MOTION EFFECTS OF MANUAL MANIPULATION ON CERVICAL LATERAL FLEXION

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INTRODUCTION

It has been estimated that neck pain in Western populations is prevalent in 70% of individuals at some time in their lives [1]. Although there is no single solution to cervical spine impairments, there are several techniques used by physicians to improve a patient's cervical mobility and relieve pain. Manual manipulation, which can be conducted in many forms, is a noninvasive technique used to improve function of the cervical region [2]. Currently there are no scientifically accepted means of quantifying the effects of manipulation on the cervical region. Of particular interest to clinicians is the magnitude of motion change resulting from treatment and the duration of treatment effects. The objective of this experiment was to quantify the effects of manual manipulation, applied in the form of muscle energy, on ranges of cervical spine lateral flexion (side-bending).

METHODS

Four subjects, all exhibiting signs of cervical dysfunction as identified by a clinical examination participated in the experiment. Subjects were asked to return 24 hours, 48 hours and 7 days from the initial test day. Prior to testing, all volunteers completed an informed consent procedure, a Visual Analog Pain Scale (VAS) as well as a Neck Pain and Disability Questionnaire. After completion of these forms, an osteopathic physician with over 20 years of experience performed a palpatory diagnostic examination of cervical lateral flexion, during which he recorded the nature of the patient's cervical range and quality of motion. For this exam, the subject was instructed to sit in an erect posture on a stool with his or her eyes closed and arms crossed. Positioning himself behind the subject, the examiner placed one hand on the top of the subject's head and the other at the base of their neck. Starting from a neutral position the head was guided to the right until an end-range of motion was determined, followed by a return to the neutral position and a guided motion to the left.

The diagnostic exam was then repeated three consecutive times in front of a five-camera motion capture system where three-dimensional kinematic data were recorded (Qualisys™, Gothenburg, Sweden) for a 35-60 second period. To obtain the kinematic data sets, three markers were placed on the subject's head, and a triad of markers was attached to the sternum.

Within 30 minutes of the collection of the kinematic data the physician performed a muscle-energy treatment on the subject. Muscle-energy treatment involves the voluntary contraction of a patient's muscles in a precisely controlled direction to relax shortened muscles that restrict motion. Upon completion of the treatment, another set of kinematic data were recorded. These data were collected within 30 minutes of treatment and were used to document effects of the treatment.

Subjects were asked to return 24 hours and 48 hours post treatment, as well as 7 days post-treatment. During the 24 hour and 48 hour tests, both kinematic and pain assessments were executed as well as a repeat of the first day's diagnostic procedure. Day 7 protocol was identical to the first test session: diagnosis of cervical lateral flexion, kinematic data collection, treatment, and a second kinematic data collection.

From the three-dimensional position data acquired, angles were computed for the head relative to the neck. Each test consisted of three trials of cervical lateral flexion, each with three cycles of right to left cervical flexion, resulting in nine end-range values per subject per assessment. The data were normalized with regard to time, and then the full cervical range of motion was analyzed on a per cycle basis. Full range of motion was defined as the total angular displacement from right maximum lateral flexion to left maximum lateral flexion, as shown in Figure 2. Statistical analysis included paired t-tests conducted at a 95% confidence level to determine whether significant kinematic changes occurred for cervical ranges of motion between pre and post-treatment.

RESULTS AND DISCUSSION

When examining the range of motion data, all participants demonstrated an increase between pre and post-treatment cervical range of motion (both on Day 1 and Day 7). Statistical analysis indicated a significant increase ($p < 0.001$) in full range of motion immediately following treatment. This is demonstrated in Figure 3 with a linear analysis of the range of motion for a subject pre and post-treatment. When comparing the linear regression lines of the two data sets, it can be observed that on average the cervical range of motion was greater post-treatment over the nine cycles.

The average increase in full range of motion over these trials was 4.53 degrees. Also, for the two subjects able to participate in the 24 hour post-treatment evaluation, a decrease in range of motion was observed from the Day 1 post-treatment examination to the 24 hour assessment. A further, but less substantial, decrease in these two patients range of motion occurred 48 hours post treatment.

These statistical findings suggest that positive effects from muscle-energy treatment are immediate. This effect is most likely due to the mechanical nature of soft tissues. The tissues appear to be able to achieve a higher strain at the same stress than that produced prior to treatment. An increase in strain is due to a percent elongation in the tissue due to muscle-energy therapy, thus extending the subjects range of motion. A confounding issue in this study is that the motions were passively guided. Although the examiner had years of experience and performs this task on a daily basis in a clinical setting, the possibility exists that the examiner was not consistent in the loading placed on the head to guide it to the end range. Further quantification of the examiner's technique is necessary.

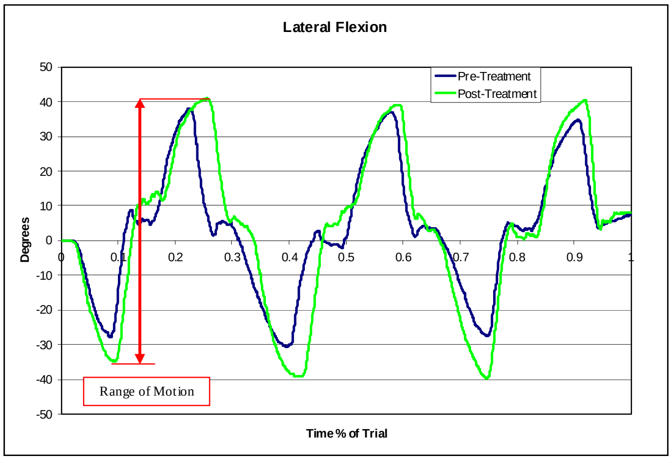

Figure 1. Lateral flexion plots of a subject pre and post-treatment for the initial day of testing.

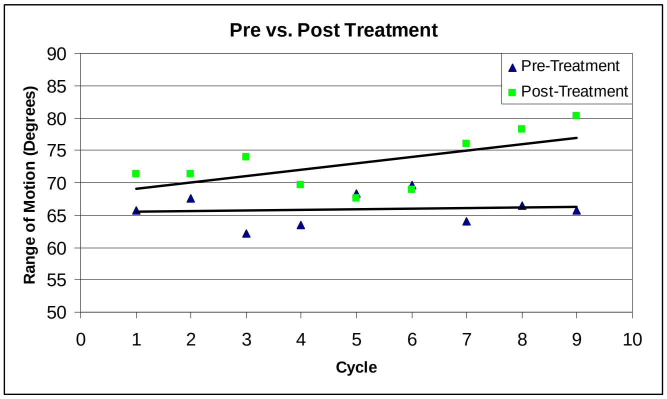

Figure 2. Linear analysis of range of motion for cervical lateral flexion for a single subject over all nine cycles: comparisons between pre and immediately post-treatment.

REFERENCES

1. Bovim G, et al. *Spine* **19**, 1307-1309, 1994.
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