Comparing Muscle Activity and Spine Shape in Various Sitting Styles

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“Stacksitting has been shockingly effective in resolving a nagging sciatic pain that was resistant to cortisone shots and medication. The effects and the underlying logic are deeply moving to me and keep me wanting to research and explore further.”

-Julie Southern, President, Spiralinks Corporation

Background and Purpose

Lower back pain is experienced by approximately 70% of the world’s population, contributing to the worldwide burden of disease. Back pain is the largest single factor in the decline in worker productivity with economic cost estimates ranging between $200 to $600 billion per year in the United States. Posture modification appears to be an effective intervention to reduce back pain. In a randomized controlled trial with 579 patients with chronic or recurrent low back pain, Little et al (2008) observed that those who were taught back exercises using the Alexander Technique (a postural modification approach) experienced significant reduction in back pain, and improved quality of life while the massage group reported no benefits (Little et al, 2008). The purpose of this poster is to explore a ‘stacksitting’ position (Gokhale, 2013) that appears to reduce experiences of back discomfort and low back pain.

Subjects

Two female volunteers (average age 25 years) who served as pilot participants to model a stacksitting technique (Gokhale, 2013).

Equipment and Sensor Location

SEMG was recorded with standard biofeedback equipment (Thought Technology, Ltd. Myoscan Pro sensors) using software bandpass filter set at 100-200 Hz (Procomp Infinity). The triode electrodes were placed on the right and left upper trapezius muscle, and on the mid-back over the erector spinae muscles, one inch from the spine in a parallel configuration (see Figure 2). Spine curvature was captured and characterized with additional biofeedback equipment (Gokhale SpineTracker, Stollenwerk et al, 2018) consisting of five sensor units, attached to the subject’s back, capturing the angle of each sensor on the spine. The sensors were placed on the back with even spacing, with the lowest sensor on the sacrum at a fixed distance of 0.5” above the intergluteal cleft.

RESULTS

The models sat in three positions: slouched (forward bent), arched upright, and in a stacksitting position as shown in Figure 5 (Gokhale, 2013).

Figure 1. Crowd sourcing data from 64,520 patients’ reports. Reproduced from: https://www.healthoutcome.org/condition/43/lower-back-pain-treatment

Figure 2: Sensor placement for Spine Tracker and EMG.

Figure 3: Average muscle tension depending sitting posture

Figure 4: Comparison of the SEMG signals for slouch, upright and stack sitting positions.

Figure 5: Comparison of the three sitting positions and the corresponding spine curves.

Stacksitting reduces the back muscle tension and intra disk pressure significantly as compared to the common technique of “sitting up straight” (arching).

SEMG devices can be used to monitor the appropriate spinal posture position that would optimize spinal alignment to reduce asymmetrical disk pressure. Stollenwerk et al (2018) observed that those who were taught back exercises using the Alexander Technique (a postural modification approach) experienced significant reduction in spine curvature as compared to the arched position (0.64 µV), and a significant increase in SEMG activity when sitting in the arched position (4.9 µV) as shown in Figure 3 and 4.

Figure 2. Sensor placement for Spine Tracker and EMG.

Table 1. Angle change of spinal curves for sitting positions.

<table>
<thead>
<tr>
<th>Position</th>
<th>Slouched</th>
<th>Arched</th>
<th>Stacked</th>
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<tbody>
<tr>
<td>angle d</td>
<td>-3 deg</td>
<td>12 deg</td>
<td>4 deg</td>
</tr>
<tr>
<td>angle c</td>
<td>-2 deg</td>
<td>19 deg</td>
<td>6 deg</td>
</tr>
<tr>
<td>angle b</td>
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<td>10 deg</td>
<td>0 deg</td>
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<tr>
<td>angle a</td>
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<td>-7 deg</td>
<td>-1 deg</td>
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<td>total curvature</td>
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REFERENCES


https://www.healthoutcome.org/condition/43/lower-back-pain-treatment