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A Pilot Investigation of Expert and Novice Intraexaminer and Interexaminer Reliability of Durometer Analysis Of The Cervical Spine

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Abstract

Introduction: The foundation of chiropractic is based on locating and correcting joint dysfunction, i.e., subluxations and fixations. Chiropractic tests used to determine the need for and site of spinal manipulative therapy (SMT) have been the subject of considerable empirical study. The conclusions of this body of literature are equivocal, with few studies finding acceptable reliability or validity for the methods used to identify joint dysfunction. The consensus of the majority of studies and systematic reviews is that chiropractic tests used to locate joint dysfunction have unacceptable reliability and/or validity, including: Motion palpation, static palpation, diagnostic imaging (x-ray, video fluoroscopy), orthopedic tests, neurological tests, leg length inequality, visual observation, and pain description. The poor to fair reliability of these chiropractic tests creates a number of problems: 1. Chiropractic researchers, educators, practitioners and students lack a scientifically supported means of determining "where to adjust"; 2. Political, economic, and legal concerns with legislation, reimbursement, and litigation; 3. Scientific issues of identifying joint dysfunction determining the effects of SMT without adequate objective measures. The Pro-Adjuster System (PAS) is an FDA approved chiropractic-specific instrument used for spinal analysis and treatment. The PAS consists of a computer, software, and a piezoelectric durometer instrument, with protocols for analysis and treatment of disorders related to vertebral motion anomalies. In scan (analysis) mode, the instrument is placed against the spinous process of a vertebrae and the instrument head engages when a preload of 6 pounds has been applied. In scan mode the instrument functions as a durometer, emitting a single impulse, which measures the vertebrae's resistance to movement. Durometers are widely used in industry and, as engineering hardware, measure the resistance of any material with nearly flawless precision. Properly used, the PAS instrument is claimed to accurately measure a vertebrae's resistance to movement in the posterior to anterior plane which, if true, would be reliable by definition. Thus, the only error in this measurement of fixation/joint dysfunction would be due to operator variables.

Objective: The current study is the first to assess intra and inter-examiner reliability of PAS scans of the cervical spine for expert and novice examiners.

Method: This study was approved the Logan College of Chiropractic (LCC) Institutional Review Board. <u>Design</u>: Intra and inter examiner reliability study designed to test the hypotheses that for all cervical vertebrae: 1. PAS cervical spine scan reliabilities for all expert and novice comparisons would not be significantly different (a priori p > .05) and 2. Interclass correlations (ICCs) for all expert and novice combinations would be > .6. <u>Participants</u>: Sixty-four asymptomatic male and female consenting volunteers (age range 22-54, mean age 28.3) were selected from the LCC student body. Exclusion criteria

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were: Systemic illness, skin or other malignancy, local infection or injury, analgesic or muscle relaxant use within 48 hours, and chiropractic manipulation within 48 hours. <u>Examiners:</u> The two experts were licensed DCs certified in PAS with 10 and 7 years PAS experience respectively. The two novices were senior chiropractic interns certified in PAS with less than 6 months of PAS experience. <u>Procedure:</u> Participants received two consecutive cervical PAS scans by each examiner in a counter-balanced order. Masked examiners rotated between two examination stations at which participants were seated in a standard PAS chair with seat height, thoracic and head positions adjusted by the first examiner according to participant size. Patients were instructed to remain "very still" during the examination procedure and remained stationary until all exams were complete. <u>Data Analysis:</u> Scan data for each cervical vertebrae were automatically stored by the PAS computer software and subsequently transferred into Excel files. SPSS was used to calculate t-tests for expert-expert, novice-novice and novices-experts comparisons; and interclass correlations (ICCs) for each examiner individually, expert-expert, novice-novice, experts-novices, and experts and novices combined.

Results: All data sets were complete with no drop-outs. Both hypotheses were supported: 1. T-tests for expert-expert, novice-novice and experts-novices were all > .05, indicating that there were no significant differences between the group comparisons for PAS cervical spine scans. 2. ICCs for each examiner, expert-expert, novice-novice, experts-novices and experts and novices combined ranged from .67 to .86 (good to excellent) for all PAS cervical spine scans.

Conclusion: In this pilot study the reliabilities for the Pro-Adjuster System scans of the cervical spine were in the good to excellent range for all examiners and all combinations of examiners for all cervical vertebrae. These reliabilities are among the highest reliability/agreement/concordance findings reported in the literature for chiropractic tests of joint dysfunction. These results, although encouraging, must be considered preliminary pending further investigation. Continued study is warranted with asymptomatic and symptomatic participants and repeated measures designs.

Key Words: Chiropractic, physical examination, reproducibility of results, palpation, motion assessment, reliability, validity, agreement, specificity, sensitivity, observer variation.

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INSTRUMENT-APPLIED CERVICAL MANIPULATIVE THERAPY ON CERVICAL RANGE OF MOTION

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ABSTRACT

Introduction: Measures of cervical range of motion (CROM) have been used to evaluate a wide range of cervical spine conditions, with numerous assessment instruments showing reliabilities ranging from poor to excellent. Several well-conducted studies have concluded that inclinometry provides valid and reliable measures of CROM when properly used. Several chiropractic manipulative therapies (CMTs) have been shown to increase CROM in symptomatic and asymptomatic populations. The current study investigated the effects of an instrument applied CMT, the Pro-Adjuster System (PAS), on CROM for the first time.

Method: The Logan College of Chiropractic (LCC) Institutional Review Board approved this investigation. Design: This was a pilot-level randomized controlled trial (RCT) of the effects of PAS on CROM. Participants: Forty consecutively selected, asymptomatic consenting volunteers were randomly assigned to treatment or control groups of 20 each. All participants were students at LCC, 18 female and 22 male between the ages of 22 and 59 years of age (mean age 29.3). Exclusion criteria were previous experience with PAS, any cervical symptoms, any contraindications to cervical manipulation, analgesic or muscle relaxant use, and any spinal manipulation within 48 hours. Measure/Examiner: Dual inclinometry (J-Tech Dualer IQ) CROMs were performed by a licensed DC with training and experience with the J-Tech. Three active passes of each ROM were taken by the examiner, who was masked to participant status. Treating Physician: A licensed DC with 10 years of experience with the PAS performed all cervical scans and treated according to standard PAS protocol. Procedure: Treatment and control groups received: 1. CROM assessment; 2. PAS CMT or a control condition; 3. Post treatment or control CROM assessment. Data Analysis: Pre and Post CROM measures of the treatment and control groups were compared by paired t-tests (a priori p < .01). <u>Hypotheses:</u> 1. The treatment group would have significant CROM increases; 2. The control group would have no CROM changes.

Results: All data sets were complete with no drop-outs. Both hypotheses were supported by data analysis. The treatment group achieved significant (p < .01) increases in all cervical ranges of motion while the controls had no CROM changes.

Conclusion: This investigation offers several implications for chiropractic research and practice. Scientific, legal and economic forces are changing chiropractic practice through evidence-based practice and best practices initiatives. New technology like the Pro-Adjuster System should be subjected to rigorous empirical investigation to provide researchers, educators and practitioners with information as to its clinical efficacy. The results of this first investigation have shown that a single PAS CMT can significantly increase CROM in asymptomatic participants. These results are similar to those obtained

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in studies using other chiropractic techniques, i.e., diversified and toggle. Further investigation of the effects of PAS on CROM is warranted. Future studies should include symptomatic participants and repeated measures designs.

Key Words: Pro-Adjuster System, chiropractic manipulative therapy, cervical range of motion

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Effect of Instrument Applied Spinal Manipulative Therapy Upon Dual-Task Performance Involving Complex Postural and Cognitive Tasks Kristan Giggey, DC, Rodger Tepe, PhD

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Abstract

Introduction:

Postural regulation and motor control were once thought to be exclusively automatic processes carried out at a sub-cortical level. A consensus of recent evidence indicates that the neural mechanisms of postural control are intimately joined to cognition (Woollacott & Shumway-Cook). The relationship between postural control and cognition is studied using a dual-task paradigm employing balance as a measure of postural control. With a dual-task methodology, a primary (postural) task will demonstrate degradation with the addition of a secondary, concurrent (cognitive) task. Using a dual-task paradigm, it is possible to show a relationship between the higher cognitive functions and those that were previously thought to be reflexive. The extent to which the two tasks interfere with each other indicates the degree of shared cognitive processing (Woollacott & Shumway-Cook). It is important to understand the cognitive implications of postural control because the activities of daily living often involve some degree of cognitive operation during motor tasks such as level walking, stair ascent, or stair descent, or reaching for an object. It has been hypothesized that there may be an attentional component associated with motor accidents such as falls (Shumway-Cook & Woollacott).

Previous studies have demonstrated that sensory and cognitive systems share common neural substrates (Woollacott & Shumway-Cook). The afferent neural impulses of mechanoreception (also known as somatosensation) as produced by joint mechanoreceptors and adjacent muscle spindle cells are necessary for the proper function of supraspinal centers (Seaman & Winterstein). Few studies have been done to determine if spinal manipulative therapy (SMT) can impact the processing that occurs at supra-spinal centers. Recently, Lersa, Stinear, and Lersa, using reaction time tasks as a measure of cognitive processing, determined that the presence of two or more sites of cervical spine dysfunction is predictive of longer reaction times, higher error rates, and a more variable performance.

The purpose of this investigation was to determine if instrument applied spinal manipulative therapy improves postural control during the performance of a complex postural task coupled with an attentionally demanding cognitive task. Three hypotheses were tested: 1. Sway velocity will increase during the dual-task condition; 2. Sway velocity will decrease post-treatment for the simple task; 3. Sway

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velocity will decrease post-treatment for the complex task. A one-week post-treatment measure will be taken to examine for any lasting effects.

Methods:

We tested 12 asymptomatic individuals (9 males, 3 females; average age 23 years) with no history of visual or vestibular problems. Following a short demonstration and explanation of the procedure, the participant was asked to stand on a forceplate (NeuroCom Balance Master) to assess and record balance data. The forceplate was covered with a compliant surface to increase sensory integration demands. Balance measures were taken at three intervals and consisted of two conditions at each interval: eyes closed, and eyes closed plus a cognitive task (serial 7's counting task). Pre-treatment measures of balance were obtained and then the participant began a two week period of instrument-applied SMT (ProAdjuster System). Participants received 6 treatments over the two week period followed by a post-treatment assessment, and then a follow-up assessment one week later.

Results:

Data were analyzed with a one-way ANOVA to examine effects between the simple and complex conditions for each balance assessment. A main effect was found for the type of balance task. The addition of the cognitive component to the simple postural task significantly altered balance at each assessment. For assessments 1 through 3 respectively: F(1, 22) = 5.8, p < .05; F(1, 22) = 7.6, p < .05; and F(1, 22) = 4.11, p < .05. The direction of the main effect was not as predicted. The mean sway velocities decreased with the addition of the cognitive task, on average by 0.62 degrees per second.

Repeated measures ANOVA were used to examine for differences across each balance assessment within the two task conditions. Significant mean differences were found for the pre, post, and follow-up assessments during the simple and complex postural task conditions. Respective values are: F(1, 11) = 6.84, p < .05 and F(1, 11) = 10.4, p < .05. Instrument-applied SMT improved postural control post-therapy with lasting effects one week later at follow-up under both simple and complex postural control conditions.

Conclusion:

It was hypothesized that use of a mental task would increase the cognitive load associated with the postural task. The use of the serial 7's counting task did significantly change the mean values between the two conditions (quiet standing versus counting) but instead of increasing sway-velocity as hypothesized, sway velocity decreased. Several authors have noted that the use of a cognitive task can demonstrate degradation of a postural task (Shumway-Cook & Woollacott;

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Woollacott & Shumway-Cook). Adkin et al., found that the use of a cognitive task improved balance and suggested that the improvement was due to a change in arousal levels.

The use of instrument applied spinal manipulative therapy was found to significantly improve postural control under both simple and complex conditions. There was a lasting effect upon postural control after one week post-treatment. The improvement in postural control found for the dual-task condition may indicate an improvement in cognition as it is related to postural control. The results of this preliminary study warrant continued investigation with symptomatic and asymptomatic participants i.e., performance athletes and geriatric populations

Key Indexing Terms: Sway, SMT, balance, dual-task

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A RANDOMIZED CONTROLLED TRIAL OF THE EFFECTS OF INSTRUMENT-APPLIED CHIROPRACTIC MANIPULATIVE THERAPY ON MYOFASCIAL TRIGGER POINTS

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ABSTRACT

Introduction: Myofascial trigger points (MTrPs) are characterized as discrete, focal, hypersensitive spots in a taut band of muscle that are painful to palpation and reproduce the patient's local and referred pain symptoms. (Borg-Stein & Simons, 2002) Other features may include "exquisite" pain on compression, a jump and/or twitch response on compression, muscle weakness, rapid muscle fatigue, restricted range of motion (ROM) with painful stretch limit, motor dysfunction and autonomic dysfunction. (Simons et al. 1999) Incidence of myofascial pain, i.e., pain derived from MTrPs, has been reported to be as high as 93% in patients presenting to specialty pain management centers. (Gerwin 1995) Diagnosis of MTrPs is equivocal in published studies (Hsieh et al. 2000, Njoo et al. 1994) with best reliabilities associated with the combination of upper trapezius + trained examiners + spot tenderness, pain recognition and jump sign. (Gerwin 1997, Sciotti 2001) Etiologies of myofascial pain include mechanical stress, joint disorders, discogenic disorders, regional soft tissue disorders, inflammatory disorders, neurologic disorders, visceral referred pain syndromes, nutritional & metabolic conditions, psychological disorders, infectious disease, fibromyalgia and widespread chronic pain. (Simons et al. 1999) Treatment effectiveness of MTrPs is equivocal in the literature with mixed results shown for physical therapy (TENS, ultrasound, spray and stretch, etc.), pharmacotherapy (NSAIDS, antidepressants, analgesics, muscle relaxants, etc), psychological therapies (stress reduction behavior modification, cognitive-behavioral, biofeedback, etc.), stretching (active, passive, positional release, etc.), acupuncture (needle, microcurrent, laser, etc.), rehabilitation (postural, mechanical, ergonomic, etc.), injection (procaine, lidocaine, steroids, botulinum toxin, etc.) and manual therapy (transverse friction, ischemic compression, myofascial release, chiropractic manipulation, etc.). (Borg & Simons 2002) A PubMed search finds 4900 MTrPs articles since 1956, yet there is no consensus on the etiology, diagnosis or treatment of this ubiquitous pain syndrome. Few studies in the chiropractic literature have examined the effects of osseous manipulation or soft tissue manipulation on MTrPs none have investigated the combined effects of both.

Objective: To investigate the effects of combined instrument-applied osseous and soft tissue chiropractic manipulation on MTrPs.

Method: This study was approved by the Logan College of Chiropractic (LCC) Institutional Review Board. <u>Design</u>: This was a randomized clinical trial (RTC) to investigate three hypotheses: 1. Post treatment (Tx) MTrPs would be significantly less (p < .05) than pre Tx MTrPs; 2. Post Tx MTrPs would be

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significantly less (p < .05) than post control MTrPs; 3. Control pre MTrPs would not be significantly different than post control MTrPs (p > .05); 4. Inter examiner kappas (k) would be > .61. Participants: One hundred seventeen consenting normal volunteers were screened by inclusion criteria of student at LCC, 18-50 years of age (yoa), two examiners (masked) agree on location of "the worst" active MTrP in upper trapezius; and exclusionary criteria of systemic illness, skin or other malignancy, local infection or injury, manipulation within 48 hours and analgesic or muscle relaxant use within 48 hours. Screening continued until 80 qualified participants were identified (49 male, 31 female, mean age 26.7 yoa). Examiners: Two senior interns were trained in manual palpation of MTrPs. Treating physician: A licensed DC with certification and 8 years of experience with the Pro-Adjuster System (PAS) percussion instrument. Procedure: 1. Participants are randomly assigned to treatment or control condition. 2 Treating physician performs PAS scan on cervical spine. 3. Treating physician is informed of MTrP location by marked drawing. 4. MTrPs are treated with PAS protocol of cervical manipulation and soft tissue manipulation. 5. Controls receive 5 minutes seated rest. 6. Examiners masked to participant status perform MTrP evaluation. Data analysis: Examiner pre and post MTrP findings were analyzed by kappa statistic for examiner agreement and Z-score transformed Mann-Whitney tests for pre-post differences.

Results: All data sets were complete with no drop-outs. All four hypotheses were supported: 1. MTrPs post < MTrPs pre (p < .001). 2. MTrPs post Tx < post control (p < .001). 3. Control MTrPs pre + MTrPs post (p > .05) 4. Inter examiner agreements for MTrP location were > .61, (> .61 < .80 is considered substantial agreement): all screened k = .73; post Tx k = .82; post control k = .77.

Conclusion: In this investigation, a single treatment of instrument-applied (Pro-Adjuster System) cervical manipulation combined with instrument applied softtissue manipulation significantly reduced upper trapezius MTrPs in the treatment group, while controls had no change. These preliminary results warrant continued study with repeated measures designs and symptomatic participants.

Key Words: Trigger Points, Myofascial Trigger Points, Myofascial Pain, Chiropractic Manipulative Therapy, Inter Rater Reliability Reliability, **References:** (Limit 5)

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Chiropractic Adjustments Reduced Urinary Incontinence John Zhang, MD, PhD, Phillip Haselden, DC, Rodger Tepe, PhD Logan College of Chiropractic

Introduction:

Urinary incontinence, inability to control urine while awake or asleep, is a common illness in elderly. The National Association For Continence has sponsored epidemiological surveys of adults across the United States in order to quantify the prevalence of bladder control problems in the community. These studies have identified that urinary incontinence and related symptoms of overactive bladder are important causes of depression and a risk factor for nighttime falls.⁶ The causes of urinary incontinence are often attributed to overactive bladder, low bladder capacity, or overproduction of urine at night (nocturnal polyuria), secondary to spinal injury. The treatment for patients with urinary incontinence are usually bladder relaxants for overactive bladder, and urinary pads to absorb urine.

Several authors have reported the effectiveness of chiropractic adjustments on elderly patients with urinary incontinence. Stude et al reported a case study of a fourteen year old female patient recovered completely from traumatically induced urinary incontinence using manual manipulation. Chiropractic adjustment seems to be effective in childhood enuresis and functional enuresis as reported in several studies. ^{11,12,13} This current study presents a Pro-Adjuster spinal adjustment approach to treat elderly and young patients with urinary incontinence that has not been reported previously. A search in the Pub-Med found no publications using Pro-adjuster for urinary incontinence.

Pro-Adjuster technique is a form of non-manual adjustment method that utilizes a hand held instrument controlled by a computer program to produce adjustable force and frequency. This study utilized a set of adjustment procedures developed and modified by the treating researcher to treat patients with urinary incontinence. Initial research began with patients who came to see the doctor for varying reasons, most often for low back pain care. In a few instances, after the patients received regular Pro-Adjuster adjustments, patients reported to him that their urinary incontinence was gone. This has lead to the routine inquiry of all patients seeking conventional chiropractic care about the presence of bladder control problems of any kind.

It was hypothesized that the Pro-Adjuster treatment may positively influence the autonomic nervous system using the four cycles per second setting. This study is a retrospective case series of patients with urinary incontinence seeking chiropractic care for other reasons.

Methods:

This study was a case series of clinical observation of patients with urinary incontinence after to 1-8 weeks of treatment with Pro-Adjuster technique without any other additional drug and physical therapy treatment.

A total of 13 patients were included in this study with an average age of 65.7 \pm 12.9, range from 42 to 79 years old. Common complaints for seeking chiropractic care were lower back pain, neck pain, thoracic pain, SI joint pain and other chronic pains. Patients rarely confided any bladder problem. In the early cases, the patient reported regaining bladder control to the treating doctor. In the later cases, the doctor asked all

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patients if they had any bladder control problems. Specific treatment was given for patients with bladder control problems. All patients were treated in the doctor's office. Standard office procedure was used to document patient condition and consent for treatment.

The Pro-A.N.S. Technique:

After finishing the routine Pro-Adjuster procedure and the Pro-Basic technique, (a pelvic balancing protocol taught in the advanced Pro-Adjuster class), set the computer to the 4 cps setting to impact the nervous system directly and 15 - 20 pound setting (depending on the size of the patient). The contact is about one inch under the coccyx and directed upward into the Sacral Plexus and Ganglion of Impar. Regarding the duration of contact, the doctor asks the patient to inhale slowly and hold the breath in for about 4 seconds and then have them to exhale slowly and hold for 4 seconds. The procedure is repeated twice, continuing the thrust for the entire time. The entire procedure takes only 25 - 30 seconds.

Results:

A total of 13 patients' data (6 female, mean ages of 65.7 ± 12.9 years old) were included in the study. The main reasons for the 13 patients seeking chiropractic care were chronic low back pain, neck pain and leg pains, (11 patients), prostate and macular degeneration (1 patient), and auto accident (1 patient). Nine patients had chronic urinary urgency and frequency where they had to void at least 3 times at night. Before treatment, the average frequency of urination at night was about 3.8 ± 1.17 times for all patients. The average history of urinary incontinence was 5 ± 2.2 years from all subjects.

After 1-8 weeks of chiropractic adjustments, the urinary frequency at night was significantly reduced from 3.8 ± 1.17 to once a night (P<0.001) (Figure 2). Three patients improved bladder control with only two adjustments. Two female elderly patients regained bladder control and no longer had to use urinary pads. All 13 subjects demonstrated reduction of urination frequency at night.

Discussion:

This study demonstrates that patients with urinary incontinence and nocturia had significant reduction in nocturia with Pro-Adjuster treatment without behavioral therapy or drug therapy. The adjustment given to patient produced no side effects. The results provide evidence that Pro-Adjuster treatment with modified ANS technique may be used in chiropractic clinics for bladder-control treatment. Based upon results of a literature search, this is the first report showing benefit for people with incontinence using Pro-Adjuster treatment. Other treatment methods have shown nocturia reductions using physical therapy with women with predominantly stress incontinence and using acupuncture. Taken in context with these other results, there are statistically significant reductions in nocturia that can occur with treatment directed at other lower urinary tract symptoms.

Conclusion:

In conclusion, a Pro-Adjuster treatment program was found to reduce nocturia in some chiropractic patients including elderly men, women and child with urinary incontinence. These reductions in nocturia improved patients' quality of life. With regard to research, large controlled and randomized study should be conducted to confirm the beneficial effect of this type of adjustment in patients with bladder control problems.

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A pilot study of the effects of instrument-applied chiropractic manipulative therapy on postural control

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ABSTRACT

Introduction: Symptoms related to equilibrium disorders occur in 5% to 10% of all patients seen by general practitioners and account for an estimated 7 million office visits per year in the United States. The ability to maintain balance is essential for mobility and overall functional independence throughout the lifespan. Equilibrium disorders are frequently due to problems with proprioception. If afferent signal input can be reduced by spinal dysfunction, then spinal manipulation may improve proprioception and equilibrium.

Objective: To determine the effects of instrument-applied chiropractic manipulative therapy (CMT) on postural control.

Method: This study was designed as a feasibility/pilot level double-blind, randomized controlled trial. Approval was obtained from the Logan College Institutional Review Board. A convenience sample of 48 consenting, asymptomatic volunteers were randomly assigned to either the experimental condition, consisting of Pro Adjuster System (PAS) analysis and treatment, or a sham condition, consisting of PAS analysis only. Postural control was measured by sway velocity (SV) scores, which were taken before and after intervention using a NeuroCom Balance Master. Participants and examiners were masked to intervention status. Interventions were provided by a Pro Adjuster certified, licensed DC.

Results: Participants receiving PAS treatment had statistically significant improvement in postural control (p < .05). The sham treatment participants had no improvement. **Conclusion:** In this study, a single PAS treatment resulted in significant increases in postural control in a sample of asymptomatic participants. Continued study in this important topic should include longitudinal designs, different types of spinal manipulation and symptomatic participants.

Key Words: Equilibrium, postural control, spinal manipulation, proprioception, dysafferentation.

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A clinical trial comparing the effects of instrument-applied and manual lumbar spinal manipulation on cervical sEMG measures.

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ABSTRACT

Introduction: Chiropractic Manipulative Therapy (CMT) has been shown to produce beneficial effects for a variety of neuromusculoskeletal (NMS) conditions.¹⁻³ It is not clear whether these effects are due to correction of misalignment or physiological effects of soft tissue stimulation.⁴ Some studies have found little change in the relative positions of vertebrae This research was designed to study the effects of instrument applied (ProAdjuster) and manual lumbar manipulation technique induced paravertebral cervical surface electromyogram (sEMG) responses.

METHODS

All subjects were tested three times using the Biopac sEMG system before and after instrument and manual chiropractic manipulations using the ProAdjuster and Diversified technique. On each day, subjects either received instrument or manual manipulation to the lumbar spine (L1 to L5) as determined by the ProAdjuster system of analysis. EMGs were recorded before and after each adjustment in both groups.

RESULTS

Forty subjects were randomly assigned into the instrument and manual manipulation groups using a random table. Every subject signed an informed consent before beginning the study.

The first pattern was increasing in the EMG amplitude with an increase in adjusting force from 10, 15, to 20 pounds. In each stimulation period with the same force, the height of the EMG spikes was at the same level and less variable. This was seen in 33% of the recordings. The second pattern was showing low EMG amplitude at the start of adjustment and then the EMG amplitude went up and down with greater variation (10% of the recordings). The third pattern was showing a consistent decrease in EMG





amplitude as the adjustment strength went up from 10, 15, and 20 pounds (15% of the recordings). The fourth pattern was showing limited or no responses when the adjustment was provided (42% of the recordings).

CONCLUSION

It was concluded that the instrument adjustment with varying frequency and forces produced surface EMG spikes from a remote adjustment site. The spikes had four different patterns.

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INTRODUCTION

This research was designed to study the effects of instrument applied (ProAdjuster) and manual lumbar manipulation technique induced paravertebral cervical surface electromyogram (sEMG) responses. The subject's lumbar area was stimulated using either the ProAdjuster system (PAS) or Diversified adjusting technique on a college student and faculty population to induce sEMG responses in the cervical area with varying forces and frequencies. The significance of the study was to investigate whether instrument applied and manual manipulation techniques induce different sEMG responses with different adjusting frequencies and forces in asymptomatic subjects.

Chiropractic manual adjusting has been used in clinical practice for over 100 years and has demonstrated varying beneficial effects.¹⁻³ However, it is still not clear whether these positive clinical effects are results of correction of misalignment of vertebrae or due to physiological soft tissue stimulation.⁴ Studies have suggested that after manual manipulation, the relative positions of the vertebrae had not changed.^{5, 6} On the other hand, studies have shown that the deep paravertebral muscle spindle afferents activities changed during manipulation⁷ and the low threshold mechanoreceptors were activated.⁸ These studies have found that manipulation of the cervical and lumbar vertebrae excite low-threshold mechanoreceptors with characteristics of muscle spindles and Golgi tendon organs located within the paravertebral muscles. Bolton and Budgell hypothesized that spinal manipulation and spinal mobilization influence different axial sensory beds.⁹ There were no studies demonstrated surface EMG changes in the cervical areas following a lumbar adjustment. The EMG responses to changing adjusting frequency and forces have not been reported. Therefore, the purpose of the current study was to investigate the effects of pulsed instrument-applied manipulation on body surface electrical potential.

The specific aims of the study were to demonstrate the electrical response in the cervical area to a single and multiple (pulsed) chiropractic manipulation using the ProAdjuster on lumbar spine.

The hypotheses was that single and multiple chiropractic manipulations induced different patterns





of sEMG, specifically that a single manipulation produced low to none sEMG changes, and the multiple manipulations produced greater sEMG changes. It is also hypothesized that greater force in the multiple manipulations method produced incremental increase in sEMG potential and that this potential increase is related to cycle per second of the manipulation pulsation.

MATERIALS AND METHODS

Two experimental groups were required in the study to compare the effect of instrument and manual chiropractic manipulations on sEMG potential. All subjects also served as their own control within each group. Forty subjects (20 in each group) for both groups in the study were recruited from a chiropractic college. Inclusion Criteria: Asymptomatic subjects (without somatosensory peripheral pain) were recruited in the study. Subjects signed an informed consent. Exclusion Criteria: Subjects with heart failure and any nervous system diseases were excluded from the study. Additional exclusions include osteoporosis, diabetes, pregnancy, vascular insufficiency, and history of joint replacement therapy. Subjects under medical treatment, surgery, and trauma within six months were excluded.

All subjects were tested three times using the Biopac sEMG system before and after instrument and manual chiropractic manipulations using the ProAdjuster and Diversified technique.¹⁰ The three readings occurred at three non-consecutive days within a two-week period. On each day, subjects either received instrument or manual manipulation to the lumbar spine (L1 to L5) as determined by the ProAdjuster system of analysis. EMGs were recorded before and after each adjustment in both groups. A licensed and certified ProAdjuster practitioner provided the ProAdjuster manipulation and manual manipulation.

The data to be collected for final analyses are:

- 1. Surface EMG from the cervical region after manipulations on the lumbar area.
- 2. ProAdjuster manipulation at 10, 15, and 20 pounds of force on the lumbar spinal area for each test.
- 3. ProAdjuster manipulation at frequency at 7 and 13 cycles per second.





The duration of the study were three separated days for all subjects. Each treatment visit took about 20 minutes for a total of 60 minutes. The subjects' participation required about 20 minutes per trial for 3 trials with a total of 60 minutes total time per subject.

It was not expected in the study to see any side effects from the chiropractic manipulation. The subjects were asked to contact the researchers for a consultation if such complications occurred. These possible complications were outlined in the written consent form.

RESULTS

Forty subjects were randomly assigned into the instrument and manual manipulation groups using a random table. Twenty subjects were assigned into each group. All subjects answered the pre-screening questionnaire. This was to ensure each subject met the inclusion and exclusion criteria. Every subject signed an informed consent before beginning the study.

Four EMG patterns were found in the ProAdjuster adjustment group on the surface EMG. The first pattern was increasing in the EMG amplitude with an increase in adjusting force from 10, 15, to 20 pounds. In each stimulation period with the same force, the height of the EMG spikes was at the same level and less variable (Fig 1). This was seen in 33% of the recordings. The second pattern was showing low EMG amplitude at the start of adjustment and then the EMG amplitude went up and down with greater variation (Fig 2) (10% of the recordings). The third pattern was showing a consistent decrease in EMG amplitude as the adjustment strength went up from 10, 15, and 20 pounds (Fig 3) (15% of the recordings). The fourth pattern was showing limited or no responses when the adjustment was provided (Figure not show) (42% of the recordings). The Diversified adjustment group did not show sEMG changes (no sEMG spiked found after each adjustment). The resting EMG did not change significantly before and after both the ProAdjuster and Diversified adjustments.

DISCUSSION

This study demonstrated clear surface EMG spikes in normal subjects who received ProAdjuster

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ProAdjuster



found in Diversified single adjustment at the same adjusting site and EMG recording sites. Therefore, the hypothesis was accepted for the ProAdjuster adjustments and rejected for the Diversified adjustments based on the study findings.

Many issues were raised in the study as the surface EMG spikes were recorded from a remote location about 15-20 inches away from the adjusting site. First, did this surface EMG changes have any physiological significance in patient care and what role is the adjusting frequency and force in the physiological responses and clinical effectiveness? A systematic review of the use of sEMG and thoracic-lumbar adjustment has concluded that there was not enough evidence for sEMG to be used as valid outcome assessment tool.¹¹ By studying the published papers on sEMG in relation to chiropractic care, it was noted that no study has documented adjusting spikes from the EMG tracings.¹¹⁻¹⁷ One study recorded decreased resting EMG after adjustments¹² and some found improved EMG activity after adjustments.^{15,16} All these evidence seemed to point to a positive correlation of EMG activity and clinical effectiveness. This current study is not about using sEMG as an outcome assessment tool for adjustment but simply reporting the EMG spikes induced by repeated mechanical stimulation at the lumbar area. It strongly suggests that the mechanical stimulation has caused a spread of electrical signals through the spinal cord and possibly to other parts of the body since this EMG recording was remote from the adjusting site.

The second issue is whether or not the sEMG pattern is a long lasting response or temporary response. In the current study, each subject was tested three times in three different days with at least one day separation. It was clear that no subject has the same pattern for all three days. This suggests that the individual daily changes in the EMG response are greater than expected. It was not known if these spikes produced any significant physiological and clinical consequences. It did not suggest that an adjustment is not effective if there are no EMG spikes.

The third issue is whether or not this EMG spike is simply a fluke from the spinal adjustments. These spikes are only seen in ProAdjuster adjustments but not by knocking the lumbar spine by hand and by Diversified adjustment. In fact, this spike is seen in 58% of the subject population, and it is so common





the other hand, some patients did not have spikes for three treatment days. Because EMG is a recording of muscle electrical activity, the fact that a mechanical stimulation turned into an electrical signal is very significant by itself regardless whether it is a fluke or not.

The fourth issue is why the EMG responses so inconsistent in each individual recording even when the subject was provided the same adjustments at the same location. This was true in the same subject showing different EMG patterns on three different days when the same adjusting routine was performed. This question needs further study and more subjects to test the consistency of sEMG responses when adjustments are provided. The researchers were puzzled on many of the recording sessions when there were no EMG spikes recorded on a subject. The researchers often thought that there was something wrong with the EMG machine or the wire connections but could not find anything wrong.

There are many limitations of the study. The most obvious was the small sample size. Since the EMG spikes were found in most patients, it was suggested that larger sample size study was warranted. The second limitation is the asymptomatic subjects. In the future study, it might be more clinically significant to have symptomatic patients and document their condition changes in relation to the EMG spikes.

CONCLUSION

It was concluded that the instrument adjustment with varying frequency and forces produced surface EMG spikes from a remote adjustment site. The spikes had four different patterns. The EMG responses and patterns are different for the same subject on three days of adjustments.

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Fig 1. Surface EMG response with increasing EMG spikes with increasing adjusting forces with ProAdjuster adjustment at 7 cycles per second at 10, 15 and 20 pounds in subject 1.



Fig 2. Surface EMG response with variable EMG spikes when adjusting force was increased with ProAdjuster adjustment at 7 cycles per second at 10, 15 and 20 pounds in subject 2.



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Fig 3. Not show due to limitations.

Surface EMG response showing decreasing EMG spikes with increasing adjusting forces with ProAdjuster adjustment at 12 cycles per second at 10, 15 and 20 pounds in subject 3.

Research



A clinical trial comparing the effects of instrument-applied and manual lumbar spinal manipulation on cervical sEMG measures.

John Zhang, MD, PhD, Dennis Enix, DC, Kris Giggey, DC, Rodger Tepe, PhD Division of Research, Logan College of Chiropractic Chesterfield, Missouri

ABSTRACT

Introduction: Chiropractic Manipulative Therapy (CMT) has been shown to produce beneficial effects for a variety of neuromusculoskeletal (NMS) conditions.¹⁻³ It is not clear whether these effects are due to correction of misalignment or physiological effects of soft tissue stimulation.⁴ Some studies have found little change in the relative positions of vertebrae This research was designed to study the effects of instrument applied (ProAdjuster) and manual lumbar manipulation technique induced paravertebral cervical surface electromyogram (sEMG) responses.

METHODS

All subjects were tested three times using the Biopac sEMG system before and after instrument and manual chiropractic manipulations using the ProAdjuster and Diversified technique. On each day, subjects either received instrument or manual manipulation to the lumbar spine (L1 to L5) as determined by the ProAdjuster system of analysis. EMGs were recorded before and after each adjustment in both groups.

RESULTS

Forty subjects were randomly assigned into the instrument and manual manipulation groups using a random table. Every subject signed an informed consent before beginning the study.

The first pattern was increasing in the EMG amplitude with an increase in adjusting force from 10, 15, to 20 pounds. In each stimulation period with the same force, the height of the EMG spikes was at the same level and less variable. This was seen in 33% of the recordings. The second pattern was showing low EMG amplitude at the start of adjustment and then the EMG amplitude went up and down with greater variation (10% of the recordings). The third pattern was showing a consistent decrease in EMG amplitude as the adjustment strength went up from 10, 15, and 20 pounds (15% of the recordings). The fourth pattern was showing limited or no responses when the adjustment was provided (42% of the recordings).

CONCLUSION

It was concluded that the instrument adjustment with varying frequency and forces produced surface EMG spikes from a remote adjustment site. The spikes had four different patterns.

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INTRODUCTION

This research was designed to study the effects of instrument applied (ProAdjuster) and manual lumbar manipulation technique induced paravertebral cervical surface electromyogram (sEMG) responses. The subject's lumbar area was stimulated using either the ProAdjuster system (PAS) or Diversified adjusting technique on a college student and faculty population to induce sEMG responses in the cervical area with varying forces and frequencies. The significance of the study was to investigate whether instrument applied and manual manipulation techniques induce different sEMG responses with different adjusting frequencies and forces in asymptomatic subjects.

Chiropractic manual adjusting has been used in clinical practice for over 100 years and has demonstrated varying beneficial effects.¹⁻³ However, it is still not clear whether these positive clinical effects are results of correction of misalignment of vertebrae or due to physiological soft tissue stimulation.⁴ Studies have suggested that after manual manipulation, the relative positions of the vertebrae had not changed.^{5, 6} On the other hand, studies have shown that the deep paravertebral muscle spindle afferents activities changed during manipulation⁷ and the low threshold mechanoreceptors were activated.⁸ These studies have found that manipulation of the cervical and lumbar vertebrae excite low-threshold mechanoreceptors with characteristics of muscle spindles and Golgi tendon organs located within the paravertebral muscles. Bolton and Budgell hypothesized that spinal manipulation and spinal mobilization influence different axial sensory beds.⁹ There were no studies demonstrated surface EMG changes in the cervical areas following a lumbar adjustment. The EMG responses to changing adjusting frequency and forces have not been reported. Therefore, the purpose of the current study was to investigate the effects of pulsed instrument-applied manipulation on body surface electrical potential.

The specific aims of the study were to demonstrate the electrical response in the cervical area to a single and multiple (pulsed) chiropractic manipulation using the ProAdjuster on lumbar spine.

The hypotheses was that single and multiple chiropractic manipulations induced different patterns of sEMG, specifically that a single manipulation produced low to none sEMG changes, and the multiple manipulations produced greater sEMG changes. It is also hypothesized that greater force in the multiple manipulations method produced incremental increase in sEMG potential and that this potential increase is related to cycle per second of the manipulation pulsation.

MATERIALS AND METHODS

Two experimental groups were required in the study to compare the effect of instrument and manual chiropractic manipulations on sEMG potential. All subjects also served as their own control within each group. Forty subjects (20 in each group) for both groups in the study were recruited from a chiropractic college. Inclusion Criteria: Asymptomatic subjects (without somatosensory peripheral pain) were recruited in the study. Subjects signed an informed consent. Exclusion Criteria: Subjects with heart failure and any nervous system diseases were excluded from the study. Additional exclusions include osteoporosis, diabetes, pregnancy, vascular insufficiency, and history of joint replacement therapy. Subjects under medical treatment, surgery, and trauma within six months were excluded.

All subjects were tested three times using the Biopac sEMG system before and after instrument and manual chiropractic manipulations using the ProAdjuster and Diversified technique.¹⁰ The three readings occurred at three non-consecutive days within a two-week period. On each day, subjects either received instrument or manual manipulation to the lumbar spine (L1 to L5) as determined by the ProAdjuster system of analysis. EMGs were recorded before and after each adjustment in both groups. A licensed and certified ProAdjuster practitioner provided the ProAdjuster manipulation and manual manipulation.

The data to be collected for final analyses are:

1. Surface EMG from the cervical region after manipulations on the lumbar area.

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2. ProAdjuster manipulation at 10, 15, and 20 pounds of force on the lumbar spinal area for each

test.

3. ProAdjuster manipulation at frequency at 7 and 13 cycles per second.

The duration of the study were three separated days for all subjects. Each treatment visit took about 20 minutes for a total of 60 minutes. The subjects' participation required about 20 minutes per trial for 3 trials with a total of 60 minutes total time per subject.

It was not expected in the study to see any side effects from the chiropractic manipulation. The subjects were asked to contact the researchers for a consultation if such complications occurred. These possible complications were outlined in the written consent form.

RESULTS

Forty subjects were randomly assigned into the instrument and manual manipulation groups using a random table. Twenty subjects were assigned into each group. All subjects answered the pre-screening questionnaire. This was to ensure each subject met the inclusion and exclusion criteria. Every subject signed an informed consent before beginning the study.

Four EMG patterns were found in the ProAdjuster adjustment group on the surface EMG. The first pattern was increasing in the EMG amplitude with an increase in adjusting force from 10, 15, to 20 pounds. In each stimulation period with the same force, the height of the EMG spikes was at the same level and less variable (Fig 1). This was seen in 33% of the recordings. The second pattern was showing low EMG amplitude at the start of adjustment and then the EMG amplitude went up and down with greater variation (Fig 2) (10% of the recordings). The third pattern was showing a consistent decrease in EMG amplitude as the adjustment strength went up from 10, 15, and 20 pounds (Fig 3) (15% of the recordings). The fourth pattern was showing limited or no responses when the adjustment was provided (Figure not show) (42% of the recordings). The Diversified adjustment group did not show sEMG changes (no sEMG spiked found after each adjustment). The resting EMG did not change significantly before and after both the ProAdjuster and Diversified adjustments.

DISCUSSION

This study demonstrated clear surface EMG spikes in normal subjects who received ProAdjuster adjustment at 7 and 13 cycles per second at 10, 15, and 20 pounds of force. These EMG spikes were not found in Diversified single adjustment at the same adjusting site and EMG recording sites. Therefore, the hypothesis was accepted for the ProAdjuster adjustments and rejected for the Diversified adjustments based on the study findings.

Many issues were raised in the study as the surface EMG spikes were recorded from a remote location about 15-20 inches away from the adjusting site. First, did this surface EMG changes have any physiological significance in patient care and what role is the adjusting frequency and force in the physiological responses and clinical effectiveness? A systematic review of the use of sEMG and thoracic-lumbar adjustment has concluded that there was not enough evidence for sEMG to be used as valid outcome assessment tool.¹¹ By studying the published papers on sEMG in relation to chiropractic care, it was noted that no study has documented adjusting spikes from the EMG tracings.¹¹⁻¹⁷ One study recorded decreased resting EMG after adjustments¹² and some found improved EMG activity after adjustments.^{15,16} All these evidence seemed to point to a positive correlation of EMG activity and clinical effectiveness. This current study is not about using sEMG as an outcome assessment tool for adjustment but simply reporting the EMG spikes induced by repeated mechanical stimulation at the lumbar area. It strongly suggests that the mechanical stimulation has caused a spread of electrical signals through the spinal cord and possibly to other parts of the body since this EMG recording was remote from the adjusting site.

The second issue is whether or not the sEMG pattern is a long lasting response or temporary response. In the current study, each subject was tested three times in three different days with at least one day separation. It was clear that no subject has the same pattern for all three days. This suggests that the individual daily changes in the EMG response are greater than expected. It was not known if these spikes produced any

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significant physiological and clinical consequences. It did not suggest that an adjustment is not effective if there are no EMG spikes.

The third issue is whether or not this EMG spike is simply a fluke from the spinal adjustments. These spikes are only seen in ProAdjuster adjustments but not by knocking the lumbar spine by hand and by Diversified adjustment. In fact, this spike is seen in 58% of the subject population, and it is so common that this makes the researchers to think all adjustment should have the spike instead of not seeing one. On the other hand, some patients did not have spikes for three treatment days. Because EMG is a recording of muscle electrical activity, the fact that a mechanical stimulation turned into an electrical signal is very significant by itself regardless whether it is a fluke or not.

The fourth issue is why the EMG responses so inconsistent in each individual recording even when the subject was provided the same adjustments at the same location. This was true in the same subject showing different EMG patterns on three different days when the same adjusting routine was performed. This question needs further study and more subjects to test the consistency of sEMG responses when adjustments are provided. The researchers were puzzled on many of the recording sessions when there were no EMG spikes recorded on a subject. The researchers often thought that there was something wrong with the EMG machine or the wire connections but could not find anything wrong.

There are many limitations of the study. The most obvious was the small sample size. Since the EMG spikes were found in most patients, it was suggested that larger sample size study was warranted. The second limitation is the asymptomatic subjects. In the future study, it might be more clinically significant to have symptomatic patients and document their condition changes in relation to the EMG spikes.

CONCLUSION

It was concluded that the instrument adjustment with varying frequency and forces produced surface EMG spikes from a remote adjustment site. The spikes had four different patterns. The EMG responses and patterns are different for the same subject on three days of adjustments.

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Fig 1. Surface EMG response with increasing EMG spikes with increasing adjusting forces with ProAdjuster adjustment at 7 cycles per second at 10, 15 and 20 pounds in subject 1.



Fig 2. Surface EMG response with variable EMG spikes when adjusting force was increased with ProAdjuster adjustment at 7 cycles per second at 10, 15 and 20 pounds in subject 2.



Fig 3. Not show due to limitations.

Surface EMG response showing decreasing EMG spikes with increasing adjusting forces with ProAdjuster adjustment at 12 cycles per second at 10, 15 and 20 pounds in subject 3.

Research



A pilot study of the effects of instrument-applied chiropractic manipulative therapy on postural control

Rodger Tepe, PhD; Kristan Giggey, DC; Dennis Enix, DC; and John Zhang, MD, PhD Division of Research, Logan College of Chiropractic Chesterfield, Missouri

ABSTRACT

Introduction: Symptoms related to equilibrium disorders occur in 5% to 10% of all patients seen by general practitioners and account for an estimated 7 million office visits per year in the United States. The ability to maintain balance is essential for mobility and overall functional independence throughout the lifespan. Equilibrium disorders are frequently due to problems with proprioception. If afferent signal input can be reduced by spinal dysfunction, then spinal manipulation may improve proprioception and equilibrium.

Objective: To determine the effects of instrument-applied chiropractic manipulative therapy (CMT) on postural control.

Method: This study was designed as a feasibility/pilot level double-blind, randomized controlled trial. Approval was obtained from the Logan College Institutional Review Board. A convenience sample of 48 consenting, asymptomatic volunteers were randomly assigned to either the experimental condition, consisting of Pro Adjuster System (PAS) analysis and treatment, or a sham condition, consisting of PAS analysis only. Postural control was measured by sway velocity (SV) scores, which were taken before and after intervention using a NeuroCom Balance Master. Participants and examiners were masked to intervention status. Interventions were provided by a Pro Adjuster certified, licensed DC.

Results: Participants receiving PAS treatment had statistically significant improvement in postural control (p < .05). The sham treatment participants had no improvement.

Conclusion: In this study, a single PAS treatment resulted in significant increases in postural control in a sample of asymptomatic participants. Continued study in this important topic should include longitudinal designs, different types of spinal manipulation and symptomatic participants.

Key Words: Equilibrium, postural control, spinal manipulation, proprioception, dysafferentation.

Research



Chiropractic Adjustments Reduced Urinary Incontinence John Zhang, MD, PhD, Phillip Haselden, DC, Rodger Tepe, PhD Logan College of Chiropractic

Introduction:

Urinary incontinence, inability to control urine while awake or asleep, is a common illness in elderly. The National Association For Continence has sponsored epidemiological surveys of adults across the United States in order to quantify the prevalence of bladder control problems in the community. These studies have identified that urinary incontinence and related symptoms of overactive bladder are important causes of depression and a risk factor for nighttime falls. ⁶ The causes of urinary incontinence are often attributed to overactive bladder, low bladder capacity, or overproduction of urine at night (nocturnal polyuria), secondary to spinal injury. The treatment for patients with urinary incontinence are usually bladder relaxants for overactive bladder, and urinary pads to absorb urine.

Several authors have reported the effectiveness of chiropractic adjustments on elderly patients with urinary incontinence. Stude et al reported a case study of a fourteen year old female patient recovered completely from traumatically induced urinary incontinence using manual manipulation. Chiropractic adjustment seems to be effective in childhood enuresis and functional enuresis as reported in several studies. ^{11,12,13} This current study presents a Pro-Adjuster spinal adjustment approach to treat elderly and young patients with urinary incontinence that has not been reported previously. A search in the Pub-Med found no publications using Pro-adjuster for urinary incontinence.

Pro-Adjuster technique is a form of non-manual adjustment method that utilizes a hand held instrument controlled by a computer program to produce adjustable force and frequency. This study utilized a set of adjustment procedures developed and modified by the treating researcher to treat patients with urinary incontinence. Initial research began with patients who came to see the doctor for varying reasons, most often for low back pain care. In a few instances, after the patients received regular Pro-Adjuster adjustments, patients reported to him that their urinary incontinence was gone. This has lead to the routine inquiry of all patients seeking conventional chiropractic care about the presence of bladder control problems of any kind.

It was hypothesized that the Pro-Adjuster treatment may positively influence the autonomic nervous system using the four cycles per second setting. This study is a retrospective case series of patients with urinary incontinence seeking chiropractic care for other reasons.

Methods:

This study was a case series of clinical observation of patients with urinary incontinence after to 1-8 weeks of treatment with Pro-Adjuster technique without any other additional drug and physical therapy treatment.

A total of 13 patients were included in this study with an average age of 65.7 ± 12.9 , range from 42 to 79 years old. Common complaints for seeking chiropractic care were lower back pain, neck pain, thoracic pain, SI joint pain and other chronic pains. Patients rarely confided any bladder problem. In the early cases, the patient reported regaining bladder control to the treating doctor. In the later cases, the doctor asked all patients if they had any bladder control problems. Specific treatment was given for patients with bladder control problems. All patients were treated in the doctor's office. Standard office procedure was used to document patient condition and consent for treatment.

The Pro-A.N.S. Technique:

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After finishing the routine Pro-Adjuster procedure and the Pro-Basic technique, (a pelvic balancing protocol taught in the advanced Pro-Adjuster class), set the computer to the 4 cps setting to impact the nervous system directly and 15 - 20 pound setting (depending on the size of the patient). The contact is about one inch under the coccyx and directed upward into the Sacral Plexus and Ganglion of Impar. Regarding the duration of contact, the doctor asks the patient to inhale slowly and hold the breath in for about 4 seconds and then have them to exhale slowly and hold for 4 seconds. The procedure is repeated twice, continuing the thrust for the entire time. The entire procedure takes only 25 - 30 seconds.

Results:

A total of 13 patients' data (6 female, mean ages of 65.7 ± 12.9 years old) were included in the study. The main reasons for the 13 patients seeking chiropractic care were chronic low back pain, neck pain and leg pains, (11 patients), prostate and macular degeneration (1 patient), and auto accident (1 patient). Nine patients had chronic urinary urgency and frequency where they had to void at least 3 times at night. Before treatment, the average frequency of urination at night was about 3.8 ± 1.17 times for all patients. The average history of urinary incontinence was 5 ± 2.2 years from all subjects.

After 1-8 weeks of chiropractic adjustments, the urinary frequency at night was significantly reduced from 3.8 ± 1.17 to once a night (P<0.001) (Figure 2). Three patients improved bladder control with only two adjustments. Two female elderly patients regained bladder control and no longer had to use urinary pads. All 13 subjects demonstrated reduction of urination frequency at night.

Discussion:

This study demonstrates that patients with urinary incontinence and nocturia had significant reduction in nocturia with Pro-Adjuster treatment without behavioral therapy or drug therapy. The adjustment given to patient produced no side effects. The results provide evidence that Pro-Adjuster treatment with modified ANS technique may be used in chiropractic clinics for bladder-control treatment. Based upon results of a literature search, this is the first report showing benefit for people with incontinence using Pro-Adjuster treatment. Other treatment methods have shown nocturia reductions using physical therapy with women with predominantly stress incontinence and using acupuncture. Taken in context with these other results, there are statistically significant reductions in nocturia that can occur with treatment directed at other lower urinary tract symptoms.

Conclusion:

In conclusion, a Pro-Adjuster treatment program was found to reduce nocturia in some chiropractic patients including elderly men, women and child with urinary incontinence. These reductions in nocturia improved patients' quality of life. With regard to research, large controlled and randomized study should be conducted to confirm the beneficial effect of this type of adjustment in patients with bladder control problems.

Research



A RANDOMIZED CONTROLLED TRIAL OF THE EFFECTS OF INSTRUMENT-APPLIED CHIROPRACTIC MANIPULATIVE THERAPY ON MYOFASCIAL TRIGGER POINTS

Rodger Tepe, PhD & John Zhang MD, PhD Logan College of Chiropractic Division of Research Chesterfield, Missouri

ABSTRACT

Introduction: Myofascial trigger points (MTrPs) are characterized as discrete, focal, hypersensitive spots in a taut band of muscle that are painful to palpation and reproduce the patient's local and referred pain symptoms. (Borg-Stein & Simons, 2002) Other features may include "exquisite" pain on compression, a jump and/or twitch response on compression, muscle weakness, rapid muscle fatigue, restricted range of motion (ROM) with painful stretch limit, motor dysfunction and autonomic dysfunction. (Simons et al. 1999) Incidence of myofascial pain, i.e., pain derived from MTrPs, has been reported to be as high as 93% in patients presenting to specialty pain management centers. (Gerwin 1995) Diagnosis of MTrPs is equivocal in published studies (Hsieh et al. 2000, Njoo et al. 1994) with best reliabilities associated with the combination of upper trapezius + trained examiners + spot tenderness, pain recognition and jump sign. (Gerwin 1997, Sciotti 2001) Etiologies of myofascial pain include mechanical stress, joint disorders, discogenic disorders, regional soft tissue disorders, inflammatory disorders, neurologic disorders, visceral referred pain syndromes, nutritional & metabolic conditions, psychological disorders, infectious disease, fibromyalgia and widespread chronic pain. (Simons et al. 1999) Treatment effectiveness of MTrPs is equivocal in the literature with mixed results shown for physical therapy (TENS, ultrasound, spray and stretch, etc.), pharmacotherapy (NSAIDS, antidepressants, analgesics, muscle relaxants, etc), psychological therapies (stress reduction behavior modification, cognitive-behavioral, biofeedback, etc.), stretching (active, passive, positional release, etc.), acupuncture (needle, microcurrent, laser, etc.), rehabilitation (postural, mechanical, ergonomic, etc.), injection (procaine, lidocaine, steroids, botulinum toxin, etc.) and manual therapy (transverse friction, ischemic compression, myofascial release, chiropractic manipulation, etc.). (Borg & Simons 2002) A PubMed search finds 4900 MTrPs articles since 1956, yet there is no consensus on the etiology, diagnosis or treatment of this ubiquitous pain syndrome. Few studies in the chiropractic literature have examined the effects of osseous manipulation or soft tissue manipulation on MTrPs none have investigated the combined effects of both.

Objective: To investigate the effects of combined instrument-applied osseous and soft tissue chiropractic manipulation on MTrPs.

Method: This study was approved by the Logan College of Chiropractic (LCC) Institutional Review Board. <u>Design:</u> This was a randomized clinical trial (RTC) to investigate three hypotheses: 1. Post treatment (Tx) MTrPs would be significantly less (p < .05) than pre Tx MTrPs; 2. Post Tx MTrPs would be significantly less (p < .05) than post control MTrPs; 3. Control pre MTrPs would not be significantly different than post control MTrPs; (p > .05); 4. Inter examiner kappas (k) would be > .61. <u>Participants:</u> One hundred seventeen consenting normal volunteers were screened by inclusion criteria of student at LCC, 18-50 years of age (yoa), two examiners (masked) agree on location of "the worst" active MTrP in upper trapezius; and exclusionary criteria of systemic illness, skin or other malignancy, local infection or injury, manipulation within 48 hours and analgesic or muscle relaxant use within 48 hours. Screening continued until 80 qualified participants were identified (49 male, 31 female, mean age 26.7 yoa). <u>Examiners:</u> Two senior interns were trained in manual palpation of MTrPs. <u>Treating physician</u>: A licensed DC with certification and 8 years of experience with the Pro-Adjuster System (PAS) percussion instrument. <u>Procedure:</u> 1. Participants are randomly assigned to treatment or control condition. 2 Treating physician performs PAS scan on cervical spine. 3. Treating physician



is informed of MTrP location by marked drawing. 4. MTrPs are treated with PAS protocol of cervical manipulation and soft tissue manipulation. 5. Controls receive 5 minutes seated rest. 6. Examiners masked to participant status perform MTrP evaluation. Data analysis: Examiner pre and post MTrP findings were analyzed by kappa statistic for examiner agreement and Z-score transformed Mann-Whitney tests for pre-post differences.

Results: All data sets were complete with no drop-outs. All four hypotheses were supported: 1. MTrPs post < MTrPs pre (p < .001). 2. MTrPs post Tx < post control (p < .001). 3. Control MTrPs pre + MTrPs post (p > .05) 4. Inter examiner agreements for MTrP location were > .61, (> .61 < .80 is considered substantial agreement): all screened k = .73; post Tx k = .82; post control k = .77.

Conclusion: In this investigation, a single treatment of instrument-applied (Pro-Adjuster System) cervical manipulation combined with instrument applied soft-tissue manipulation significantly reduced upper trapezius MTrPs in the treatment group, while controls had no change. These preliminary results warrant continued study with repeated measures designs and symptomatic participants.

Key Words: Trigger Points, Myofascial Trigger Points, Myofascial Pain, Chiropractic Manipulative Therapy, Inter Rater Reliability Reliability,

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Research



Effect of Instrument Applied Spinal Manipulative Therapy Upon Dual-Task Performance Involving Complex Postural and Cognitive Tasks

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Abstract

Introduction:

Postural regulation and motor control were once thought to be exclusively automatic processes carried out at a sub-cortical level. A consensus of recent evidence indicates that the neural mechanisms of postural control are intimately joined to cognition (Woollacott & Shumway-Cook). The relationship between postural control and cognition is studied using a dual-task paradigm employing balance as a measure of postural control. With a dual-task methodology, a primary (postural) task will demonstrate degradation with the addition of a secondary, concurrent (cognitive) task. Using a dual-task paradigm, it is possible to show a relationship between the higher cognitive functions and those that were previously thought to be reflexive. The extent to which the two tasks interfere with each other indicates the degree of shared cognitive processing (Woollacott & Shumway-Cook). It is important to understand the cognitive implications of postural control because the activities of daily living often involve some degree of cognitive operation during motor tasks such as level walking, stair ascent, or stair descent, or reaching for an object. It has been hypothesized that there may be an attentional component associated with motor accidents such as falls (Shumway-Cook & Woollacott).

Previous studies have demonstrated that sensory and cognitive systems share common neural substrates (Woollacott & Shumway-Cook). The afferent neural impulses of mechanoreception (also known as somatosensation) as produced by joint mechanoreceptors and adjacent muscle spindle cells are necessary for the proper function of supraspinal centers (Seaman & Winterstein). Few studies have been done to determine if spinal manipulative therapy (SMT) can impact the processing that occurs at supraspinal centers. Recently, Lersa, Stinear, and Lersa, using reaction time tasks as a measure of cognitive processing, determined that the presence of two or more sites of cervical spine dysfunction is predictive of longer reaction times, higher error rates, and a more variable performance.

The purpose of this investigation was to determine if instrument applied spinal manipulative therapy improves postural control during the performance of a complex postural task coupled with an attentionally demanding cognitive task. Three hypotheses were tested: 1. Sway velocity will increase during the dual-task condition; 2. Sway velocity will decrease post-treatment for the simple task; 3. Sway velocity will decrease post-treatment for the complex task. A one-week post-treatment measure will be taken to examine for any lasting effects.

Methods:

We tested 12 asymptomatic individuals (9 males, 3 females; average age 23 years) with no history of visual or vestibular problems. Following a short demonstration and explanation of the procedure, the participant was asked to stand on a forceplate (NeuroCom Balance Master) to assess and record balance data. The forceplate was covered with a compliant surface to increase sensory integration demands. Balance measures were taken at three intervals and consisted of two conditions at each interval: eyes closed, and eyes closed plus a cognitive task (serial 7's counting task). Pre-treatment measures of

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balance were obtained and then the participant began a two week period of instrument-applied SMT (ProAdjuster System). Participants received 6 treatments over the two week period followed by a post-treatment assessment, and then a follow-up assessment one week later.

Results:

Data were analyzed with a one-way ANOVA to examine effects between the simple and complex conditions for each balance assessment. A main effect was found for the type of balance task. The addition of the cognitive component to the simple postural task significantly altered balance at each assessment. For assessments 1 through 3 respectively: F(1, 22) = 5.8, p < .05; F(1, 22) = 7.6, p < .05; and F(1, 22) = 4.11, p < .05. The direction of the main effect was not as predicted. The mean sway velocities decreased with the addition of the cognitive task, on average by 0.62 degrees per second.

Repeated measures ANOVA were used to examine for differences across each balance assessment within the two task conditions. Significant mean differences were found for the pre, post, and follow-up assessments during the simple and complex postural task conditions. Respective values are: F(1, 11) = 6.84, p < .05 and F(1, 11) = 10.4, p < .05. Instrument-applied SMT improved postural control post-therapy with lasting effects one week later at follow-up under both simple and complex postural control conditions.

Conclusion:

It was hypothesized that use of a mental task would increase the cognitive load associated with the postural task. The use of the serial 7's counting task did significantly change the mean values between the two conditions (quiet standing versus counting) but instead of increasing sway-velocity as hypothesized, sway velocity decreased. Several authors have noted that the use of a cognitive task can demonstrate degradation of a postural task (Shumway-Cook & Woollacott; Woollacott & Shumway-Cook). Adkin et al., found that the use of a cognitive task improved balance and suggested that the improvement was due to a change in arousal levels.

The use of instrument applied spinal manipulative therapy was found to significantly improve postural control under both simple and complex conditions. There was a lasting effect upon postural control after one week post-treatment. The improvement in postural control found for the dual-task condition may indicate an improvement in cognition as it is related to postural control. The results of this preliminary study warrant continued investigation with symptomatic and asymptomatic participants i.e., performance athletes and geriatric populations

Key Indexing Terms: Sway, SMT, balance, dual-task

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A RANDOMIZED CONTROLLED TRIAL OF THE EFFECTS OF INSTRUMENT-APPLIED CERVICAL MANIPULATIVE THERAPY ON CERVICAL RANGE OF MOTION

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ABSTRACT

Introduction: Measures of cervical range of motion (CROM) have been used to evaluate a wide range of cervical spine conditions, with numerous assessment instruments showing reliabilities ranging from poor to excellent. Several well-conducted studies have concluded that inclinometry provides valid and reliable measures of CROM when properly used. Several chiropractic manipulative therapies (CMTs) have been shown to increase CROM in symptomatic and asymptomatic populations. The current study investigated the effects of an instrument applied CMT, the Pro-Adjuster System (PAS), on CROM for the first time.

Method: The Logan College of Chiropractic (LCC) Institutional Review Board approved this investigation. Design: This was a pilot-level randomized controlled trial (RCT) of the effects of PAS on CROM. Participants: Forty consecutively selected, asymptomatic consenting volunteers were randomly assigned to treatment or control groups of 20 each. All participants were students at LCC, 18 female and 22 male between the ages of 22 and 59 years of age (mean age 29.3). Exclusion criteria were previous experience with PAS, any cervical symptoms, any contraindications to cervical manipulation, analgesic or muscle relaxant use, and any spinal manipulation within 48 hours. Measure/Examiner: Dual inclinometry (J-Tech Dualer IQ) CROMs were performed by a licensed DC with training and experience with the J-Tech. Three active passes of each ROM were taken by the examiner, who was masked to participant status. Treating Physician: A licensed DC with 10 years of experience with the PAS performed all cervical scans and treated according to standard PAS protocol. Procedure: Treatment and control groups received: 1. CROM assessment; 2. PAS CMT or a control condition; 3. Post treatment or control CROM assessment. Data Analysis: Pre and Post CROM measures of the treatment and control groups were compared by paired t-tests (a priori p < .01). Hypotheses: 1. The treatment group would have significant CROM increases; 2. The control group would have no CROM changes.

Results: All data sets were complete with no drop-outs. Both hypotheses were supported by data analysis. The treatment group achieved significant (p < .01) increases in all cervical ranges of motion while the controls had no CROM changes.

Conclusion: This investigation offers several implications for chiropractic research and practice. Scientific, legal and economic forces are changing chiropractic practice through evidence-based practice and best practices initiatives. New technology like the Pro-Adjuster System should be subjected to rigorous empirical investigation to provide researchers, educators and practitioners with information as to its clinical efficacy. The results of this first investigation have shown that a single PAS CMT can significantly increase CROM in asymptomatic participants. These results are similar to those obtained in studies using other chiropractic techniques, i.e., diversified and toggle. Further investigation of the effects of PAS on CROM is warranted. Future studies should include symptomatic participants and repeated measures designs.

Key Words: Pro-Adjuster System, chiropractic manipulative therapy, cervical range of motion

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A Pilot Investigation of Expert and Novice Intraexaminer and Interexaminer Reliability of Durometer Analysis Of

The Cervical Spine

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Abstract

Introduction: The foundation of chiropractic is based on locating and correcting joint dysfunction, i.e., subluxations and fixations. Chiropractic tests used to determine the need for and site of spinal manipulative therapy (SMT) have been the subject of considerable empirical study. The conclusions of this body of literature are equivocal, with few studies finding acceptable reliability or validity for the methods used to identify joint dysfunction. The consensus of the majority of studies and systematic reviews is that chiropractic tests used to locate joint dysfunction have unacceptable reliability and/or validity, including: Motion palpation, static palpation, diagnostic imaging (x-ray, video fluoroscopy), orthopedic tests, neurological tests, leg length inequality, visual observation, and pain description. The poor to fair reliability of these chiropractic tests creates a number of problems: 1. Chiropractic researchers, educators, practitioners and students lack a scientifically supported means of determining "where to adjust"; 2. Political, economic, and legal concerns with legislation, reimbursement, and litigation; 3. Scientific issues of identifying joint dysfunction determining the effects of SMT without adequate objective measures. The Pro-Adjuster System (PAS) is an FDA approved chiropracticspecific instrument used for spinal analysis and treatment. The PAS consists of a computer, software, and a piezoelectric durometer instrument, with protocols for analysis and treatment of disorders related to vertebral motion anomalies. In scan (analysis) mode, the instrument is placed against the spinous process of a vertebrae and the instrument head engages when a preload of 6 pounds has been applied. In scan mode the instrument functions as a durometer, emitting a single impulse, which measures the vertebrae's resistance to movement. Durometers are widely used in industry and, as engineering hardware, measure the resistance of any material with nearly flawless precision. Properly used, the PAS instrument is claimed to accurately measure a vertebrae's resistance to movement in the posterior to anterior plane which, if true, would be reliable by definition. Thus, the only error in this measurement of fixation/joint dysfunction would be due to operator variables.

Objective: The current study is the first to assess intra and inter-examiner reliability of PAS scans of the cervical spine for expert and novice examiners.

Method: This study was approved the Logan College of Chiropractic (LCC) Institutional Review Board. <u>Design</u>: Intra and inter examiner reliability study designed to test the hypotheses that for all cervical vertebrae: 1. PAS cervical spine scan reliabilities for all expert and novice comparisons would not be significantly different (a priori p > .05) and 2. Interclass correlations (ICCs) for all expert and novice combinations would be > .6. <u>Participants</u>: Sixty-four asymptomatic male and female consenting volunteers (age range 22-54, mean age 28.3) were selected from the LCC student body. Exclusion criteria were: Systemic illness, skin or other malignancy, local infection or injury, analgesic or muscle relaxant use within 48 hours, and chiropractic manipulation within 48 hours. <u>Examiners</u>: The two experts were licensed DCs certified in PAS with 10 and 7 years PAS experience respectively. The two novices were senior chiropractic interns certified in PAS scans by each examiner in a counter-balanced order. Masked examiners rotated between two examination stations at which participants were seated in a standard PAS chair with seat height, thoracic and head positions

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adjusted by the first examiner according to participant size. Patients were instructed to remain "very still" during the examination procedure and remained stationary until all exams were complete. <u>Data Analysis:</u> Scan data for each cervical vertebrae were automatically stored by the PAS computer software and subsequently transferred into Excel files. SPSS was used to calculate t-tests for expert-expert, novice-novice and novices-experts comparisons; and interclass correlations (ICCs) for each examiner individually, expert-expert, novice-novice, experts-novices, and experts and novices combined.

Results: All data sets were complete with no drop-outs. Both hypotheses were supported: 1. T-tests for expert-expert, novice-novice and experts-novices were all > .05, indicating that there were no significant differences between the group comparisons for PAS cervical spine scans. 2. ICCs for each examiner, expert-expert, novice-novice, experts-novices and experts and novices combined ranged from .67 to .86 (good to excellent) for all PAS cervical spine scans.

Conclusion: In this pilot study the reliabilities for the Pro-Adjuster System scans of the cervical spine were in the good to excellent range for all examiners and all combinations of examiners for all cervical vertebrae. These reliabilities are among the highest reliability/agreement/concordance findings reported in the literature for chiropractic tests of joint dysfunction. These results, although encouraging, must be considered preliminary pending further investigation. Continued study is warranted with asymptomatic and symptomatic participants and repeated measures designs.

Key Words: Chiropractic, physical examination, reproducibility of results, palpation, motion assessment, reliability, validity, agreement, specificity, sensitivity, observer variation.