**BACKGROUND**

- Asymmetrical molding of the head caused by external forces.
- Infants and children undergo corrective orthopaedic helmet treatment.
- Currently, there is no quantitative measurement of the forces the orthopaedic helmet applies on the skull.

**OBJECTIVES, SPECIFICATIONS, CONSTRAINTS & RISKS**

- **OBJECTIVES**
  - To produce a method of measuring controlling forces applied to the helmet on the skull.
  - To monitor the helmet's forces and the complete treatment on a patient.
- **SPECIFICATIONS**
  - **Objective:** To create a device that accurately measures the forces applied to the patient's skull.
  - **Material:** A lightweight material that can withstand repeated applications.
- **CONSTRAINTS**
  - **Material:** Must be lightweight and durable.
  - **Design:** Cannot interfere with standard medical procedures.
- **RISKS**
  - **Safety:** Device may be considered a minor surgical intervention.
  - **Cost:** Initial investment is low.

**DEVICE ILLUSTRATION**

- Battery-powered device
- Wire connects to computer
- Capacitive sensor and LED lights indicate sensor position
- Helmet with a design that allows for sensor placement

**RESULTS: FORCE / SENSOR OUTPUT RELATIONSHIP**

- Highly linear relationship between sensor output and force.
- Sensor sensitivity maintained after incorporation into helmet.
- Linearity was unaffected by sensor incorporation into helmet (R² = 0.99 for each sensor).
- Connection of sensor 1 was weakened during helmet incorporation.

**SPECIFICATIONS VS. ACTUAL PERFORMANCE**

<table>
<thead>
<tr>
<th>Specification</th>
<th>Specified</th>
<th>Actual Performance</th>
<th>Test Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>External power</td>
<td>3.7 V (DC power)</td>
<td>DIR V</td>
<td>N/A</td>
</tr>
<tr>
<td>Power consumption</td>
<td>1.5 W</td>
<td>1.4 W</td>
<td>N/A</td>
</tr>
<tr>
<td>Fallomit resistance</td>
<td>1 G</td>
<td>1 G</td>
<td>N/A</td>
</tr>
<tr>
<td>Maximum force</td>
<td>0.35 N</td>
<td>0.25 N</td>
<td>0.75 N</td>
</tr>
<tr>
<td>Minimum force</td>
<td>0.05 N</td>
<td>0.12 N</td>
<td>n/a</td>
</tr>
<tr>
<td>Strain</td>
<td>3.25%</td>
<td>2.5%</td>
<td>0.2%</td>
</tr>
</tbody>
</table>

**CONCLUSIONS, RECOMMENDATIONS, & ACKNOWLEDGEMENTS**

- Conclusions:
  - Incorporation into the system improved accuracy.
  - Design optimization reduced overall forces applied to the skull.
  - However, sensitivity of the device was reduced following incorporation into helmet.
- Recommendations:
  - Further study is needed for long-term effectiveness.
  - Collaboration with orthopaedic specialists is encouraged.
- Acknowledgements:
  - Thank you to all the contributing members.