INTRODUCTION

The Motion Foot is a new foot/ankle system that offers near-normal ankle range of motion via a hydraulic ankle (ROM = 50 deg), paired with an energy-storing foot plate. This system has been developed to offer to above-knee and below-knee prosthesis wearer: 1) improved comfort, 2) reduced loads on proximal joints and 3) improved stability.

Improved comfort and reduced proximal joint loading is achieved through: 1) shock absorption at heel-strike by plantar flexion of rotary hydraulic spring/damper system, 2) smooth adjustable resistance to roll-over in mid-stance, 3) Higher toe clearance during swing phase that reduces uncomfortable and energy consuming hip elevation.

Stability is improved by adjustable plantar flexion resistance that allows the ankle to go flat in a manner that reduces the knee flexion force that can cause instability at the knee. 5 to 10 degree dosi-flexion can improve stability standing and walking up inclines.

METHOD

Ratings of the stability and comfort (in a number of different conditions) have been gathered from nearly 20 wearers, compared with their earlier prosthetic foot.

Also instrumented gait lab analysis has been performed with trans-tibial and trans-femoral wearers of the new Motion Foot on a ramp. (The gait lab utilized a 10 camera Vicom MX and four AMTI force plates.) This gait lab analysis shows proximal joint loading with the Motion Foot compared to their previous foot.

RESULTS

Wearers of the Motion Foot have reported improved comfort and stability as a result of improved hydraulic controls. Comfort is improved by providing shock absorption at heel strike through a smooth natural plantar-flexion movement.

This natural method of shock absorption does not lengthen the prosthesis during swing phase as a result of static vertical loading, but instead shortens the prosthesis, improving toe clearance. Patients have reported much less concentration and effort while walking on declines with the new foot/ankle system.

Gait lab results and moments measured with the Compas system both show reduced proximal limb loading especially on declines. Furthermore, gait symmetry was improved.

DISCUSSION

The benefits of a near-normal range of ankle plantar/dorsi flexion are verified for wearers of the Motion Foot, from both high ratings in comfort and stability (compared with their earlier feet) and also from gait analysis data which indicates greater stability and shock absorption, especially on slopes – the higher the slope, the greater difference between this foot and others.

CLINICAL APPLICATIONS

A foot/ankle prosthesis that offers anthropomorphic range of motion with hydraulic damping can improve comfort, stability, reduce proximal joint loadings at heel strike and improve gait symmetry.

REFERENCES