Measuring the Effects of Osteopathic Manipulative Treatment on Range of Motion in Subjects with Postural Asymmetries in the Lateral Perspective: A Potential Implication for People with Lateral Spinal Curvatures

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Introduction

Background: According to the American Academy of Orthopaedic Medicine, asymmetry is often referred to as lateral curvature. A poorly positioned backpack, chronic sitting, and slouching are factors that contribute to asymmetrically modified postures and gait (Cattaneo, 2004). This misalignment in spinal posture creates poor posture and can influence a postural asymmetry. Although postural asymmetries and lateral spinal curvatures, like postures, can be noticeable to the eye, many cases go undetected unless the subject undergoes a radiograph or complains of pain (Goldberg, 2008).

The Cobb angle, established in 1948, is the gold standard for measuring lateral curvatures on diagnostic imagery (Glotter, 2007). However, exposure to numerous radiographs can cause undue exposure to radiation. Studies have found that exposing tissue in adolescent girls diagnosed with scoliosis are affected by radiation the most during their peak of biological growth (Goth, 1998). Use of radiographs when assessing for lateral spinal curvatures may be avoided by utilizing such techniques as 2D morphometrics. 2D morphometrics has recently been shown to be of benefit when describing posture (Stone et al., 2014). The authors could then further apply the techniques to measure the effects of OMT on patients with presenting with dysfunctions such as postural asymmetries and restricted range of motion.

Purpose: For this thesis, I explored the impact of treatment on a sample of subjects documented with lateral postural asymmetries, which demonstrated significant changes in subjects treated with OMT vs Sham or Control (Stone, 2014). I sought to further quantify through morphometrics, the potential changes in range of motion as a result of the same OMT protocol.

Hypothesis: I hypothesized that OMT would increase range of motion (ROM) in patients with lateral curvatures. I further hypothesized that treatment would not increase ROM. I expected to see an increased ROM reflected in the morphometric shape analyses.

Materials and Methods

Organization: Subjects who completed 6, 8, 9, and 13 sessions were placed into groups: pre-1 treatments, treatment side benefits and post side benefits. For example, Subject 25 (Figure 1) completed Treatments 1, 9, 11, and 19 post side (left) pre-treatment; treatment side left and post side (right) treatment and post side (left) pre-treatment.

Morphometric Shape Analysis: Shape analysis is a way to quantify variation and morphological transformation (Zelditch, 2004), such as potential shifts in posture as a result of OMT. Morphometric analysis through landmarks quantifies shape change for all the skin data points collected through the COI template. By landmarking a subject’s body through the OMT protocol, it can be determined whether changes in the subject’s body have a significant effect on the subject’s body’s range of motion. Changes in range of motion are then attributed to the OMT protocol or treatment, if any, the subject has received.

Landmarks: Analyses of any area and semi-landmark data points has been conducted by using morphometric shape analysis. The first step of analysis is to choose a “frame” or “closed landmarks,” consisting of the landmarks placed and marked on the subjects’ posterior back. The second set of landmarks, referred to as “landmarks,” are then placed on the subject’s back between the landmarks that outline the subject’s body, the shape transformation of the subject, and the central axis of the subject in question. According to Zelditch (2004), “Landmarks are ideally homologous anatomical loci that do not alter their topography relative to other landmarks, provide adequate coverage of the morphology, can be found reproducibly, and within the same plane” (Zelditch, 2004). In other words, this means that all the data points collected pre- and post-treatment were not altered when the morphometric test analysis to see if a shape change occurred with each treatment.

Bone Landmarks: The bone landmarks consisted of 11 landmarks placed on the subject’s back. There were 6 landmarks on the left side and 5 on the right side. The landmarks were placed on the superior, lateral, and inferior views of the subject. Then, the overlapping landmarks, which were on the posterior side of the subject, were analyzed for each subject. The resulting values were then used to determine if there was an observed value change in the subject’s lateral view.

Subjects: 14 subjects were included in the study (Table 1). Subjects were all participants at the Philadelphia College of Osteopathic Medicine. Participation in the study was voluntary, and all subjects signed an informed consent form, as stipulated in the Department of Osteopathic Medicine’s Institutional Review Board. All subjects were tested on their right side followed by their left side. Subjects 1, 4, 8, and 12 were females, while Subjects 2, 3, 5, 6, 7, 9, 10, 11, 13, and 14 were males.

Osteopathic Manipulative Treatment: Osteopathic manipulative treatment is a form of manual therapy that involves hands-on manipulation of joints, muscles, tendons, ligaments, and other soft tissues to improve range of motion and realign the muscle spindles (Gustoettner, 2012). In this study, all subjects were treated with OMT using the treatment protocol that was developed for the study.

The morphometric shape analysis uses a combination of Principal Component Analysis (PCA) and Canonical Variates Analysis (CVA). PCA is used to examine the large groups of subjects with spinal curvatures or postural asymmetries.

The mean 1 is conducting the OMT treatment protocol (CVA) on the subjects (Figure 2). The results are then analyzed to determine whether or not OMT improves range of motion and/or changes the shape of the subject. The results are then analyzed using shape analyses using the principal components of the subject’s shape. Therefore, it is possible to determine whether OMT changes the shape of an individual’s back and improves range of motion. In my project, I am analyzing pre- and post OMT treatment digital photographs of patients who were treated in 2014 as part of joint study with the Department of Bio-Medical Sciences and the Department of Osteopathic Manipulative Medicine at PCOM. Photographs were taken of the subjects’ back before and after their 1st treatment session. The photographs were then analyzed utilizing shape analysis. The photographs were analyzed using Image-J software to determine range of motion through graph and statistical analysis. The data was then evaluated to determine the effects of OMT on the subjects’ back and to determine any significant range of motion indicated by side bending in the postures (Figure 3).

The results for this landmark populations showed the greatest change in shape when comparing groups from a sham protocol and treatment protocol before the first day of treatments and after the sixth day of treatments. The first principal component analysis (PCA) eigenvalues accounted for 44.4% (Table 1). This indicates that Landmarks 1, 2, and 3 show the most variation. In addition to this, PCA analysis, a way shape analyses, was done to analyze the data sets and again revealed that Landmarks 1, 2, and 3 show the most variation. The results further show that when looking at the PCA and CVA results, the marks on the left side have greater range of motion than the marks on the right side. The marks show that there is a significant change in the shape of the subject’s back when comparing the left and right postures. Therefore, the results for this study show that OMT is effective in improving range of motion and can be used to determine whether or not OMT is effective in improving range of motion and/or can be used to determine whether or not OMT is effective in improving range of motion.

Conclusions

Subjects (predominantly OMT subjects) with correctly palpated bony landmarks showed increased ROM in the relative adequate analysis, PCA principal component analysis, and CVA canonical variates analysis.

Principal Component Analysis results show shape changes indicating lateral ROM increased for individual subjects treated with OMT, but not sham control.

Moving down the Y-axis (Figures 2 and 3), warp shapes showed increased side-bending left.

Therefore observers would expect a drop along the Y-axis, which is increased for individual subjects treated with OMT, but not sham control.

Table 1: Observed trends of individuals for side bend left to right

Recommendations

All Bony Landmarks must be present when still images are taken of subjects.

All hair must be tied in a bun, revealing C7, scapula and Acromion Process Landmarks.

Tight clothing should not be worn when posterior shots are taken for analysis.

Pre- and Post- Images from previous treatments will be compared to see if subject is side-bending to their full potential.

Surveys will be taken at the end of treatment to evaluate subject experience.

Acknowledgements

We thank the members of the departments of Bio-Medical Sciences and Osteopathic Manipulative Medicine, especially D. Allison, M. Bona, D. Hagyes, N. Bieber, R. Behren, N. Friedman, K. Hummerston, J. Lorine, B. McMahon, L. Noto, P. Reeman, G. Zane, and P. Mattix. The PCOM Department of Research provided funding for this study.

Methods were performed in accordance with the IRB protocol #193-040.

References


