

The effect of prosthetic device satisfaction on functional performance in lower-limb amputated populations

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Clinical Question: Do people with unilateral lower-limb amputations who are satisfied with their prosthesis perform better on functional performance measures compared to those who are not satisfied with their devices?

Background: People with lower limb loss often experience discomfort or dissatisfaction with their prosthetic device. These negative experiences can be attributed to a multitude of factors such as prosthesis mass, prosthesis bulk, residual limb pain, poor socket fit, and general discomfort.¹⁻³ This dissatisfaction may also affect their functional capabilities. Previous studies have suggested that factors such as amount of daily prosthesis use, physical function, psychological distress, clinical recovery, and the ability to return to work could influence patient satisfaction following prosthesis delivery.⁴ Self-report outcome measures such as the Prosthesis Evaluation Questionnaire (PEQ),⁵ and the Sickness Impact Profile (SIP)⁶ allow clinicians and researchers to make inferences on how patients are perceiving their functional ability. While these measures include questions about the patient's perceived ability to complete everyday tasks with their device, these measures do not include objective, physical measures of function. Utilizing self-report measures of satisfaction and function alongside established objective measures of physical function can inform the best practices for orthotic and prosthetic clinicians. Our purpose was to review existing literature that defined and assessed whether there was a relationship between device satisfaction and objective measures of functional ability in lower-limb prosthesis users.

Search Strategy:

Databases Searched: Google Scholar, PubMed

Search Terms: (prosthetic OR prosthesis) AND (functional measure OR function) AND (satisfaction) AND (lower limb OR "lower-limb")

Inclusion/Exclusion Criteria: 2005 - present, English

Synthesis of Results: Three studies were identified (see Evidence Table) that utilized both measures of device satisfaction, as well as objective and subjective measures of functional performance. Generally, the majority of patients in the literature had a unilateral trans-tibial or trans-femoral amputation due to trauma^{4,7,8}, yet one study also included individuals that had undergone lower limb salvage procedures in addition to amputation.⁴ Despite the multitude of studies describing different measures of satisfaction or function with several types of devices,

there are few articles that look at the specific relationship between satisfaction and function. For instance, there exists evidence where lower PEQ scores for a prosthetic knee joint coincided with lower measures of physical function, but this study does not directly assess the relationship between the two.⁷ Similarly, another study compared patient satisfaction (N = 463) with the progress following surgery (amputation and limb salvage) using the physical functioning component of the SIP and self-selected walking speed and found that these two measures were associated with higher scores of satisfaction.⁴ In contrast, Kark and Simmons found that performance-based measures such as step length, walking speed, timed up-and-go, and 6 minute walk tests did not significantly correlate with prosthesis satisfaction.⁸ This non-significant finding was likely due to a low number of participants (N=20).⁸ This was the only study identified that had a direct comparison between prosthetic device satisfaction and functional capability.

Clinical Message: Overall, the results demonstrate both statistically significant and nonsignificant data on the relationship between device satisfaction and functional performance. This places further emphasis on the necessity for future studies with larger recruitment numbers to utilize both measures of satisfaction and functional performance and make direct comparisons between those measures.

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Evidence Table

	Kark & Simmons, 2011	O'Toole et al., 2008	Lythgo et al., 2010
Population	20 community based unilateral lower-limb amputees (12 TTA, 8 TFA)	463 patients treated for limb-threatening lower-extremity injuries at 8 level-1 trauma centers	Men with unilateral transfemoral amputation
Study Design	Cross-sectional	Multisite prospective cohort study	Intervention study with crossover design
Intervention	No intervention	Amputation vs. reconstruction and time to treatment	Prosthetic knee joints
Methodology	Participants completed PEQ with embedded satisfaction-related questions, the TUG, and the 6 minute walk test.	Participants reported self-measured satisfaction and injury severity	Participants fitted with either 3R90 or 3R92, completed PEQ, and then physical tests (TUG, FSST, 6MWT).
Outcomes	Happiness with prosthesis, satisfaction with prosthesis/walking/prosthetist/training (current and overall), TUG, 6MWT, Gait profile score	Pain, range of motion, muscle strength, self-selected walking speed, depression, anxiety, physical and psychological scores of SIP, return to work, and number of major complications	Physical function, gait, dynamic balance, and satisfaction
Key Findings	Satisfaction strongly correlated with PEQ scales. Relationship between satisfaction and performance-based outcome measures were not significant. GPS did not correlate with satisfaction.	Patient satisfaction after surgical treatment of lower-extremity injury is predicted more by function, pain, and the presence of depression at 2 years than by any underlying characteristic	PEQ scores and measures of physical function were higher in 3R92 knee joint compared to 3R90, but gait velocity was significantly lower.

		of the patient, injury, or treatment.	
Limitations	Small sample size.	Secondary data analysis, how results can be extrapolated to patients treated in other medical facilities is unknown, patient satisfaction was measured on 1-5 scale.	Sudden-stop test was not sensitive enough to ascertain differences between knee devices. Sample size is small (n=5).

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References:

1. Gailey R, McFarland LV, Cooper RA, Czerniecki J, Gambel JM, Hubbard S, Maynard C, Smith DG, Raya M, Reiber GE. Unilateral lower-limb loss: Prosthetic device use and functional outcomes in service members from Vietnam War and OIF/OEF conflicts. *Journal of Rehabilitation Research & Development*. 2010;47(4):317-32.
2. Sherman RA. Utilization of prostheses among US veterans with traumatic amputation: A pilot survey. *Journal of Rehabilitation Research & Development*. 1999;36(2):100–108.
3. Karmarkar AM, Collins DM, Wichman T, Franklin A, Fitzgerald SG, Dicianno BE, Pasquina PF, Cooper RA. Prosthesis and wheelchair use in veterans with lower-limb amputation. *Journal of Rehabilitation Research & Development*. 2012;46(5):567-76.
4. O'Toole RV, Castillo RC, Pollak AN, MacKenzie EJ, Bosse MJ, LEAP study group. Determinants of Patient Satisfaction After Severe Lower-Extremity Injuries. *The Journal of Bone & Joint Surgery*. 2008;90(6):1206-1211.
5. Legro MW, Reiber GD, Smith DG, del Aguila M, Larsen J, Boone D. Prosthesis Evaluation Questionnaire for Persons with Lower Limb Amputations: Assessing Prosthesis-Related Quality of Life. *The Archives of Physical Medicine and Rehabilitation*. 1998;79:931-8.
6. Bergner M, Bobbitt RA, Carter WB, Gilson BS. The Sickness Impact Profile: Development and Final Revision of a Health Status Measure. *Medical Care*. 1981;19(8):787-805.
7. Lythgo N, Marmaras B, Connor H. Physical Function, Gait, and Dynamic Balance of Transfemoral Amputees Using Two Mechanical Passive Prosthetic Knee Devices. *The Archives of Physical Medicine and Rehabilitation*. 2010;91:1565-70.
8. Kark L, Simmons A. Patient satisfaction following lower-limb amputation: the role of gait deviation. *Prosthetics and Orthotics International*. 2011;35(2):225-233.