

Title : Influence of alignment variations of a prosthetic foot on lower limb kinematics and plantar pressure during below knee amputee gait.

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Summary and Conclusion: Progressive changes in the alignment of a prosthetic foot tend to influence the hip and knee kinematics of the below-knee amputee as well as the roll-off of the artificial foot. Closer analysis of different pressure parameters describing footmotion, such as anterior and medio-lateral deviation of the center of pressure, as well as time variables defining the different sequences of the foot roll-off, are found to be possible parameters for the objectivation of the quality of prosthetic alignment. Generalization of these findings will require further investigation.

Introduction: The quality of the alignment a the prosthetic leg is strongly influenced by subjective interpretation by the prothesist and the patient. From the clinicians' point of view, normal gait serves as a frame of reference for detection of gait deviations caused by incorrect alignment. Important criteria for the patient are referred to as comfort and smoothness in locomotion. Objectivation of the findings of both parties involved, could prove to be indispensable in the achievement of correct prosthetic alignment. Therefore preliminary studies search for indications that might contribute to the development of dynamic alignment tools.

Method and Patient: Complete gait analysis was performed on one subject. A 24 year old left-side BK amputee equipped with a prosthetic socket fitted according to the TSC-procedure (Total Surface Contact) using the ICECAST[®] system. Alignment of the prosthetic leg was performed using the LASAR posture static alignment system. An infra-red high frequent video-analysis system (Vicon[®]) was combined with a plantar pressure measurement system. Sampling frequency of both systems was set at 120Hz. The alignment of the prosthetic foot was progressively changed towards 2, 4 and 6° of plantar - and dorsiflexion as well as endo- and exorotation. Effects of these changes in alignment on kinematic and pressure data were investigated and compared to the neutral alignment.

Results and discussion: Results of the kinematic analysis show that progressive changes in prosthetic alignment can be detected by 3D kinematic analysis as well as in plantar pressure measurements. Inspection of specific joint motion in the different planes as well as the parameters defining the unrolement of the prosthetic foot show how, at certain sequences of the gait cycle, alteration of these parameters strongly relates to the changes in alignment. These findings are on the other hand sometimes doubtful in other sequences of the stance phase. Further investigation will either confirm or reject that changes in alignment can be detected by consistent changes in gait and pressure parameters. Confirmation of these findings might contribute to the development of clinically useful dynamic alignment procedures.