Which Prosthetic Foot to Prescribe?: Biomechanical Differences Found during a Single-Session Comparison of Different Foot Types Hold True 1 Year Later

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Summary

A case study was performed in which gait analysis was used to assess the gait of a unilateral trans-tibial amputee using Epirus and Elan feet. The process was repeated 14 months later and the same differences were observed between the two feet types.

Method

Components: Epirus, Elan

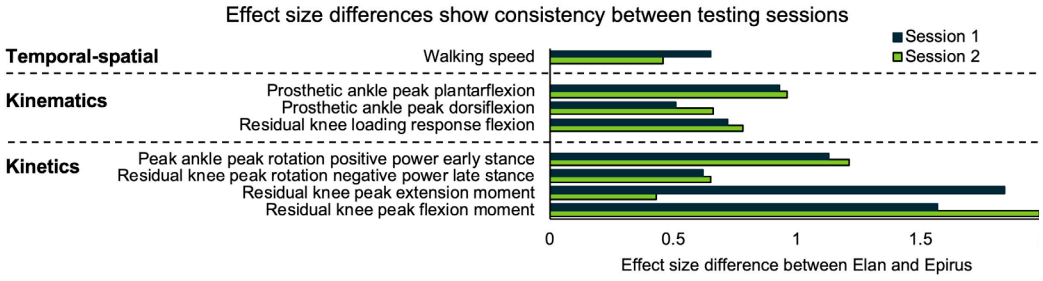
Measurements: 3D gait analysis

Subjects: A single K4 unilateral trans-tibial amputee (35.8 years; 90.4kg (1st session); 96.4kg (2nd session))

Data collection protocol: 3D motion was captured as the amputee completed 12 walking trials, at a self-selected speed, over an 8m walkway with two integrated force plates. This was performed for both prosthetic feet. The amputee's habitual foot was an Echelon VT so acclimatisation to each foot didn't bias results. A second session was conducted 14 months later where the protocol, trial order, laboratory setup, experimenters and prosthetist were identical. The same method was employed to align the devices.

Analysis: Various gait parameters were compared and clinically meaningful differences were defined as those with an effect size difference (d) between prosthetic conditions of at least 0.4 (medium effect size). No inferential statistical tests were applied.

Results



Clinically meaningful differences between feet were observed for eight gait parameters during the first session and again during the second session. These parameters were walking speed, peak plantarflexion and dorsiflexion at the prosthetic ankle, residual knee loading response flexion, peak positive power during early stance at the prosthetic ankle, peak negative residual knee power during late stance, and peak stance phase extension and flexion moments at the residual knee. The mean effect size difference between foot types was similar over both sessions for each parameter, respectively.

Conclusion

The authors conclude that given the comparable differences between foot type at both sessions, even with a change in patient condition, that a single-session comparison, as conducted within a clinical setting, is sufficient for identifying biomechanical gait differences between two devices. With respect to the performance of the different feet, the higher self-selected walking speed with Elan (1.39±0.08m/s and 1.38±0.09m/s for sessions 1 & 2, respectively), compared with Epirus (1.31±0.10m/s and 1.33±0.07m/s for sessions 1 & 2, respectively) can be considered a global descriptor of improved gait function. They also interpret the reduction in peak negative residual knee power in late stance when using Elan (1.51±0.30m/s and 1.89±0.37m/s for sessions 1 & 2, respectively), compared to Epirus (1.76±0.25m/s and 2.15±0.17m/s for sessions 1 & 2, respectively), as a beneficial change.

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