INTRODUCTION
Energy efficiency measured through muscle fatigue in KAFOs has not been investigated in detail. The clinical relevance of stance-control KAFOs and their effects on the quality of life has yet to be documented with a validated outcome measure. The purpose of this study was to systematically quantify any differences in EMG signals and gait mechanics as well as qualitative orthosis function for one subject diagnosed with post-polio wearing a custom, conventional locked KAFO and an immediate-fit stance control KAFO.

METHOD
One participant met enrollment criteria, was officially enrolled, and completed the entire study protocol. The study control was the subject’s normal gait with their locked KAFO. The subject completed two sessions of data collection. Each session consisted of 10 walking trials on a 10-foot long walkway for each testing condition. Prior to the first SCO trial, the subject completed a familiarization session during which he was instructed on use and activation of the PreStride™ SCO device. For each of the 10 walking trials, data was collected using a Vicon 3D motion capture system, GaitRite portable gait analysis system, and a wireless electromyography (EMG) system. Two representative trials were chosen for data analysis from each session.

RESULTS
Vicon data supported use of the KAFO over the SCO. Hip and knee joint angles were measured closer to normal values with the KAFO. In both orthoses, the subject never reached full hip or knee extension. The subject demonstrated a more normal stance to swing ratio in the KAFO. The anterior tibialis muscle activation was also increased in the KAFO condition. However, the SCO trials showed an increased right calf, hamstrings and quadriceps muscle group activation. The spatiotemporal values derived from the GaitRite system were closer to expected normal values in the KAFO. Single and double limb support was more normalized with the KAFO. The OPUS survey demonstrated that the subject has a good outlook on his condition and quality of life. He appears to be limited more physically than emotionally.

DISCUSSION
The overall effectiveness of the SCO was reduced in part because of instability experienced with the selectively unlocked mechanical knee joint, as well as the allowed motion in the ankle joints. Additional time for gait training beyond the protocol may have improved results. The KAFO yielded more symmetric gait with improved spatiotemporal values. It is essential that further research incorporate additional SCO gait training and an extended accommodation phase. Additional trials, subjects, and data collection are necessary to determine energy expenditure differences between the SCO and KAFO.

CONCLUSION
While results indicated the locked KAFO provide more normal gait parameters for the subject, the SCO has potential to add therapeutic benefits by increasing muscle activity of lower extremity muscles for patients with similar presentations to this subject in a controlled therapy setting.

CLINICAL APPLICATIONS
The utilization of an immediate-fit stance control orthosis allowed increases in muscle activation of the lower limb of the subject in this case study; however, spatiotemporal gait parameters were closer to normal in the locked KAFO.

REFERENCES