INTRODUCTION

Low back pain (LBP) has long been recognized as one of the major health problems in the US not only because of its impact on quality of life but also the staggering medical and socioeconomic costs [1]. The pathophysiology of chronic LBP is poorly understood. A majority of LBP cases are idiopathic or non-specific. Previously it was shown that LBP may interfere with postural stability [2]. In general, patients with LBP demonstrate a larger excursion, indicating less ability to regulate their postural stability. However, it is not clear how postural sway varies with the severity of LBP. In the present study this relationship was examined.

The treatment methods for LBP include medication, exercise, manual therapy, and surgery. Spinal manipulation (SM) is a form of manual therapy with moderate clinical effectiveness similar to other nonsurgical interventions for acute and chronic LBP. In the present study, two forms of SM, High-Velocity Low-Amplitude (HVLA) side-posture adjustment and Low-Velocity Variable-Amplitude (LVVA) flexion-distraction, were applied to treat patients with sub-acute or chronic LBP. It was hypothesized that the interventions would reduce postural sway due to a decrease in LBP severity.

METHODS

Participants were eligible if they were 21-54 years old, presented with LBP of at least 4 weeks in duration, scored 6 or above on the Roland Morris Disability Questionnaire (RMDQ), and met diagnostic classification of 1, 2, or 3 of the Quebec Task Force Classification for Spinal Disorders. 192 participants (89 females, 103 males) were randomly assigned to HVLA (N=72), LVVA (N=72), or a wait-list control (N=48), respectively. SM was applied to one or two joints at L4-L5, L5-S1, or sacroiliac joints for 4 intervention visits over 2 weeks.

The mean excursion of the center of pressure in the anterior-posterior (AP) and side-to-side (SS) directions were monitored using a force plate at a sampling rate of 1000 Hz [3]. The participant stood quietly first on a hard surface, i.e. directly on the force plate, and then on a soft surface, i.e. on a 10 cm thick latex foam pad, for a period of 30 seconds, respectively. They were allowed to choose their comfortable stance while blindfolded and in their socking feet. The procedure was repeated twice.

Postural sway, pain (Visual Analog Scale) and RMDQ scores, were obtained at baseline and following the two-week SM intervention. To examine the association between postural sway and pain or RMDQ, a mixed model with repeated measures was applied using the SAS software package. The estimated least-square means and 95% confidence intervals adjusted for sex, age and height were presented for each model. Statistical significance was set at 0.05.

RESULTS AND DISCUSSION

The mean±SD age and height of the participants were 40±9.4 years old and 172.7±9.7 cm. The mean baseline pain and RMDQ scores were 55.7±20.9 and 9.7±3.2. 62% of the participants had the condition longer than one year. The relationship between the baseline postural sway and pain or
RMDQ are demonstrated by dividing all possible pain (0-100 mm) or RMDQ (0-24) scores into equal segments (Figures 1). There were significant associations between postural sway on the soft surface and LBP severity in both the AP and SS directions at baseline (Table 1). There was a significant association between postural sway on the hard surface and pain in the SS direction.

![Figure 1: The relationship between the model estimated least-square mean s of postural sway in the anterior-posterior (AP) and the side-to-side (SS) directions and pain (A. and B.) or RMDQ (C. and D.) scores on the hard and soft surfaces at baseline. The dash lines represent 95% confidence intervals.](image)

Table 1: p values for the association between postural sway and pain or RMDQ at baseline.

<table>
<thead>
<tr>
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<th>Pain</th>
<th>RMDQ</th>
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<tbody>
<tr>
<td></td>
<td>AP</td>
<td>SS</td>
</tr>
<tr>
<td>Hard</td>
<td>0.26</td>
<td>0.04</td>
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<tr>
<td>Soft</td>
<td>0.003</td>
<td>0.002</td>
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The HVLA and LVVA interventions had significant effects (p < 0.001) on LBP severity while the wait-list control group did not. Specifically, the mean pain scores dropped 23.5±28.1, 17.8±25.7, and 6.1±19.4, and the mean RMDQ scores dropped 4.0±4.2, 3.8±4.1, and 1.0±3.0 for three groups, respectively. Table 2 summarizes the adjusted effects of the change in postural sway from baseline to 2 weeks. While the HVLA and LVVA groups had larger mean changes in postural sway than the wait-list group on the soft surface, there were not significant differences between the groups.

CONCLUSIONS

In the present work we demonstrated significant associations between postural sway and LBP severity at baseline when the participants stood on the soft surface while blindfolded. While there was a significant improvement in LBP severity in patients receiving SM interventions, the decrease in postural sway compared to the control was not significant, suggesting a more complex nature in balance control. It is possible that the two-week SM intervention was not long enough to improve balance control or the SM interventions provided was too restricted compared to normal practice.

REFERENCES


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