ASSESSING THE IMPACT OF FORWARD CENTER OF GRAVITY HELMETS ON THE REPORT OF CERVICAL PAIN AMONGST F-15C PILOTS

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I have no financial relationships to disclose.

I will not discuss off-label use and/or investigational use in my presentation.

The views expressed are those of the author and do not necessarily reflect the official policy or position of the Air Force, the Department of Defense, or the U.S. Government.
A Century of Development
The Move Forward
Prospectively assess the change in cervical pain reported by F-15C pilots using the Joint Helmet-Mounted Cueing System (JHMCS) helmet.

Assess any risk factor correlations between pilot-reported cervical pain and past history, posture, peak Gz exposure, age, totals hours in high-G aircraft, and duration of sortie.
Methods

- Enrolled 21 full-time F-15C instructor pilots
- IRB-approved, HIPAA-compliant
- For 12 weeks, pilots logged
  - Pre- and Post-flight cervical pain using Numerical Rating Scale
  - Whether the Joint Helmet Mounted Cueing System (JHMCS) was employed
  - Maximum +Gz experienced
  - Sortie duration

Also recorded pilot age, total high-G hours and prior neck problems

Measured cervical range of motion with dual inclinometry

Performed statistical analysis
  - Pain with and without JHMCS was compared using paired t-tests
  - Potential risk factor correlations with Pearson or Spearman coefficients.

Photo courtesy of Jim "Hazy" Hazeltine, High-G Productions
Twenty pilots reported adequate data for inclusion.

Sixteen (80%) of the pilots reported at least one neck issue on the questionnaire.
- 71% report prior hx of neck injury (either while flying or other activity)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>38 (4)</td>
</tr>
<tr>
<td>Time in High-G Aircraft (hours)</td>
<td>2338 (892)</td>
</tr>
</tbody>
</table>
## Results

<table>
<thead>
<tr>
<th>Variable</th>
<th>All Flights Combined</th>
<th>Flights With JHMCS</th>
<th>Flight With Other Head Gear</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Number of Flights</strong></td>
<td>25 (10)</td>
<td>13 (7)</td>
<td>12 (6)</td>
<td>0.342</td>
</tr>
<tr>
<td><em>Mean (SD)</em></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Hours per Flight</strong></td>
<td>1.3 (0.1)</td>
<td>1.3 (0.1)</td>
<td>1.2 (0.2)</td>
<td>0.193</td>
</tr>
<tr>
<td><em>Mean (SD)</em></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Max +Gz per Flight</strong></td>
<td>7.3 (0.4)</td>
<td>7.4 (0.5)</td>
<td>7.3 (0.7)</td>
<td>0.432</td>
</tr>
<tr>
<td><em>Mean (SD)</em></td>
<td></td>
<td></td>
<td></td>
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</tr>
</thead>
<tbody>
<tr>
<td>Initial Pain Mean (SD)</td>
<td>1.51 (1.02)</td>
<td>1.53 (1.07)</td>
<td>1.50 (1.03)</td>
<td>0.761</td>
</tr>
<tr>
<td>Pain After Flying Mean (SD)</td>
<td>2.15 (1.24)</td>
<td>2.26 (1.38)</td>
<td>2.01 (1.11)</td>
<td>0.101</td>
</tr>
<tr>
<td>Pain Difference Mean (SD)</td>
<td>0.64 (0.60)</td>
<td>0.73 (0.66)</td>
<td>0.52 (0.53)</td>
<td>0.005</td>
</tr>
</tbody>
</table>
Results

Age, maximum +Gz per sortie, total high-Gz hours flown, and hours per sortie
- Showed no significant correlation with the change in neck pain either with JHMCS use or use of other head gear

A significant correlation was found between number of self-reported neck issues (as noted on intake history) and increased neck pain when using JHMCS

<table>
<thead>
<tr>
<th>Variable</th>
<th>Neck Pain with JHMCS (Post Flight minus Pre Flight)</th>
<th>Neck Pain with Other Head Gear (Post Flight minus Pre Flight)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Neck Issues</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spearman $r$</td>
<td>0.629</td>
<td>0.342</td>
</tr>
<tr>
<td>$P$-Value</td>
<td>0.004</td>
<td>0.139</td>
</tr>
</tbody>
</table>
Results

Neck extension coupled with JHMCS use correlated negatively with increased pain

R = -0.551, DF = 17, P = 0.014
Discussion

- In this observational study, mean flight-related pain increased by 0.73 on Numerical Rating Scale with JHMCS and 0.52 without.
- History of prior neck problems as well as limited neck extension correlated with increased pain when combined with JHMCS use.
- Going forward…. Recommend comparison to other airframes with slightly different missions and equipment.

U.S. Air Force photo/Senior Airman John Hughel
The authors wish to thank

- Office of the Air National Guard Air Surgeon, Joint Base Andrews, MD
- 711th Human Performance Wing, Wright-Patterson Air Force Base, OH
- 173rd Fighter Wing (Oregon ANG), Kingsley Field, OR
References


Background

Cervical pain is a common complaint among fighter pilots

In-flight risk factors for neck pain
- High +Gz
- Neck rotation under +Gz
- Flight hours
- Fatigue
- Time devoted to physical exercise
- Prolonged flexed posture
- Night vision goggles
- Joint Helmet-Mounted Cueing System