

A Clinical Comparison of Variable-Damping and Mechanically Passive Prosthetic Knee Devices

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OBJECTIVE

Although variable-damping knee prostheses offer some improvements over mechanically passive prostheses to transfemoral amputees, there is insufficient evidence that such prostheses provide advantages at self-selected walking speeds. In this investigation, we address this question by comparing two variable-damping knees, the hydraulic-based Otto Bock C-leg and the magnetorheological-based Ossur Rheo, with the mechanically passive, hydraulic-based Mauch SNS.

DESIGN

For each prosthesis, metabolic data were collected on eight unilateral amputees walking at self-selected speeds across an indoor track. Furthermore, kinetic, kinematic, and electromyographic data were collected while walking at self-selected speeds across a 10-m walkway in a laboratory.

RESULTS

When using the Rheo, metabolic rate decreases by 5% compared with the Mauch and by 3% compared with the C-leg. Furthermore, for the C-leg and Rheo knee devices, we observe biomechanical advantages over the mechanically passive Mauch. These advantages include an enhanced smoothness of gait, a decrease in hip work production, a lower peak hip flexion moment at terminal stance, and a reduction in peak hip power generation at toe-off.

CONCLUSION

The results of this study indicate that variable-damping knee prostheses offer advantages over mechanically passive designs for unilateral transfemoral amputees walking at self-selected ambulatory speeds, and the results further suggest that a magnetorheological-based system may have advantages over hydraulic-based designs.

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