DIFFERENCES IN CERVICAL AND TRUNK NEUROMUSCULAR CHARACTERISTICS BETWEEN BLACKHAWK PILOTS AND CREW CHIEFS

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INTRODUCTION

• Military helicopter pilots and crew chiefs have a high prevalence of neck pain and low back pain, due to the physical stresses of flight missions/training (prolonged sitting, whole-body vibration, and/or heavy gear)
• Pilots and crew chiefs perform occupationally-specific tasks, potentially causing cervical and trunk neurohumeral characteristics to deteriorate through different mechanisms.
• The purpose of this study was to compare cervical and trunk strength and flexibility as well as forward head/shoulder posture and cervical proprioception between Blackhawk pilots and crew chiefs.

METHODS

EXPERIMENTAL DESIGN

• Cross-sectional study design
• Subjects participated in a two-hour test session for assessing cervical and trunk muscular strength and range of motion, posture, and cervical proprioception

SUBJECTS

• A total of 34 US Army Blackhawk helicopter pilots and crew chiefs were recruited and matched based on gender, age, and total flight hours
• Subject demographics are represented in TABLE 1

TABLE 1: Demographics

<table>
<thead>
<tr>
<th>Flight (h)</th>
<th>Crew-Chief (h)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neck Flex</td>
<td>Neck Ext</td>
<td>Neck Lat 1</td>
</tr>
<tr>
<td>34.6 ± 9.4</td>
<td>33.6 ± 9.9</td>
<td>30.9 ± 11.0</td>
</tr>
</tbody>
</table>

PROCEDURES

Neck and Trapezius Muscular Strength Testing
• After warm-up trials, subjects performed the maximal isometric contraction against HHD for neck and scapular strength

Trunk, Trapezius, and Hip Muscular Strength Testing
• After warm-up trials, subjects performed the maximal isometric contraction for trunk and trapezius strength and isometric contraction for hip abduction strength (FIG1)

Neck, Lumbar Spin, and Hip Flexibility
• For neck flexibility testing, subjects were CROM 3 and actively rotated neck in each direction (flexion, extension, lateral flexion, and rotation)
• For lumbar extension, flexion, and lateral flexion, and rotation flexibility testing, subjects were in prone, sitting, and standing positions respectively, and actively moved their spine as far as possible for each direction/position
• For hip internal/external rotation flexibility testing, subjects were in prone position with their toes fixed at 90 degrees while the examiner moved their hips as far as possible without any discomfitude

RESULTS AND CONCLUSIONS

• Crew chiefs had significantly less ROM on cervical rotation, trunk rotation and extension, and upper trapezius strength, but exhibited increased forward head posture
• The differences may be explained by the fact that crew chiefs frequently lean forward to scan the area underneath the helicopter
• Clinicians should recognize specific occupational-related differences in neuromuscular characteristics and develop strategies to counterbalance those needs

TABLE 3: Strength between pilots and crew chiefs

<table>
<thead>
<tr>
<th>Strength</th>
<th>Pilots</th>
<th>Crew-Chiefs</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neck Flex</td>
<td>164.6 ± 6.6</td>
<td>167.7 ± 4.7</td>
<td>0.537</td>
</tr>
<tr>
<td>Neck Ext</td>
<td>124.6 ± 6.2</td>
<td>125.6 ± 4.5</td>
<td>0.503</td>
</tr>
<tr>
<td>Neck Lat 1</td>
<td>152.2 ± 6.6</td>
<td>212.5 ± 5.3</td>
<td>0.032</td>
</tr>
<tr>
<td>Neck Lat 2</td>
<td>124.3 ± 5.6</td>
<td>225.3 ± 5.9</td>
<td>0.032</td>
</tr>
<tr>
<td>L Neck Rotation</td>
<td>22.1 ± 6.5</td>
<td>22.4 ± 6.2</td>
<td>0.860</td>
</tr>
<tr>
<td>R Neck Rotation</td>
<td>22.1 ± 6.5</td>
<td>22.4 ± 6.2</td>
<td>0.860</td>
</tr>
<tr>
<td>L Neck Translation</td>
<td>22.1 ± 6.5</td>
<td>22.4 ± 6.2</td>
<td>0.860</td>
</tr>
<tr>
<td>R Neck Translation</td>
<td>22.1 ± 6.5</td>
<td>22.4 ± 6.2</td>
<td>0.860</td>
</tr>
<tr>
<td>L Middle Trapezius</td>
<td>11.1 ± 3.5</td>
<td>18.4 ± 3.7</td>
<td>0.542</td>
</tr>
<tr>
<td>R Middle Trapezius</td>
<td>14.6 ± 3.0</td>
<td>19.6 ± 3.7</td>
<td>0.230</td>
</tr>
<tr>
<td>L Lower Trapezius</td>
<td>15.7 ± 2.7</td>
<td>18.8 ± 4.1</td>
<td>0.212</td>
</tr>
<tr>
<td>R Lower Trapezius</td>
<td>15.7 ± 2.7</td>
<td>18.8 ± 4.1</td>
<td>0.212</td>
</tr>
</tbody>
</table>

FUNDING AND DISCLOSURE STATEMENT

• The work was supported by the US Army Research and Development (W911NF-10-1-0637, W911NF-11-1-0205, and W911NF-12-1-0877) and the US Army Medical Research and Materiel Command (W81XWH-14-1-0303, W81XWH-14-1-0502, W81XWH-12-1-0877, and W81XWH-12-1-0877) grants
• The authors have no financial relationships to disclose

TABLE 2: Flexibility, Posture, and Proprioception between Pilots and Crew Chiefs

<table>
<thead>
<tr>
<th>Posture</th>
<th>Pilots</th>
<th>Crew-Chiefs</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neck Rotation</td>
<td>140.3 ± 5.6</td>
<td>147.4 ± 4.7</td>
<td>0.001</td>
</tr>
<tr>
<td>Trunk Ext</td>
<td>600.5 ± 20.4</td>
<td>612.1 ± 19.8</td>
<td>0.012</td>
</tr>
<tr>
<td>R Hip Rotation</td>
<td>130.1 ± 3.4</td>
<td>130.7 ± 2.2</td>
<td>0.911</td>
</tr>
<tr>
<td>L Hip Rotation</td>
<td>132.4 ± 3.5</td>
<td>131.9 ± 3.2</td>
<td>0.884</td>
</tr>
</tbody>
</table>

FIG1: Trunk Strength Testing
FIG2: Lumbar Flexibility Testing
FIG3: Forward Head/Shoulder Testing
FIG4: JPS Testing

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TABLE 2: Strength between pilots and crew chiefs

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