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Editorial Staff

Biomechanical and neurophysiological responses to spinal manipulation in patients with lumbar radiculopathy.

Christopher Colloca, DC; Tony Keller, PhD; Robert Gunzburg, MD, PhD

World Federation of Chiropractic 1st Prize Winner

Objective: The purpose of this study was to quantify *in vivo* vertebral motions and neurophysiological responses during spinal manipulation.

Methods: Nine patients undergoing lumbar decompression surgery participated in this study. Spinal manipulative thrusts (SMTs) (~5 ms; 30 N [sham], 88 N, 117 N and 150 N [max]) were administered to lumbar spine facet joints (FJs) and spinous processes (SPs) adjacent to an intraosseous pin with an attached tri-axial accelerometer and bipolar electrodes cradled around the S1 spinal nerve roots. Peak-baseline amplitude compound action potential (CAP) response and peak-peak amplitude axial (AX), postero-anterior (PA) and medial-lateral (ML) acceleration-time and displacement-time responses were computed for each SMT. Within each subject, statistical analysis of the effects of contact point and force magnitude on vertebral displacements and CAP responses were performed.

Results: SMTs (3 88 N) resulted in significantly greater peak-to-peak ML, PA and AX vertebral displacements compared to sham thrusts ($P < 0.002$). SMTs delivered to the FJs resulted in approximately threefold greater ML motions compared to SPs ($p < 0.001$). SMTs over the SPs resulted in significantly greater AX displacements compared to SMTs applied to the FJs ($p < 0.05$). Seventy-five percent of SMTs resulted in positive CAP response with a mean latency of 12.0 milliseconds. Collectively, the magnitude of the CAP responses was significantly greater for max setting SMTs compared to sham ($p < 0.01$).

Conclusions: Impulsive SMTs in human subjects were found to stimulate spinal nerve root responses that were temporally related to the onset of vertebral motion. Further work, including examination of the frequency and force duration dependency of SMT, is necessary to elucidate the clinical relevance of enhanced or absent CAP responses in patients.

Key indexing terms: Chiropractic manipulation; vertebral motion; neurophysiology.

Adverse reactions to chiropractic treatment and their effects on satisfaction and clinical outcomes among patients enrolled in the UCLA Neck Pain Study.

Eric Hurwitz, DC, PhD; Hal Morgenstern, PhD; Maria Vassilaki, MD, MPH; Lu-May Chiang, MS

World Federation of Chiropractic 2nd Prize Winner

Background: Minor side-effects associated with chiropractic are common. However, little is known about their predictors or the effects of reactions on satisfaction and clinical outcomes.

Objective: The objectives of this study are to compare the relative effects of cervical spine manipulation and mobilization on adverse reactions and to estimate the effects of adverse reactions on satisfaction and clinical outcomes among patients with neck pain.

Methods: Neck-pain patients were randomized to receive cervical spine manipulation or mobilization. At two weeks, subjects were queried about possible treatment-related adverse reactions and followed for six months with assessments for pain and disability at two, six, 13, and 26 weeks. Numerical rating scales and the Neck Disability Index were used to measure pain and disability. Perceived improvement and satisfaction with care were assessed at four weeks.

Results: Of 960 eligible patients, 336 enrolled and 280 responded to the adverse-event questionnaire. Thirty percent of respondents reported at least one adverse symptom, most commonly increased pain and headache. Patients randomized to manipulation were more likely than those randomized to mobilization to report an adverse reaction (adjusted odds ratio = 1.44, 95 percent confidence interval = 0.85, 2.43). Subjects reporting adverse reactions were less satisfied with care and less likely to have clinically meaningful improvements in pain and disability.

Conclusions: Adverse reactions are more likely to be reported following cervical spine manipulation than mobilization. Chiropractors may reduce iatrogenesis, increase satisfaction and clinical outcomes by mobilizing, rather than manipulating their neck-pain patients.

Key Indexing Terms: Chiropractic; spinal manipulation; neck pain; adverse reactions; side-effects; iatrogenesis; patient satisfaction.

Assessing the clinical significance of change scores recorded on subjective outcome measures.
Hugh Hurst, DC; Jennifer Bolton, PhD

World Federation of Chiropractic 3rd Prize Winner

Background: To date, clinical trials have relied almost exclusively on the statistical significance of changes in scores from outcome measures in interpreting the effectiveness of treatment interventions. It is becoming increasingly important, however, to determine the clinical, rather than statistical significance of these change scores.

Objective: To determine cut-off values for change scores that distinguish patients who have clinically improved from those who have not.

Method: Data were obtained from 165 back and 100 neck patients undergoing chiropractic treatment. Patients completed the Bournemouth Questionnaire (BQ) before treatment, and the BQ and Patient's Global Impression of Change (PGIC) scale after treatment. Three statistical methods were applied to individual change scores on the BQ. These were 1) the Reliable Change Index (RCI); 2) the Effect Size (ES) and 3) the raw and percentage change scores. The PGIC scale was used as the "gold standard" of clinically significant change.

Results: The RCI, using the cut-off value of >1.96 , appropriately identified clinical improvement in back, but not in neck, patients. An individual ES of approximately 0.5 had the highest sensitivity and specificity in distinguishing back and neck patients who had undergone clinically significant improvement from those who had not. In terms of raw score changes, percentage BQ change

scores ($[\text{raw change score}/\text{baseline score}] \times 100$) of 47 percent and 34 percent were identified as having the highest sensitivity and specificity in distinguishing clinically significant improvement from nonimprovement in back and neck patients, respectively.

Conclusion: This study provides a methodological framework for identifying clinically significant change in patients. This approach has important implications in providing clinically relevant information about the effect of a treatment intervention in an individual patient.

Key indexing terms: Clinical significance; statistical significance; sensitivity; specificity; neck pain; back pain.

Guidance hypothesis with verbal feedback in learning a palpation skill.

R. Kevin Pringle, DC, MEd

World Federation of Chiropractic Clinical Prize Winner

Objective: In this study, we use the guidance hypothesis to investigate whether a force application of a novel motor skill was simple or complex, and to determine the appropriate level of feedback during training. The objective is to determine the effects of various amounts of knowledge of results (KR) on learning a novel skill that is frequently taught in chiropractic for the assessment of vertebral motor unit dysfunction.

Methods: Thirty-five active subjects were taught the novel skill of spring testing to a particular force range through nine or 10 teaching sessions over a two-week period (a school holiday limited some to only nine sessions). To determine the particular force range, an initial phase of the study involved a licensed and practicing clinician to perform motion palpation spring testing of the thoracic spine of a prone subject. The data from a total of 47 pushes throughout the thoracic spine were recorded, and the mean force and standard deviation were calculated.

The second phase of the study used the obtained mean and standard deviation for teaching the force of prone thoracic spine motion palpation to 35 active subjects by administering spring testing to 35 passive subjects. The active subjects were randomly divided into four groups, each receiving a varying amount of verbal feedback to move toward the target force of their learned skill. Each passive subject was laid prone on an instrumented adjusting table. Group 1 received the least amount of feedback while learning the novel skill. Groups two and three received more frequent, intermittent feedback while learning the skill, and group four received constant, frequent feedback during each of the 10 teaching sessions. All subjects returned within two weeks for two retention trials to determine the efficacy of the learned skill.

Results: The mean force determined was 143N, with a standard deviation of 14N. Each subject was taught spring testing within this target range. The two final retention trials showed group three to have demonstrated the most targeted retention of the learned motor skill. These subjects exhibited the closest force range to the target for the motor skill learned, and fewer changes in standard deviation compared to their acquisition trials, and thus the highest retention. Group four, receiving 100 percent feedback, demonstrated the most accurate spring testing during the acquisition trials, but the subjects did not effectively demonstrate compared on acquisition and retention trials.

Conclusion: The results of this study show data to be consistent with the guidance hypothesis in learning a novel motor skill. The constant KR feedback is beneficial for learning when used to reduce error during practice, but detrimental when relied upon for retention and learning. These

data suggest the necessity of using motor skill development learning theory in the teaching of chiropractic.

Key indexing terms: Motor learning; spine; chiropractic.

Response rates for surveys of chiropractors.

M. Russell, MD, PhD, FRCPC; M. Verhoef, PhD; S. Injeyan, DC, PhD; D. McMorland, DC

Background: Survey response rates may vary by type of practitioner studied and may have declined over time. Response rates for surveys of complementary practitioners have not been studied.

Objective: To describe the response rates in published surveys of chiropractors and explore for secular trends in response rates, and for methodologic and geographic correlates of response rates.

Methods: Secondary analysis of data extracted from published English language reports of surveys of chiropractors. Response rates were calculated as the total number of persons from whom a questionnaire was returned divided by the total number of persons who were sent a questionnaire.

Results: Sixty-two surveys represented by 79 articles published in the interval 1980-2000 met inclusion criteria for analysis. We were able to calculate a response rate for 46 postal surveys. The mean response rate was 52.7 percent. There was no significant association between geographic setting and response rate, and there was no evidence of secular trend in response rates. None of the studies employed incentives. The strongest predictor of response rate was the number of contacts with the target population.

Conclusion: Response rates for surveys of chiropractors are similar to those observed for surveys of medical doctors. The key to obtaining high response rates is the use of evidence-based methods in design and conduct of the surveys.

Key indexing terms: Research design; health care surveys; data collection; health services research; chiropractic; bias (epidemiology).

The forces applied by female and male chiropractors during thoracic spinal manipulation.

D. Forand; J. Drover; Z. Suleman; B. Symons; W. Herzog

Background: On average, women weigh less, have a smaller frame and are less muscular than men. Since the peak thrust force applied during spinal manipulative treatments can be quite high and must be reached in a very short period of time, one might question the physical ability of women to generate such high forces.

Objective: To study the forces generate by male and female chiropractors as they deliver spinal manipulation to the thoracic spine.

Methods: Fourteen male and 14 female experience-matched chiropractors participated in this study. They each manipulated one of nine asymptomatic male adult subjects of similar height and weight. The clinicians were asked to manipulate a transverse process in the vicinity of T4 and T9. Any technique could be used, as long as the treatment thrust was in a posterior to anterior direction and the hand contact fit onto the sensor pad (area=100 cm²).

Results: There were no significant differences ($p < 0.05$) between male and female chiropractors for any measurements in the upper thoracic area. For the lower thoracic manipulations, the preload forces for the male chiropractors were significantly greater ($p < 0.05$) than those for the female chiropractors. The remaining variables were the same between the two groups.

Conclusions: Female chiropractors produce, from a mechanical point of view, similar manual treatments as their male colleagues.

Key indexing terms: Thoracic spine; chiropractic manipulation; treatment forces.

Biomechanical assessments of lumbar spinal function: how low back pain sufferers differ from normals. Implications for outcome measures research, part I: kinematic assessments of lumbar function.

Gregory Lehman

Objective: To review new and advanced biomechanical assessment techniques for the lumbar spine and illustrate the differences in lumbar function in patients with low back pain and asymptomatic subjects.

Data Sources: The biomedical literature was searched for research and reviews on spinal kinematic differences between low back pain subjects and healthy controls. A data search for articles indexed on MEDLINE until April 2002 was performed.

Results: Kinematic measurements of lumbar function were categorized into three areas where low back patients may differ from normals: 1. End range of motion during simple movements; 2. Higher order kinematics (displacement, velocity and acceleration) during complex movement tasks; and 3. Spinal proprioception. The assessment of higher order kinematics during complex movement tasks is the most highly researched and the most successful in describing differences between the populations. The use of simple end range of motion appears questionable while assessing spinal proprioception is the least researched, yet shows potential in highlighting differences between low back pain sufferers and asymptomatics.

Conclusion: Current kinematic biomechanical assessment techniques are capable of identifying functional differences between low back pain populations and controls. The use and validity of the majority of these techniques as outcome measures is currently unknown yet may be valuable in generating functional diagnoses, evaluating the mechanisms of current therapies and prescribing specific rehabilitation programs.

Key indexing terms: Biomechanics; spine kinematics; chiropractic; low back pain; outcome measures.

Routine screening for abuse: opening Pandora's box?

Roel te Kolstee DC; Joyce Miller, DC; Simone Knaap, DC

Objective: To review the case of a patient who had been physically abused by a previous partner and to discuss the importance of routine screening for abuse.

Clinical features: A 33-year-old female had neck pain, right shoulder pain and low-back pain. During the history-taking, she noted that she had been in an abusive relationship, and her current

complaints were thought to be a direct result of one of the violent episodes she suffered. Radiographs of her neck and shoulder were obtained to rule out a traumatic etiology. In the absence of any gross abnormalities, her symptoms were found to be biomechanical in origin.

Intervention and outcome: Therapy included spinal manipulation and soft-tissue techniques to the symptomatic areas. During the treatments, much consideration was given to the fact that she had been a victim of domestic violence and the emotional and physical impact this had on her current situation. Manipulative techniques were adapted so that the patient would not perceive them as threatening, and a considerable amount of time was spent on counseling. After a number of treatments, she reported significant improvement in her overall condition.

Conclusions: For practitioners of spinal manipulative therapy, routine screening for abuse is an essential part of history-taking. Awareness of a patient's experiences with domestic violence is required to make appropriate adjustments in the management plan.

Key indexing terms: Domestic violence; routine screening; chiropractic manipulation.

Evaluation of Chapman's neurolymphatic reflexes via applied kinesiology: a case report of low back pain and congenital intestinal abnormality.

Marcello Caso, DC

Objective: To describe the applied-kinesiological evaluation of Chapman's neurolymphatic reflexes in the management of a person with an unusual congenital bowel abnormality and its role in the manifestation of low back pain. The theoretical foundations of these reflexes will be elaborated upon and practical applications discussed.

Clinical features: A 29-year-old male had chronic low back pain. Radiographs of the patient's lumbar spine and pelvis were normal. Magnetic resonance imaging (MRI) demonstrated a mild protrusion of the fifth lumbar disc. Oral anti-inflammatory agents, cortisone injections, and chiropractic manipulative therapy provided little relief. Though generally in robust health, the patient was aware of a congenital intestinal abnormality, diagnosed when he was a child; it was thought to be of no consequence with regard to his current back condition.

Intervention and outcome: The patient's history, combined with applied kinesiology examination, indicated a need to direct treatment to the large bowel. The essential diagnostic indicators were the analysis of the Chapman's neurolymphatic reflexes themselves, coupled with an evaluation of the traditional acupuncture meridians. The primary prescribed therapy was the stimulation of these reflexes by the patient, at home. This intervention resulted in the resolution of the patient's musculoskeletal symptomatology, as well as improved bowel function.

Conclusion: The rather remarkable outcome from the application of this relatively simple, yet valuable, diagnostic and therapeutic procedure represents a thought-provoking impetus for future study and clinical application.

Key indexing terms: Low back pain; chiropractic manipulation; neurology; gastrointestinal disease.

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