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Current clinical practice for prosthesis alignment does not yield lowest interlimb asymmetry in people with unilateral transtibial amputation during walking

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Introduction

Proper alignment of prostheses is critical for reducing interlimb asymmetry and secondary injury risk for people with unilateral transtibial amputation (UTTA). Currently, aligning a prosthesis is done by a prosthetist based on their subjective evaluation. In this study, we modified prosthesis alignment by systematically changing 3D angular rotations from a neutral alignment. We aimed to investigate whether prosthetic alignment based on current clinical practice (baseline) yields the lowest interlimb asymmetry during walking compared to the modified alignment. We hypothesized that the baseline alignment will yield the smallest symmetry index (SI) for both step length and peak horizontal ground reaction force (hGRF) compared to 3° and 6° alignment changes.

Methods

Five participants with UTTA walked on an instrumented treadmill at 1.25 m/s for 3 minutes with 13 alignment conditions for the same low-profile passive-elastic prosthesis. We started with a baseline trial, with the prosthesis set to a neutral alignment by a prosthetist. The prosthetic alignment between the socket and pylon was then changed by ±3° and ±6° in the three planes (sagittal, coronal, and transverse), 6 directions total (plantarflexion/dorsiflexion, abduction/adduction, internal/external rotation; Figure 1). We assessed the SI of step length and hGRF at baseline, and all alignment conditions. SI=0 means perfect symmetry.

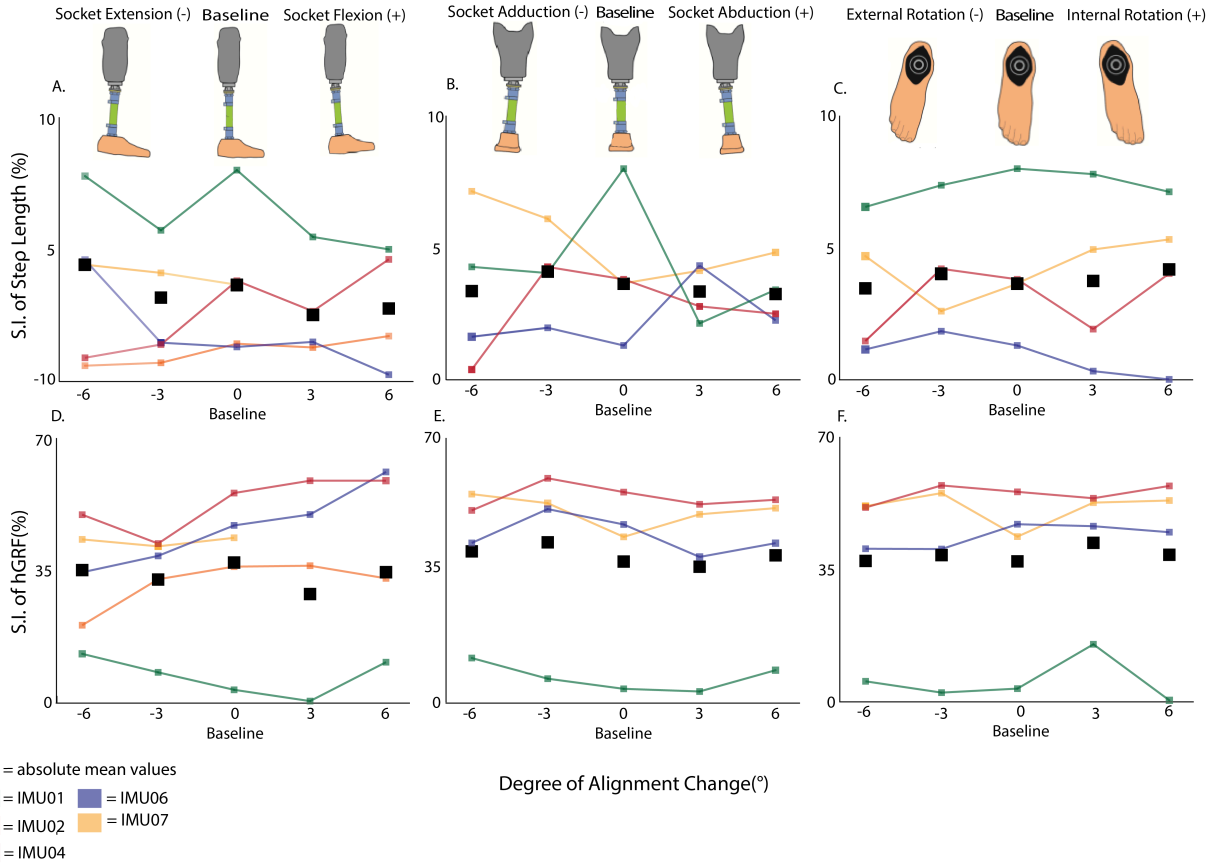
Results

None of the 5 participants presented the lowest SI for step length or hGRF at baseline (Figure 1). SI at baseline was averaged at 3.64±4.89% (step length) and 37.06±20.09% (hGRF). Modifying alignment with +3° change in sagittal plane yielded the lowest SI for step length (2.53±3.46%) and hGRF (28.37±30.04%) SI of step length was the highest (4.43±5.46%) with -6° change on the sagittal plane alignment. SI of hGRF was the highest (42.16±30.33%) with -3° change on the coronal plane.

Discussion

The baseline alignment did not yield the lowest interlimb asymmetry compared to the 3° and 6° alignment changes in 3 directions. Our results suggest that subjective evaluation may not be the most effective

Images (Optional)



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