



PROSTHETIC FOOT WITH ADJUSTABLE STABILITY AND ITS EFFECTS ON BALANCE AND MOBILITY

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INTRODUCTION

Able-bodied persons utilize a nearly flat ankle-foot effective rocker shape for standing and swaying and a circular shape with a radius of about 1/3 leg length for walking (Hansen and Wang, 2010). Some currently available prosthetic feet are perceived by users to have a “flat region” during walking. This “flat region” may be beneficial for prosthesis users in the lowest functional levels, particularly those with balance problems or low balance confidence, because it may provide a region of higher stability for standing (Curtze et al, 2009). The purpose of this study was to use a prosthetic foot with an adjustable “flat region” to determine the effects of this region on standing balance and mobility of lower limb prosthesis users.

METHODS

The Shape&Roll Prosthetic Foot (S&R PF, Sam et al, 2004) was altered to accommodate a standard heel height shoe and to fit into College Park foot shells. The S&R PF conforms to the appropriate effective rocker shape for walking through closure of saw cuts in the forefoot. The “flat region” was adjusted by blocking 0, 2, and 4 cuts as shown in Figure 1. We are having persons with unilateral and bilateral transtibial amputations perform tests of balance using a Neurocom Smart Equitest Clinical Research System with long force plate (limits of stability, motor control test, sensory organization test – conditions 1 and 2, sit to stand), tests of mobility (L-Test, walking speed), and the activities-specific balance confidence scale while using the foot conditions in Figure 1. Participants are also asked to provide a preference ranking of the foot conditions.

RESULTS AND DISCUSSION

To date, we have tested two unilateral transtibial prosthesis users (one having a transmetatarsal amputation on the contralateral side) and three bilateral transtibial prosthesis users. So far no clear patterns in balance, mobility, or balance confidence outcomes are emerging as a function of the different “flat region” lengths. However, all of the participants have chosen the prosthetic foot condition with 2 cuts blocked (Figure 1B) as their top preference. We are continuing to recruit for this study and will soon begin studying transtibial prosthesis users in the K3 and K4 levels as well as unilateral transfemoral prosthesis users. We expect that higher functioning prosthesis users (K3 and K4) will prefer the foot with 0 cuts

blocked (Figure 1A) and that balance outcomes may be more pronounced in transfemoral prosthesis users, who do not have an anatomical knee joint to compensate for the missing ankle-foot system.

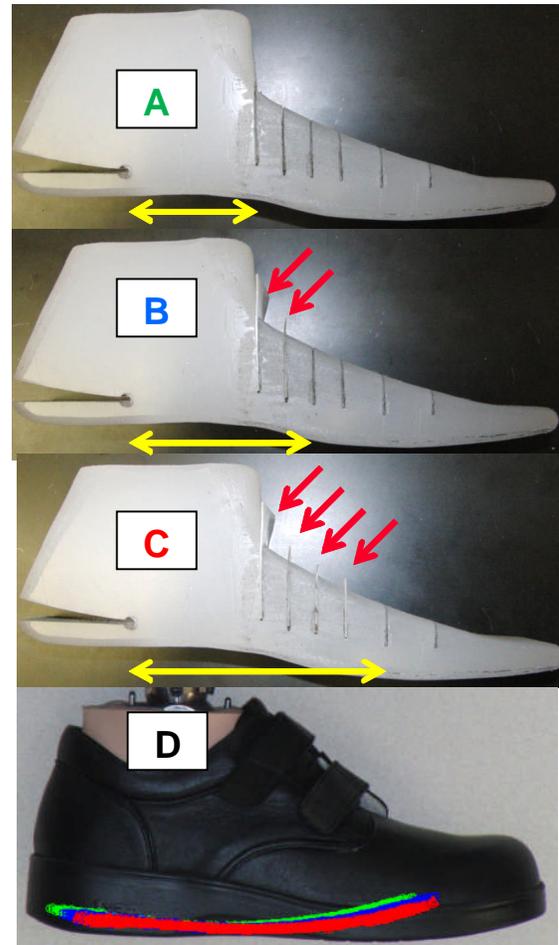


Figure 1. (A) Redesigned Shape&Roll Prosthetic Foot. “Flat region” length (horizontal distances shown in yellow) was adjusted by blocking two and four forefoot cuts (B and C respectively). (D) Roll-over shapes for the three foot conditions, A – green, B – blue, C – red.

REFERENCES

Hansen, A.H., Wang, C.C. *Gait Posture* 32:181-184, 2010.
Curtze, C. et al. *J Biomech* 42:1746-1753, 2009.

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