AMPUTATION SIDE AND SITE DETERMINE PERFORMANCE CAPACITY IN PARALYMPIC CURVE SPRINTING

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Background / Purpose

In the 2015 IPC world championships athletes with amputation at the curve inside leg were underrepresented in the finals of the 200 m and 400 m sprinting events. Yet there is only very limited information on amputee curve sprinting and the influence of side and site (level) of amputation on propulsion mechanisms. Without comprehensive understanding about the effect of side and level of amputation on curve running performance the classification of amputee athletes in sprint distances over 100 m stays partly intuitive. The aim of this study was to describe amputee curve sprinting kinetics and compare it to able-bodied athletes (AB).

Methods

Table 1: Subject details including anthropometrics and level/side of amputation for amputee athletes (P1-P3) and able-bodied reference group (AB)

<table>
<thead>
<tr>
<th>Subject</th>
<th>Side of Amputation</th>
<th>Site of Amputation</th>
<th>Mass [kg]</th>
<th>Height [m]</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1</td>
<td>right</td>
<td>transfemoral</td>
<td>80.2</td>
<td>1.96</td>
</tr>
<tr>
<td>P2</td>
<td>bilateral</td>
<td>transfemoral</td>
<td>71.7</td>
<td>1.87</td>
</tr>
<tr>
<td>P3</td>
<td>left</td>
<td>knee excitorcular</td>
<td>80.4</td>
<td>1.81</td>
</tr>
<tr>
<td>AB (0)</td>
<td></td>
<td></td>
<td>76.3 ± 8.2</td>
<td>1.86 ± 0.08</td>
</tr>
</tbody>
</table>

- 3 amputee athletes (highest international level)
- 6 able-bodied athletes (national competitive level)
- Curve sprinting in counter clockwise direction
- 3D motion capturing (250 Hz, Vicon Nexus, 16 F40)
  → CoM velocity
- 4 Force Plates (1000 Hz, 90 x 60 cm, Kistler)
  → GRFs, impulses
- Differences are stated if samples were disjunct

Results / Discussion

• P2 and P3 had lower (8.64 and 7.94 m/s) curve running velocities compared to P1 and AB (9.20 and 9.56 m/s).
• P2 and P3 generated lower inward orientated GRFs and impulses with their inside leg compared to P1 and AB.
• In contrast to all other athletes the vertical GRF of P3’s inside (prosthetic) leg was lower compared to his outside leg.
• Prosthetic curve sprinting kinetics depend on level and side of amputation.
• Athletes with amputations at the inside leg (uni- or bilateral) seem to be disadvantaged in terms of generating high curve running velocities due to an impaired inward force and impulse generation.

Conclusion

Current rules and regulations should be reconsidered to guarantee equal opportunities for all athletes.

Future prostheses designs should allow for higher inward forces and impulses.