Foot type symmetry and change of foot structures from sitting to standing conditions

The Harvard community has made this article openly available. Please share how this access benefits you. Your story matters.

<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Published Version</td>
<td>doi:10.1186/1757-1146-7-S1-A34</td>
</tr>
<tr>
<td>Citable link</td>
<td><a href="http://nrs.harvard.edu/urn-3:HUL.InstRepos:12717397">http://nrs.harvard.edu/urn-3:HUL.InstRepos:12717397</a></td>
</tr>
<tr>
<td>Terms of Use</td>
<td>This article was downloaded from Harvard University’s DASH repository, and is made available under the terms and conditions applicable to Other Posted Material, as set forth at <a href="http://nrs.harvard.edu/urn-3:HUL.InstRepos:dash.current.terms-of-use#LAA">http://nrs.harvard.edu/urn-3:HUL.InstRepos:dash.current.terms-of-use#LAA</a></td>
</tr>
</tbody>
</table>

Foot type symmetry and change of foot structures from sitting to standing conditions

Howard Hillstrom1*, Jinsup Song2, Michael Neary3, William Brechue3, Rebecca A Zifchock3, Steven Svoboda3, Marian T Hannan4

From 4th Congress of the International Foot and Ankle Biomechanics (i-FAB) Community Busan, Korea. 8-11 April 2014

Introduction
Foot symmetry and change in foot structure as a function of weight bearing status have not been investigated in a large cohort study. The foot structure of 1,054 incoming cadets at the US Military Academy (172 female, 18.5±1.1 years, 24.5±3.0 kg/m²) was examined. Arch Height Index (AHI) was assessed in sitting and standing condition, and its value was used to classify each foot into 3 foot types as previously described [1].

Method
Based on standing AHI, 68.1%, 24.5%, and 7.5% of the study subjects’ left foot was categorized into planus, neutral, and cavus foot types, respectively. An asymmetrical foot type was observed in 28.6% of subjects in sitting and 23.6% standing conditions. Foot length increased from sitting to standing conditions; this change was significantly greater in cavus and neutral foot type groups than the planus group. In contrast, arch height flexibility (AHF) was significantly greater in the planus group than both cavus and neutral foot type groups.

Results
Results of this study suggest the importance of controlling for weight bearing status when assessing foot structure or fitting footwear. Given that about a quarter of participants demonstrated an asymmetrical foot type, findings also suggest the importance of assessing both feet independently. Table 1.

Acknowledgements
Volunteers from the New York College of Podiatric Medicine, Temple University School of Podiatric Medicine, the Hospital for Special Surgery, and novel GmbH were instrumental in the collection of these data. We appreciate the study participants and support of the United States Military Academy.

Authors’ details
1Hospital for Special Surgery, New York, New York, USA. 2Temple University School of Podiatric Medicine, Philadelphia, Pennsylvania, USA. 3United States Military Academy, West Point, New York, USA. 4Hebrew Senior Life, Harvard Medical School, Boston, USA.

Published: 8 April 2014

Reference

Table 1 Mean arch height flexibility and change in foot length across the 3 foot type groups

<table>
<thead>
<tr>
<th></th>
<th>Cavus</th>
<th>Neutral</th>
<th>Planus</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>AHF (mm/kN)</td>
<td>13.2 ± 7.4</td>
<td>14.8 ± 7.4</td>
<td>16.6 ± 7.4</td>
<td>&lt;.0001 a,c</td>
</tr>
<tr>
<td>ΔFoot Length (mm)</td>
<td>4.8 ± 2.6</td>
<td>4.3 ± 2.2</td>
<td>3.6 ± 2.1</td>
<td>&lt;.0001 a,c</td>
</tr>
</tbody>
</table>

Arch height flexibility = [(arch height in sitting − arch height in standing)/(0.4 * body weight)]. A significant difference (P<0.05) was observed between a cavus and planus foot types and b between neutral and planus foot types.

* Correspondence: hillstromh@hss.edu
1Hospital for Special Surgery, New York, New York, USA
Full list of author information is available at the end of the article

© 2014 Hillstrom et al; licensee BioMed Central Ltd. This is an Open Access article distributed under the terms of the Creative Commons Attribution License (http://creativecommons.org/licenses/by/4.0), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited. The Creative Commons Public Domain Dedication waiver (http://creativecommons.org/publicdomain/zero/1.0/) applies to the data made available in this article, unless otherwise stated.