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The Effect of Different Foams on Posturography Measures in Healthy and Impaired Populations

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Introduction and Background

• Balance and maintenance of upright stance is the result of complex interactions between multiple sensory systems1 (Figure 1)
  • Manipulation of sensory input during static posturography testing (Figure 2) allows for examination of multisensory reweighting ability

A common method used to perturb balance is to place a foam block under an individual’s feet

• However, no standard has been established which specifies what kind of foam should be used
  • Ex. Studies using static posturography have described foam as “high density visco-elastic foam”2 or simply “soft foam”3

• Prior research has determined different outcome measures are affected by choice of foam4,5, but few have investigated influence on detecting differences between two populations

Research Objective

To compare balance outcome measures of postural control when using two different types of foam blocks to perturb balance. This will be done by evaluating the effect it has on the ability to differentiate between a healthy and impaired population.

Methodology

• 30 subjects participated in this study
  • 15 subjects were in the impaired group and 15 were healthy controls
  • No significant differences in age, height, or weight between the two groups

• Subjects performed a modified clinical test for sensory integration (Figure 2) while standing on two different types of foam (Table 1)

Data Analysis

• 3 standard balance measures calculated from filtered center of pressure output from the force plate
  • Anterior-Posterior Sway Range
  • Medial-Lateral Sway Range
  • Mean Sway Velocity

Results

• The surface significantly affected each outcome measure (Table 2)

Results

• Post-hoc analysis of Mean Velocity revealed between-subject factor of disease was significant for each surface condition
  • hard flat surface p=0.018
  • open-cell foam p=0.007
  • closed-cell foam p=0.007

Conclusions

While the surface used in posturography was shown to significantly affect measures of postural sway, findings did not strongly support that there is a single superior type of foam which would best differentiate between healthy and impaired balance. As such, until standardization can be reached it does not appear to matter whether open-cell or closed-cell foam is used, but foam characteristics are important to report to allow study comparison.

References


Figure 1: Sensory systems used to maintain balance (image courtesy of http://www.ilo.org/safework_bookshelf/)

Figure 2: Traditional Static Posturography

Figure 3: The two foam blocks used for the mCTSIB

Table 1: Foam Specifications

<table>
<thead>
<tr>
<th>Type</th>
<th>Dimensions (LxWxH) (cm)</th>
<th>Density (kg/m^3)</th>
<th>UTS (kPa)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Foam 1</td>
<td>Open-cell</td>
<td>50.8x50.8x7.9</td>
<td>32.0</td>
</tr>
<tr>
<td>Foam 2</td>
<td>Closed-cell</td>
<td>47.3x38.4x6.7</td>
<td>55.0</td>
</tr>
</tbody>
</table>

Table 2: Foam Specifications

<table>
<thead>
<tr>
<th>Surface Factor</th>
<th>F</th>
<th>df</th>
<th>sig/p-value</th>
<th>Est. effect size</th>
<th>Observed power</th>
</tr>
</thead>
<tbody>
<tr>
<td>AP Sway</td>
<td>153.392</td>
<td>2</td>
<td>&lt;.001</td>
<td>0.846</td>
<td>0.99</td>
</tr>
<tr>
<td>ML Sway</td>
<td>143.835</td>
<td>2</td>
<td>&lt;.001</td>
<td>0.837</td>
<td>0.99</td>
</tr>
<tr>
<td>Mean velocity</td>
<td>218.357</td>
<td>2</td>
<td>&lt;.001</td>
<td>0.888</td>
<td>0.99</td>
</tr>
</tbody>
</table>

Figure 3: Schematic of the Modified Clinical Test of Sensory Integration on Balance

Figure 4: Representative plot of center of pressure data

Figure 5: Comparison of mean values