Quantification of forward head: early detection of symptomatic forward head posture

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Introduction

Faulty posture of the head, neck, and shoulders have been implicated in the development or perpetuation of craniofacial pain, headache, neckache, and shoulder pain (Braun, 1991; Griegel-Morris et al., 1992; Raine et al., 1997; Greenfield et al., 1995). Subjects with forward head and rounded shoulder have been reported to have an increased incidence of neckache or interscapular pain (Griegel-Morris et al., 1992). However, early detection of potential symptomatic forward head posture is difficult. Attempts are made in early studies to objectify a grading method for posture. Among these postural investigations, angular measurement is the most common method of measuring head or shoulder posture (Braun et al., 1989; Darling et al., 1984; Braun et al., 1991). While symptomatic subjects were found to display a more forward head and more rounded shoulder position than asymptomatic subjects without craniofacial pain (Braun, 1991) or neck pain (Shiau et al., 1990), no statistically significant differences in head position were also reported between the patient sample with cervical pain and the nonpatient sample (Harrison et al., 1996). On the other hand, the interrater reliability for angular measures of head position (r=0.34) was found to be lower than distance measures (r=0.87) (Harrison et al., 1996). These controversial findings clearly suggest that posture measurement techniques need to be improved so that minor postural differences in various situations can be distinguished. The purpose of this study are to (1) introduce distance parameters for quantifying forward head posture (forward head distance, FWD) and rounded shoulder position (rounded shoulder distance, RSD), and to (2) examine their ability of detecting postural differences resulting from the existence of pain experience or from various sitting positions.

Methods

88 subjects with or without a history of neck-shoulder pain (subjects with pain history, n=59, age 24±5; healthy control subjects, n=26, age 25±9) were recruited for sitting posture measurement. A Fujifilm MX500 digital camera was mounted on a tripod and used to obtain lateral-view slides of subjects while they are seated in slouched position, habitual sitting position, or self-corrected position. Floor markers and a plumb line hung 1 meter away from the camera lens were used to ensure a direct lateral view of each subject during measurement and to provide a vertical reference for proceeding calculation. To quantify the head position and shoulder position, two distance measures (FWD, RSD) and two angular measures that were widely used in the literature (Forward Head Angle, FWA; Round Shoulder Angle, RSA) were obtained from the images taken by the digital camera. FWD refers to the horizontal distance (defined by the reference plumb line) between C7 spinous process and tragus of ear. RSD refers to the horizontal distance between C7 spinous process and the posterior angle of acromion process. FWA was
the inclination angle of C7-tragus horizontal made by the line between tragus and C7 spinous process to the horizontal. RSA refers to the angle made by the line passing through C7 spinous process and the posterior angle of acromion process to the horizontal. A two-way MANOVA was used to examine the effect of different sitting positions (slouched, habitual and self-corrected sitting) and pain experience on these postural variables.

Results and Discussion

Table 1 shows the mean value of FWA, RSA, FWD and RSD for subjects with or without neck-shoulder pain experience in different sitting positions. The results of two-way MANOVA revealed significant multivariate effects attributable to both factors (position factor: F=3.8, p<0.001, pain experience factor: F=8.0, p<0.001). Further univariate F-tests showed that the significance of pain experience effect was only specified to the distance measures namely FWD and RSD (FWD: F=6.6, p<0.05, RSD, F=7.7, p<0.01) but not to the angular measures. The effect of sitting position factor was significant on both forward head measures (FWA: F=11.6, p<0.001, FWD: F=3.7, p<0.05) but not on rounded shoulder measures. Post-hoc analysis of position effect on FWA and FWD both showed that forward head alignment is significantly less prominent in self-corrected sitting positions in comparison with slouched sitting positions. In addition, FWA in habitual sitting position also showed significant differences from FWA in slouched sitting position.

<table>
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<tr>
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<th>with neck-shoulder pain experience (n=59)</th>
<th>without neck-shoulder pain experience (n=26)</th>
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<tbody>
<tr>
<td></td>
<td>slouched sitting</td>
<td>habitual sitting</td>
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<td>Angular measures</td>
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<tr>
<td>FWA* (°)</td>
<td>49±8</td>
<td>51±5</td>
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<td>RSA (°)</td>
<td>122±14</td>
<td>120±14</td>
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<td>Distance measures†</td>
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<tr>
<td>FWD (cm)</td>
<td>10.2±2.2</td>
<td>9.9±1.5</td>
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<td>RSD (cm)</td>
<td>6.0±2.7</td>
<td>5.3±4.2</td>
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* Significant position effect was found in forward head measures (FWA: F=11.6, p<0.001; FWD: F=3.7, p<0.05) but not in rounded shoulder measures.
† Significant differences between subjects with and without a history of neck-shoulder pain were found in distance measures but not in angular measures (FWD: F=6.6, p<0.05; RSD: F=7.7, p<0.01).

Table 1. Quantification of forward head and rounded shoulder posture in different sitting positions for subjects with or without neck-shoulder pain experience
Head or shoulder posture in subjects with a history of neck-shoulder pain were found to be different from those without pain experience by using distance measures but not by using angular measures although these measures were all obtained from the same source photos. The findings imply that the distance measures no matter for measuring head posture or shoulder posture is more sensitive in distinguishing the differences from the experience of neck-shoulder pain than the angular measures commonly used in the literature.

In addition, head posture was found to be significantly different in self-corrected sitting position from slouched or habitual sitting positions while no differences in shoulder posture were found among different sitting positions. The ability for self-correcting faulty head posture was seen to be significantly better than the ability for self-correcting faulty shoulder posture. The implication might be clinically important. Treatment program in posture reeducation might need to be emphasized more on the management of rounded shoulder since it is difficult to be self-corrected.

References

8. Shiau Y.Y. et al., J Craniomandib Prac, 8, 244-251, 1990

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