EFFECTS OF A MODIFIED RUNNING FOOT PROSTHESIS ON USERS’ ENDURANCE AND PERCEIVED EXERTION
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INTRODUCTION
For people with transtibial amputations (TTA), use of a prosthesis can facilitate return to a basic level of functional mobility. However, absence of an anatomical foot and ankle still greatly impairs physical performance, resulting in decreased walking speeds, diminished endurance, and restricted ability to participate in life situations. Contemporary energy storing feet (ESF), which use advanced materials and geometric designs, have been developed to address these deficits. Yet even the most advanced ESF do not significantly mitigate the increased energy demands required for walking compared to conventional, rigid prosthetic feet (Hsu, 2006). Running-specific feet (RSF), however, enable runners with TTA to achieve endurance similar to people without limb loss (Brown, 2009) by extending the length and increasing the stiffness of the keel. One limitation to RSF is that the keel-only design does not provide users the stability needed for walking.

A novel modified running-specific foot (mRSF, Figure 1), which combines features of both ESF and RSF, has been developed for use in walking, running, and other daily activities. The mRSF includes an extended carbon keel that is directly connected to the socket, heel springs to facilitate heel-toe walking, and a shell to enable the foot to fit in a typical shoe. Although users’ opinions of the mRSF have been positive, evidence is needed to support clinical prescription. The goal of this pilot study was to assess endurance and perceived exertion of people with TTA walking with the developed mRSF and an ESF.

METHOD
Subjects: People with TTA (n=7, mean age=43 yrs) who own comfortable ESF and mRSF prostheses.
Apparatus: Six-Minute Walk Test (6MWT) and Borg Rating of Perceived Exertion (RPE) CR100 scale.
Procedures: Subjects attended a one-time, cross-sectional data collection session where they performed the 6MWT in both prosthetic conditions. Immediately following the 6MWT, they were asked to rate their perceived exertion with the Borg RPE. The order of conditions was randomized to reduce order effects.
Data Analysis: Participants’ individual and sample mean 6MWT times and RPEs were plotted for visual inspection and comparison. Group-level statistical testing was not performed, due to the small sample.

RESULTS
6MWT: 5 of 7 subjects increased their distance (in feet) when using the mRSF compared to the ESF (mean difference +65, range: -18 to +230). Two subjects increased their distance by more than 131ft.
Borg: 6 of 7 subjects reported reduced exertion when using the mRSF compared to the ESF (mean difference -13, range: -38 to 0).

DISCUSSION
Results of this study suggest that the mRSF may improve endurance while simultaneously decreasing perceived exertion for people with TTA. However, differences were substantial for only 2 of 7 participants for the 6MWT and 4 of 7 subjects for the Borg, indicating that improvements may not be clinically significant for all users.

CONCLUSION
Initial results suggest that the mRSF may facilitate improvements in mobility by increasing endurance while mitigating exertion when compared to traditional ESF in people with TTA. Prospective research is needed to assess mobility and other health outcomes.

CLINICAL APPLICATIONS
The mRSF is a novel prosthetic foot design that may enhance mobility outcomes in people with TTA.

REFERENCES