BioRID
Comparison upright vs. normal spine adjustment

28. April 2010
Comparison upright vs. normal spine adjustment

• Comparison of one BioRID spine
  a) adjusted with standard adjustment tool → normal spine vs.
  b) adjusted with new adjustment tool → upright (steeper) spine

• Pelvis plate of the spine (pelvis to spine attachment) was mounted horizontally on a table for geometric measurement

• In this study, the original jacket was used without any modification with both spine settings (normal/upright)
## Results

<table>
<thead>
<tr>
<th></th>
<th>horizontal distance h-point / O.C. pin [mm]</th>
<th>vertical distance h-point / O.C. pin [mm]</th>
<th>O.C. plate angle</th>
<th>T2 vertebra angle</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Normal adjustment</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>without jacket</td>
<td>153</td>
<td>610</td>
<td>29,0</td>
<td>37,5</td>
</tr>
<tr>
<td><strong>Steeper adjustment</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>without jacket / with jacket</td>
<td>40 / 119</td>
<td>655 / 629</td>
<td>10,0 / 21,0</td>
<td>56,0 / 45,0</td>
</tr>
<tr>
<td><strong>Normal adjustment</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>without jacket / with jacket</td>
<td>153 / 153</td>
<td>610 / 610</td>
<td>29,0 / 28,5</td>
<td>37,5 / 37,5</td>
</tr>
</tbody>
</table>

**Normal spine adjustment:**

- Normal adjustment
- Steeper adjustment with new adjustment tool:

![29°](image1)

- Normal spine adjustment:
  - 29°

- Steeper adjustment with new adjustment tool:
  - 10°
  - 21°
Results

- Head angle 5° rearwards
- Pelvis angle with 26° set by certification sled

Torso with steeper adjusted spine on certification sled
Findings

By using new adjustment tool:

• the O.C. pin moves 45 mm upwards and 113 mm rearwards

• the angle of O.C. plate decreases from 29° to 10°

• the jacket affects the O.C. angle → O.C. angle increases from 10° → 21° with jacket → stressed spine!
  (The jacket has no influence on normal adjusted spine!!! → no stressed spine)

• head angle is 8° more upright (rearwards)

• the O.C. pin moves relatively to the h-point square hole 34 mm rearwards and 19 mm upwards

• the 0° head angle can not be reached on certification sled
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BioRID positioning with normal & steep spine adjustment

• Test Setup:
  – Vehicle Volkswagen Polo with textile-covered seat (manual)
  – Seat back adjusted to torso angle, measured with oscar (25° - 13°)
  – One BioRID-II was used with normal and upright (steeper) spine adjustment
    Guidelines:
    - Head angle = 0° +/- 0,5°
    - Pelvis angle = 26,5 +/- 2,5°
    - H-point = max. +/- 5mm of starting location with normal spine

• Results:

<table>
<thead>
<tr>
<th>Measurement No.</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seat backrest (torso angle)</td>
<td>25°</td>
<td>23°</td>
<td>21°</td>
<td>19°</td>
<td>17°</td>
<td>15°</td>
<td>13°</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Normal Spine</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pelvis angle [°]</td>
<td>27.5</td>
<td>25.3</td>
<td>24</td>
<td>22.8</td>
<td>21.8</td>
<td>21.6</td>
<td>20.3</td>
</tr>
<tr>
<td>Head angle [°]</td>
<td>0.1</td>
<td>1.2</td>
<td>3.5</td>
<td>6.5</td>
<td>10.2</td>
<td>9.0</td>
<td>10.9</td>
</tr>
<tr>
<td>Backset [mm]</td>
<td>117</td>
<td>106</td>
<td>95</td>
<td>85</td>
<td>75</td>
<td>65</td>
<td>73</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Steep Spine</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
<th>13</th>
<th>14</th>
<th>15</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pelvis angle [°]</td>
<td>30.8</td>
<td>30.0</td>
<td>29.0</td>
<td>28.1</td>
<td>26.3</td>
<td>24.7</td>
<td>23.7</td>
<td>24.1</td>
</tr>
<tr>
<td>Head angle [°]</td>
<td>-8.0</td>
<td>-3.5</td>
<td>-1.7</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>1.9</td>
<td>0.0</td>
</tr>
<tr>
<td>Backset [mm]</td>
<td>102</td>
<td>81</td>
<td>73</td>
<td>65</td>
<td>57</td>
<td>46</td>
<td>42</td>
<td>40</td>
</tr>
</tbody>
</table>

\[x\] = Measuring sequence
BioRID positioning with normal & steep spine adjustment

Comparison Head and Pelvis angle / Torso angle (Oscar)

Pelvis angle 26.5 +/- 2.5°

Assumption: head angle = 0 +/- 2.5° can be corrected to 0° without stressing the neck or spine of the dummy!
BioRID positioning with normal & steep spine adjustment

Findings

- **Normal adjusted spine** → the BioRID can be used within a range of 5° seat back angle (oscar angle) – above approx. 20°.

- **Steeper adjusted spine** → the BioRID can be used within a range of 5° seat back angle (oscar angle) – below approx. 20°.

- Torso angle deviation > 5° (seat back to flat or steep) → the requirements of head and pelvis angles can not be achieved with the dummy.

- **The Backset of BioRID** with steeper adjusted spine is always **20 – 30 mm** smaller in comparison with normal spine adjustment.

- Static positioning with steep adjusted spine is feasible, but the influence on the dummy performance in dynamic tests due to modification of the spine will probably be significant.