INTRODUCTION
In contrast to a conventional AFO, the DRAFO includes an inner soft plastic Dynamolene liner and a rigid external shell (polypropylene) with a heel cut-out, integrated with a lift to vertically align the shank at terminal stance. The objective of the softer heel is to provide enhanced proprioception during loading response.

The objective of this study was to investigate the effects of the DRAFO design, contrasting gait for healthy normal subjects without a brace, with the DRAFO, and with a conventional AFO (both locked and free). The specific research hypothesis is that the soft heel of the DRAFO design will increase the femoral or thigh to vertical angle (Owen, 2010) and will affect dorsiflexion activity during ambulation.

METHODS
Eight young (aged 19-22 years), healthy subjects (5 female and 3 male) were recruited and provided written informed consent prior to research participation. After casting, a conventional AFO (free and locked in neutral ankle orientation) and DRAFO were fabricated for each subject. Each subject then completed gait analysis trials (2 minute duration), walking on an instrumented, level, split belt treadmill (Bertec, Columbus, OH). Testing conditions included: no AFO, followed by 3 randomly selected interventions: DRAFO, AFO (locked), and AFO (free), for the right leg. Acquired data included bilateral lower limb kinematics (6-8 cameras, Vicon; Oxford, UK), ground reaction forces (Bertec), and EMG (Motion Lab Systems, Baton Rouge, LA) activity of the subjects’ anterior tibialis and medial gastrocnemius.

Data were analyzed using Vicon Nexus and MatLAB® (Mathworks Inc.) to identify heel strike and toe off events, calculate ground reaction forces, 3D joint angles, shank to vertical and thigh to vertical angles for each gait cycle for each subject and test condition. Data were also averaged across gait cycles; the range of motion for the respective joints and limb segments were also calculated.

PRELIMINARY RESULTS & DISCUSSION
Mean kinematic data for all subjects are shown in Fig. 1. Although statistical analysis has not yet been conducted, preliminary results indicate that ambulation in the DRAFO resulted in increased range of motion in thigh to vertical angle, perhaps reflecting increased step length. The ankle range of motion was decreased for both the DRAFO and locked AFO test conditions. The range of motion of the shank to vertical angle was slightly reduced for DRAFO ambulation.

Mean dorsiflexor activity is also shown for a single subject in Fig. 2. These preliminary data indicate that the timing and duration of dorsiflexion activity may be affected by AFO design.

FUTURE WORK
Additional subjects are being recruited and tested. Further data analysis will be conducted to confirm these preliminary findings and investigate the effect of the AFO on EMG activity. The timing at which the shank is vertical (e.g. shank to vertical angle is zero) and its rate of change during initial to mid-stance will also be investigated. Finally, statistical analyses will be conducted to assess the potential significance of observed parameter differences. This work might then be extended to individuals with neurological and orthopedic conditions.

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A Functional Comparison of Conventional AFOs with the Dynamic Response AFO

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CLINICAL APPLICATIONS
These data will help assess AFO function, providing insight into AFO prescription and use.

REFERENCES

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