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THE RELATIVE EFFECTIVENESS OF SPINAL MANIPULATION AND ULTRASOUND IN MECHANICAL PAIN: PILOT STUDY

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ABSTRACT

Objectives: To assess the efficacy of spinal manipulation versus ultrasound in the treatment of patients with neck pain.

Design: Randomized clinical trial.

Setting: Technikon Natal Chiropractic Clinic—Durban, South Africa

Subjects: Thirty randomly allocated subjects with neck pain, (aged between 16 and 60 years), responded to advertisements from the "college" (Technikon Natal, Department of Chiropractic), in the local newspapers and from the radio.

Method: Two groups of subjects were treated. Group 1 received spinal manipulation and Group 2 received ultrasound. Both groups were assessed with a CROM goniometer used for cervical range of motion assessments, algometer measurements (to assess pain thresholds), completion of the Numerical Pain Rating Scale 101 (for intensity of pain), level of disability using the CMCC Neck Disability Index, and the Short Form McGill Questionnaire to assess for the sensory dimension of pain.

Results: Ultrasound increased only right rotation range of motion of the neck, whereas spinal manipulation increased left rotation, right lateral flexion (ranges of motion of the neck) and decreased disability.

Conclusion: From the results it appears that both ultrasound and adjustments are useful in treating mechanical neck pain; however, it appears that adjustments were more effective in restoring overall mobility and in decreasing cervical disability than ultrasound alone. (J Chiropr Med 2002;1:184–188)

KEY INDEXING TERMS: Chiropractic; Ultrasound; Neck Pain

INTRODUCTION

A wide variety of treatments, including manipulation, mobilization, interferential current therapy, ultrasound, trigger point therapy and pharmaceutical intervention have been applied in the treatment of neck pain (1–3). However, there is little information available from clinical trials to support many commonly used treatments for mechanical neck pain. Conservative interventions have not been studied in enough detail to assess efficacy adequately (4).

Despite the common occurrence of neck pain, the exact nature of its etiology or pathology remains obscure and the pain is often attributed to mechanical factors (5). This clinical study investigated the effects of chiropractic adjustments compared to therapeutic ultrasound in treatment of mechanical neck pain. The 2 randomized groups of subjects were treated and assessed on measures of cervical ranges of motion, algometer readings, and the completion of the Numerical Pain Rating Scale—101, CMCC Neck Disability Index and the Short Form McGill questionnaires.

The primary treatment modality used by the chiropractic profession since its inception has been vertebral manipulation. This is employed to restore normal joint and muscle function. More recently, nonspecific exercises and physical therapeutic modalities have been used to help an injured area heal (6). Manipulative therapy involves the application of specific, accurately determined forces to the body. Its objective is to improve mobility in areas where mobility is restricted, whether

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the restrictions are within the joints, connective tissues or skeletal muscles. The result may be an improvement in posture, locomotion, and the relief of pain and discomfort (7).

Ultrasound is a modality that has long been used as a therapeutic agent, as a means of stimulating repair of soft tissue injuries and to relieve pain (8). Ultrasound therapy has achieved recognition as a suitable method in physical medicine for treating acute and chronic musculoskeletal disorders. Ultrasound consists of sound waves with a frequency of more than "20 counts per second," and well beyond the range of human hearing. The sound waves are absorbed differently in tissue with low and high protein content. It is therefore possible to heat deeper structures, such as joints, muscle and bone, with ultrasound (9).

The types of injuries treated with ultrasound include damage to ligaments, joint capsules, tendons and muscles, inflammation of tendon sheaths, scar tissue tension and sensitivity (8).

We intended this study to draw attention to the need for a better understanding of the effects of ultrasound protocols commonly employed by chiropractors. The longer the treatment period necessary for satisfactory recovery, the greater the financial burden on the patient, medical aids and society. It is therefore important to attempt to determine the need and/or most efficacious way to use ultrasonic therapy in chiropractic treatment of mechanical neck pain.

This clinical study may help to determine if any one procedure (ultrasound or adjustments) is more successful in producing a faster recovery in terms of pain, disability or range of motion, and to establish which procedure may have a superior long term benefit.

METHODS

This study received approval from the Technikon Natal Ethics Committee before experimentation. This was a randomized, consecutive comparative group study involving a sample group of 30 patients. Advertisements were placed at the Technikon, in local Natal newspapers, and on radio. All patients who responded were screened to determine if they suffered from mechanical neck pain. Only patients between the ages of 16 and 60 years of age without serious neurological signs (such as post stroke), CT or MRI proof of very large herniated cervical discs, marked anesthesia, or serious loss of muscle strength or function, were accepted into this clinical trial.

Having obtained informed consent, patients were divided randomly using a random number generator into 2 groups: Group 1 received adjustments and Group 2 received ultrasound.

Patients in both groups received soft tissue therapy to the upper back and cervical musculature for a duration of 5 minutes before manipulation or ultrasound was performed.

Group 1: Patients in this group with fixation/s of the cervical spine motion unit received adjustments, using Diversified cervical rotatory and/or lateral break techniques at each consultation (10). Patients received adjustments involving minimal rotation, whereby skin slack was removed in the direction of thrust until the contact was firmly secure over the posterior articular pillar of the cervical spine. A high-velocity short-amplitude thrust was applied in the direction of the planes of articulation of the posterior facet joints.

Group 2: Patients in this group received therapeutic ultrasound over the fixations and/or affected area/s of the cervical musculature. This procedure had the patient placed in a prone position; the affected area/s were then isolated. Ultrasound gel was applied over the sound head and on the skin over the affected area/s of the neck. The ultrasound machine was then switched on and set on a pulsed mode, at an intensity ranging from 0.5 watts per square centimeter to 1.0 watts per square centimeter, for a duration of 5 minutes. The sound was then moved by the clinician, in circular, overlapping strokes, over the affected area/s of the neck. This procedure was continued until the timer on the ultrasound machine elicited an audible signal, indicating the end of treatment.

Patients in both groups received treatment twice a week for 4 weeks. After the end of treatment (and with both groups having received no additional therapy of any type), measurements of the cervical spine ranges of motion with the CROM goniometer, algometer readings, completion of the Numerical Pain Rating Scale-101, the CMCC Neck Disability Index, and, the Short Form McGill questionnaires were recorded before, at the first, fourth, and last or conclusive treatments, all of which were finally followed with the obtaining of a one month(non-treatment) consultation.

Radiological studies of the cervical spine were conducted on subjects when clinically indicated. This was to ensure that no contraindications to manipulation existed (such as rheumatoid or psoriatic arthritis). All subjects were treated by the same practitioner.

Measurement

The CROM goniometer (Performance Attainment Associates, ST. Paul, MN), was chosen because it has been demonstrated to produce good to excellent intra-tester and inter-tester reliability in measuring cervical ranges of motion. Cervical ranges of motion were measured in all 6 degrees with the patient sitting in a straight-backed chair with his or her arms resting at the side and the feet flat on the ground. The CROM goriometer was placed on the patient as if he/she were putting on a pair of glasses and the velcro straps were fastened behind the head. Measurements were made in the following manner:

1. Cervical Flexion and Extension—The patient was instructed to firstly tuck in his/her chin to include sub-occipital flexion, and then attempt to put his/her chin onto his/her chest. Cervical extension was measured by getting the patient to tilt his/her head back and to then try and get his/her head parallel to the ceiling. These readings were taken off the sagittal plane meter and recorded.
2. Lateral Flexion—The patient was instructed to laterally flex his/her neck as far as possible to the left and the right without elevating the shoulders or rotating the head. The 2 measurements were then recorded off the lateral flexion meter.
3. Rotation—For rotation, the magnetic yoke and rotation arm was used. The patient was instructed to turn his/her head as far as he/she could to the right and then to the left, keeping the eyes moving along a horizontal line and to avoid any shoulder rotation. Two readings were read off the rotation meter and recorded.

The affected joint/s were identified using motion palpation to detect loss of end feel or joint play and, to also detect muscle hypertonicity, tenderness, texture or tonal changes of the underlying tissues, and/or any lasting soreness.

The algometer has received variable reports of reliability. Studies show a high reproducibility and an excellent validity of measurements obtained from the use of the device and thus it was used in the present study (11). A single pressure threshold meter reading was obtained from each patient. Before the procedure the patient was instructed to respond with "yes" when the pressure applied was felt to cause tenderness. With the patient lying prone (head in the neutral position), the most tender spinous process of the cervical vertebra was then identified by the observer with the left index finger. The pressure pad was then placed directly over the articular pillars of the cervical facet joint and a force applied directly posterior to anterior to the vertebra. The force was applied at a rate of one kilogram per second until the patient reported discomfort. At this stage, the algometer was removed and the reading was recorded.

The disability, pain intensity and pain quality questionnaires (as previously described) were completed by the patients, and had been chosen because they have been previously demonstrated to exhibit significant reliability and validity in measuring neck pain (12).

The collected data were transferred to spread sheets and then underwent non-parametric statistical analyses, using a 95% confidence level. Analyses within each group was performed, using the Wilcoxon Signed Rank test and various readings were compared. The reading taken before the first treatment was compared to reading taken before the final treatment. The initial reading was then again compared with the reading taken at the one month follow-up consultation.

Comparison of the results of both treatment groups was then statistically evaluated, using the Mann-Whitney U-Test. The comparison was made using the data from the first, fourth and final treatments, as well as the one month follow-up consultation. This was done for all measurement parameters.

RESULTS

The results indicated that the first treatment group (adjustments) achieved significant improvements with regard to extension and right lateral flexion at the one month follow-up consultation ($p < 0.05$). The first treatment group also achieved significant improvements with regard to disability at the final consultation and decreased pain intensity at the final and follow-up consultations ($p < 0.05$). The second treatment group (ultrasound) achieved significant improvements in left lateral flexion at the final and one month follow-up consultations ($p < 0.05$). Forward flexion was only significantly improved at the final treatment, whereas right lateral flexion, and right and left rotation were significantly improved at the one month follow-up consultation ($p < 0.05$). The second treatment group also had significant improvements in pain intensity at the final and one month follow-up consultations ($p < 0.05$).

Statistically significant differences were noted between the 2 treatment groups for left and right rotation (Table 1 and Table 2) at the fourth consultation, right lateral flexion (Table 3) at all 4 measurement stages of the study, and disability measurements (Table 4) at the

TABLE 1
TWO SAMPLE ANALYSES OF LEFT ROTATION MEASUREMENTS COMPARING BOTH TREATMENT GROUPS

	TX 1	TX 2	TX 3	TX 4
Z VALUE	0.440783	0.083313	0.517424	0.47688
P VALUE	0.220391 (NS)	0.041656 (S)	0.258712 (NS)	0.23844 (NS)

TABLE 2
TWO SAMPLE ANALYSES OF RIGHT ROTATION MEASUREMENTS COMPARING BOTH TREATMENT GROUPS

	TX 1	TX 2	TX 3	TX 4
Z VALUE	0.317667	0.087254	0.145406	0.491697
P VALUE	0.158833 (NS)	0.043627 (S)	0.072703 (NS)	0.245848 (NS)

TABLE 3
TWO SAMPLE ANALYSES OF RIGHT LATERAL FLEXION MEASUREMENTS COMPARING BOTH TREATMENT GROUPS

	TX 1	TX 2	TX 3	TX 4
Z VALUE	0.064969	0.0549957	0.049254	0.024755
P VALUE	0.032484 (S)	0.027497 (S)	0.024627 (S)	0.012377 (S)

TABLE 4
TWO SAMPLE ANALYSES OF CMCC NECK DISABILITY MEASUREMENTS COMPARING BOTH TREATMENT GROUPS

	TX 1	TX 2	TX 3	TX 4
Z VALUE	0.279446	0.479012	0.111951	0.28831
P VALUE	0.139723 (NS)	0.239506 (NS)	0.055975 (S)	0.144155 (NS)

final consultation ($p < 0.05$). Note: z value = 2-tailed probability of equalling or exceeding 0; if $p = <0.05$ = significant difference.

DISCUSSION

We hypothesized that both treatment groups would show favorable results in terms of subjective and objective findings. The results indicate that both treatment groups responded favorably to their respective treatment protocols, that each treatment method acted with equivalent efficacy and that the rate of patient improvement was similar.

The first 2 hypotheses, which stated that there would be an improvement as a result of each respective treatment protocol, were accepted. The third hypothesis, stating that there would be a difference in efficacy between the 2 treatment groups, was rejected for all data except for right lateral flexion, right and left rotation ranges of motion measurements, and disability measurements, for which the hypothesis was accepted. This would indicate that the first treatment protocol (adjustments) was more effective than the second, in terms of increasing overall ranges of motion. Of greater importance is the data that Grade v adjusting more quickly and effectively decreases disability (which results in less time off work and therefore likely less loss of government funding and disability payment).

In comparison, Koes et al conducted a blinded randomized clinical trial comparing the effectiveness of manual therapy, physiotherapy (including ultrasound), treatment by the general practitioner, and a placebo therapy. This was performed on patients with non-specific back, midback and neck complaints. Results indicated that patients who received manipulative procedures had slightly less pain, less relapses, and greater improvement in overall physical functioning at all measurements compared to the other groups that did not receive manipulative treatment (3).

The results of this study cannot be compared directly to Koes' because in the cited study there was not a clear enough distinction made between neck pain and low-back pain patients. What can be correlated is that both treatment (the manual therapy and physiotherapy) groups of this study, showed a significant improvement in cervical range of motion as a result of the treatment, with the adjustment group showing superior improvement. Both treatment groups also showed a significant

improvement in pain intensity and quality of life, with the manual therapy group again showing superior improvement. These findings support spinal manipulative therapy, and to a slightly lesser degree physiotherapy (which in some cases included ultrasound), as effective treatment protocols for neck pain.

Limitations of this study may have occurred objectively, as a result of the difficulty in goniometer readings. The subjective measurements, in the form of the 3 questionnaires, may also have had some limitations in that some patients may have felt the need to please the researcher and record an improvement which was beyond that which was actually and comfortably felt. Another weakness of this study was the small sample size. With treatment groups of only 15, and with limited measurement tools this study may only be considered a pilot study. For future studies, a sample size of at least 30 in both groups should be used so that parametric tests (that better reflects the patient population) may be used. This would make a trend in results more apparent and sensitive to the subtle changes in data.

CONCLUSIONS

It is our opinion, by considering the results produced in this study, that both forms of treatment are effective in treating mechanical neck pain. In order to decide which treatment is of greater benefit the primary objective of the treatment must be established. It it is to restore mobility and improve disability, then adjustments appear to be more beneficial. Future research is required to refute or validate these findings.

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