

Oral presentation

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## Comparison of gait data using two different protocols for ankle joint kinematics

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### Introduction

Gait analysis is an important instrument in various fields of clinical research and its protocols are intended to make kinematics interpretable for clinicians.

Although they use the same nomenclature for joint angles, different protocols produce different results [1]. The purpose of this study was to compare gait events of the ankle joint to determine differences between two protocols.

### Methods

Two different protocols were used to quantify distinctive kinematic variables in the stance-phase of barefoot walking at a normal speed:

(1) A functional approach (FA), assuming a ball-and-socket joint at the ankle [2].

(2) A prediction approach (PA) based on anatomical studies [3], differentiating between upper and lower ankle joint.

A single comprehensive marker-set was defined allowing the use of exactly the same gait cycles for both protocols. 10 healthy normal weight subjects (mean = 27 y, s = 5.8) were analyzed on two consecutive days M1 and M2. Landmark definition was done by the same physiotherapist for all subjects. A 12-camera Vicon MX40 system system collected data at 100 Hz. Five force plates were used to detect

gait events. Peak eversion, frontal plane range of motion (ROM) and peak plantar flexion of the ankle joint were extracted from the curve data. At least 5 trials were averaged for each subject and measurement day, respectively.

Agreement between the two methods was quantified using the Bland & Altman Plot [4].

### Results (preliminary data of 4 subjects)

Figure 1 exemplifies the differences of the peak plantar flexion between the two methods (y-axis) plotted against their mean values (x-axis). Each subject (2, 4, 6, 7) is represented for M1 (i.e. 201) and M2 (i.e. 202). Mean Diff 1 and 2 display the mean difference between methods for each day.

Based on the preliminary data, there does not seem to be a relation between the magnitude of the mean values of the two protocols and the magnitude of their differences. Furthermore, differences between protocols are similar for both days.

Table 1 shows a smaller peak plantar flexion (see also Figure 1) and peak eversion and frontal plane ROM for FA.

### Conclusion

The use of different gait analysis protocols for the description of ankle joint kinematics yields different results for both absolute joint angles and ROM. This should be considered when results from different studies are compared.

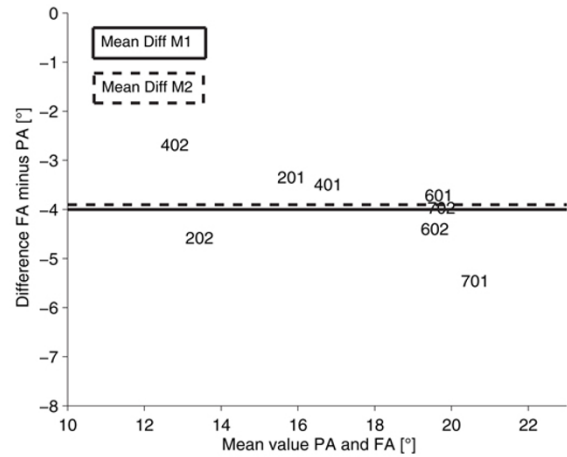
**Table 1: Mean differences FA-PA in degrees**

Variable	Mean Diff (FA-PA)	
	M1	M2
Peak eversion	-1.3	-1.4
Frontal plane ROM	- 6.3	- 5.9
Peak plantar flexion	-4.0	-3.9

The Bland & Altman Plot illustrates differences between methods in a very comprehensive way, incorporating diverse information in one single plot. Final results will incorporate limits of agreement to allow an estimate of the range in which 95% of the differences can be expected.

**References**

1. Ferrari , et al.: *Gait Posture* 2008 in press.
2. List , et al.: *J Biomech* 2006, **39(S1)**:S550.
3. Inman : *Bul Pros Res* 1969, **Spring**:130-145.
4. Bland , Altman : *Stat Meth Med Res* 1999, **2(8)**:135-60.



**Figure 1**  
PA vs. FA for peak plantar-flexion.

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