

Title : Repeatability of the Oxford Foot Model for Kinematic Gait Analysis of the Foot and Ankle
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Introduction: Kinematic gait analysis via the multi-segmental Oxford foot model (OFM) may be a valuable addition to the biomechanical examination of the foot and ankle. The aim of this study is to assess the repeatability of the OFM in healthy subjects.

Methods: Nine healthy subjects, without a history of lower extremity injury, were recruited. Markers were placed according to the OFM requirements. Motion capture was conducted using the VICON NEXUS system on two separate test days, with two tests on each day conducted by two independent examiners. The range of motion (ROM) of the following inter-segments was selected for further analysis: forefoot-hindfoot, forefoot-tibia and hindfoot-tibia in frontal, sagittal and transverse planes. Each step was divided in two parts, a loading phase (from heel strike to midstance) and a push-off phase (from midstance to toe-off). The Intraclass correlation coefficient (ICC), standard error of the measurements with 90% confidence bounds (SEM_{90}) and the Minimal Differences needed to be considered real (MD) with 95% confidence interval were calculated for inter-observer and intra-observer and effect of trial using SPSS.

Results: There was a linear correlation between the number of trials and the ICC's ($r^2=0.49$, $p<0.001$), with six trial leading to good ICC's. Inter-observer repeatability: In the loading phase almost all ICC's were good or excellent (0.53-0.97) with only one parameter below 0.60. In the push-off phase two parameters scored moderate agreement, where the other 7 parameters had well to excellent agreement. The SEM_{90} values were varying from 0.85° to 2.49° in the loading phase and from 0.92° to 4.40° in the push-off phase Intra-observer repeatability: In the loading phase all ICC's were good or excellent (0.71-0.97). In the push-off phase two parameters scored moderate agreement and the other 7 parameters had well to excellent agreement. The SEM_{90} ranged from 1.15° to 4.53° in the loading phase and in the push-off phase from 1.71° to 5.49° .

The SEM_{90} values were varying from 0.85° to 2.49° in the loading phase and from 0.92° to 4.40° in the push-off phase. Intra-observer repeatability: In the loading phase all ICC's were good or excellent (0.71-0.97). In the push-off phase two parameters scored moderate agreement and the other 7 parameters had good to excellent agreement.

Conclusion: The repeatability analysis presented in this study provide excellent basis for objective measurement of the ankle and foot biomechanics. Results for inter-observer and intra-observer repeatability showed moderate to excellent ICC's and acceptable SEM_{90} . Best result were found in the sagittal plane (flexion/extension) followed by the frontal plane (abduction/adduction) and the transverse plane (inversion/eversion).

Keywords

Repeatability; Reproducibility; Reliability; 3D motion capture; Foot model

