Palpation of the upper thoracic spine: an observer reliability study.
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Objective: To assess the intra-observer reliability (in terms of hour-to-hour and day-to-day reliability) and interobserver reliability with three palpation procedures for the detection of spinal biomechanical dysfunction in the upper eight segments of the thoracic spine.

Design: A repeated-measures design was used in all substudies.

Setting: Department of Nuclear Medicine, Odense University Hospital, Denmark.

Participants: Two chiropractors examined 29 patients and 27 subjects in the interobserver study; one chiropractor examined 14 patients and 15 subjects in the intraobserver studies.

Intervention: Three types of palpation were done: Sitting motion palpation and prone motion palpation for biomechanical dysfunction and paraspinal palpation for tenderness. Each dimension was rated as absent or present for each segment. All examinations were carried out according to a standard written procedure.

Results: Using an expanded definition of agreement which accepts small inaccuracies (one segment) in the numbering of spinal segments, we found, based on the pooled data from the thoracic spine, kappa values of 0.59 to 0.77 for the hour-to-hour and day-to-day intraobserver reliability with all three palpation procedures. Kappa coefficients were 0.24 and 0.22 for the interobserver reliability with prone and sitting motion palpation and 0.67 and 0.70, respectively, with paraspinal palpation for tenderness.

Conclusion: With expanded agreement we found good hour-to-hour and day-to-day intraobserver reliability with all three palpation procedures, and good interobserver reliability for paraspinal tenderness. The interobserver reliability was unacceptably poor with prone and sitting motion palpation.
Key Indexing Terms: observer variation; reliability; chest pain; thoracic spine; chiropractic.

Clinical considerations in the use of surface electromyography: Three experimental studies.
Gregory Lehman, DC.

Background: The validity and applicability of EMG use in clinical practice is questionable. Differences in the amplitude of the EMG signal between low-back pain populations and controls have been hypothesized, but not sufficiently documented.

Objective: To examine issues of EMG asymmetry and repeatability in low-back pain and healthy populations in three separate studies.

Study Design: Three separate experimental research studies.

Methods: Study #1 examined the intraclass correlation of the EMG signal of the paraspinal musculature at L3 on three separate days during quiet stance using three different normalization techniques: percent maximum voluntary contraction, percent submaximal voluntary contraction and percent averaged submaximal contractions. Study #2, used a chronic low-back pain population to compare the bilateral asymmetry of paraspinal musculature in segments exhibiting pain and in segments with no pain during quiet stance. A one-way ANOVA was used to compare differences between asymmetry scores in the pain and non-pain groups. In study #3, low-back pain sufferers and controls had the dynamic asymmetry of paraspinal musculature compared during forward bending. A cross-correlation coefficient assessing bilateral muscle activity was calculated for each subject and differences between groups were evaluated using a one-way ANOVA.

Results: Study #1: Subjects showed excellent repeatability (ICC> .75) regardless of the normalization technique. Study #2: During quiet stance no differences were found in bilateral asymmetry between painful and non-painful motion segments. Study #3: No differences existed in bilateral dynamic symmetry for the upper erector spinae; however, differences did exist for the lower erector spinae between groups.

Conclusion: Repeatability of the EMG signal during quiet stance is acceptable; however, bilateral asymmetry may not be a definitive indicator of dysfunction.
The effect of simulating lumbar manipulations on lumbar nucleus pulposus pressures. *(Electronic paper.)*

Bi Sheng; Li Yi-Kai, PhD; Zhao Wei-dong.

**Objective:** To study the effect of different lumbar manipulations on the pressure of the lumbar nucleus pulposus.

**Design:** Experimental study.

**Setting:** Institute of Clinical Anatomy and Biomechanics, the First Military Medical University, Guangzhou, China.

**Subjects:** Seven fresh cadaveric lumbar spines, from L1 to sacrum.

**Interventions:** Lumbar spines were loaded on a Material Test System whose computer quantitative control simulated three manipulations. State A: the lumbar spines were rotated only; State B: the lumbar spines were simultaneously rotated and compressed; State C: the lumbar spines were simultaneously rotated and tractioned.

**Main Outcome Measures:** Pressures of the lumbar nucleus pulposus of L3-4, L4-5, L5-S1 were measured using pressure sensors.

**Result:** Lumbar nuclear pressure for rotation manipulation and compression-rotation manipulation was apparently increased, and the pressures of lumbar nucleus pulposus for traction-rotatory manipulation were reduced or slightly changed.

**Conclusions:** The results of this preliminary research suggest that rotary manipulation of lumbar spine under traction created the lowest pressures and was theoretically the safest of the three procedures.

**Key Indexing Terms:** chiropractic manipulation; lumbar vertebrae; intervertebral discs; nucleus pulposus.
Chiropractic management: Beyond manual care. *(Electronic paper.)*

*Jennifer Jamison, MB, BCh, PhD, EdD.*

**Background:** Chiropractic, recognized for its success in the management of back pain, relies overwhelmingly on manual intervention for its clinical care. Psychoemotional factors are, however, known to profoundly influence the presentation and clinical outcome of back pain patients.

**Objective:** This study describes the psychological profile of chiropractic patients and presents a case for broadening chiropractic’s case management.

**Method:** Eight chiropractors were requested to recruit patients, taking care to include workers’ compensation cases. Patients were requested to complete up to three questionnaires. The first questionnaire was to be completed on admission; the second three weeks later or on discharge, whichever occurred first. A third questionnaire was to be completed by patients still receiving care at three months. Validated questionnaires were used to assess psychological status. Practitioners were asked to document the patient’s level of disability.

**Results:** One hundred and sixteen patients entered the study; 57 percent were acute on admission, and 53% of all patients recruited had been injured at work. Analysis using the Dallas Pain Questionnaire suggested that only two acute nonwork care patients would respond well to medical intervention alone; all other patients also required behavioral intervention. Of the 105 patients who completed the DRAM, 36% were found to be normal, 34% at risk and 30% distressed. Of the 108 patients in this study who completed the DSSI/sAD analysis, 31% were personally disturbed and 40% were psychologically ill.

**Conclusion:** The extent of psychological disease amongst acute and chronic, work care and non work care, chiropractic patients suggests it may be prudent for chiropractors to consider expanding their physical clinical focus to include psychoemotional status.

**Key Indexing Terms:** chiropractic; back pain; psychological state; education.
Expectations of the chiropractic treatment. An investigation of the expectations of new patients consulting a chiropractor and whether chiropractors and patients have similar expectations.

Håkan Sigrell.

Background: There are conflicting views as to whether expectation plays a role in patient satisfaction. No studies regarding the importance of patient expectations have been done in the chiropractic field.

Objective: To investigate the expectations of new patients consulting a chiropractor. Furthermore, to evaluate differences and similarities in expectations between chiropractors and patients.

Design: A questionnaire survey.

Study participants: Thirty chiropractors and 336 patients from 17 private practices throughout Sweden.

Results: Chiropractors and patients expect the chiropractor to find the fault and explain the problem to the patients. Furthermore, they also expect patients to feel better and become free of symptoms. However, the following differences were revealed: patients have lesser expectations of the chiropractic treatment than chiropractors and patients have stronger expectations of being given advice and exercises than chiropractors. There is also a tendency for the patients to expect to get better faster than the chiropractors expect them to.

Conclusion: Although chiropractors and patients have some common goals in relation to the therapeutic encounter, there is also a mismatch in certain areas for some study subjects. It is possible that these differences in expectations influence treatment and outcome negatively. This reinforces the importance of communication between the chiropractor and patients. More research is needed to evaluate whether fulfillment of expectations have an impacts patient satisfaction.

Key Indexing Terms: chiropractic; expectations; patient satisfaction.

Can custom made biomechanical shoe orthoses prevent problems in the back and lower extremities? A randomized, controlled intervention trial of 146 military conscripts.

Kristian Larsen,PT; Flemming Weidich,MD; and Charlotte Leboeuf-Yde,DC,MPH,PhD.
**Background:** Shock absorbing and biomechanical shoe orthoses are frequently used in the prevention and treatment of back and lower extremity problems. A Cochrane review concludes that the former is clinically effective in relation to prevention, whereas the latter has only been tested in one randomized clinical trial, concluding that stress fractures could be prevented.

**Objectives:** To investigate if biomechanical shoe orthoses can prevent problems in the back and lower extremities and if it is possible to reduce the number of off-duty days because of back or lower extremity problems.

**Design:** Prospective, randomized controlled intervention trial. Study subjects: One female and 145 military conscripts, aged 18-24. (25 percent of all new conscripts at a Danish regiment.)

**Method:** Health data were collected through questionnaires at baseline and three months later. Custom-made biomechanical shoe orthoses were provided to all in the study group, to be worn in their military boots, during the three-month intervention period. No intervention was provided for the control group. Differences between the two groups were tested with the chi-square test, and statistical significance was accepted at p<0.05. Risk ratio (RR), risk difference (ARR), numbers needed to prevent (NNP), and costs per successfully prevented case were calculated.

**Outcome Variables:** 1) Any self-reported back and/or lower extremity problems; 2) specific problems in the back, knees, shin splints, Achilles tendonitis, sprained ankle, or other problems in the lower extremity; 3) number of persons with at least one day off duty because of back or lower extremity problems, and total number of off-duty days because of back or lower extremity problems, within the first three months of military service.

**Results:** Results were significantly better in an actual-use analysis in the intervention group for: 1) total number of persons with back or lower extremity problems, (RR 0.7, ARR 19%, NNP 5, and a cost of $98 U.S.); 2) number of persons with shin splints, (RR 0.2, ARR 19%, NNP 5, and a cost of $101 U.S.); 3) number of off-duty-days because of back or lower extremity problems, (RR 0.6, ARR <1%, NNP 200, and cost $3,750 U.S.). In an intention-to-treat analysis, a significant difference was found only for number of persons with shin persons with shin splints, (RR 0.3, ARR 18%, NNP 6, and a cost of $105 U.S.), whereas a worst-case analysis revealed no significant differences between the study groups.
Conclusions: This study shows that it may be possible to prevent certain musculoskeletal problems in the back or lower extremities among military conscripts, using custom made biomechanical shoe orthoses. However, because care seeking for lower extremity problems is relatively rare, it would be far too costly to use this as a method of prevention in military conscripts. It was also noted here that the choice of statistical approach determined the outcome.

Key Indexing Terms: orthosis; lower extremity; low back pain; biomechanics.

A simplified conceptual model of the human cervical spine for evaluating force transmission in upright static posture.

John Dulhunty, DC.

Objective: To develop a simplified graphical model appropriate for the evaluation of proposed theoretical force transmission mechanisms in the upright static cervical spine. The model is used to demonstrate in a visual format the underlying mechanical principles contributing to an optimal mechanical configuration of the cervical spine in upright posture. The model is also used to explore the relative mechanical efficiency of two different force transmission methods.

Method: A graphic model was developed to illustrate relevant force vectors acting on the head and neck in upright posture. This model was used to calculate theoretical static loading on the structures of the neck under various loading conditions due to specific configurations of passive elements and active supportive muscle effort.

Results: From the information gained from the model, a theorized optimal mechanical configuration and theorized role of various components of the cervical spine in static upright posture is presented. The model is used to test the mechanical validity of a concurrent force system utilizing intersegmental muscle force rather than the parallel force system presented in the literature. The alternate models are examined in relation to their predictions and theoretical implications with respect to force transmission in the cervical spine.

Conclusion: A simplified model has been developed that facilitates the graphical representation of forces involved in maintaining static upright posture in the human cervical spine. The model is used to explore the
optimal spinal configuration of the major mechanical components of the neck.

**Key Indexing Terms**: biomechanics; cervical spine; lordosis; neck; model.

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**Comparison of tibial nerve H-reflex excitability following cervical and lumbar spine manipulation.**

*J. Donald Dishman, DC; Brian Cunningham, DC; Jeanmarie Burke, PhD.*

**Background**: Previous investigations indicate that spinal manipulation leads to short-term attenuation of alpha motoneuron excitability, when assessed via the Hoffmann reflex (H-reflex). Past studies, however, are limited to regional effects, e.g., lumbar manipulation effects on lumbar alpha motoneuron activity.

**Objectives**: This study compares and contrasts the effects of cervical and lumbar spine manipulation on the excitability of the lumbar alpha motoneuronal pool in human subjects without low back pain. This study compared the effects of cervical (nonregional) and lumbar (regional) spinal manipulation on lumbar alpha motoneuron pool excitability in healthy subjects. The specific aim of this study was to determine if the inhibitory effects on the lumbar alpha motoneuron pool associated with spinal manipulation are limited to the specific region in which the manipulative procedure was applied, or if rostral (cervical) manipulation can also influence caudal (lumbar) motoneuron excitability.

**Method**: Thirty-six nonpatient, human subjects were utilized to study the effects of cervical and lumbar spinal manipulation on the amplitude of the tibial nerve Hoffmann reflex (H-reflex), recorded from the gastrocnemius muscle. The H-reflex technique allows for an indirect index of motoneuron pool excitability via peripheral nerve Ia afferent fiber stimulation. Reflexes were recorded prior and subsequent to spinal manipulative procedures.

**Results**: Lumbar spinal manipulation attenuated lumbar alpha motoneuronal activity, as measured by amplitude changes of the tibial nerve H-reflex. Suppression of motoneuronal excitability was significant (p<0.05) but transient, with a return to baseline within 60 seconds postmanipulation. Cervical spinal manipulation had no significant effect of lumbar motoneuron activity.

Conclusions: These data indicate that the inhibitory effects of spinal manipulation on motoneuronal excitability are regional, rather than global.
Osteogenesis imperfecta in a weightlifter.

Terry Yochum, DC; Stephen Kulbaba, DC; Richard Seibert, DC.

Objective: To discuss the case of a 42-year-old weightlifter with osteogenesis imperfecta.

Clinical Features: The patient suffered from bilateral acute elbow pain and had a previous history of more than 35 fractures of the spine and extremities.

Intervention: There is no current treatment for osteogenesis imperfecta. Treatment objectives were designed to minimize pain, improve range of motion, and decrease stress on the elbow joints. Nutritional supplementation was utilized to help maintain bone density.

The elbow pain improved with treatment, and the patient has had no new fractures in the last six years.

Conclusion: Although most patients with osteogenesis imperfecta are physically inactive due to the high risk of fracture, some patients with milder forms of the condition may be involved in some athletic activities. Although manipulation is contraindicated in patients with osteogenesis imperfecta, chiropractors may be of service by offering pain relief and rehabilitation in addition to advice regarding nutrition and supplements.

Key Indexing Terms: osteogenesis imperfecta; wheelchair athletics; weightlifting; chiropractic.

Pathologic fracture of metacarpal enchondroma: Case study and differential diagnosis.

Michael McVey, DC, and Norman Kettner, DC.

Objective: To discuss a case of enchondroma initially appearing as a pathologic fracture in a metacarpal bone. The recommended treatment for a pathologic fracture of an enchondroma in the hand is reviewed. Additionally, a reasonable list of differential considerations is presented with accompanying radiographic and advanced imaging characteristics.
Clinical Features: A 25-year-old male chiropractic student suffered from a painful, bruised and swollen thumb following athletic trauma. Radiographs demonstrated a pathologic comminuted fracture of the first metacarpal with resultant anterior angulation of the distal fragment. Fracture occurred through a well-defined, geographic, lucent lesion in the proximal metaphysis consistent with enchondroma.

Intervention and Outcome: Closed reduction of the fracture and casting was utilized. No treatment was administered for the enchondroma. Adequate healing of the fracture took place with residual angulation at the fracture site. Size and extent of the enchondroma was unchanged after fracture healing.

Conclusions: Recommended treatment for a pathologic fracture through an enchondroma in the hand is casting. This allows fracture healing. Curettage of the lesion without packing of the resultant cavity is then recommended. In this case, casting and fracture healing took place without any treatment directed at the enchondroma. The patient was advised of the rationale for undergoing the removal of the enchondroma. Removal was recommended to prevent fracture recurrence secondary to structural weakening. Fracture recurrence is likely due to the unusually high level of mechanical stress from the professional demands of manual treatment.

Key Indexing Terms: enchondroma; pathologic fracture; treatment; hand; neoplasm.

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