Temporal pattern in segmental motions of the foot and ankle in healthy older people: Comparison between young and old people

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My disclosure is in the Final AOFAS Mobile App.

I have no potential conflicts with this presentation.
Introduction

• Several multi-segmental foot models have been introduced for the in vivo analysis of dynamic foot kinematics

• Applicable to pathologic conditions such as hallux valgus, hallux rigidus, flatfoot, cavovarus deformity, and ankle arthritis

• But, previous reports on inter-segmental foot motions have been composed of limited number of subjects with diverse ages

• No describing the segmental foot motion in normal older people

• Previous our study (Dong Yeon Lee et al, under review) (gender difference in 100 healthy subjects with 20-35 aged)
  - Female : sagittal ROM, hallux valgus : female
Purpose

• To obtain reference data using multi-segment foot model with 15 marker set from healthy older adults

• To compare the old and young adults on segmental foot motion during gait
Materials & Methods

• Inclusion criteria
  - No subjective symptom during gait
  - No proven osteoarthritis in simple radiograph of the hip, knee, ankle, and foot
  - Normal function of the foot and ankle (100 points of AOFAS score)

• Inclusion
  - 99 volunteers (49 males, 50 females)
  - 60-69 years old (5 in each age)

• Temporal gait parameters
  - Cadence, Speed, Stride length, Step width, Step time, Proportion of stance phase

• Inter-segmental position of foot
  - Hindfoot relative to tibia : sagittal, coronal, transverse
  - Forefoot relative to hindfoot : sagittal, coronal, transverse
  - Hallux relative to forefoot : sagittal, transverse
  - Arch data : length, height, index (length/height)

• Analysis for
  - Maximum, minimum, range during whole gait cycle
  - Inter-segmental angle and range at 8 gait phase
Methods

- 8 meter walking of comfortable walking with 5-minute warm-up
- Foot 3D Multi-Segment Model with a 15-marker set
  (Motion Analysis Co., Santa Rosa, CA)

MFM with 15-marker set had high intra- and inter-session repeatability

J Foot Ankle Res, 2014 Apr 22
Results

Demographics, Temporal gait parameters

<table>
<thead>
<tr>
<th></th>
<th>MALE</th>
<th></th>
<th>FEMALE</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Older (n=49)</td>
<td>Young (n=50)</td>
<td>P value</td>
<td>Older (n=50)</td>
</tr>
<tr>
<td>Cadence (step/min)</td>
<td>109.3 ± 6.6</td>
<td>110.2 ± 6.1</td>
<td>0.467</td>
<td>114.6 ± 6.9</td>
</tr>
<tr>
<td>Speed (cm/sec)</td>
<td>114.0 ± 9.2</td>
<td>123.6 ± 9.6</td>
<td>&lt;0.001</td>
<td>111.5 ± 7.9</td>
</tr>
<tr>
<td>Stride length (cm)</td>
<td>124.5 ± 7.3</td>
<td>134.3 ± 7.6</td>
<td>&lt;0.001</td>
<td>116.3 ± 7.4</td>
</tr>
<tr>
<td>Step width (cm)</td>
<td>11.5 ± 2.3</td>
<td>12.2 ± 2.4</td>
<td>0.132</td>
<td>8.6 ± 2.2</td>
</tr>
<tr>
<td>Step time (sec)</td>
<td>0.55 ± 0.04</td>
<td>0.55 ± 0.03</td>
<td>0.509</td>
<td>0.53 ± 0.03</td>
</tr>
<tr>
<td>Proportion of stance phase (%)</td>
<td>61.1 ± 1.1</td>
<td>59.0 ± 1.7</td>
<td>&lt;0.001</td>
<td>60.6 ± 1.1</td>
</tr>
</tbody>
</table>

Speed, Stride length, and Proportion of stance phase was decreased in older people.
Hallux

Hallux valgus angle
=> larger in older

Pre-swing phase
=> Dorsiflexion lower in older adults

Similar gait pattern

A : male
B : female
* : significant difference
Forefoot

Pre- and initial- swing
=> Dorsiflexed in older

Motion in pre-swing
=> lower in older

Coronal plane
=> Supinated in older female

Similar gait pattern

A : male
B : female
* : significant difference
Hindfoot

Pre-swing phase
=> plantar flexion lower in older female

Coronal plane
=> Pronated in older female

Similar gait pattern

A : male
B : female
*: significant difference
Conclusion

- Age-related change in foot segment motion
  - Reduced ROM in sagittal plane of the hallux, sagittal and coronal plane of the hindfoot: both genders
  - Hallux valgus angle increase: both genders
  - Flattened change in female: dorsiflexed and supinated forefoot, pronated hindfoot
  - Overall patterns of inter-segmental foot motions is similar with young healthy adults
References


