of sensory inputs: 1) Muscle proprioceptors, 2) Vestibular receptors, 3) Visual inputs.Bending t neck & turning t head evoke reflexes in neck muscles (cervicocollic reflexes), axial & limb muscles (cervicospinal reflexes). Spindles in neck muscles & receptors in jts of upper cervical vert are responsible. By exciting interneurons & long propriospinal neurons, vestibular & neck reflexes produce complex patterns of facilitation & inhibition in motor neurons innervating axial muscles of t neck & back.

Nansel, PhD et al. JMPT 1993;16(2):91-95. Changes in cervical afferent PR input entering t CNS can induce postural changes in t trunk & lower extremity muscles. These "tonic neck reflexes" are mediated thru changes in activities of descending & ascending intersegmental spinal pathways, altering activities of motoneurons at spinal levels often some distance away from t entry level of afferent PR input. On head rotation, asymmetric PR signals from cervical facet joints & muscles enter t spinal cord intra & intersegmental reflex pathways & orchestrate appropriate mov't patterns. Inter-segmental reflex pathways carry descending impulses to lumbosacral levels of t cord wh modulate activities of motoneurons coordinating contractions of various muscle grps of t lower extremities. Afferent input from 1) t labyrinths to t vestibular nuclei, 2) input from t retina of t eye, & 3) from PRs in joint capsules & muscles, particularly those of t neck, are known to participate in t maintenance of static & dynamic equilibrium & spatial orientation. A significant proportion of PR info entering t CNS at spinal levels may exert direct influences on motoneurons by means of purely spinal intersegmental pathways not requiring participation by higher brain stem centers. In this study lower cervical (C7) adjustments caused a decrease in lumbar muscle tone.

Pollard, DC, MS, Ward, PhD. T effect of upper cervical or sacroiliac manipulation on hip flexion ROM. JMPT 1998; 21(9):611-616. Study compares t effectiveness of an

upper cervical manip & a manip of t SI jt for increasing hip ROM in 52 Ss (18 to 34 yrs) by using a reliable hand held digital electrogonimometer using a SLR before & after t Tx. 3 groups of Ss: 1) received cervical SM; 2) SI SM (side posture), & 3) sham (digital pressure on t mastoid process). **Results**: T 2 SM Txs resulted in increased flexion ROM at t hip, but only t upper cervical SM increased hip flexion ROM significantly. SM of t neck may affect hip ROM & indicates t existence of a link between C-spine & t lower extremity. A study by same authors found tt hip flexion ROM could be improved after a stretch to t hamstring or a stretch to t suboccipital muscles & t cervical stretch effect was greater than t effect of t locally applied stretch on hip ROM changes. Findings lend support to DCs tt emphasize a role of upper cervical Tx on t function of sites removed from t spine, tt upper cervical SM can affect extraspinal function. Potential mechanisms: Tonic Neck Reflexes: Result may be due to a change in muscle spindle output of t suboccipital muscles, causing reflex PR changes to centers controlling posture. This is supported by animal studies. It is likely tt lower limb flexion has resulted from stimulation of t suboccipital muscles & jt capsules assoc w a cervical SM of t area. It is possible tt these effects may manifest in other regions of t spine. As all muscles under consideration are postural in nature, it is highly probable tt all would be affected by such reflex activity. This is t first study to demonstrate improv't in an objective ROM measure of peripheral jt function after a single cervical SM.The study suggests a link between t neck & hip exists & t link can be affected by cervical SM. A potential reflex action of SM on long loop reflexes has been suggested as a possible mechanism for increased hip flex.

Patterson, PhD. Somatic Dysfunction in Osteopathic Medicine. The Role of Subluxation in Chiropractic. FCER 1997: 26-31. Various areas of the Musculoskeletal System are extensively & richly innervated with mechanoreceptors, especially around the **spinal column which seems to operate as one vast proprioceptive organ.**

Nyland, MEd, PT, ATC. JOSPT 1994; 19(1):2-11. The mechanoreceptors in ligaments & joint capsules influence gamma-motoneurons & modulate muscle activity & joint stabilization. Failure or destruction of mechanoreceptors' ability to provide feedback contributes to unpredictable "giving way" and may result in progressive degenerative changes of joints & muscle atrophy. PRs provide postural & kinesthetic sensation to the sensory regions of the cerebral cortex allowing the brain to make informed decisions for effective motor programs. Afferent input enables motor program changes based on information provided by changes in body position.

Dietz (Dept Neurology & Neurophys). Physio Reviews 1992; 72(1):33-69 Afferent input influences central motor programs. PR input from muscles and joints is required to adjust the motor program by modulating muscle EMG activity.

Freeman, MD & Wyke, MD. Brit J Surg 1967;54(12):990-1001. Articular MRs along with descending projections from the brain stem reticular system help determine the coordination & degree of gamma-motoneuron activity in muscles working a joint.

MRs directly influence segmental & intersegmental reflex coordination of muscles. Indirectly, they exert control thru supra-segmental projections to brain stem, cerebellum & cortex.

Yeung MS. **Survey on Ankle Sprains** Br J Sp Med 1994;28(2):112-116. Previous studies found 67.3% of football players & 70% of basketball players had sprained ankles. 26.5% of athletes surveyed had a Hx of one ankle sprain, 51.5% had a Hx of 2 to 4, & 22% had a Hx of 5 or more ankle sprains.

Neurology and the Cervical Spine

Abrahams, (Dept Physio). In: Garlick D (ed). Proprioception, posture, & emotion. Committee in Postgraduate Medical Education, Kennsington, NSW, Aust; 1982: T evidence that t neck plays a critical role in posture is overwhelming. Muscle receptors may be of great importance in sensing joint position. A characteristic of neck muscles is an abundance of muscle spindles. The spindle density in large muscles of the neck range from 46-106/gm, among the highest of anywhere. High spindle density is characteristic of muscle executing fine motor control. The abundance of afferent information may not only be due to fine motor control. Polysynaptic pathways from neck muscle afferents to neck motoneurons are powerful. Afferents leaving neck muscles can exert profound effects on hindlimb motoneuron excitability. The neck structures are unusually rich in receptors. Small muscles close to the cervical vertebrae may have up to 500 muscle spindles/gm, a density almost 100 times as great as some muscles of locomotion & 5 times greater than the large dorsal neck muscles which are regarded as spindle rich. These deep structures play an important role in reflexes & maintenance of posture & provide precise information with respect to position.

Guyton, MD. Textbook of medical physiology (9th ed). WB Saunders, Phila 1996; 714. The vestibular apparatus detects the orientation & movements only of the head. Therefore, it is essential that the nervous centers also receive appropriate information depicting the orientation of the head with respect to the body. This information is transmitted from the proprioceptors of the neck & body directly into the vestibular & reticular nuclei of the brain stem & also indirectly by way of the cerebellum. By far the most important proprioceptive information needed for the maintenance of equilibrium is that derived from the joint receptors of the neck.

McLain RF, MD, Pickar JG, DC, PhD. Spine 1998; 21(2): 168-173. Human facets contain MRs tt detect motion & distortion and provide PR & protective information to t CNS regarding jt function & position. Spinal PR may play a role in modulating protective muscular reflexes (PMRs) tt prevent injury or facilitate healing. Cervical facets have a more consistent pattern of MR innervation & a greater density of receptors per capsule than the thoracic or lumbar spine suggesting tt PR function in t thoracic & lumbar spine is less refined &, perhaps, less critical. T predominance of receptors in t cervical spine is consistent w its greater mobility & t need for coordinated muscle control for posture & for accurate positioning & protection of t

head in space. The paucity of receptors in t thoracic spine is consistent w t limited motion & intrinsic stability of t thoracic cage. Receptor complexes may work in concert to provide proprioception, modulate protective muscular reflexes (PMRs) & signal potential tissue damage in t face of excessive movement.

Wyke, MD. Neurology of Cervical Joints. Physiotherapy 1979;65(3):72-76.Electrical or mechanical stimulation of 1 C3-C4 facet jt results in a coordinated pattern of motor responses in all 4 extremities including rectus & bicep femoris, biceps & triceps brachiaii

Grillner, MD, PhD. Scientific American 1996; Jan:64-69. Neural Networks for Locmotion. Neural networks governing specific, often repeated motions are called **Central Pattern Generators**. They can execute a particular action over & over again w/o need for conscious effort. The circuits for walking, running & some protective reflexes aren't located in t brain but reside in t spinal cord. The essential neural patterns for locomotion are generated completely within t spinal cord. T brain controls these circuits by a simple control signal from an area of t brain which can generate intricate patterns involving large numbers of muscles in t trunk & limbs by activating pattern generators for locomotion housed w/i t spinal cord. Although t brain stem issues t overall command to walk, it delegates t task of coordinating muscle mov'ts to local teams of neurons wh process incoming sensory data & adjust their own behavior accordingly.

Radanov, MD.. Cognitive deficits post-cervical soft tissue injury. Spine 1992:17(2):127-131. In whiplash, functional brain stem disturbance was reported without morphologic lesions in any part of the brain. It was noted that cognitive impairment & reduced speed of information processing disappeared with the use of cervical collar or infiltration of deep neck muscles with local anesthetic. A reflex influence of PRs can lead to functional brain stem disturbances.

Galm R et al. Vertigo in patients with cervical spine dysfunction. Eur Spine J 1998;7:55-58. 50 Pts w dizziness & previous ENT & neuro exams excluding causes in their fields followed a program of PT & F-U at 2 wks & 12 wks. All Pts received a manual med exam to Dx segmental C-spine dysfunction, wh if present, was Tx w manual therapy consisting of mobilizing techniques w/o impulse & manip w high velocity impulse. All Pts got PT for 3 mo & had F-U at 2 wks & at 12 wks. Results: All 50 Pts had dizziness/vertigo. 31 of 50 Pts had signs of dysfunctions of t upper C-spine & received manual therapy, 19 didn't. At 2 wks F-U, 16 of 31 Pts w signs of dysfunction had signif improv't of vertigo. 4 more Pts had temporary improv't but later had recurrence. At 3 mo 24 of 31 Pts w signs of upper cervical dysfunction (77.4%) reported lasting improv'ts of vertigo & 5 had complete relief. 7 Pts had no improv't. In t 19 Pts who had no signs of upper cervical dysfunction, 8 showed improv't of vertigo after 2 wks of PT. At 3 mo, only 5 (26.3%) had an improv't of vertigo, t other 14 had no improv't. Improv't of vertigo was more frequent in Pts w signs of dysfunction (77.4 vs 26.3%). PT is more likely to succeed in reducing vertigo if

Pts have upper cervical dysfunction tt is successfully resolved by manual medicine prior to PT. The authors regard t C-spine dysfunction as t principal cause of these Pt's vertigo.

Loudon, PhD, PT et al. Ability to reproduce head position after whiplash. Spine 1997; 22(8):865-868. 11 Sx whiplash Pts (w/i t past 2 yrs but >3mo) & 11 age-matched asymp Ctls tried to reproduce various positions of t cervical spine: 30 & 50 degrees of rotation & 20 degrees of lat bending left & right using a CROM. "Neutral" position was also assessed. **Results**: Whiplash Pts were less accurate in reproducing t angles. Average differences in whiplash Pts was 5.01 vs 1.75 degrees in Ctls. Whiplash Pts possess an inaccurate perception of head position secondary to their injury. Injury of MRs in t C-spine w whiplash has profound effects on postural reflexes. With pain & muscle inflam there's inhibition of gama-motoneuron discharge & information from muscle spindles is inaccurate, altering PR sensibility. Whiplash Pts also had an impaired ability to reproduce a neutral head position. Whiplash Pts may have PR deficits tt do not allow them to accurately calculate head position.Coordination activities & PR retraining can have positive effects on kinesthetic awareness after injury. Rehab after whiplash should focus not only on ROM & strength but on postural awareness.

Fitz-Ritson, DC.. Cervicogenic Vertigo. JMPT 1991;14(3):193-198. In 112 post-whiplash Pts with cervicogenic vertigo. 90% were symptom free by 18 adjustments. Pts with upper cervical problems improved the fastest. Goals of care: to normalize motor function and afferent input. All 11 Pts who only improved slightly or not at all had their injury 21-43 months earlier. Disturbances in cervical soft tissues may be important in producing vertigo due to the potency of their disturbed afferent input.

Fitz-Ritson, DC. JMPT 1995; 18(1):21-24. Phasic exercises including rapid eye-head-neck-arm mov'ts can benefit Ps w chronic cervical injuries. Pts w >12 wks post whiplash who had been Tx w SM & rehab exercises but still suffered pain/soreness/stiffness were randomized into 2 grps. Grp 1 had SM & rehab exercises; Grp 2 had SM & phasic exercises. Both grps were Tx 4X/wk for 8 wks. Results: Grp 1 improved by 7.4%; grp 2 by 48.3% on t Neck disability index.

Field et al. J Back & Musculoskel Rehab 1997; 8:199-207. The effect of back injury on ability to replicate a posture. 16 back injured Ss (injured 4 mo to 6 yrs previously) & 16 aged matched ctls were asked to reproduce a target standing posture. Ss were blindfolded. After back injury Ss may develop an inaccurate perception of body position. Improved accuracy was stat signif in injured grp after rehab but still not as accurate as controls.

Neurology and Chiropractic: Subluxation, Joint Complex Dysfunction, Dysafferentation and Adjustment

Seaman DR, DC, MS, DABCN. JMPT 1997; 20(9):634-644. Joint Complex Dysfunction has been described by DCs, PTs, MDs. All agree tt reduced mobility promotes

pathological changes in t structures tt make up t jt complex & tt pain, inflam, & stiffness are common manifestations of t lesion. Restoring mobility is often a primary objective of Tx. Muscle functional imbalances, such as tightening, shortening & trigger points are intimately assoc w jt hypomobility/immobility & may be components of jt complex dysfunction. Muscles develop weakness or tightness in typical imbalance patterns wh promote faulty movement patterns, an essential component of jt complex dysfunction. It is likely tt jt complex dysfunction develops before pain is generated. Connective tissue, disc & muscle pathology (degen & atrophy) w/o any symptoms can exist in asymp & apparently healthy individuals. Muscle play a role in stabilizing t spinal column & muscle weakness may predispose t spine to injury. This suggest tt t great majority of people suffer asymp jt complex dysfunction before spinal tissue injury generates pain. Once injury occurs, a new set of dynamics come into play, including inflam, nociception & pain, all of wh promote jt immobility & further development of jt complex dysfunction, including increased formation & deposition of fibrous tissue wh further reduces mobility & promotes jt complex dysfunction.

Owens MS, DC. Theoretical constructs of vertebral subluxation as applied by chiropractic practitioners and researchers. Top Clin Chiro 2000;7(1):74-79. Preventive subluxation care: Degeneration of tissues is thought to occur in areas of disturbed kinematics, which can eventually lead to arthritic changes in t jts or nerve involvement if t disturbance is not addressed. Care is focused on detecting areas of kinematic dysfunction & correcting them before Sx arise. In this case, chiro care is indicated whether Sx are present or not.

Meeker, W. DC, MPH. Concepts germane to an evidence-based application of chiropractic theory. Top Clin Chiro 2000;7(1):67-73. SM & adjustments (Adj) have been studied for certain kinds of health outcomes, usually MS pain & disability. In this regard, t concept of subluxation has been somewhat ignored. Few studies examine t effect of Adj on subluxation directly, assuming tt any improvements in health status as measured by pain & disability are an indirect indication that a "subluxation" was improved. This has yet to be directly tested, leaving t possibility tt t concept of subluxation is relatively unimportant in t relationship between Adj & health. In other words, there may be effects of Adj on health tt are independent of subluxation. This would have tremendous implications for chiropractic practice, let alone theory.

Chiropractic researchers set sights on the spine. J Am Chiro Assoc 2002; 39(1):9-15. It is an irony of chiropractic research that we have demonstrated the therapeutic effectiveness of what we do, but not the reality of the spinal lesion - the subluxation - that is the focus of our treatment approach.

Seaman DR, DC, Winterstein JF, DC. JMPT 1998;21(4):267-280. **Dysafferentation** is an imbalance in afferent input resulting in an increase of NC input & reduction in MR input. Jt complex dysfunction influences both MRs & NCs leading to excitation of

NCs & reduced activity in Mrs. Reduced activity in MR system reduces t ability to inhibit pain in t spinal cord & may magnify Sx due to NC input. MR input to t brainstem, cerebellum, thalamus & cortex **plays a major role in equilibrium, PR, & motor control.** Reducedt mobility assoc w jt complex dysfunction may reduce MR activation & result in dysequilibrium, vertigo, **faulty motor control.**

Brumagne et al. Spine 2000;25(8):989-94. Deficits in PR input may change perception .
Deficits in PR may reorganize spinal motor reflexes so they no longer protect t spine from mechanical injury. Interventions tt enhance PR acuity may aid in recovery & reduce t likelihood of recurrence of chronic LBP.

Rieman, PhD, ATC, Lephart, PhD, ATC. The sensori-motor system, Part II: The role of proprioception in motor control and functional joint stability. J Athletic Training; 2002 37(1): 80-4. PR is fundamental for sensorimotor control over jt stability. PR is conveyed to all levels of t CNS & provides a unique sensory component to optimize motor control. Jt receptors, wh are often damaged during articular injury, appear to be an important component of PR. Their role in influencing gamma motoneurons & supraspinal motor programs appears to be substantial. Critical to effective motor control is accurate sensory information. Adaptive motor programs are stimulated by sensory triggers. Three sensory sources (somatosensory, visual, vestibular) have specific unique roles tt may not be compensated for by t other sensory sources. Before & during a motor command, t motor control system must consider t current & changing positions of t jts involved. PR best provides t needed segmental movement & position information to t motor control system to solve movement problems. Motor control undergoes constant review & modification based upon t analysis & integration of sensory input, motor commands, & movements. PR info stemming from jt & muscle receptors plays an integral role in this process.
These actions represent neuromuscular control. PR is essential to maintaining both stability of the entire body (postural stability) & stability of individual segments (jt stability).

Normal Sensory input (Somatosensory Input: Mechanoreception and Visual & Vestibular Input) leads to normal sensory processing (Perceptual Processing & Coordination of Motor Programs to Execute Movement) & results in normal motor output (Effective Motor Control & Movement Strategy). Abnormal sensory input (Nociception, Altered MR due to decreased ROM, Spasm, Swelling & Sensory Mismatch) can lead to abnormal central processing (Inability to Integrate Disturbed Input) & result in abnormal motor output (Spasm, Restriction, Hypermobility, Increased Risk of Injury & Degeneration).

CAUSES OF DISTURBED PROPRIOCEPTION: 1) Tissue injury, 2) Inflammation, 3) Pain, 4) Loss of Motion, 5) Degeneration.

Freeman, MD. Ankle Sprain. J Bone & Jt Surg 1965;47B(4):678-85. Forces strong

enough to damage ligaments damage nerve fibers which have lower tensile strength. Results in partial joint deafferentation & functional instability. Wobble board exercises provide sensorimotor facilitation &improve balance & sensorimotor control. Ankle sprain not only damages the lateral ligaments but damages proprioceptor (PR) nerve fibers which run in the ligaments leading to partial joint deafferentation and instability. Muscles need PR input in order to perform in a coordinated fashion needed for joint stability

Lephart, PhD, ATC et al. Am J Sports Med 1997;25(1):130-137. Dynamic joint stabilization exercise performed with a wobble board to stimulate coactivation of shoulder muscles. Trauma to tissues that contain MRs may result in partial deafferentation which can lead to proprioceptive deficits. Susceptibility to reinjury becomes more likely because of the decreased proprioceptive feedback. Deficits in neuromuscular reflex pathways may have a detrimental effect on the the motor control system's role as a protective mechanism to prevent acute joint injury.

Parkhurst, MS, PT & Burnett, MS, PT. JOSPT 1994;19(5):282-295: Musculotendinous junction is the weakest link in the muscle-tendon unit. This region fails first when exposed to excess tension. This is the site of Golgi tendon organs & may expose them to structural derangement or denervation resulting in possible proprioceptive impairment. Intramuscular bleeding can lead to increased pressure & local tissue ischemia. The muscle spindle may be susceptible to these types of trauma. Muscle spindles may be susceptible to this type of trauma. Spindles surviving mechanical disruption, denervation & tenotomy have evidence of abnormal afferent impulses. This can alter proprioception.

Lachman, MA, MD. Soft tissue injuries in sport. 2nd ed. London, Blackwell Scientific Publications 1994:12-31: Proprioceptors provide information at the conscious level about position & movement & subconsciously eliciting spinal reflexes that alter muscle action to control posture & prevent excessive deformation of jts & tissues. Its failure results in the loss of control of posture & complex movements. The end organs cease to function in the presence of inflammation or after prolonged immobilization of a jt. This loss of afferent input results in failure of postural reflexes so that the joint gives way, known as functional instability. **When treating injuries involving structures around a joint it is very important to stimulate the proprioceptive endings from an early stage of Tx. This appears to prevent atrophy of some endings & probably also recruits resting proprioceptive organs in surrounding tissues.**

Pain causes 1. A distortion of body image in space. A painful body part occupies a much greater part of our perceptual awareness in space. 2. Pain can produce marked and involuntary changes in motor strategies to protect the painful body part.

Nansel, PhD. The electrophysiologic consequences of early neurovascular compression. Top Clin Chiro 1999;6(4):1-5. Tactile discrimination, vibratory detection

& position sense are transmitted primarily along thick myelinated A-beta fibers. Pain & temp are transmitted over much smaller, lightly myelinated A-delta (fast pain) & smaller unmyelinated C fibers (slow). T reason tt t largest, myelinated nerve fibers are so sensitive to oxygen deprivation is tt their relatively huge surface areas simply require a much higher ATP production rate & a much higher rate of O2 use. Because of their high metabolic demand, they are, by far, t first to feel t effects of a decrease in oxygen delivery wh results in dysfunctional physiologic changes.

Caranasos, MD, Israel, MD. Gait Disorders in the Elderly. Hospital Practice 1991;June 15: 67-94. MRs in cervical facet jts provide major input regarding the position of the head in relation to the body. With aging, mild defects impair MRs function. Loss of PR can also involve the legs, esp w diabetes. With decreased PR, body positioning in space is impeded and the Pt becomes reliant on vision to know the location of a limb. To compensate for loss of PR in t legs, t feet are keep wider apart than usual. Steps become irregular & uneven in length. As impairment increases t Pt becomes unable to compensate. W severe loss of PR, t Pt is rendered unable to get up from a chair or rise after a fall w/o assistance.

Nies, Sinnott. Variations in balance & body sway in middle-aged adults. Subjects w healthy backs compared w subjects w low-back dysfunction. Spine 1991; 16(3): 325-30. In 45 middle aged adults, 20 w LBP & 25 ctls w healthy backs, balance responses (body sway) were measured under with computerized force plate stabilometry. Compared w ctls, LBP Ss demonstrated significantly greater postural sway, kept their center of force significantly more posterior, & were significantly less likely to be able to balance on one foot w eyes closed. Tx of LBP Pts may require attention to postural alignment, strength, flexibility, joint stability, balance reactions, & postural strategies.

Tjon, MA, Geurts, MD et al. Postural control in rheumatoid arthritis patients scheduled for total knee arthroplasty. Arch Phys Med Rehabil 2000;81:1489-93. Study of postural stability in 18 rheumatoid arthritis (RA) Pts scheduled for total knee arthroplasty & 23 age matched ctls evaluating anterior to posterior & lateral sway during quiet standing w 1) eyes open, 2) eyes closed, & 3) while performing an attention-demanding arithmetic task. RA patients with severe knee joint impairment have substantial postural instability & a high reliance on visual information (visual dependency) wh suggests compensation for impaired sensory feedback from the lower limbs. There is ample evidence for an association between postural instability & an increased risk of falling. Visual dependency deteriorates Pts safety even further in situations in wh visual information is limited.

Hassan, B. S. et al. Static postural sway, PR, & maximal voluntary quadriceps contraction in Pts w knee osteoarthritis & nl controls. Ann Rheum Dis 2001; 60(6): 612-8. 77 Ss (ave age 63.4 yrs) w knee osteoarthritis (OA) & 63 healthy age matched ctls w nl knees were evaluated for static postural sway, knee PR acuity & quadriceps strength. Results: Pts w knee OA had increased postural sway especially w eyes

closed, reduced PR acuity & weaker quadriceps. Ss w knee OA have impaired PR. Studies of ligaments from OA knees show a marked reduction in t number of MRs. Knee OA is also assoc w a 50-60% reduction in max quadriceps torque possibly resulting from disuse atrophy & arthrogenic inhibition.

Seaman D, DC, DABCN, MS. JMPT 1999;22(1):46-47. Reduced muscle spindle reflex activity is common & is a cause of postural instability, particularly in t elderly. Movements during stance of elderly Ss indicate delayed postural reactions to stabilize t body before initiation of voluntary mov'ts. Impaired reflex function in older Ss contributes to a greater instability during stance. It appears tt muscle spindle reflex hypofunction is t norm for t average elderly individual & it is probably a similar case in those w musculoskeletal injuries & jt complex dysfunction. Sensory motor stimulation is seen as an important adjunct to SM & is performed for enhancing sensory input, sensory motor integration & motor control.

Wolf, PhD. J Am Geriatr Soc 1996;44:489-497. 2 new studies find elderly Pts taking Tai Chi improve their balance & reduce their number of falls. Tai Chi use slow graceful & precise body mov'ts to improve both balance & body awareness. Study found 15 wk program reduced their rate of falls by 47.5%

Lan C, et al. 12- month Tai Chi training in the elderly: its effect on health fitness. Med & Sci in Sports & Exerc 1998;30(3):345-351. Study of the effect of Tai Chi on health in 38 older community dwelling Ss (58 to 70 yr). The Tai Chi grp included 9 M & 11F; t ctl grp 9 M & 9 F. Tai Chi grp practiced for 11.2 mo, an ave of 4.6 times/wk. Exercise intensity was 52-63% of the heart range. Cardiorespiratory function, strength, flexibility, & percent of body fat were evaluated. Results: T male Tai Chi grp showed 16.1% increase in VO2max, 11 degree increase in thoracic/lumbar flexibility, 18.1% increase in muscle strength of knee extensor, & 15.4% increase of knee flexor. T female Tai Chi grp showed 21.3% increase in VO2max, 8.8 degree increase in flexibility, 20.3% increasse in muscle strength of knee extensor, & 15.9% increase of knee flexor. T ctl grp showed no signif change in these variables. Conclusions: Results indicate tt a 12 mo Tai Chi program is effective for improving health fitness of the elderly.

Neuroplasticity - Learning in the Nervous System

Liebenson C, DC. Dyn Chiro 1998;16(20):36, 40, 41. Dynamic stabilization training requires some cortical effort, but once it is trained, a new motor program will form tt will subcortically protect vulnerable jts from injury on a reflex, semi- automatic basis. To facilitate t formation of a new motor program, labile surfaces (balls, foam, platforms) are used as much as possible. By challenging balance, afferent pathways are spontaneously facilitated in a concentrated way.

Liebenson, DC. The state of the art - "Evidence-Based Care." Dyn Chiro 2000; 18(25): 22, 24, 25, 30-1. Muscles can work to either produce or control movement. Injury prevention depends more on movement control than strength. Two distinct muscle

systems: One to produce movement -the superficial muscles are responsible for voluntary movement. The deep (intrinsic) muscles for maintaining jt stability (multifidi & transverse abdominus). The deep, intrinsic muscles are responsible for jt stability on an involuntary or subcortical basis.

Edelman, MD, PhD, Tononi, MD, PhD. A Universe of Consciousness. Basic Books 2000: 57-59. In t initial stages of learning a new skill, conscious control has to be exerted at every step, about every detail, in a process tt is slow, laborious, & prone to error. But with practice, conscious control becomes superfluous & disappears. Our performance becomes automatic & fades from consciousness. With practice, new & specialized circuits may augment those already present (long-term changes in synaptic strength) in t areas involved, & performance becomes automatic, fast, easy, accurate & largely unconscious. Automatization suggests tt conscious control is exerted only at critical junctures, when a definite choice or a plan has to be made. In between, unconscious routines are continuously triggered & executed, so tt consciousness can float free of all those details & proceed to plan & make sense of t grand scheme of things.

Carter, R. Mapping the Mind. Univ California Press, Berkeley 1998: 196. PET scans: areas in the prefrontal & temporal cortex are lit up when subject is concerned with making decisions & focusing attentionin learning a word task. When the person has practiced the task & it has become routine these areas remained switched off. When the person is choosing new words the activity returns.

Kandel E, MD. Cellular mechanisms of learning and the biological basis of individuality. In: Kandel E, editor. Principles of Neuroscience. 4th ed: McGraw Hill; 2000. p. 1247-1279. T molecular mechanisms of memory storage change t connectivity of neurons in the brain. Learning changes t effectiveness of t synaptic connections tt make up t pathway mediating t behavior. Learning can lead to increases in synaptic strength & structural changes in sensory & motor neurons. At synapses involved in learning & memory storage, a relatively small amount of training can produce large & enduring changes in synaptic strength. Long-term changes require new protein synthesis wh involves: 1) gene activation & expression, 2) new protein synthesis, & 3) growth of synaptic connections. T number of presynaptic terminals in t sensory neurons increases & may become twice as great in t long-term sensitization. Changes also occur in motor neurons - their dendrites grow to accommodate additional synaptic input. Long-term sensitization also involves facilitation of transmitter release at synapses. Long-term sensitization involves t synthesis of new proteins & leads to t growth of new synaptic connections . Specific enzymes translocate to t nucleus activating certain genes tt encode proteins important for t growth of new synaptic connections. Connections of afferent & efferent pathways in t cortex can expand or retract depending on activity. Organizational changes probably occur throughout t somatic afferent pathways as well. All brains are uniquely modified by experience. Learning produces changes in the effectiveness of neural connections.

LeDoux, J. PhD. Synaptic Self. How our brains become who we are. Viking 2002: 78-81
Neural activity drives t formation of new synapses & axon branches, as well as, provides cues tt act to select & stabilize existing ones. Active axons branch & sprout new connections. Plasticity is accompanied by axon branching & new synapse formation following learning. Once this occurs, an action potential (AP) will be more effective in firing t postsynaptic cell because it activates more synapses on tt cell. An important set of molecules are neurtrophins, which promote t survival & growth of neurons. When an AP occurs in a postsynaptic cell, neurtrophins are released from t cell & diffuse backward across t synapse, where they are taken up by presynaptic terminals. Under t influence of neurotrophins, axon terminals branch & sprout new synaptic connections. Since only the presynaptic cells tt were just active take up t molecules, only they sprout new connections. Activity thus induces growth, & t growth is restricted to t active terminals. Cell death is prevented if a presynaptic terminal receives a life-sustaining shot of neurotrophins from its postsynaptic partner.

Sandkuhler J. Learning and memory in pain pathways. Pain 2000;88:113-118. Contemporary terminology for models of cellular learning and memory. 1) Use-dependent change in synaptic strength, 2) Synaptic plasticity, 3) Synaptic long-term plasticity in nociceptive systems, 4) Use-dependent long term potentiation of synaptic strength, 5) Injury induced hyperalgesia

DeLeo, J. A. PhD, Winnem, PhD. Physiology of Chronic Spinal Pain Syndromes. Spine;2002 27(22): 2526-2537. In chronic pain tt has extended beyond t period of normal tissue healing, a cascade of changes initiated by tissue or neural damage elicits a collection of synaptic, neurotransmitter, & modulatory events tt mimics synaptic plasticity & remodeling similar to tt seen in learning & memory. A large body of evidence indicates tt sensitization in t CNS is largely responsible for t development of persistent pain states.

Janda L, Vavrova M. In Liebenson C (ed). Rehabilitation of the spine. Baltimore, Williams & Wilkins 1996:319-328. The afferent system not only has an informative role, but also participates substantially in motor programming & motor system regulation. Therefore, PR stimulation (sensory motor stimulation) is stressed more & more. To prevent injury, fast reflex muscle contraction is needed to protect jts. It is possible to accelerate muscle contraction about twofold w increased proprioceptive flow & balance exercises. In sensory motor stimulation an attempt is made to facilitate the PR system & those circuits & pathways tt play an important role in regulation of equilibrium & posture.

Posner-Mayer, Joanne, P.T. Orthopedic, sports medicine, & fitness exercises using the (Swiss) Gymnic Ball. 1995. Besides improving strength & ROM, these exercises facilitate balance, coordination & muscle recruitment for trunk stability & posture

control. This occurs through unconscious neuromotor programming that will carry over at a functional level, something that most exercises for specific muscle groups fail to do. These exercises have the potential range that allows the patient to continue improving beyond his or her preinjury or disability status.

Balogun, PhD, PT. Physiotherapy Canada 1992;44(4):23-30. 6 wk wobble board training in asymptomatic males. Eyes open balance increased 201.2%. Eyes closed balance increased 58.8%. Findings: wobble board exercise can improve static balance

Taylor, MA, PT, Gunter, PhD, PT. In: Posner-Mayer J, PT, editor. Orthopedic, Sports Medicine, & Fitness Exercises using the Swiss Ball; 1995: 5-18. The gym ball provides dynamic challenges that elicit protective & equilibrium reactions in response to movement. Not only is the strength of individual muscles increased, but each muscle is strengthened as part of a larger functional unit involved in the development of optimal timing & appropriate force to promote biologically sound & efficient movement. The dynamic nature of these exercises stimulates visual, vestibular, & somatosensory systems simultaneously & presents the opportunity to work on integration of multimodal sensory information wh may be impaired in a wide range of conditions. Use of t ball elicits quick postural reactions made automatically, utilizing intrinsic sensory feedback & challenges Pts, in a very unconscious way, to make reflex postural adjustments reinforcing coordination between postural muscles wh is useful in movement re-education following injury or trauma.

Janda, V, MD. Sensory Motor Stimulation 1994. The goal of the exercise program is to achieve, as quickly as possible, an automatized control of the muscles responsible for maintenance of good posture & repeated movements such as gait. A goal is to increase the flow of stimuli from the peripheral structures of the musculoskeletal system & exteroreceptors of the skin to increase activation of the subcortical regulatory centers. Activation of the subcortical nervous system increases the fast, automatized activation of muscles with minimal cortical or voluntary control. The program is based on the concept of two stages of motor learning. In the first stage, proprioceptive & exteroceptive information from the periphery passes to the cerebellum where the primitive pattern is formulated & then to the sensory cortex & finally to the motor cortex where the pattern is refined. It is transmitted directly & by the subcortical centers along efferent pathways to the periphery & movement is accomplished. This stage of the motor learning process is tiring & requires cortical motor regulation & deep concentration. The goal of the program is to progress quickly to the second stage of motor control in which the cortex is protected & the decisive role in motor regulation is maintained by subcortical areas. This leads to a fast reflexive manner requiring less concentration. One means of facilitating the second stage of motor control is to increase proprioceptive input. The facilitation of the 3 following areas is important: PRs of the sole of the feet; Exteroceptors of the skin; Activation of the neck muscles. The whole regimen attempts to provide in the subcortex, a basis for movement which is progressively elaborated by more complicated movements which demand increasing coordination, precision & skill

acquisition.

Vellas BJ, MD, PhD et al. JAGS 1997; 43:735-738. One leg balance: A predictor of injurious falls. Study of 316 healthy, community living older Ss (mean 73 yrs). At baseline 84.5% of Ss could perform one-leg balance for 5 sec. Impairment on t test was assoc w older age & gait abnlities. Over 3 yr F-U, 71% (225) of Ss experienced a fall & 22% (70), an injurious fall. T only signif predictor of all falls was age >73. But, impaired one-leg balance was t only signif predictor of injurious falls. Conclusion: One-leg balance is an easy test to do to predict injurious falls, but not all falls. Ss who couldn't stand on one leg for 5 sec had 2.1 times t risk of an injurious fall over 3 yrs.

Hurvitz MD, et al. Unipedal stance testing as an indicator of fall risk among older patients. Arch Phys Med Rehabil 2000;81:587-91. 53 ambulatory outPts 50 yrs & older underwent 3 timed unipedal stance at a electroneuromyography lab. Unipedal stance time (UST) & fall Hx during t previous yr were evaluated. Results: 20 Ss (38%) reported falling in t past yr. Compared w Ss who had not fallen, those who fell had a signif shorter UST (9.6 sec vs 31.3 sec). An abnl UST (<30 sec) was assoc w an increased risk of having fallen. Conclusions: UST of <30 sec in an older ambulatory outPt population is assoc w a Hx of falling, while a UST of >/= 30 is assoc w a low risk of falling.UST appears to be a more effective means of identifying Pts at high risk for a fall than a relatively detailed peripheral neurologic exam.

Wiesel. Backletter 1998;13(1):6,7. 30% of community dwellers over t age of 65 fall every year. By t age of 80, 50% fall at least once per year. 10% of elderly sustain a serious injury caused by a fall each year (Fx, jt dislocations, & head injuries). Falls are a risk factor for institutionalization. A single non-injurious fall tripled t risk of admission to a nursing home, more than 1 non-injurious fall quintupled t risk, & a fall w serious injury resulted in a 10 fold increased risk. Medications are not t only answer to prevent osteoporotic fractures. While drugs play a role in slowing bone loss in some older Pts, MDs need to do more than write prescriptions. Unfortunately, many nonpharmacological strategies to prevent falls are under utilized because they are not as simple as writing a prescription & are not publicized by $50 million advertising campaigns from pharmaceutical companies.

Gillespie, et al. Interventions to prevent falls in elderly people (Cochrane Review). The Cochrane Library 2001 Issue 4. Interventions likely to prevent falls in the elderly: 1) A program of muscle strengthening & balance retraining, individually prescribed at home by a trained health professional. (3 trials, 566 Ss); 2) Tai Chi: a 15 wk Tai Chi group exercise intervention (1 trial, 200 Ss);
3) Home Hazard assessment & modification professionally prescribed for older people w a Hx of falling; 4) Withdrawal of psychotrophic medications.

Wyke, MD. Aspects of manipulative therapy. 1985: 67-71: Patterns of normal proprioceptive input are profoundly distorted when articular nociceptive activity is

added. This interferes with the precise continuous input necessary for coordinated multisegmental reflexes which are required for normal patterns of motion, balance, coordination and equilibrium.

Bogduk, MD, PhD. In Grant R. Physical therapy of t cervical & thoracic spine (2nd ed). NY, Churchill Livingstone 1994:65-76. There is no known mechanism whereby nociceptive afferents can be selectively affected by lesions tt cause root compression. Such lesions indiscriminately affect both large diameter afferent fibers (touch, vibration & proprioception) & small diameter fibers (nociceptive). Both compression & ischemia affect large diameter fibers sooner than small.

Guido, PT, SCS et al. JOSPT 1997;25(3):208-212. Effects of chronic effusion on knee joint proprioception. Jt receptors provide PR throughout t entire ROM, but discharge frequency & intensity increases at t limits of motion. Afferent feedback also arises from muscle spindles in juxta-articular muscles. Passive jt position sense derives from receptors in jt capsules & ligaments, active jt position sense from receptors in tendons & muscles. Knee jt effusion causes a reflex inhibition of quadriceps muscles due to capsular distention. With an effusion t role of MRs becomes unclear. T amount of intra- articular effusion (pressure) & t rate of capsular distention powerfully excites type I & II MRs as well as NCs.

Charcot's Joint. Cecil Textbook of Med 1985:1958. The result of a chronic progressive degenerative arthropathy in which impairment of proprioception & pain deprives the joint of the normal protective reactions that ordinarily modulate the forces of weight bearing & motion leading to severe destruction & disorganization of the involved joint

Horner, MPhil, Urban, PhD. Effect of nutrient supply on viability of cells from t nucleus pulposus of t IVD. Spine 2001; 26(23): 2543-9. Discs degenerate much earlier in life than other tissues. Because t disc is t largest avascular tissue in t body, one reason for degeneration is a fall in transport of nutrients into t disc. Discs have a low cell density & cells make & maintain t extracellular matrix. Nucleus & inner anulus cells rely on a long, precarious path from blood vessels of t vertebral body for their nutrients & removal of wastes. Nutrients are supplied by a capillary network tt penetrates t subchondral plate of t vertebral body & terminates above t cartilage endplate. Nutrients diffuse from capillaries across t endplate thru t dense disc matrix to t cells. Changes in permeability of t bone–endplate, (calcification) limits penetration of solutes into t disc & is assoc w disc degeneration. Endplate permeability is lower in degenerate than normal discs. If nutrient supply is restricted by a fall in endplate permeability or decreased blood flow, nutrient concentrations in central regions of t disc fall steeply, possibly to levels below those tt can sustain viable cells. T central region of the disc, is most vulnerable to a loss of nutrients. Although cells may survive a variety of external stresses under optimal nutritional conditions, they may not be able to survive high mechanical or other stresses under adverse conditions. Results support tt nutritional limits dictate t cell density in

avascular tissues such as t IVD or articular cartilage. Even if nutrient supply is sufficient to maintain cell viability, it may not be adequate to support matrix production. Proteoglycan synthesis falls steeply eventually leading to a fall in proteoglycan concentration & disc degeneration. Nutritional factors do not have to cause cell death to lead to disc degeneration.

Restoring Function, Pain Relief, Goals of Care

Liebenson, DC. Rehabilitation of the Spine. Wms & Wilkins, Baltimore. 1996: 13-43. Improving function is the key to long term pain relief. Joints that have good function are not painful.

Waddell, MD. The Chiropractic Report 1993; July:1-6: Traditional medical treatment according to the disease model has failed. **Bed rest:** should die as soon as it can. Avoid it if possible. **Physical therapy:** there is no adequate evidence of effectiveness. **Spinal manipulation**: 1 of the 2 Txs of proven value. The last 10 yrs produced a lot of solid scientific evidence to support the value of manipulation. **Early active exercise**: the other Tx supported by good evidence.

Restoration of function and relief of pain must occur at the same time. Failure to restore function means any pain relief will be temporary and reinforces chronic pain. In the management of occupational back pain, the chiropractic profession is leading the way. The problem is weakness and loss of function not disease.

Waddell G. MD. The Back Pain Revolution. Churchill Livingstone 1998. Many professionals assume that it is pain causing disability & that if we treat the pain, the disability will disappear. Too often, that just does not work.

Liebenson, DC. Improving activity tolerance in pain patients: a cognitive-behavioral approach to reactivation. Top Clin Chiro 2000;7(4):6-14. The main goal of management is to maintain physical functioning. Goals setting should be mutual & related to activities deemed important to the Pt. This enhances Pt motivation & compliance with an active care plan. Often, Pts have sacrificed various features of their lifestyle as a result of pain. Example: can't sit thru movies due to LBP, or play tennis or golf, or enjoy sex. Whatever lifestyle changes they have made as a result of their pain should be uncovered in the initial history. The restoration of these activities can become agreed upon goals of rehab. Establishing functional restoration as a goal along with pain relief is essential to achieving a positive outcome. Recovery depends on restoring function & moving again. The focus is on activity not pain.

Michelson, MD, Hutchins, MD. J Bone & Jt Surg 1995;77-B(2)March: 219-224. Type III MRs provide sensation at the extremes of movement & act to alert the CNS of imminent danger to the joint. Ligaments provide more than structural support. Sensory output from ligaments aids in controlling muscle stiffness & co-ordination, thereby increasing jt stability. MRs influence gamma motoneuron output, & thereby, the discharge of alpha motorneurons, enhancing muscle contractility. At the

extremes of motion, MRs elicit protective reflexes to prevent injury to the joint.

O'Connor BL, PhD, Brandt KD, MD. Rheumatic Disease Clinics of North America 1993; 19(3):581-605. MRs inform t CNS when t limits of excursion are about to be exceeded & t CNS then prevents jt injury by issuing appropriate commands to t muscles crossing t jt. Some consider tt failure of this system will lead to Charcot arthropathy which develops when an insensitive jt is unable to inform t CNS when t nl limits of excursion are about to be exceeded. As a result, t CNS is no longer able to coordinate normal protective muscular reflexes (PMRs) & t articular & periartic tissues of t unguarded jt are repeatedly traumatized, leading to jt breakdown. This theory integrates t roles of 1) a somatic sensory deficit, 2) disrupted somatic muscular reflexes & 3) mechanical trauma in t developm't of a Charcot jt, wh exhibits changes of an exaggerated form of osteoarthritis (OA). If Charcot jt is an exaggerated form of OA resulting from trauma following a major breakdown of PMRs, then a proportion of so called primary OA may represent a mild form of Charcot arthropathy resulting from a minor breakdown of PMRs. From this perspective, t role of t nervous system in t pathogenesis of OA assumes enormous importance. **The joint survives at the pleasure of the neuromuscular system.**

Gottlieb MS, DC. JMPT 1997; 20(6): 400-414. Tissues of synovial jts are inherently susceptible to t development of DJD if t ROM or magnitude of loading on articular cartilage is excessive. Joint ligaments, capsules & articular surfaces are not adequate to withstand many of t forces tt threaten jts. Much of t jt protection is conferred to a dynamic system of coordinated muscle activity - **a protective muscular reflex tt prevents injury to a jt by preventing it from exceeding its nl ROM.** The CNS is informed by receptors when t limits of motion are about to be exceeded & responds to tt sensory info w motor signals to t muscles crossing t jt, causing appropriate muscle contraction or relaxation to protect t jt. A jt lacking this sensory info is unable to inform t CNS when t nl limits of excursion are about to be exceeded & thus, t jt can be overstressed, leading to breakdown. **The nervous system plays an important role in the survival of jts.**

Kirkaldy-Willis, MD, Cassidy, DC, PhD: Can Fam Physician 1985; 31:535-540. Articular mechanoreceptor stimulation has a reflexogenic effect on motor unit activity in the muscles operating the joint. Stretching the facet joint capsules can reflexly inhibit facilitated motoneuron pools which are responsible for the increased muscle excitability & spasms that commonly accompany LBP. In more chronic cases, there is shortening of periarticular connective tissue & intra-articular adhesions may form. We believe that in some cases, manipulation will stretch or break these adhesions. Thru these mechanisms spinal manipulation can break the cycle of pain, muscle spasm & immobility.

Nansel, PhD, Slazak, DC. Advances in Chiropractic 1994; 373-415. Joint capsule PR connect with gamma-motoneurons & can alter the sensitivity of muscle spindles & muscle tone. Changes in capsular pressure (joint swelling), tension (muscle spasm)

or integrity (tear) create aberrant signals which can lead to inappropriate increases in muscle tone & restriction of motion. Gapping of the joint by SM, induces a sudden burst of capsular afferent activity which can cause reflex decreases in muscle tone allowing for an increase in joint movement. Postural muscles (multifidi, rotatores, etc) can sustain contractions for long periods. Asymmetries in their contractile state can account for asymmetries of ROM. The sudden stretch of muscles by SM causes an increase in tension stimulating Golgi tendon receptors to inhibit alpha-motoneurons, relaxing muscles. Such changes in muscle activity can last for hours, sometimes days.

Thabe, MD. Manual Med 1986;2:53-58. SM applied to restricted atlanto-occipital joint results in an immediate disappearance of spontaneous activity in the oblique capitus superior muscle. With SM this is more rapid than either anesthetic applied to the joint capsule or to the muscle directly. These results indicate manipulation can immediately relax intrinsic spinal muscles and reduce segmental irritation.

Murphy, DC, PhD et al. Electromyogr Clin Neurophysiol 1995; 35:87-94. Study of t effect of SM or a sham manip of t SI jt on t Hoffman (H) reflex (a monosynaptic reflex induced by electrically stimulating an afferent nerve eliciting an alpha motoneuron response) by stimulating t tibial N & measuring t response in t soleus muscle in asymp Ss. H-reflex response was decreased (12.9%) in t ipsilateral leg post SM but no change post sham. An anesthetic cream was applied to t skin over t SI jt & SM was repeated. There was still a decrease in reflex excitability suggesting t reflex changes are mediated by jt &/or muscle afferents, not skin receptors. Findings indicate tt jt manip affects t CNS, probably at t segmental level. SM probably alters afferent input from jt structures leading to a reduction in excitability of motoneurons -breaking a pain-spasm reflex. SM reduces t amplitude of t H-reflex suggesting tt t excitability of t S1 alpha-motoneurons were reduced due to central effects of SM and is specific to t manipulative procedure. SM exerts an important effect on pain & muscle spasm reflected in decreased motoneuron excitability.

Murphy, DC, DABCO. AM J of Clin Chiro 1997; 7(2) : 23-24. Golgi-tendon organs (GTOs) are high threshold receptors & their input is inhibitory. Because their threshold is higher than muscle spindles, it is difficult to have GTO input to t spinal cord be t predominant influence on alpha motorneurons. Recent studies show tt a fast stretch force of sufficient magnitude will primarily fire GTOs causing inhibition of alpha motoneurons ipsilaterally.. Speed appears to be a critical factor. Insufficient speed will primarily fire low threshold muscle spindle resulting in excitation of alpha motoneurons & will perpetuate t increased muscle tone & biomechanical problems. Fast stretch tt fires GTOs achieves inhibition of alpha motoneurons. Cavitation adds sufficient speed to result in high threshold GTO discharge. Activator & drop table devices input sufficient speed to also achieve inhibition of alpha motoneurons.

Seaman DR, DC, Winterstein JF, DC. JMPT 1998;21(4):267-280. Golgi Tendon Organs have a dynamic sensitivity & are more suited to signaling rapidly changing tensions

rather than static levels of tension.

Floman et al. J Bone & Jt Surg (Br) 1997;79-B: Sup III:319-320. 24 Pts w sciatica & unilat disc herniation at L5-S1 documented by CT or MRI had electrophysiological eval before & after SM. H-reflex responses were recorded bilat from t triceps surae muscle after stim of t tibial sensory fibers before & after side posture manip. Both t involved side & t contralat non-involved side were manip in succession. H-reflex amplitude (HR-A) & H-reflex latency (HR-L) were measured. Results: 13 Pts had abnl H-reflexes prior to SM indicating an S1 N-root lesion. HR-A level was signif lower on t affected side. After manip, t abnl HR-A increased signif on t affected side while t nl HR-A on healthy side remained unchanged. There was a signif increase of HR-L on t affected side. Following SM there was a trend toward a decreased HR-L on t involved side, but this didn't reach stat signif. Conclusion: SM may cause immediate changes in t H-reflex parameters in Pts w nerve root compression & enhance immediate relief from radicular conduction block by t offending disc herniation.
Ebenbichler, et al. Sensory-motor control of the lower back: implications for rehabilitation. Med Sci Sports Exerc 2001; 33(11): 1889-98. T presence of a ligamento-muscular reflex has been proposed for t automatic control of t motion segment. Changes in PR, kinesthetic, & NC info from MRs in t spinal ligs, discs, & jt capsules may project to motor neurons tt activate muscles wh stabilize t jt. Studies find EMG activity in both short & long paraspinal muscles after electrical stim of MRs in t disc, facet jts, & supraspinal ligs. T presence of a spinal ligamento-muscular reflex has been demonstrated in humans.

Solomonow M et al. Spine 1999; 24(23): 2423-2433. Study finds that repetitive mechanical loading progressively desensitizes receptors in ligaments & viscoelastric structures tt support t spine. Fatiguing these receptors "results in an exponential decrease in reflexive muscle activity, exposing t spine to possible injury & pain," according to Solomonow et al. (from Louisiana State Univ Med Center). T study was presented at ISSLS where it won t Volvo Award in biomechanics. Spinal ligaments, discs, & other viscoelastic structures become progressively deformed (creep) under repetitive loads. T experiment demonstrated tt t cyclic loading desensitized MRs in spinal ligs, leading to a loss of stability. T force from t supraspinal lig decreased to 50% of its original value after t 50 min loading period.

Dishman, DC, Bulbulian R. Spinal reflex attenuation associated with SM. Spine 2000;25(19):2519-25. Study of HVLA SM & mobilization w/o thrust on the excitability of the alpha motoneurons in 17 Ss w/o LBP. Results: Both side posture SM & mobilization produce a profound but transient attenuation of alpha motoneuron excitability. Both significantly but transiently attenuate alpha motoneuron activity. Results indicate tt inhibition of motoneurons is a short-term consequence of SM procedures, lasting a maximum of 20 to 30 sec. Findings substantiate tt manual spinal procedures may lead to short-term inhibitory effects on the human motor system. Herzog's report indicates tt an excitatory reflexive discharge of paraspinal muscles occurs as a consequence of SM & is attributed to afferent discharges of

cutaneous, jt & ligament receptors, muscle spindles, MRs, & free nerve endings of t spine. These discharges may synapse on inhibitory interneurons to inhibit alpha motoneuron pools of t paraspinal muscles. Results indicate tt SM & mobilization leads to short-term attenuation of alpha motoneuron activity. Postactivation depression (depression of Ia-motoneuron synapse after a previous activation of a stretch reflex arc) is well-documented & may be involved in post-SM inhibition. Regardless of t exact mechanism, t effects of SM on motoneuron pool excitability clearly show inhibition of motoneurons tt is persistent.

Suter, PhD et al. Conservative lower back treatment reduces inhibition in knee-extensor muscles. JMPT 2000;23(2):76-80. Anterior knee pain (AKP), is assoc w strength deficits & reduced activation of the knee extensors, known as muscle inhibition (MI). Txs that reduce MI appear necessary for successful rehabilitation. Observations suggest that AKP may be associated with SI joint dysfunction. 28 Pts w AKP were randomized to a Tx or ctl grp. Tx grp received chiropractic SM to correct SI joint dysfunction. Ctl grp received no SM. Before and after Tx, knee-extensor moments, MI, and muscle activation during full effort, isometric knee extensions were measured. Results: Pts had MI in both legs. Functional assessment revealed SI-joint dysfunction in all subjects. After SI-joint manip, a signif decrease in MI of 7.5% was seen in t involved legs of the treatment group. MI did not change in the contralateral legs of t Tx grp or in either leg of t ctl grp. Conclusions: Results suggest that SI- joint manip reduces knee-extensor MI. SM may possibly be an effective treatment of MI in the lower limb musculature.

Keller PhD, Colloca, DC. Mechanical force spinal manipulation increases trunk muscle strength assessed by EMG. JMPT 2000;23:585- 595. Study of 40 LBP Pts (20 LBP Pts got activator chiropractic technique - mechanical force, manually- assisted (MFMA) & 10 LBP Pts in a sham-SM grp & 10 in control grp) to determine if SM affects para-spinal muscle strength assessed via surface EMG (sEMG). Pts performed a maximum voluntary contraction (MVC) isometric trunk extensions while lying prone. Surface electrodes recorded activity from t erector spinae muscles at L3 and L5 during trunk extension. Pts were then assessed by t use of t Activator protocol, & received MFMA SM wh was followed by a dynamic stiffness & algometry assessment, & then a second (post-SM) MVC isometric trunk extension and sEMG assessment were performed. 10 LBP Pts received a sham-SM & 10 to a control grp. The sham grp had t protocol except Ss received a sham-MFMA SM & dynamic stiffness assessment. The control grp received no SM & stiffness assessment. 19 of 20 Pts in the SM grp showed a positive increase in sEMG output during MVC after the active MFMA SM & stiffness assessment. The SM group showed a signif increase in erector spinae muscle sEMG output (average of 21% increase vs pre-SMT levels) during MVC isometric trunk extension trials. There were no signif changes in t sham-SM (5.8% increase) & control (3.9% increase) grps. Results demonstrate tt MFMA SM results in a signif increase in sEMG erector spinae isometric MVC muscle output & indicate tt altered muscle function may be a short-term therapeutic effect of MFMA SM.

Dishman, DC., Bulbulian. Comparison of effects of spinal manipulation and massage on motoneuron excitability. Electromyogr Clin Neurophysiol; 2001 41(2): 97-106. Study compares motoneuron inhibition after SM or massage (MA). Both SM & MA have been reported to produce short-term inhibition of motoneurons. Asymptomatic Ss randomized to SM, MA or control (ctl) grp. Tibial nerve H-reflex amplitudes were obtained prior to & after lumbosacral SM or paralumbar & limb MA.
With SM there was a significant decrease in H-reflex max immediately following SM which was maintained for up to 30 sec post-SM. T decrease in H-reflex max values reflects decreases in alpha motoneuron pool excitability. SM effects on motoneuron excitability are persistent post-treatment to segmentally related muscles. There was no such decrease with either MA or in t controls. Findings demonstrate tt SM leads to short-term inhibitory effects on motoneuron excitability to a greater magnitude than MA. Findings clearly show tt t impulsive, high velocity thrust of SM leads to persistent inhibition of alpha motoneurons. This attenuation likely occurs as a response by jt MRs to t velocity, force & direction of SM. Although, t clinical consequence of attenuation of motoneurons is unknown, it is proposed tt reduced excitability produced by SM may disrupt t so-called 'pain-spasm-pain' cycle. SM may assist in t disruption of t cycle to a greater degree than does MA.

Kelly DD, Murphy DC, PhD, Backhouse DC. JMPT 2000;23(4):246-251. Study uses a mental rotation reaction time test to measure SM effects on cortical processing to see if cortical processing, measured by response time is altered by SM. Mental rotation reaction time tests require Ss to judge if an object is in its normal orientation or its mirror image. T task is complex when images are presented at varied angles. Reaction time increases as t angular disparity increases, suggesting tt Ss mentally rotate t object into its normal position before responding. This requires more cortical processing than a simple recognition test & has a longer central processing component. Rotation reaction time may demonstrate t effects of interventions tt affect cortical processing vs peripheral neuromuscular changes tt affect mov't time. 36 chiro students w upper cervical subluxation (based on static & motion palpation) were randomized. 18 Ss in (experimental grp) received a toggle recoil upper cervical adjustment & 18 ctls rested for 2 minutes & then were retested. Ss responded "N" for normal or "B" for backward when presented w t capital letter "R" in either normal or mirror-reversed orientation, both randomly presented at angles of 0 deg, 45 deg, 90 deg, 135 deg, 225 deg, 270 deg, & 315 deg for 80 stimulus presentations. T reaction time was compared to evaluate t change in cognitive processing. Results: T average decrease in reaction times in t experimental grp was 98 ms, a 14.9% improv't,, whereas t ave decrease in th ctl rp was 58 ms, a 8.0% improv't. Results demonstrate a signif improv't for both grps. T reaction time improv't of t experimental grp was signif greater than tt of t control grp. A decrease in reaction time occurred in both grps, but t significantly greater improv't in reaction time for t experimental grp suggests tt t upper cervical adj may have resulted in an effect on cognitive function beyond tt of a learning effect alone. Conclusion: Study demonstrates a signif improv't

in cognitive function, as measured by an improved reaction time to a mental rotation task after upper cervical adjustments. More research is needed to investigate t mechanism of these effects.

Licht, P. MD, PhD. Vertebral artery blood flow during chiropractic treatment of the cervical column. PhD Thesis. Odense University, Denmark 2000: 67. Cervical manipulation had a modest effect on vertebral artery volume blood flow, median maximal increase of 20%, in pigs wh increased for 20 -40 sec & then returned to baseline values. We measured flow velocity & volume blood flow in t human vertebral artery by non-invasive color-duplex technique before & after SM & found no change. A short lived effect similar to these experimental findings could have passed undetected in t human study because we measured flow velocity only twice, immediately before & 3 minutes after SM. However, we assumed tt flow changes of similar magnitude as in t pig study would not be of clinical relevance.

Müller SV et al. Effects of PR stim on cognitive processes in Pts after TBI. Arch Phys Med Rehab 2002; 83(1): 115-121. 11 Pts w normal intelligence but w traumatic brain injury (TBI) & slowed cognitive processing were matched w 11 healthy, age matched ctls. Ss were examined w event-related potential (ERP) - voltage fluctuations tt can be recorded noninvasively from t scalp - during a choice–reaction-time task, choosing between even & odd digits. Trials w & w/o vibratory stimuli (PR stimulation) applied to t left forearm were done. In the choice–reaction-time task, latencies were longer in TBI Pts, but were shortened by vibratory stimuli. Ctls were not affected by vibratory stimuli. Findings support t hypothesis tt pathologic cognitive processes after TBI can be improved by PR stimulation. Muscle vibration has positive effects on pathologically slowed cognitive processes. Vibration sped up t detectability of targets & enhanced accuracy. Slowed motor & cognitive processes in TBI may be caused by deficient sensorimotor cortical activation resulting from disturbed thalamocortical gating. T thalamus plays a crucial role because it's an important gating & integration station between cortical & subcortical signals. Vibratory stimuli may overcome thalamic inhibition & improve thalamocortical activation resulting in enhanced cognitive functions. If PR stim induces short-term cortical plasticity by coactivating input patterns, is it possible to induce long-term cortical plasticity by long-term stim? More need to be known about long-term effects of vibration & possible persisting improv'ts in cognitive processing.

Brumagne et al. Spine 2000;25(8):989-94. The role of paraspinal muscle spindles in lumbosacral (LS) position sense was tested by reproducing sacral tilt angles w & w/o lumbar paraspinal muscle vibration in 23 LBP Pts w mechanical LBP & in 21 ctls. Results: Repositioning accuracy was lower in the LBP Pts than ctls. LBP Pts have less refined position sense & lower acuity in repositioning t back presumably because of altered paraspinal muscle spindle feedback & central processing of this sensory input. Precise paraspinal muscle spindle input is essential for accurate positioning of t pelvis & LS spine. LBP Pts errors in repositioning accuracy are likely to originate from distortion in t central representation of LS spine posture.

Rearrangement of t internal representation of t body is proposed as a cause of disorders such as idiopathic scoliosis. LBP may be caused by deficits in spinal reflexes. Motion & stabilization of t spine are based on a complex reflex activation system in wh PRs in t anulus, facet jts, ligs, & muscles initiate various reflex motor patterns. Deficits in PR input may change perception & reorganize spinal motor reflexes so they no longer protect t spine from mechanical injury. Indahl suggests tt restoring t reflex system must be a focus of t LBP Tx regimen. Reduced PR acuity may be a precursor to back injuries, increasing t risk of developing LBP. Interventions tt enhance PR acuity may aid in recovery & reduce t likelihood of recurrence of chronic LBP.

Basmajian, MD & Nyberg, PT, MSc. Rational Manual Therapy. William s& Wilkins 1993: 451-
467. Capsular or ligamentous injury results in loss & deactivation of mechanoreceptors. The proprioceptive role of the affected segment is adversely affected. Spinal manipulation may help activate inactive receptors & improve postural & kinesthetic awareness. Reviving inactive mechanoreceptors & restoring proprioceptive control reduces the chance of reinjury & hence is an important consideration in preventive care.

Gillette, MS. Manual Med 1987;3:1-14. Adjustive force (ave 180 Newtons) was more than enough to stimulate every type of mechano & nociceptor in all tissues through which the force is transmitted, thereby generating a marked afferent barrage of the CNS.

Vernon, DC JMPT 1986;9(2):115-123. Mechanisms of Pain Relief with Adjustments. SM will cause stimulation of the dorsal columns stimulating supraspinal mechanisms of pain control including endorphin production via the hypothalmus-pituitary axis, & via the central raphe as well as segmental stimulation of met-enkephalin.

Segmental Control of Nociception

Cramer, DC, PhD, Darby SA, PhD. Top Clin Chiro 1996;3(3):1-8. Neurotransmission of pain can be modulated at the segmental level - the **Gate Control Theory**. Increased activity of large-diameter, low-threshold MR afferents competitively inhibit transmission of NC to higher centers. Inhibition of NC neurons is due to interneurons in lamina II (substantia gelatinosa) which use enkephalins as neurotransmitters. These neurons receive excitatory input from large diameter fibers &, in turn, inhibit projection (spinothalamic tract) neurons. **Supraspinal Control of Nociception:** Descending pathways can also modulate NC input. The periaqueductal gray matter (PAG) of the midbrain projects to the nucleus raphe magnus. From here serotonergic fibers in the dorsolat funiculus of the spinal cord (raphe-spinal tract) descend & synapse on neurons in the superficial dorsal horn (lamina I & II). This is the region that receives input from NC fibers & is also the origin of the spinothalamic tracts. This area is also involved with segmental modulation of NC. Descending fibers synapse with inhibitory inter-neurons containing enkephalin. The inhibitory

interneurons are close to both primary NC afferents & tract neurons. The NC afferent endings & the dendrites of the tract neurons both contain opiod receptors. Release of opiod peptides from inhibitory interneurons blocks transmission of NC by 1) binding to receptors & blocking release of neurotransmitters like SP from the primary afferents and by 2) directly synapsing with the postsynaptic membrane of the tract neuron. Endogenous opiods peptides found in the brain can activate the descending system.

Gating Mechanisms for Pain Modulation: MRs transmit thru large myelinated fibers & compete with and block pain at the substantia gelatinosa stimulating t release met-enkephalin which inhibits transmission of pain impulses to the central nervous system, closing the gate in the Substantia Gelatinosa. Nociceptors (NCs) w Substance P as a primary neurotransmitter inhibit substantia gelatinosa cells, inhibiting the release of met-enkephalins which, doesn't block the central transmission of pain, therefore the gate is open. **Counterirritants**: various forms of stimulation which selectively stimulate mechanoreceptors without stimulating nociceptors, thus help block the central transmission of pain. They include: massage, acupuncture, spinalators, ultrasound, TENS, heat, cold. Adjustments also work as a counterirritant, because t thrust stimulates many populations of sensory receptors, but this is only a side effect. The central goal of restoration of motion by chiropractic adjustments permits the previously immobile joint which was generating very little MR input when immobilized to now generate its own ongoing MR input because now it's movement is restored. This allows the body to dampen its own pain input & may result in long term pain relief.

Effects of normalizing proprioception & fine motor tuning: Results in improved sensorimotor function:

1. Enhanced kinesthetic perception, agility, balance
2. Increased range & symmetry of motion
3. Improved joint stability
4. Better coordination & balance of muscle tone
5. More symmetrical load distribution, less localized biomechanical stress
6. Improved control, coordination
7. Optimized peak performance
8. Reduced risk of injury & degeneration

Subluxation: (AKA Functional Spinal Lesion, Articular Dyskinesia, Dysfunctional Joint, Manipulable Joint Lesion). Joints which have disturbed neurology including disturbed patterns of sensory input & abnormal motor programs. These changes result in disturbed kinematics, joint stability, range of motion, symmetry of motion, and symmetrical muscle tone & balance. Subluxations also have abnormal mechanical restrictive barriers which further disturb joint mechanics & kinematics, restrict range of motion, and cause asymmetrical load distribution. Such joints disrupt the segmental order mechanically & neurologically. This is because the spine only works multisegmentally & requires the coordination & cooperation of multiple

segmental levels, joints and muscle groups. Local or segmental problems disrupt the multisegmental order & function.

Adjustment: a controlled input of force on a specific contact point in a specific line of correction in order to overcome abnormal restrictive barriers in or around a joint that are limiting or confining its ROM. The adjustive force takes the joint beyond its limited or restricted ROM back toward its full ROM, stimulating many populations of neurologic receptors in the process. The adjustive thrust may initiate protective muscular reflexes important in preventing joint degeneration & instability. The biomechanical and neurological effects of the adjustment help restore normal function, range of motion, sensorimotor coordination & control, pattern of motion, biomechanics, load distribution and joint neurology. This helps re-establish the normal biomechanical & neurologic segmental order, restoring smooth, harmonious function.

Sympathetic changes in response to nociceptive input
Coote JH, (Dept Physio). In Korr(ed). Neurobiologic mechanisms of manip therapy 1980; 91-127: Nociceptive input from cutaneomuscular system produces increases in sympathetic outflow of 200%-300%. Mechanoreceptive input reduces sympathetic outflow.

Goff, EdD. Chiro: J Chiro Res & CLin Investigation 1991;7(1):4-9. Cervical adj reduced frontalis muscle tone by 27%. T frontalis is a good indicator of general muscle tone. Adj may reduce general muscle tone.

Sato, MD, PhD. JMPT 1984;7(3):141-55. Mechanical low force applied to T11-12 resulted in decreased blood pressure, heart rate, decline in adrenal activity.

Monk, Green, Pert, PhD. Massage Ther J 1994; Fall: 64-72 & Horrigan, Pert, PhD. Alternative Therapies 1995;1(3):70-76. Neuropeptides are the biochemical substrate of emotions.

Pert CB, PhD, Dreher HE, Ruff MR, PhD. The psychosomatic network: foundations of mind-body medicine. Altern Therapies 1998;4(4):30-41. Locations inside & outside t brain were found to be "nodal points" of neuropeptide receptor distribution. T dorsal horn of mammalian spinal cord, where neurons transmitting information from glands, skin, & other peripheral organs first make synaptic contact w t CNS is enriched w virtually all neuropeptide receptors. T entry point w/i t CNS for filtering somatosensory info is replete w neuropeptide receptors & similar nodal points were found in virtually all locations in t brain where sensory info enters t nervous system.

Bogduk, MD, PhD. In Jayson (ed). The lumbar spine & back pain. Churchill Livingstone, Edinburgh 1992; 4th edition; Chapter 4: 61-88. There is no evidence that back pain can be caused by nerve root irritation in the absence of radicular pain, if it

all. Fewer than 30% & perhaps as few as 5% or 1% of LBP can be attributed to nerve root irritation due to disc herniation. It is therefore, illegitimate to focus any discussion about back pain on nerve root irritation & its causes. Back pain & sciatica are not synonymous. Back pain & somatic referred pain imply a somatic origin of pain.

Bogduk, MD, PhD. In Grant R. Physical therapy of t cervical & thoracic spine (2nd ed). NY, Churchill Livingstone 1994:65-76. There is no known mechanism whereby nociceptive afferents can be selectively affected by lesions tt cause root compression. Such lesions indiscriminately affect both large diameter afferent fibers (touch, vibration & proprioception) & small diameter fibers (nociceptive). Both compression & ischemia affect large diameter fibers sooner than small. Therefore, nerve root compression cannot be t mechanism of symptoms, if pain is t only feature. Any radicular pain must to some extent be assoc w signs or symps of conduction block or ischemia of t large diameter fibers in t affect root. Consequently, nerve root compression cannot legitimately be deemed to be t mechanism responsible for symps unless numbness, weakness, or paresthesia is present.

Tissue Injury and Repair

Acute Macrotrauma: Force applied one time exceeds tissue's maximal failure load or biomechanical tolerance results in tissue damage that may affect many different types of tissue simultaneously depending on by how much the force exceeds tissue tolerance. Massive release of chemical mediators results. This results in marked loss of function, severe swelling, acute inflammatory pain, obvious clinical signs & symptoms.

Leadbetter, MD. Clinics in sports med 1995; 14(2):353-410. Acute athletic trauma is assoc w vascular disruption, tissue necrosis or destruction & hematoma. The intense chemical activity & exudation result in inflam, edema, & tissue hypoxia can extend beyond the initial injury defining a zone of secondary injury.

Repetitive Strain (Overuse Syndrome or Cumulative Trauma Syndrome). Repetitive, sustained, or cyclical forces below tissues maximal failure load but applied enough times results in an accumulation of microdamage leading to tissue injury. Most commonly occurs with an abusive (excessive) athletic training program or with repetitive tasks at work. Tissue fatigue limits are exceeded. Damage accumulates faster than the body's ability to repair it. The same chemical mediators are released as with macrotrauma but smaller amounts are released over a longer period of time. This results in a somewhat different clinical presentation: pain onset & loss of function is more gradual developing over a period, usually, of several days. Loss of function, swelling & pain are not as disabling but may increase to a point of severe loss of function.

Renstrom, MD, Johnson, MD. Sports Med 1985;2:326-333. T ground reaction force at mid-stance in running is equivalent to a vertical force approximating 250-300%

bodyweight. T runner absorbs at ground contact a total of 440,275 lbs on each foot per mile. A runner who runs 100 miles/wk is subjected to 1,144,000,000 lbs/foot/yr. Even small biomechanical abnormalities can result in a significant concentration of stress & load.

Bamberger M, Yaeger D.. Sports Illustrated 1997; April 14: 60-70. Bob Goldman, MD has conducted this survey every 2 yrs since 1982 & has gotten more of less t same response each time. A poll of 198 sprinters, swimmers, powerlifters & other athletes, mostly US Olympians: "You are offerred a banned performance-enhancing substance that comes with two guarantees: 1) You will not be caught. 2) You will win every competition you enter for the next 5 yrs, and then you will die from side effects of t substance. Would you take it?"More than half the athletes said yes.

Outerbridge, MD & Micheli, MD. Clinics in Sports Med 1995; 14(3):503-516. It's estimated that male elite swimmers move each shoulder through a full stroke about 400,000 times in a season & female swimmers as much as 660,000! This leads to chronic irritation producing pain & dysfunction typical of "swimmer's shoulder."

Leadbetter, MD. Clinics in sports med 1995; 14(2):353-410. Sports induced inflammation is initiated by injury or disruption of tissue exposed to excessive mechanical load or use. The inflam may resolve or become a major part of t athlete's problem. Cell perturbation, like cyclic loading, results in intermittent hypoxia & inflammation. In overuse injury, inflammation disrupts cell membrane phospholipids wh are degraded to arachidonic acid & further metabolized to form biologically active substances including PGE-1 & 2, prostacyclin, thromboxanes & leukotrienes. Acute evolves into chronic inflammation because continued abuse of load & irritation may repeatedly stimulate the release such substances.

Inflammatory Cascade, NSAIDs, COX2 Inhibitors

Leadbetter, MD. Clinics in Sports Med 1995; 14(2):353-410. The inflammatory cascade. Tissue damage due to acute trauma or repetitive hypoxia result in cell membrane disruption & t release of accessible lipids. Corticosteroids blocks the action of phospholipase but retards wound healing, tissue maintenance & induces tissue catabolism. NSAIDs block cyclo-oxygenase but not lipo-oxygenase or phospholipase and block both PGE-1 & PGE-2.

Nature Medicine 1999; 5(6):621-622. COX-2 Inhibitors - Is there caus for concern? Cox-2 inhibitors can distinguish isoenzymes Cox-2 from Cox 1 & reduce risks of bleeding & ulcers. Celebrex & Vioxx.

Beiner JM, MD et al. Am J of Sports Med 1999;27(1):2-9. T effect of an anabolic steroid (nandrolone decanoate) & a corticosteroid (methylprednisolone) on injured, healing muscle (a partial thickness crush injury) in a muscle contusion model in rats. At day 7 t corticosteroid muscles were signif weaker than t control muscles. At day 14, t

corticosteroid muscles were totally degenerated, w disorganized muscle fiber architecture. Results indicate tt corticosteroids cause irreversible damage to healing muscle including disordered fiber structure & a marked diminution in force-generating capacity. Despite t fact tt corticosteroids have repeatedly been shown to be catabolic & inhibit t healing process, they continue to be used clinically to treat muscle contusion injuries, injected into t site of injury to relieve pain & expedite a player's return to active status.

Wiesel S, MD. FDA takes the wind out of COX-2 drugs. Backletter 1999;14(2):18-19. T COX-2 inhibitors haven't lived up to their hype as an anti-inflammatory & analgesic tt are virtually free of t serious adverse side effects assoc w traditional NSAIDs. FDA recently approved Celebrex (Searle). But FDA determined tt studies have not yet proven Celebrex causes less clinically signif GI bleeding than NSAIDs on th market. Until such studies are done, t drug labeling for Celebrex will include t standard warning for all NSAIDs including risk of GI ulceration, bleeding, & perforation. T label currently states tt "serious GI toxicity such as bleeding, ulceration, & perforation of t stomach, small intestine, or large intestine, can occur at any time, with or without warning Sx." T label warns tt Celebrex is no safer than other NSAIDs for Pts w kidney problems. Further studies involving thousands of Pts would be necessary to prove COX-2 inhibiotors actuallyr educe t risk of clinically signif bleeds.

Wiesel, MD. Celebrex cited for misleading TV Ads. Backletter. 2001; 16(1): 8. "Celebrate, celebrate, Do what you like to do." T FDA doesn't like to way Searle is promoting Celebrex (celecoxib). T FDA says Searle's direct to consumer television advertisements are misleading & violate FDA rules. The 60 sec TV ad is misleading because t totality of images, music, & audio overstate t efficacy of Celebrex," wrote an FDA's Pharm D, of t Division of Drug Marketing, Advertising & Communications. This suggest tt Celebrex is more effective than has been demonstrated by evidence." FDA ordered Searle to immediately cease distribution of t ads. Cox-2 inhibitors such as Celebrex are no more effective than other NSAIDs in relieving MS pain according to t FDA. Although Cox-2 inhibitors are widely touted to prevent serious GI bleeds, t FDA has not accepted this claim & doesn't allow manufacturers of COX-2 inhibitors to advertise this putative benefit in their product labeling or advertising.

Wiesel, MD. Are COX-2 agents safer than other NSAIDs? FDA weighs evidence. Backletter 2001;16:54. FDA's arthritis advisory committee concluded tt Celebrex is no safer than other NSAIDs. Its verdict on Vioxx was more complex. Although Vioxx is easier on t stomach than naproxen, it is also assoc w twice as many cardiovascular deaths & thrombotic events. "T risk reduction in relevant GI events didn't translate into an overall safety benefit of Vioxx over naproxen. There was also no significant difference among grps in renal & cardiac events. The advisory committee concluded tt Celebrex & Vioxx do not provide t cardiovascular prophylaxis effects of aspirin. "Celebrex didn't protect against GI catastrophies. So where's t advantage? Efficacy? Safety? Cost? There is none." says Kenneth Brandt, MD, chief of rheumatology at Indiana U & a former member of t FDA's Arthritis Advisory Committee. In terms of

effectiveness, Celebrex offers no consistent advantage over conventional NSAIDs. Celebrex was comparable to diclofenac & ibuprofen w no consistent clear trends suggesting superiority. It would appear tt celecoxib doesn't offer a consistent advantage over t other NSAIDs in terms of efficacy or effectiveness in OA or RA." says FDA's James Witter, MD - Medical Officer.

Class action law suit against Vioxx. Tri-Valley Herald 2001; Nov 26

Mukherjee, D e t al. Risk of cardiovascular events associated with selective COX-2 inhibitors. JAMA 2001; 286(8):954-9. A lit search on the use of COX-2 inhibitors published between 1998 & 2001 yielded 2 major randomized trials, the Vioxx Gastrointestinal Outcomes Research Study (VIGOR: 8076 patients) & the Celecoxib Long-term Arthritis Safety Study (CLASS: 8059 patients), & 2 smaller trials with approximately 1000 patients each. Results from VIGOR showed that the relative risk of developing a thrombotic cardiovascular event (myocardial infarction, unstable angina, cardiac thrombus, cardiac arrest, sudden death, ischemic stroke, and TIA) with rofecoxib compared with naproxen was 2.38. There was no significant difference in cardiovascular events between celecoxib & NSAIDs in CLASS. The myocardial infarction rates for COX-2 inhibitors in both VIGOR and CLASS were significantly higher than in the placebo group of a recent meta-analysis of 23,407 patients. The data raise a cautionary flag about the risk of cardiovascular events with COX-2 inhibitors.

Friedman MA, MD et al. The safety of newly approved medicines. JAMA 1999;281:1728-1734. Duract's incidence of serious hepatotoxicity was @ 1 in 20,000 Pts who took t drug longer than 10 days. To reliably detect this toxic effect, databases would have to include some 100,000 Pts. Limitations of US clinical testing: Trials may exclude certain Pts: 1) elderly, 2) t very young, 3) those too sick, or 4) those taking certain other meds. Any special vulnerability to adverse events in these grps will be missed. Although drug labeling may warn about t lack of info in such Pts, an MD may decide to Tx t Pt. Postmarketing surveillance & trials may be needed to define risks to subgroups, w long-term use, or when used w other meds. A drug tested in a few thousand people may be administered to several million w/i t first yrs of marketing.

The National Institute for Health Care Management Research and Educational Foundation. Barents Group LLC. Factors affecting the growth of prescription drug expenditures 1999; July 9. In 1998 average price per Tx for new drugs (introduced in 92 or later) was $71.49, more than twice t ave $30.47 for previously existing drugs. In some categories, new drugs are many times more expensive than older products. Imitrex cost > 7X t ave price of older drugs in its category. At Costco's Pharmacy for 30 pills of **Ibuprophen** (generic Motrin): **$5.99; Celebrex: $64.27;** At Railey's Pharmacy for 40 pills: **Ibuprophen** (generic Motrin): **$10.09; Celebrex :** $109.49

Schultz S. When drug costs sting, look for relief. US News & World Report 2001; June 4: 69-70.

Data from Rxaminer.com show sharp differences in monthly costs for prescription medications.
High Cholesterol Drugs - cost per month: Zocor 20 mg tablet/ once a day $301; Baycol 0.4 mg tablet/ once a day $130; Lipitor half 20 mg tab/once a day $117; Arthritis Drugs - cost per month:
Celeberx 200 mg tab/once a day $189; Mobic 7.5 mg tab/once a day $157; Ibuprofen 800mg tab/3X a day $33; Depression Drugs - cost per month: Prc 20mg/once a day $203; Celexa half 40 mg tab/once a day $83; Nortriptyline 75 mg cap/once a day $44.

Pert CB, PhD. The Molecules of Emotion. NY, Scribner 1997. Prozac, Zoloft: antidepressant drugs are t ubiquitous medical solution to t epidemic of depression. T drugs work at t synapse, blocking reuptake of serotonin, allowing excess serotonin to flood t receptors. What is going on in other parts of t brain & body when these drgus are used? T intestines, for example, are loaded w serotonin receptors. What happens when these receptors get flooded w serotonin as result of taking Prozac? It's known tt Pts on Prozac often have GI disorders. What might be happening to cells in t immune system tt also have these same receptors? Could this affect t ability of natural killer cells to attack mutated cells? No one's doing research to explore these kind of effects. Certainly not t pharmaceutical companies.

Gibbs Nancy. Time 1998; Nov 30: 86-96. Childhood depression is common: about 3.4 million Americans under 18 are said to be seriously depressed. That's a lot of potential consumers for Prozac, Zoloft, Paxil. In North America up to to 800,000 antidepressant prescriptions were written for children last year. Eli Lilly is conducting clinical studies in under 18 & may have just the product for this booming new market: liquid Prozac flavored a tasty peppermint.

LeFever. The extent of drug therapy for attention deficit-hyperactivity disorder among children in public schools.ö e. a. (1999). Am J Public Health 89(9): 359 - 364. Experts contend tt 3 - 5% of US pediatric pop suffers from ADD. NIH recognized t possible over Dx & over Tx of ADD may be an important public health issue. A study of 30,000 grade school students in 2 US cities (grades 2 - 5) eval t extent of med use for ADD. Results: t percentof students receiving ADD meds was similar in both cities (8% & 10%) - 2 to 3X higher than t expected rate of ADD. Meds were used 3 times more frequently on boys than girls & 2X more on white than black kids. By 5th grade, 18 - 20% of white boys were receiving meds.

Ritalin Fraud: May 2000. (www.ritalinfraud.com) The law firm of Waters & Kraus is filing a class action lawsuit against Ciba Geigy Corporation, Novartis Pharmaceuticals Corporation, Children and Adults With Attention-Deficit/Hyperactivity Disorder (CHADD), and the American Psychiatric Association. Waters & Kraus' usual practice concerns toxic exposure and cancer cases, but the pattern & practice of improper conduct on the part of the defendants in this case rivals that of the asbestos corporate defendants and tobacco companies in other cases. The allegations are based on fraud and conspiracy. From 1955 thru 1995, the

exclusive manufacturer/supplier of Ritalin in this country was defendant Ciba-Geigy. In 1996 Ciba merged with Sandoz to become Novartis Pharmaceuticals. Ciba/Novartis planned, conspired, and colluded to create, develop and promote the diagnosis of Attention Deficit Disorder (ADD) in a highly successful effort to increase the market for its product Ritalin. In addition, Ciba/Novartis took steps to promote and dramatically increase the sales of Ritalin by: 1. Actively promoting the concept that a significant percentage of children suffer from a "disease" which required narcotic treatment. 2. Actively promoting Ritalin as the "drug of choice" to treat ADD. 3. Actively supporting groups such as CHADD financially so that they would promote increasing implementation of ADD Dx as well as directly increasing Ritalin sales; 4. Distributing misleading sales & promotional literature to parents, schools and others in a successful effort to further increase the number of diagnoses and persons prescribed Ritalin. CHADD received contributions from Ciba/Novartis for many years including $748,000 in the period 1991 to 1994 alone. CHADD deliberately made efforts to increase the sales & supply of Ritalin (methylphenidate) available in t USA & to reduce or eliminate laws and restrictions concerning its use in t USA all to the financial benefit of Ciba/Novartis. Ciba/Novartis made such financial contributions with the purpose of advertising and promoting sales of Ritalin – an internationally controlled substance. Ciba/Novartis has thus repeatedly violated Article 10 of the United Nations Convention on Psychotropic Substances. CHADD's activities have led to significant increase in the amount of Ritalin taken by school children and directly resulted in enormous profits to Ciba/Novartis. Parents, the school districts and other interested parties are unaware that use of Ritalin can cause a significant number of health problems. In addition, it is not generally known that use of Ritalin precludes a child from ever joining the U.S. military because Ritalin is a Class II controlled substance, along with morphine and other amphetamines.

Landry, MD, PhD. Immunotherapy for cocaine addiction. Scientific American 1997; Feb: 42-45. Attention Deficit Hyperactivity Disorder. **Barkley**, MA. PhD. Scientific American 1998; Sept: 66-71. Neurotransmitters released at a synapse stimulate t post-synaptic neuron to discharge. To prevent excessive signaling, t first neuron actively takes up t transmitter from t synaptic cleft. Ritalin acts by inhibiting t dopamine transporter, increasing t time tt dopamine has to bind to its receptors on postsynaptic neurons. Cocaine interferes w this system by preventing transport proteins tt carry dopamine from t synapse back into t presynaptic cell, so too much dopamine remains in t synapse. T excess dopamine stimulates t reward pathway & reinforces cocaine use.

Zito, PhD et al. Trends in the prescribing of psychotropic medications to preschoolers. JAMA 2000; 283(8): 1025-1030. Psychotropic med-ications (stimulants, antidepressants, & neuroleptics) prescribed for preschoolers (2 - 4 year olds) increased dramatically between 1991 & 1995. For some types of psychotropic drugs there was as much as a 3 fold increase in prescriptions in just 5 years!

Thomas. Parents pressured to put kids on drugs. Courts, schools force Ritalin use.

USA Today 2000; Aug 8: 1D, 10D. Public schools are accusing parents of child abuse when they balk at giving their kids drugs such as Ritalin, & judges are beginning to agree. Parents are medicating their children for fear of having them hauled away by authorities. An Albany, NY couple put their 7 yr old son back on Ritalin after the child's school district called protective services, alleging child abuse, when the parents said they wanted to take their son off Ritalin because of side effects (sleeplessness & loss of appetite). A family court ruled tt t parents must continue medicating him for ADD. This case is t first pitting educators against parents tt progressed to a judge's ruling. Child protective services in Millbrook, NY visited a couple to check out anonymous allegations of "medical neglect" after they took their son off Ritalin & Dexadrine because they made him withdrawn. With t introduction of Paxil the child began to hallucinate. There are similar cases in Boston. Often divorced parents disagree on medicating kids and judges have recently begun ruling in favor of parents who want to medicate. But should parent be forced to put their kids on drugs? "We as a society do t same thing w parents who don't immunize their kids. T risk for severe ADD going untreated is not trivial." says a psychologist. T long-term effects of children taking stimulants have not been studied. About 3.8 million kids are Dx w ADD & at least 2 million are on medications for it.

Slatyer, MD, PhD. Am J of Sports Med 1997;25(4): 544-553, Piroxicam in acute ankle sprain.
364 Pts w acute ankle sprains were randomized to Tx w either piroxicam or placebo. Ss Tx w piroxicam had less pain, were able to resume training more rapidly (in 2.74 vs 8.57 days), & were found to have increased exercise endurance on resumption of activity. Nausea was t only side effect. Findings suggest tt t early use of piroxicam saved money. Pts Tx w piroxicam had greater instability, less ROM & increased swelling. It is possible tt t analgesic effects of NSAIDs actually allows Pts to resume activity prematurely, before there had been sufficient tissue healing to prevent further swelling & interference w healing tt leads to increased instability & reduced ROM.

Kibler, MD. Clinics in Sports Med 1995;14(2):447-457. Repetitive overload injuries in soft tissues reveal many blood vessels & a large am't of unorganized fibrotic tissue - evidence of a failed healing response to chronic low grade injury. This immature tissue lacks t capacity to mature to beneficial tissue. T repair process has largely been turned off. T disorganized nature of t tissue shows tt it cannot respond to normal biologic signals for repair & recovery, collagen orientation, or maturation - reflecting a process tt characterizes a degenerative condition. These degenerative changes may be due to mechanical, tensile, vascular or hypoxic causes. T result is a cell incapable of making matrix of normal quality & quantity.

Degeneration: A variation of repetitive strain syndrome in which there is a gradual accumulation of microdamage over an extended period of time. Damage is due to repetitive, high, localized biomechanical stress (force per unit area) as result of poor or uneven load distribution in response to normal movement and load bearing over

extended periods of time. Tissue fatigue limits are exceeded and damage accumulates more quickly than the body can repair it. This process is accelerated in abnormal tissues which have reduced biomechanical properties including a decreased ability to recover/regenerate after damage. Abnormal tissues may become injured by exposure to forces normally encountered in daily living, and because of their decreased mechanical properties, will be less able to tolerate the higher or more sustained forces that occur with more strenuous activities such as athletics. The same chemical mediators are released as occurs with macrotrauma and repetitive strain, but with degeneration only very small amounts are released over very prolonged periods of time because there is only a very small amounts of tissue damage gradually occurring. If the amount of chemicals released are small enough, degeneration is painless. If slightly more is released, patients experience discomfort or achiness, minimal loss of function & subclinical inflammation. Clinical presentation is complicated by scar tissue, & bony changes, disc atrophy & other degenerative changes.

Buckwalter, MD, Lane Nancy E, MD. Am J Sports Med 1997; 25(6):873-881. Joint subluxation or incongruity prevent normal distribution of contact stress over the articular surface. These abnormalities increase peak stresses on some regions of the articular surface & decrease stresses on other regions. As a result, normal physical activities may produce damaging levels of peak contact stress in focal regions of the joint surface, leading to articular cartilage injury & joint degeneration.

Bishop, DC, PhD, MD. JMPT 1993;16(5):300-305: If joint mechanics are altered, the cells (chondrocytes & fibroblasts) responsible for biosynthesis of proteoglycans will be stimulated to change the composition of the extracellular matrix to produce connective tissue better suited for the new mechanical demands. In a joint that has been severely injured the connective tissue may change sufficiently to permanently alter the function of the joint & thus predispose to premature degeneration &/or further injury. **By the same mechanism, maintaining normal joint mechanics may act to prevent premature degeneration &/or joint injury**.

Key to Abbreviations

ABP - acute back pain
adj - adjustment
ADLs - activities of daily living
AHCPR - Agency for Health Care Policy & Research
ALBP - acute low back pain
CAM - complementary & alternative medicine
chiro - chiropractic
CLBP - chronic low back pain
CSA - cross-sectional area
ctls - controls
DOs - osteopaths
DTRs - deep tendon reflexes
Dx - diagnosis
FCLB - Federation of Chiropractic Licensing Boards
F-U - follow-up
GPs - General Practitioners
grp(s) - group(s)
HAs - headaches
HMOs - Health Maintenance Organizations
HVLA - High velocity low amplitude
Hx - history
Ins - insurance

IVD - intervertebral disc
jts - joints
LBP - low back pain
lig(s) - ligament(s)
MCOs - Managed Care Organizations
med - medical
MMI - maximum medical improvement
mo(s) - month(s)
MO - mobilization
MRs - mechanoreceptors
MS - musculoskeletal
MSAs - medical savings accounts
MVAs - motor vehicle accidents
NCs - nociceptors
NP - neck pain
orthos or orthops - orthopedists
PCPs - Primary Care Providers
PRs - proprioceptors
Pt(s) - patient(s)
P.T. - physical therapy
RCT - randomized controlled trial
RTW - return to work
Rx - treatment (prescription)
SLR - straight leg raise
SM - spinal manipulation
Ss - subjects
Sx - symptoms
t - the
tt - that
Tx - treatment
w - with
WAD – whiplash assoicated disorder
wh - which
yr - year