ABSTRACT

Background and Objectives: Evidence of the kinesiopathological component of the vertebral subluxation complex is frequently apparent in observation and assessment of posture. Postural distortion from loss of the normal cervical lordosis has been referred to as forward head posture (FHP) and may precipitate pain, decreased ranges of motion and other health problems. FHP can be quantified by measurement of neutral lateral cervical radiographs. The objective of this study was to determine if the use of head weighting and balancing protocols could improve the cervical curvature and head carriage.

Methods: One hundred and thirty one patients from six Chiropractic clinics in the United States, two in Canada and one in the Russian Federation participated in the study. Study participants were randomly selected and assessed with neutral lateral cervical radiographs. These patients performed motion activities while wearing three or five pounds of weight on the front of their heads for five minutes then a weighted stress lateral cervical film was taken.

Results: A comparison of the measured results from the two films was made considering the cervical lordosis and FHP. Average improvements in the cervical lordosis of 34% (p < .0001) and in FHP 14mm (p < .0001) were noted after the head weighting protocol was performed with five pounds. Improvement of cervical lordosis of 31% (p < .001) and in FHP 18mm (p < .0001) was recorded in a group using three pounds of weight.

Conclusion: Head weighting may prove to be a useful therapeutic tool in addressing FHP and the concurrent loss of the normal cervical lordosis.

Key words: cervical lordosis, forward head posture, anterior head weighting, proprioceptive retraining, wobble chair, vertebral subluxation.

Introduction

The biomechanical ideal configuration for the human cervical spine is a posterior concave arc or lordosis.1,2,3 This positions the center of gravity of the skull over the mid cervical vertebrae.4 The loss or reversal of the normal cervical lordosis and attendant forward head posture has long been identified with numerous consequential health problems including decreased vital lung capacity,5 cervical, interscapular and headache pain,7,8 and temporomandibular disorders.9 Many symptoms may be moderated or eliminated by improving posture.10 Chiropractors and other health care professionals have attempted to measure and correct these postural problems through spinal adjustments and rehabilitative protocols. Successes in changing forward posture through spinal adjusting and other therapeutic activities have been reported but routine predictable changes have not. Published opinion and unpublished clinical research has suggested that purposefully attached external weights can cause the body’s righting reflexes to react and correct posture to a more ideal state.10,11 Proprioceptive balance activities have been used therapeutically in recent times and studies show that stimulation of sensory receptors in spinal ligaments elicits reflex activity in the paraspinal muscles and contributes to maintaining spinal stability.11,12,13 There are five righting reflexes14 that relate to proprioception (orientation in time and space). See Table 1, page 2.

To our knowledge, no literature exists that combines proprioceptive activities with corrective external weighting protocols to produce postural improvements that are measurable on radiographs.

Methods and Materials

One hundred and thirty one patients from six Chiropractic clinics in the United States, two in Canada and one in the Russian Federation participated in the study. Eighty female and
Improvement of Cervical Lordosis

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Table 1: The Five Righting Reflexes

<table>
<thead>
<tr>
<th>Reflex Type</th>
<th>Function</th>
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<tbody>
<tr>
<td>Labyrinthine (inner ear)</td>
<td>Maintains the head’s orientation in space (medulla)</td>
</tr>
<tr>
<td>Optic (ocular)</td>
<td>Keeps the head in proper orientation to its gravitational environment (occipital cortex)</td>
</tr>
<tr>
<td>Neck righting (joints of reflex the neck)</td>
<td>Keeps the body oriented to the head (medulla).</td>
</tr>
<tr>
<td>Body righting (body surface reflex receptors)</td>
<td>Orientates the body in space (medulla).</td>
</tr>
<tr>
<td>Body righting reflex #2</td>
<td>Keeps the head, oriented to the body (midbrain).</td>
</tr>
</tbody>
</table>

Patient performs proprioceptive exercises on Pettibon Wobble Chair™ with five pounds of anterior head weight for five minutes.

Results

The average loss of the cervical curve was 94% in the North American cohort. 35 of the 97 subjects had kyphotic or kyphotic S curves of the cervical spine. Forward head posture averaged 1.2 inches or 31mm for the 97 subjects. Average loss of curve was 76% in the smaller sample from the Russian Federation. FHP averaged 30mm or 1.1 inches in this smaller sample. Films taken after the proprioceptive training activity, with the subjects weighted, demonstrated average loss of curve improved from 94% to 58%, a 34% improvement, in the North American study group.

A paired t-test showed this improvement to be highly significant in a statistical sense (t = 7.20, p < .0001). Data from the Clinic in Vladivostok identified average improvements from 76% loss of curve to 45% loss of the cervical lordosis, a 31% improvement. A paired t-test showed this improvement to also be highly significant in a statistical sense (t = 3.92, p < .001). Forward head posture improved from an average of 31 to 17 mm, for a total of 14 mm improvement of anterior head transla-
tion in the American cohort. A paired t-test showed this improvement to be highly significant \((t = 13.11, p < .0001)\). The Russian sample showed an average of 18 mm improvement, again highly significant \((t = 8.50, p < .0001)\). The sample of thirty patients in the American cohort showed an average change of 2.70 degrees of the hard palate angles from the non-weighted to the weighted x-rays. This verifies that there was good consistency with patient positioning.

Further investigation of the relationship of the percentage loss before and after the training activity continued by examining the scatterplot of the two \% loss variables in the American cohort. The graph of the 97 subjects is shown in Figure 1. The patients plotted in the lower right-hand corner of the graph experienced the greatest improvement (reduction) in \% loss. These are some of the 35 patients exhibiting kyphotic or kyphotic S curves of the cervical spine. The North American cohort was then separated into two subgroups. Group 1 was the 35 subjects with kyphotic or kyphotic S curves (\% loss greater than 100), while Group 2 were the 62 subjects not exhibiting this condition. (In Figure 1, Group 1 is all points on the right side and Group 2 is all points on the left side.) Table 2 summarizes the statistical information from the two groups.

**Table 2: North American Cohort (training with 5 lb)**

<table>
<thead>
<tr>
<th></th>
<th>Group 1</th>
<th>Group 2</th>
<th>Overall</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N = 35</td>
<td>N = 62</td>
<td>N = 97</td>
</tr>
<tr>
<td>Before training, Mean % Loss</td>
<td>166%</td>
<td>54%</td>
<td>94%</td>
</tr>
<tr>
<td></td>
<td>(6%)</td>
<td>(3%)</td>
<td>(6%)</td>
</tr>
<tr>
<td>After training, Mean % Loss</td>
<td>93%</td>
<td>39%</td>
<td>58%</td>
</tr>
<tr>
<td></td>
<td>(8%)</td>
<td>(4%)</td>
<td>(5%)</td>
</tr>
</tbody>
</table>

Separate t-tests were run on the two groups to see if each group exhibited significant improvement. For Group 1, the average loss of curve improved from 166\% to 93\%, a 73\% improvement. The paired t-test showed this to be a highly significant improvement \((t = 7.53, p < .0001)\). For Group 2, the average loss of curve improved from 54\% to 39\%, a 15\% improvement. The paired t-test showed this to also be a highly significant improvement \((t = 4.50, p < .0001)\). There was no significant difference in age or gender composition between the two groups.

**Discussion**

Case reports in the chiropractic literature have demonstrated positive changes in the cervical lordosis as a result of specific chiropractic care. Wallace et al have reported a close association between changes in the cervical curve and decreased subjective symptoms.\(^17\)

A comparison of the data from the North American sites and the Russian Federation revealed a surprising consistency and has suggested that there is a range of weight that produces beneficial changes. Prior to the trial, clinical observations had suggested that three pounds was insufficient to produce the desired changes in individuals with significant degenerative joint disease in the cervical spine. Due to the fact that the Russian participants were younger and with less pathology, this may suggest utilizing a 3-pound head weight on a non-pathological cervical spine and a 5-pound head weight where osteoarthritic degenerative changes are present. The amount of the weight may also be varied based on patient strength, stature and comfort.

One subject demonstrated a significant worsening of the lordosis and the magnitude of forward head posture. It is speculated that this individual was of slight stature and with her relatively small muscle mass, the cervical spine buckled with the five-pound weight.

An important and pertinent finding from this study was that the changes in the cervical curve and forward head posture were produced within five minutes without any other therapeutic intervention other than the proprioceptive activity while wearing the head weight. The study did not evaluate whether the changes were apparent after the subject removed the head weight or whether the protocol produced lasting changes. Further study is necessary to evaluate these questions.

It was also noted that the kyphotic and kyphotic S-curved necks responded better than a lordotic S-curve or a hypolordotic curve. It is unknown why individuals with kyphotic or kyphotic-S curves showed such large improvements during the head weighting protocol. This may simply be a product of the magnitude of the percentage loss of curve calculated in the kyphotic-S configurations. It may represent rapid adaptation to the imposed demands of the weight with an unstable spine and demonstrate the spines ability to alter structure to a more efficient configuration.

It is proposed that external head weighting is based on adaptive principals, forcing the body to react in ways that produce a more optimum posture. The frontal head weight imbalances the skull, which in turn activates the extensor muscles that then cause the front of the skull to rotate upward. The upward rotated skull causes the optic and labyrinthine righting reflexes as well as the mechanoreceptors and body surface receptors to bring the optic righting reflex in line with the horizon by activating the cervical flexor muscles.

**Conclusions**

Anterior head weighting combined with proprioceptive retraining activities produced significant and immediate improvements in forward head posture in a sample group. The encouraging initial results demonstrate large improvements in static posture. This suggests that these simple therapeutic protocols...
may be recommended to patients with health problems related to forward head posture and combined with traditional adjusting approaches to produce significant postural improvements. These inexpensive, low-tech activities can be administered as active care protocols that, after coaching, can be performed by patients without provider supervision at home. Additional studies are needed to determine the long-term effects of this adjunctive rehabilitation to ascertain if this protocol makes lasting changes to the posture and function of the spine.
Acknowledgments

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