Vacuum-Assisted Socket Suspension Compared With Pin Suspension for Lower Extremity Amputees: Effect on Fit, Activity, and Limb Volume

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Abstract

Objective: To investigate the effect of a vacuum-assisted socket suspension system as compared with pin suspension on lower extremity amputees.
Design: Randomized crossover with 3-week acclimation.
Setting: Household, community, and laboratory environments.
Participants: Unilateral, transtibial amputees (N_20 enrolled, N_5 completed).
Interventions: (1) Total surface–bearing socket with a vacuum assisted suspension system (VASS), and (2) modified patellar tendon–bearing socket with a pin lock suspension system.
Main Outcome Measures: Activity level, residual limb volume before and after a 30-minute treadmill walk, residual limb pistoning, and Prosthesis Evaluation Questionnaire.
Results: Activity levels were significantly lower while wearing the vacuum-assisted socket suspension system than the pin suspension (*P*_.0056; 38,000_9,000 steps per 2wk vs 73,000_18,000 steps per 2wk, respectively). Residual limb pistoning was significantly less while wearing the vacuum assisted socket suspension system than the pin suspension (*P*_.0021; 1_3mm vs 6_4mm, respectively). Treadmill walking had no effect on residual limb volume. In general, participants ranked their residual limb health higher, were less frustrated, and claimed it was easier to ambulate while wearing a pin suspension compared with the VASS.

Conclusion

The VASS resulted in a better fitting socket as measured by limb pistoning, although the clinical relevance of the small but statistically significant difference is difficult to discern. Treadmill walking had no effect, suggesting that a skilled prosthetist can control for daily limb volume fluctuations using conventional, nonvacuum systems. Participants took approximately half as many steps while wearing the VASS, which, when coupled with their subjective responses, suggest a patient preference for the PIN. The need for fewer check sockets and a shorter time to obtain an adequate fit suggest a clinician preference for the pin suspension.

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