TRACTION REQUIREMENTS OF YOUNG SOCCER PLAYERS

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SUMMARY

Forty-eight subjects of three age groups (children (5-8), kids (9-13), and adults) performed two soccer movements. The magnitude of the shear forces and the ratio between the shear and vertical forces were used to determine traction requirements for each age group. In comparison to adults, children (5-8 years of age) have lower traction needs in both the medio-lateral (ML) and antero-posterior (AP) directions, and kids (9-13) had similar traction needs in the ML direction and lower traction needs in the AP direction. These findings provided direction for designing a kids-specific soccer plate.

REVIEW AND THEORY

The plate of a soccer shoe is designed to provide appropriate traction on a given surface for the athlete. To date, most soccer shoe plates for kids are takedown versions of adult plates. Thus, they follow the assumption that young players have the same traction requirements as adults. Traction needs can be evaluated by (a) the magnitude of the shear forces, and (b) the ratio between the shear and vertical forces. The peak traction ratio typically occur during the braking phase of a cutting movement (at approximately 14% of contact), and during the latter stages of acceleration. The purpose of this study was to test whether the traction requirements were different between age groups.

PROCEDURES

Forty-eight soccer players (21 children, 19 kids, and 8 adults) performed 3 lateral cuts & 3 forward accelerations (the second step from a standing start was analyzed) wearing turf shoes on a Kistler force plate and a running lane covered by AstroTurf. Ground reaction force (GRF) data were collected for each trial @ 480 Hz. Kinematic motion of two markers (one heel and one toe) was also collected (240 Hz) to establish a shoe reference frame. The x and y axes were aligned with the longitudinal and transverse axes of the shoe, and the shear forces were calculated with respect to those axes. Ground reaction forces were normalized to body weight (BW) and were used to calculate traction ratios (shear force/vertical force) in both the ML and AP directions (Figure 1). A threshold of vertical force of 0.5 BW was set for the calculation of traction ratios. A one-way analysis of variance (ANOVA) was conducted to test for differences between groups in shear forces and traction ratios.

RESULTS

During cutting, the magnitude of the peak lateral shear forces and peak traction ratios (ML) for children, were significantly lower than those of kids and adults (Table 1). There were no significant differences between kids and adults in for these variables. During acceleration, the magnitude of the peak propulsion forces and the peak traction ratios (AP) for children and kids were significantly lower than those of adults (Table 1). There were no significant differences between children and kids in the peak AP forces and traction ratios.
DISCUSSION

Traction requirements of children and kids are lower than those of adults. These findings initiated the development of a specific soccer plate for kids.

<table>
<thead>
<tr>
<th>Movement</th>
<th>Code</th>
<th>Variable</th>
<th>Children</th>
<th>Kids</th>
<th>Adults</th>
<th>Alpha</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cutting</td>
<td>A</td>
<td>Peak ML braking force (BW)</td>
<td>0.97 ± 0.20</td>
<td>1.13 ± 0.22</td>
<td>1.17 ± 0.20</td>
<td>&lt;0.01</td>
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<tr>
<td></td>
<td>B</td>
<td>Peak braking traction ratio</td>
<td>0.46 ± 0.08</td>
<td>0.51 ± 0.07</td>
<td>0.51 ± 0.07</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Acceleration</td>
<td>C</td>
<td>Peak AP force (BW)</td>
<td>0.46 ± 0.10</td>
<td>0.50 ± 0.08</td>
<td>0.73 ± 0.13</td>
<td>&lt;0.01</td>
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<tr>
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<td>D</td>
<td>Peak propulsion traction ratio</td>
<td>0.53 ± 0.06</td>
<td>0.52 ± 0.07</td>
<td>0.69 ± 0.05</td>
<td>&lt;0.01</td>
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</tbody>
</table>

Table 1. Shear forces and traction ratios during cutting and acceleration. Significant differences are presented in different shades. For example, peak ML force during cutting is significantly larger in kids compared to children, and significantly larger in adults compared to children.

Figure 1. Typical GRF (Top) and traction ratio (Bottom) for Cutting (Left) and Acceleration (Right).

REFERENCES


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