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Original Research—CME

Functional Outcomes After the Prosthetic Training Phase of Rehabilitation After Dysvascular Lower Extremity Amputation

Cory L. Christiansen, PT, PhD, Thomas Fields, PT, Guy Lev, PT, DPT, Ryan O. Stephenson, DO, Jennifer E. Stevens-Lapsley, PT, PhD

Abstract

Objective: To describe physical function outcomes and modes of physical therapy intervention for a cohort of patients with dysvascular lower extremity amputation (LEA) during the prosthetic training phase of rehabilitation.
Design: A retrospective cohort study.
Setting: Physical rehabilitation clinics at a Veterans Affairs medical center and a university hospital.
Patients: Forty-two patients (38 men, 4 women, age 60.2 ± 8.4 years) who completed outpatient physical therapy rehabilitation with prosthetic training after dysvascular LEA.
Methods: All patients underwent a prosthetic training phase of rehabilitation, with standardized outcome measures performed at initiation and discharge.
Main Outcome Measures: Performance-based physical function measures included Two-Minute Walk (2MW), Timed-Up and Go (TUG), and 5-meter gait speed. Self-report physical function measures included the Prosthesis Evaluation Questionnaire—Mobility Section (PEQ-MS) and the Patient-Specific Functional Scale. Rehabilitation dose was tracked as total number of clinic visits, rehabilitation duration, and specific intervention modes.
Results: There were significant improvements between initial and discharge values (mean ± SD) for the Two-Minute Walk (67.5 ± 29.9 m and 103.3 ± 45.8 m, respectively, $P < .001$), gait speed (0.58 ± 0.27 m/s and 0.88 ± 0.39 m/s, respectively, $P < .001$), TUG (34.8 ± 21.3 seconds and 18.6 ± 13.9 seconds, respectively, $P < .001$), PEQ-MS (2.2 ± 0.9 and 2.8 ± 0.8, respectively, $P < .001$), and Patient-Specific Functional Scale (3.2 ± 2.0 and 5.9 ± 2.3, respectively, $P < .001$). Performance-based (TUG) and self-report (PEQ-MS) changes in functional mobility from initial exam to discharge had low or no correlations with rehabilitation dose measures. The number of clinic visits was 12.7 ± 13.1 and rehabilitation duration was 13.7 ± 16.8 weeks.
Conclusions: Significant improvements in performance-based and self-report measures of physical function occurred during the prosthetic training phase of physical rehabilitation after dysvascular major LEA. Despite improvements in function, gait speed, and TUG outcomes remained below clinically important thresholds, indicating patients were limited in community ambulation and at risk for falls. Lack of moderate or greater correlation between rehabilitation dose and outcome measures may indicate the need for more specific rehabilitation dose measures.

Introduction

Poor physical function outcomes are reported commonly for patients with dysvascular major lower-extremity amputation (LEA) [1-5]. Dysvascular LEA can be operationally defined as amputation resulting from severe peripheral artery disease (PAD) with critical limb ischemia or severe diabetes mellitus (DM) with dense distal neuropathy leading to a nonhealing wound. Importantly, dysvascular amputations account for more than 80% of major LEAs in the United States [6,7]. Research evidence on functional outcomes is based largely on mixed populations of patients with amputation, including patients with traumatic, congenital, or cancer-related amputations. The scarce amount of physical function outcome data limits the knowledge needed to develop rehabilitation programs and guidelines for people after dysvascular amputation [8,9].

Approximately one half of patients with dysvascular transtibial amputation (TTA) referred for prosthetic care are likely to not walk as their primary method of community mobility 1 year after amputation [2,3,10,11]. The

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ability of patients to perform tasks such as walking, sit-stand transitions, and turns is particularly limited [5,12,13]. For example, Schoppen et al [12] found the mean ± SD time for the Timed Up-and-Go (TUG) test (which includes walking, sit-stand transitions, and turning) to be 23.8 ± 23.0 seconds for a group of older adults (n = 27) at mean time of 3.7 years after dysvascular TTA. In comparison, 13.5 seconds is an established threshold time that indicates risk of falls for older adults [14]. The presence of this functional limitation is a significant health care issue, considering that physical mobility and ambulation ability are key indicators of successful function for older adults [15].

Much of the current research on performance-based physical function after dysvascular LEA is based on cross-sectional analyses, which limit the ability to assess expected changes during physical rehabilitation. Findings from the small number of longitudinal cohort and intervention studies indicate that rehabilitation within the first year after dysvascular LEA can help to improve physical function [4,16-19]. For example, Czerniecki et al [4] examined the 1-year course of change in ambulatory function for 25 patients with dysvascular LEA. They found that patients made significant improvements in ambulatory function from 6 weeks to 12 months after LEA, but even at 12 months after amputation, ambulatory function did not return to preamputation levels.

The lack of continued gain in physical function after rehabilitation is problematic. For example, several studies demonstrate that patients with dysvascular LEA are likely to have chronic postrehabilitative functional deficits [3,20,21]. Such unresolved functional limitations could predispose individuals to premature loss of functional independence, as well as other physical health concerns, such as increased risk of falling. To advance rehabilitation practice, it is critical to better understand the course of change in both performance and self-report measures of physical mobility and ambulation function early after dysvascular LEA, during the prosthetic training phase of rehabilitation.

Therefore, the purposes of this retrospective study were to: (1) describe changes in physical mobility and ambulation function; (2) describe the documented modes of physical therapy intervention; and (3) examine correlations between change in physical mobility and physical therapy dose during the prosthetic training phase of rehabilitation for patients with unilateral dysvascular LEA.

Methods

Study Design

A retrospective cohort study design was used to examine outcomes from 2 rehabilitation clinics: a Veterans Affairs medical center and a university hospital. All patients underwent physical therapy during the prosthetic training phase of rehabilitation, with the same standardized outcome measures performed at prosthetic training initiation and discharge. All testing was performed in the clinics by physical therapists who were trained and assessed in performance of the outcome measures before measures with patients were conducted. The usual-care intervention for the cohort was described retrospectively, based on systematic review of patient medical records. No changes were made to the intervention procedures at either clinic and length of rehabilitation was not controlled. This study was approved by the VAMC and Colorado Multiple Institutional Review Boards.

Patients

Medical records of all patients with transfemoral amputation (TFA) or TTA within a 2-year period from September 2012 to September 2014 that met the study inclusion criteria were analyzed. Inclusion criteria were: (1) physical rehabilitation that included prosthesis training for ambulation; (2) complete initial and discharge functional outcome data; (3) documented diagnosis of DM and/or PAD; (4) 40-90 years of age; (5) unilateral TFA or TTA (ie, no history of amputation above the ankle on the contralateral limb); (6) fitted for and received prosthesis to allow start of prosthetic training; and (7) dysvascular etiology of amputation.

Dysvascular etiology was determined by medical record confirmation that the amputation resulted from severe PAD with critical limb ischemia or severe DM with dense distal neuropathy leading to a nonhealing wound without history of lower extremity trauma or cancer. Inclusion criteria were intentionally broad to capture characteristics of diversity in the sample. Although individuals were not excluded on the basis of comorbidities, a Functional Comorbidity Index [22] was used to document individual comorbidities during chart review. The level of amputation (TFA or TTA) also was documented.

Intervention

Physical therapy intervention was provided at each clinic by licensed physical therapists and documented in the medical record. Rehabilitation dose was tracked as total number of clinic visits, rehabilitation duration (weeks of intervention), and frequency of the use of a specific intervention mode. Usual-care intervention for this retrospective, descriptive study was assessed as follows: each documented intervention was assigned a mode of intervention category, based on Current Procedural Terminology codes, including Gait/Prosthetic-Use Training, Activity Training, Therapeutic Exercise, and Self-Care Education and Training (Table 1). The frequency of each intervention mode was then calculated by determining the number of visits in which intervention within that category was used divided by