Age dependent flexibility of pediatric flatfeet: a 3D foot analysis during heel raise

Sebastian Müller

Thomas Dreher, Sebastian I. Wolf, Britta K. Krautwurst

Heidelberg, University Hospital, Department of Orthopaedics and Traumatology
AOFAS Disclosure

Mueller, Sebastian

Me and my coauthors have no potential conflicts with this presentation.
Flatfoot

• Common foot deformity in children (1)
• Accepted examinations for evaluating the flexibility of flatfoot (2)
  – Heel-raise test
  – Jack-test
• A large variability concerning the interpretation and resulting treatment with regard to the child's age exists (3)

• Observation of the flexibility of
  – Medial border / column
  – Hindfoot position
• Subjective visual assessment
Aim

The aim of this study was to detect the age-dependent flexibility of paediatric flatfoot using an objective assessment, based on a 3D foot model.
Patients

- 33 children with flexible flatfeet and normal reference feet
  - 15 3-6-year-old
  - 12 7-9-year-olds
  - 6 10-11-year-olds

- Mean 7.2 years
Material & Methods

• Heidelberg Foot Measurement Method (HFFM)(4) adapted for small feet of children and for the present research question

• Examination
  – Heel-raise
  – Jack-test
  – Foot pressure analysis
  – Clinical examination
Heel lean (valgus / varus)

Medial border inclination
Statistics

• Calculation of the heel-raise test
  – Heel lean
  – Medial border inclination

• Statistical methods
  – Mean and standard deviation at different positions of sole angle
  – Gradient
  – ANOVA with Bonferroni method
Results heel lean (valgus / varus)

Figure: Blue line: 3-6-year-olds, green line: 7-9-year-olds, red line: 10-11-year-olds
100% heel-raise: 0% = standing position, 100% = maximal heel-raise position

Table: Mean (SD) at different sole angle (SA) positions, gradient and p-values (with Bonferroni method)

<table>
<thead>
<tr>
<th></th>
<th>@ 5° SA</th>
<th>@ 15° SA</th>
<th>@ 45° SA</th>
<th>gradient</th>
</tr>
</thead>
<tbody>
<tr>
<td>3-6 yrs.</td>
<td>-8.8 (4.0)</td>
<td>-3.1 (4.3)</td>
<td>6.2 (3.3)</td>
<td>0.2 (0.1)</td>
</tr>
<tr>
<td>7-9 yrs.</td>
<td>-6.1 (4.9)</td>
<td>-2.3 (3.7)</td>
<td>5.7 (3.2)</td>
<td>0.4 (0.2)</td>
</tr>
<tr>
<td>10-11 yrs.</td>
<td>-4.5 (5.3)</td>
<td>-1.7 (4.6)</td>
<td>3.5 (3.4)</td>
<td>0.3 (0.1)</td>
</tr>
<tr>
<td>p-value</td>
<td>0.12</td>
<td>0.77</td>
<td>0.26</td>
<td>0.03</td>
</tr>
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</table>
Results medial border inclination

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<td>3-6 yrs.</td>
<td>-12.6 (11.8)</td>
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<td>10.9 (5.9)</td>
<td>0.2 (0.1)</td>
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<td>7-9 yrs.</td>
<td>-10.0 (10.7)</td>
<td>-6.1 (9.9)</td>
<td>5.9 (6.1)</td>
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<td>10-11 yrs.</td>
<td>-9.0 (6.5)</td>
<td>-5.1 (6.1)</td>
<td>6.0 (6.1)</td>
<td>0.6 (0.2)</td>
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<td>p-value</td>
<td>0.73</td>
<td>0.97</td>
<td>0.08</td>
<td>&lt;0.01</td>
</tr>
</tbody>
</table>
Discussion

- Demonstration of age-dependent flexibility in paediatric flatfeet using an objective assessment
- 3-6 year old children showed a higher ROM and a higher amount of deformity in standing position
- After 7 years the flexibility decrease without age-dependent differences
- 7-9 year group have a similar ROM compared to the 10-11 year group

This study provides important objective information about the flexibility of paediatric flatfeet
References


