Moving towards evidence based classification in wheelchair rugby: classification of trunk impairment in relation to static sitting balance measures

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Classification

• **Aim**: to minimise the impact of permanent impairment of body functions on the outcome of competition\(^1\)
• Evidence based
• Sport specific

1. IPC position stand Tweedy SM, 2009
Wheelchair rugby classification

- Developed for athletes with complete cervical SCI
- Arm score / 2 + trunk score = athlete class
- Eligible class < 4.0
- 4 Athletes / 8.0 points on court
Changing athlete population

Athletes with SCI complete → incomplete
Athletes with impairments in all four limbs:
• Neuromuscular conditions
• Amputations
• Congenital limb defects
• Cerebral palsy
The revised trunk evaluation (2010)

- Minimum of 10 tests, arranged in an algorithm
- Failing tests determine the trunk score
- Maximum trunk score increased from 1.0 to 1.5
Evidence

- Adequate reliability (Kappa 0.75)¹
- Validity related to biomechanical impairment ²-⁵:
  - Static sitting balance
  - Dynamic sitting balance
  - Coordination

1. IPC Vista conference, Altmann, 2011
2. Chen et al. 2003,
3. Bernard et al. 1994
4. Curtis et al. 1995
5. Van Nes et al. 2008
Aim

• To determine the association between trunk score and static sitting balance

• Hypothesis: the higher the trunk score, the better the performance in static sitting balance tasks
Participants

• Wheelchair rugby and wheelchair basketball athletes (n = 37) with any kind of health condition leading to eligible biomechanical impairment
• Inclusion criteria
  – Minimum age 18 years
  – ≥ 1 year experience
  – No pressure sores

• Revised trunk score was assessed by an experienced classifier.
Sitting balance set up

- Sitting balance tasks only if sitting unsupported \( \geq 30 \) s
- Adjustable chair mounted on a force plate
- No support during tasks
- Measurement of CoP

Sitting balance tasks

Sitting still for 30 s.
• Eyes open, stable surface
• Eyes open, unstable surface
• Eyes closed, stable surface
• Eyes closed, unstable surface
Outcome measures

- ‘Sway Area’ (SA) = surface of ellipse [mm²]
- ‘Sway Velocity’ (SV) = average velocity of CoP [mm/s]
Statistical analysis

• Consistency of the data: intraclass correlation coefficient (ICC)
  ICC > 0.70 → effect of trunk class analysis

• Effect of trunk class on sitting balance:
  Kruskall Wallis for each condition.

• Bonferroni Post Hoc test

• $\alpha = 0.05$
Results - classification

• Trunk score according to IWRF classification:
  – 0  (n = 18)
  – 0.5  (n = 7)
  – 1.0  (n = 5)
  – 1.5  (n = 7)
Results - ICC static balance

• ICC unstable conditions > 0.70

<table>
<thead>
<tr>
<th></th>
<th>SA</th>
<th>SV</th>
</tr>
</thead>
<tbody>
<tr>
<td>EOSS</td>
<td>0.61</td>
<td>0.68</td>
</tr>
<tr>
<td>ECSS</td>
<td>0.52</td>
<td>0.52</td>
</tr>
<tr>
<td>EOUS</td>
<td>0.66</td>
<td>0.85</td>
</tr>
<tr>
<td>ECUS</td>
<td>0.94</td>
<td>0.88</td>
</tr>
</tbody>
</table>
Results-trunk class and sitting balance

- Sway velocity (SV) was not significantly different between trunk scores.
- Sway area (SA) was significantly different between trunk scores for the eyes closed unstable surface condition $P = 0.019$.
Results - trunk class and sitting balance

- open stable
- closed stable
- open unstable
- closed unstable
## Discussion - Sensation

<table>
<thead>
<tr>
<th>Trunk class</th>
<th>n</th>
<th>Age (y) mean (sd)</th>
<th>Sex M/F</th>
<th>Sport B/R/B+R</th>
<th>Impaired sensibility at the buttocks N/Y</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0</td>
<td>2</td>
<td>34.0 (22.6)</td>
<td>2/0</td>
<td>1/0/1</td>
<td>0/2</td>
</tr>
<tr>
<td>0.5</td>
<td>7</td>
<td>33.9 (11.6)</td>
<td>7/0</td>
<td>1/6/0</td>
<td>4/3</td>
</tr>
<tr>
<td>1.0</td>
<td>5</td>
<td>32.8 (12.2)</td>
<td>5/0</td>
<td>3/2/0</td>
<td>2/3</td>
</tr>
<tr>
<td>1.5</td>
<td>7</td>
<td>42.3 (12.6)</td>
<td>6/1</td>
<td>5/2/0</td>
<td>6/1</td>
</tr>
</tbody>
</table>

*[^M = Male; F = Female; B = Wheelchair Basketball; R = Wheelchair Rugby; Y = Yes; N = No.*]
Discussion - sensation

- Sway Area ECUS-EOUS [mm²]

- Sway Velocity ECUS-EOUS [mm/s]

Impaired Normal
Sensibility at the buttocks

*
Conclusion

• Tests for static sitting balance are discriminative for athletes with full trunk impairment vs. athletes with any trunk impairment
• Impairment of sensation is not an eligible impairment type for Paralympic sport
• Impairment of sensation is an important confounder for static sitting balance measures
• Impairment of sensation may be a confounder for other measures of biomechanical impairment
Many thanks to

- All athletes from the Netherlands and Belgium who volunteered