
Reference

Klute GK, Berge JS, Biggs W, Pongnumkul S, Popovic Z, Curless B.

Department of Veterans Affairs Center of Excellence for Limb Loss Prevention and Prosthetic Engineering, Seattle, WA, USA.

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

Archives of Physical Medicine and Rehabilitation 2011; 92(10):1570-5.

Products

Vacuum-assisted socket system* (VASS) vs pin suspension system (PSS)

* TEC, later acquired by Otto Bock and sold as Harmony

Major Findings

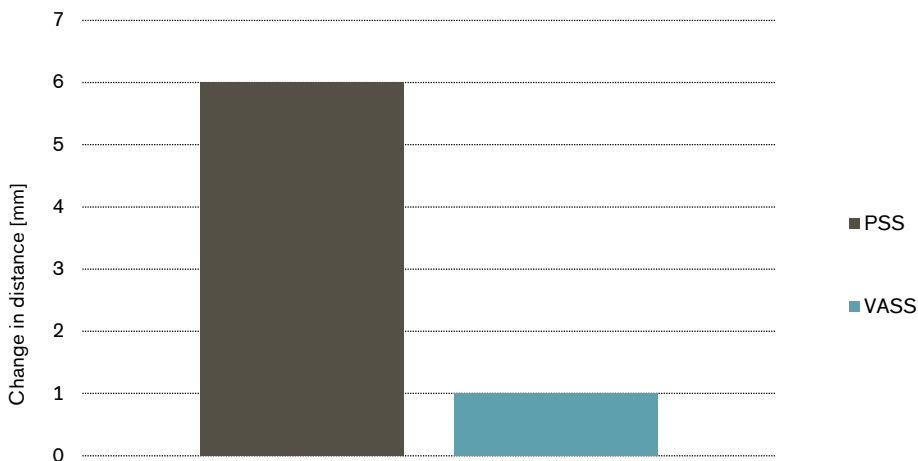
With VASS compared to PSS:

→ **A better fit of the residual limb in the socket is achieved during weighting and unweighting prosthesis**

Limb pistoning decreased by 83%

Caution: From 20 enrolled subjects only 5 completed the study. 3 subjects withdrew before study started, 12 withdrew during study. This was probably caused by poor socket fit. Since residual limb volume decreases in first months after using VASS, the socket volume has to be checked on a regular basis and adjusted as necessary.

Decreased pistoning with VASS



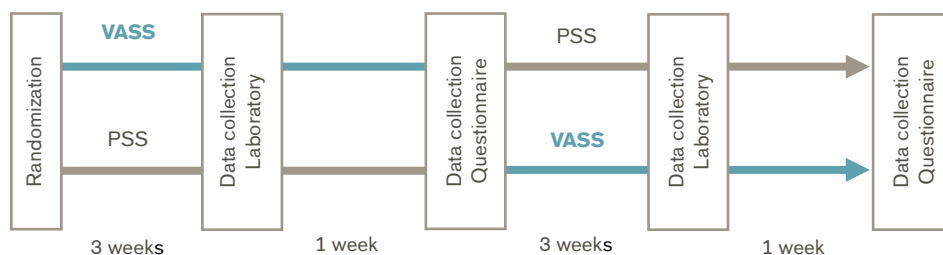
Pistoning was defined by the change of distance between prosthesis and residual limb while subjects weighted and unweighted their prosthesis.

Population

Subjects:	5 transtibial amputees
Previous socket system:	Pin suspension system (PSS)
Amputation causes:	80% trauma, 20% dysvascular
Mean age:	56 ± 9 yrs
Mean time since amputation:	13 ± 15 yrs
MFCL:	not reported

Study Design

Interventional, randomized crossover design:



Results

Body Function				Activity			Participation	Others	
Wound Healing	Limb Volume Fluctuation	Pain	Comfort, Limb Health	Level Walking	Balance	Activity, Mobility, ADLs	Preference, Satisfaction, QoL	Pistoning	Pressure Measurement

Category	Outcomes	Results for VASS compared to PSS	Sig.*
Limb Volume Fluctuation	Residual limb volume was measured before and after a 30 min walk with a limb scanning system	No difference in limb volume, independent of exercise.	0
Comfort, Limb Health	Questionnaire about sweat, smell, volume changes, rashes, in-grown hairs, and blisters. A score of 100 indicates the best outcome.	Residual limb health decreased by 14% (77 vs 90 points) after having used the socket for 4 weeks.	n.a.
Activity, Mobility, Activities of daily living (ADLs)	Activity level, measured by total number of steps	Activity level decreased by 48% (38'000 vs 73'000 steps per two weeks).	--
	Questionnaire about ability to walk in general, in close spaces, on stairs and ramps, in urban environments, and on slippery surfaces. A score of 100 indicates the best outcome.	Difficulty to ambulate increased by 31% (67 vs 95 points) after having used the socket for 4 weeks.	n.a.
Preference, Satisfaction, QoL	Questionnaire about frustration (frequency of occurrence and rating). A score of 100 indicates the best outcome.	Frustrating increased by 53% (43 vs 91 points) after having used the socket for 4 weeks.	n.a.
Pistoning	Changes of distance between prosthesis and residual limb when weighted and un-weighted prosthesis was measured using a 12-camera motion analysis system	Limb pistoning decreased by 83% (1 vs 6 mm).	++

Category	Outcomes	Results for VASS compared to PSS	Sig.*
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* no difference (0), positive trend (+), negative trend (-), significant (++/--), not applicable (n.a.)

Author's 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 PSS. The need for fewer check sockets and a shorter time to obtain an adequate fit suggest a clinician preference for the pin suspension.” (Klute et al. 2011)

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