Impact of trunk and arm impairment on performance of wheelchair and ball activities in wheelchair rugby during competition

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Wheelchair rugby

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

- Developed for athletes with complete cervical SCI
- All athletes have some degree of impairment in at least one arm
- Trunk score 0-1.5 and arm score 0.5-3.5
- Arm score/2 + trunk score = athlete class
- Eligible class < 4.0
- 8.0 points on court
Evidence Based Classification (EBC)

Step 1: Specify impairment types eligible for the sport

Step 2a: Develop valid measures of impairment/s (i.e., ratio scaled; reliable; precise; training resistant; specific to one impairment and account for the greatest variance in performance)

Step 2b: Develop standardized, sport specific measures of performance.

Step 3: Assess the relative strength of association between valid measures of impairment and key performance determinants.

Retrieved from: Tweedy et al., PM & R 2014
Information that is lacking

- Impact of trunk and arm impairment on ball activities
- Impact of trunk and arm impairment on performance in realistic game situation
- Validity of arm impairment in relation to objective, ratio scaled measures of impairment
Study aim

To determine the impact of trunk and arm impairment on wheelchair and ball activities in elite wheelchair rugby players during competition
Methods

- Setting: World Wheelchair Rugby Challenge 2015
- Participants: 31 athletes from 3 world top 10 ranked teams
- 5 matches per team
- Physical data: indoor tracking system (Ubisense)\(^1\)
- Technical data: video analysis (2 cameras)

1. Rhodes et al., Journal of Sports Sciences 2014
Methods

- Impairment of participating athletes
Methods
Physical parameters
- Relative distance covered
- Peak speed
- Relative time spent in each of six speed zones:

<table>
<thead>
<tr>
<th>Zone</th>
<th>Intensity</th>
<th>Speed threshold (m(\cdot)s(^{-1}))</th>
</tr>
</thead>
<tbody>
<tr>
<td>Z1</td>
<td>Very low</td>
<td>&lt; 0.50</td>
</tr>
<tr>
<td>Z2</td>
<td>Low</td>
<td>0.50 – 1.49</td>
</tr>
<tr>
<td>Z3</td>
<td>Moderate</td>
<td>1.50 – 2.49</td>
</tr>
<tr>
<td>Z4</td>
<td>High</td>
<td>2.50 – 2.99</td>
</tr>
<tr>
<td>Z5</td>
<td>Very high</td>
<td>3.00 – 3.49</td>
</tr>
<tr>
<td>Z6</td>
<td>Maximal</td>
<td>≥ 3.50</td>
</tr>
</tbody>
</table>
Methods

Technical parameters

Goals  total number (n), driving into the key (%), received pass in the key (%)

Catching
  number of passes received (n), catch success rate (%), time spent in possession of the ball (mean time), number of loose balls recovered (n)

Passing
  number of passes attempted (n), pass success rate (%), one-handed passes (%), long passes (%), assists (n), inbounds (n)

Defending
  turnovers (n), blocks (n), defensive blocks (%)

International Wheelchair Rugby Federation
Methods

Analysis:
• Frequency data normalised to a 32 minutes match
• Reliability for video data
• Multiple forward regression analysis
• Kruskall-Wallis for categories of trunk and arm impairment
• All performance parameters that were successfully entered in the regression analysis and showed a significant effect between trunk and arm impairment \( (P < 0.05) \) → Effect Size and 90% confidence intervals, meaningful if \( \geq 0.2 \)
Results – trunk impairment

- Relative distance
- Peak speed
- Z1
- Z2
- Z3
- Z4
- Z5
- Z6

- Goals scored
- Goals scored by driving into key
- Passes received
- Possession duration
- Pick-ups
- Passes
- Pass success rate
- One-handed passes
- Long passes
- Assists
- Inbounds
- Turnovers
- Defeensive blocks
Results – arm impairment

- Relative distance
- Peak speed

Z1
Z2
Z3
Z4
Z5
Z6

Large  Moderate  Small  Trivial  Small  Moderate  Large  Very large
Results – arm impairment

- Goals scored
- Goals scored by driving into key
- Passes received
- Possession duration
- Pick-ups
- Passes
- Pass success rate
- One-handed passes
- Long passes
- Assists
- Inbounds
- Turnovers
- Defensive blocks
Conclusions

- Trunk and arm impairment have an impact on chair and ball activities in wheelchair rugby in realistic game situation
Conclusions

- Trunk impairment has an impact on fewer activities than arm impairment
- Trunk impairment affects offensive game
- Arm impairment affects both offensive and defensive game
Conclusions

• Difference in impact of arm impairment between poor and moderate/good
Discussion

Limitations

• Tests for arm impairment are based on expert opinion
• Poor arm function represents three arm scores
• Impact of team line-up and role in the team are unknown
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