Design and Development of Children’s Shoes
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Abstract

INTRODUCTION
The Children's feet grow at a rapid rate thus necessitating a frequent change in footwear to accommodate this foot growth. In order to provide correct fitting shoes for them it is essential to gather reliable foot dimensions of children which is done through a digital capture of the foot images. A novel method of ‘cluster analysis’ leads us to compress the complete children's size range from Children Size 10 to Adult Size 3 into only 5 Groups which helps in optimizing the size range to be manufactured, accommodates the foot growth in children and also reduces the frequency of footwear change.

Validation
1. Physical testing
   • Upper material
     - Grain crack resistance
     - Color fastness to rubbing
     - Tear strength
     - Tensile strength
     - Flexing resistance
     - Moisture vapor transmission rate
     - Heat resistance
   • Soles - Hardness; Density; Abrasion resistance; Flexing resistance and Bond strength
   • Lining - Colour fastness to rubbing; Tear strength and Abrasion resistance (Martindale method)
   • Insock - Colour fastness to rubbing; Tear strength; Abrasion resistance

2. Gait Analysis

AIM
To develop a new sizing system with 5 sizes for school children by anthropometric survey and develop school shoes in accordance to the trend forecasts prevalent and the styling ensured ‘comfort’ and safety to the children.

MATERIALS AND METHODS
- Recruitment of School children in the age group of 6 to 10 years
- Foot scan was done using 3D foot scanner
- Selection of upper material for shoe making
- Shoe designing based on fashion trends
- Shoe manufacturing with fit and comfort as main criteria
- Statistical tool used: Cluster analysis

RESULTS

<table>
<thead>
<tr>
<th>Sizing System</th>
<th>Children's Size</th>
<th>Adult Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Existing</td>
<td>10 &amp; 11</td>
<td>12 13</td>
</tr>
<tr>
<td>Optimized</td>
<td>I II III IV V</td>
<td></td>
</tr>
</tbody>
</table>

Conclusion
The children's shoe size ranging from 10 to adult size 3 were optimized and grouped into 5 categories. The shoes made out of these 5 sizes accommodates the foot growth and reduce the frequency of changing footwear. The validation was done using gait analysis and the results showed that there exists an uniform pressure distribution under the foot of children. Spatial temporal parameters measured using 3D motion analysis system clearly says that the new shoes improve the gait pattern of the children.

Acknowledgement: