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Case study

Rehabilitation Outcomes and Functional Performance in an Older Adult with Transfemoral Amputation: A Case Study

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ABSTRACT

Background: Transfemoral amputation in older adults is associated with substantial mobility limitation, balance impairment, increased energy demand during ambulation, reduced prosthetic control, and loss of independence, particularly in the presence of vascular and metabolic comorbidities. Objective: To describe functional mobility, walking endurance, balance, prosthetic mobility, and independence after a structured outpatient rehabilitation program in an older adult with unilateral transfemoral amputation. Methods: This single-case report presents a 68-year-old woman with left transfemoral amputation secondary to peripheral vascular disease and medically controlled hypertension and type 2 diabetes mellitus. She completed a 12-week supervised outpatient prosthetic rehabilitation program delivered three sessions per week. The intervention emphasized progressive strengthening, balance retraining, gait re-education, endurance conditioning, prosthetic education, transfer training, and functional task practice. Outcomes were assessed at baseline and week 12 using the Timed Up and Go test, 6-Minute Walk Test, Berg Balance Scale, and Amputee Mobility Predictor with Prosthesis. Results: Timed Up and Go performance improved from 34 to 19 seconds, and 6-Minute Walk Test distance increased from 110 to 248 meters. Berg Balance Scale score increased from 29/56 to 43/56, while Amputee Mobility Predictor with Prosthesis score increased from 26/47 to 37/47. The patient progressed from close-supervision ambulation to independent cane-assisted community walking and independence in basic activities of daily living. Conclusion: Individualized, progressive prosthetic rehabilitation was associated with improved mobility, endurance, balance, prosthetic function, and independence in this older transfemoral amputee, although single-case findings require cautious interpretation. Keywords: Transfemoral amputation; prosthetic rehabilitation; older adults; functional mobility; balance; 6-Minute Walk Test; Timed Up and Go; AMPPro.

INTRODUCTION

Lower-limb amputation is a major cause of long-term disability in older adults and is frequently associated with vascular disease, diabetes mellitus, reduced mobility, loss of independence, and increased need for rehabilitation services (1,2). Among lower-limb amputation levels, transfemoral amputation presents distinct functional challenges because the loss of the anatomical knee joint reduces limb control, shortens the mechanical lever arm, increases dependence on proximal hip musculature, and imposes greater biomechanical and metabolic demands during ambulation than more distal amputation levels (3,4). These demands are especially important in geriatric patients, in whom age-related

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sarcopenia, impaired postural control, reduced cardiovascular reserve, fear of falling, and medical comorbidities may limit prosthetic adaptation and community mobility (5,6).

The primary aim of rehabilitation after transfemoral amputation is not limited to prosthetic ambulation; it also includes restoration of safe transfers, standing balance, gait efficiency, endurance, confidence, skin and prosthetic self-management, and independence in activities of daily living. Previous rehabilitation literature supports the role of progressive strengthening, task-oriented balance retraining, gait re-education, endurance conditioning, and structured prosthetic training in improving mobility and functional capacity after lower-limb amputation (3,7). However, outcomes after transfemoral amputation remain variable in older adults because recovery is influenced by pre-amputation functional status, comorbidity burden, prosthetic componentry, residual limb condition, balance confidence, motivation, and access to supervised rehabilitation (4,5,8).

Although cohort studies and prosthetic technology research have improved understanding of mobility outcomes in lower-limb amputees, detailed clinical descriptions remain valuable because they show how rehabilitation principles are applied in routine practice to an individual patient with specific impairments, functional goals, and contextual limitations. This is particularly relevant in older transfemoral amputees using conventional mechanical-knee prostheses, where meaningful gains may depend more on individualized rehabilitation progression, safety training, and adherence than on advanced prosthetic components alone (9,10). Case-based evidence can therefore help clinicians understand practical rehabilitation sequencing, realistic outcome expectations, and the functional changes that may occur over a defined outpatient rehabilitation period.

Using a PICO-oriented framework, the population of interest was an older adult with unilateral transfemoral amputation; the intervention was a structured, supervised, 12-week outpatient prosthetic rehabilitation program; no formal comparator was applicable because this was a single-case report; and the outcomes were functional mobility, walking endurance, balance, prosthetic mobility, and independence in daily activities. The objective of this case report was to describe changes in Timed Up and Go performance, 6-Minute Walk Test distance, Berg Balance Scale score, Amputee Mobility Predictor with Prosthesis score, and functional independence following a progressive rehabilitation program in a 68-year-old woman with unilateral transfemoral amputation.

MATERIALS AND METHODS

This single-patient clinical case report describes the rehabilitation process and functional outcomes of a 68-year-old woman who underwent left-sided transfemoral amputation secondary to complications of long-standing peripheral vascular disease. Her medical history was significant for medically controlled hypertension and type 2 diabetes mellitus. She had no reported history of cerebrovascular accident, cognitive impairment, or major musculoskeletal disorder that would independently prevent participation in prosthetic rehabilitation. Before amputation, she was independently ambulatory without an assistive device and was independent in basic and instrumental activities of daily living. After uncomplicated postoperative wound healing, she was referred for outpatient prosthetic rehabilitation approximately eight weeks after surgery.

The patient was assessed at baseline before commencement of the rehabilitation program and reassessed after completion of the 12-week supervised intervention. At initial assessment, clinical examination focused on residual limb condition, hip muscle performance, static and dynamic balance, transfer ability, gait safety, walking tolerance, prosthetic handling, and perceived fear of falling. She demonstrated reduced residual limb strength, particularly in the hip extensors and abductors, impaired balance during static and dynamic tasks, inefficient gait mechanics, limited walking tolerance, and difficulty with transfers and prolonged standing. Prosthetic fitting consisted of a modular transfemoral prosthesis with a conventional mechanical knee joint selected according to her functional level and safety requirements.

Functional mobility was evaluated using the Timed Up and Go test, walking endurance was evaluated using the 6-Minute Walk Test, balance was evaluated using the Berg Balance Scale, and prosthetic mobility was evaluated using the Amputee Mobility Predictor with Prosthesis. These outcome measures were selected because they reflect clinically relevant domains of rehabilitation after transfemoral amputation, including transfer ability, gait performance, endurance, balance control, fall-risk-related function, and prosthetic functional capacity. Baseline scores were recorded before the intervention, and post-intervention scores were recorded at the end of the 12-week program using the same outcome measures and comparable testing procedures.

The rehabilitation intervention was delivered in an outpatient setting for 12 weeks, with three supervised sessions per week. Each session lasted approximately 60 minutes and was individualized according to the patient's tolerance, safety, fatigue level, prosthetic control, and functional goals. The program was progressive and task-oriented, with emphasis on strengthening, balance retraining, gait re-education, endurance conditioning, prosthetic education, and functional independence. Strengthening exercises targeted the hip extensors, hip abductors, and core musculature to improve pelvic stability, stance control, and prosthetic limb management. Balance training began with supported static and dynamic activities within parallel bars and progressed to more functional tasks, including weight shifting, reaching activities, controlled perturbations, turning practice, and balance activities in less restricted environments as safety improved.

Gait training focused on safe prosthetic loading, step-length symmetry, stance-phase control, prosthetic knee management, turning, transfer-related mobility, and efficient use of assistive support. Endurance training was incorporated through graded walking practice and low-impact aerobic conditioning, with progression guided by walking tolerance, fatigue, and movement quality. Functional task training included sit-to-stand transfers, standing tolerance, stair negotiation, indoor ambulation, and preparation for community walking. Prosthetic education addressed donning and doffing, residual limb and skin care, recognition of prosthetic fit problems, safety precautions, and strategies to improve confidence during daily mobility tasks.

To reduce measurement variability, the same standardized outcome measures were used at baseline and at 12 weeks, and functional testing was performed under comparable clinical conditions. Potential confounding clinical factors, including age, diabetes mellitus, hypertension, pre-amputation independence, and baseline balance limitation, were documented as part of the case profile. Because this was a single-case report, no inferential statistical testing, hypothesis testing, or adjustment for confounders was performed. Results were summarized descriptively using baseline and post-intervention values, absolute change, and clinically relevant functional interpretation. No missing outcome data were reported for the pre- and post-intervention assessments.

RESULTS

The patient was an older adult with left transfemoral amputation following peripheral vascular disease, with medically controlled hypertension and type 2 diabetes mellitus. Before amputation, she was independently ambulatory and independent in activities of daily living. At baseline, she required close supervision for ambulation and transfers and presented with reduced residual limb strength, balance impairment, gait inefficiency, limited walking tolerance, and fear of falling. Rehabilitation was delivered over 12 weeks through supervised outpatient sessions three times weekly.

After 12 weeks of supervised prosthetic rehabilitation, functional mobility improved, with Timed Up and Go performance decreasing from 34 seconds to 19 seconds, representing a 15-second reduction. Walking endurance increased from 110 meters to 248 meters on the 6-Minute Walk Test, corresponding to an absolute gain of 138 meters. Balance performance improved from 29/56 to 43/56 on the Berg Balance Scale, while prosthetic mobility improved from 26/47 to 37/47 on the Amputee Mobility Predictor with

Prosthesis. These changes indicate improvement across mobility, endurance, balance, and prosthetic functional capacity domains.

Table 1. Patient Clinical Profile and Baseline Rehabilitation Characteristics

Variable	Data
Age, years	68
Sex	Female
Amputation level	Transfemoral
Amputation side	Left
Primary etiology	Peripheral vascular disease
Comorbidities	Hypertension; type 2 diabetes mellitus
Pre-amputation ambulation	Independent without assistive device
Pre-amputation ADL status	Independent
Time from surgery to rehabilitation referral	8 weeks
Prosthesis type	Modular transfemoral prosthesis
Prosthetic knee type	Mechanical knee joint
Baseline ambulation status	Close supervision
Baseline transfer status	Close supervision
Baseline impairments	Reduced residual limb strength; impaired balance; gait inefficiency; reduced walking tolerance; fear of falling
Rehabilitation duration	12 weeks
Supervised session frequency	3 sessions/week
Supervised session duration	60 minutes

Table 2. Functional Outcomes Before and After the 12-Week Prosthetic Rehabilitation Program

Outcome Measure	Baseline	Week 12	Absolute Change	Percentage Change
Timed Up and Go, seconds	34	19	−15	−44.1
6-Minute Walk Test, meters	110	248	+138	+125.5
Berg Balance Scale, score/56	29	43	+14	+48.3
Amputee Mobility Predictor with Prosthesis, score/47	26	37	+11	+42.3

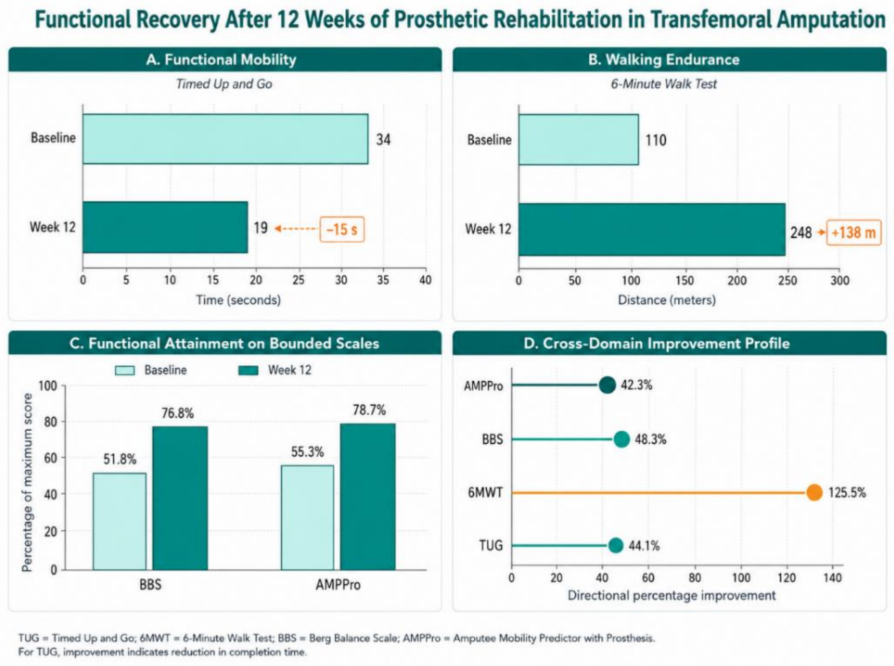

Figure 1 Functional recovery after 12 weeks of supervised prosthetic rehabilitation in a 68-year-old woman with unilateral transfemoral amputation. Timed Up and Go performance decreased from 34 to 19 seconds, reflecting a 44.1% reduction in completion time, while 6-Minute Walk Test distance increased from 110 to 248 meters, corresponding to a 125.5% improvement in walking endurance. Balance and prosthetic mobility also improved, with Berg Balance Scale performance increasing from 29/56 to 43/56 and AMPPro score increasing from 26/47 to 37/47. When normalized to maximum possible scores, BBS increased from 51.8% to 76.8%, and AMPPro increased from 55.3% to 78.7%, indicating parallel gains in postural control and prosthetic functional capacity.

Table 3. Functional Status Change After Rehabilitation

Functional Domain	Baseline	Week 12
Ambulation supervision	Close supervision	Independent
Community ambulation	Limited walking tolerance	Cane-assisted community distances
Basic activities of daily living	Difficulty reported	Independent
Transfers	Close supervision	Independent
Standing tolerance	Limited	Improved
Fear of falling	Reported	Reduced confidence limitation

At the end of the rehabilitation period, the patient progressed from close-supervision ambulation to independent walking with a cane for community distances. She also achieved independence in basic activities of daily living and transfers. Functional progression was consistent with the observed improvements in Timed Up and Go, 6-Minute Walk Test, Berg Balance Scale, and Amputee Mobility Predictor with Prosthesis scores.

DISCUSSION

This case report describes functional recovery after a 12-week supervised outpatient prosthetic rehabilitation program in a 68-year-old woman with unilateral transfemoral amputation secondary to peripheral vascular disease. Improvements were observed across all measured domains, including functional mobility, walking endurance, balance, prosthetic mobility, transfers, ambulation status, and independence in basic activities of daily living. Timed Up and Go performance improved from 34 to 19 seconds, 6-Minute Walk Test distance increased from 110 to 248 meters, Berg Balance Scale score increased from 29/56 to 43/56, and Amputee Mobility Predictor with Prosthesis score increased from 26/47 to 37/47. These findings suggest that a structured, progressive, task-oriented rehabilitation program may support meaningful functional gains in older adults with transfemoral amputation, even when rehabilitation is delivered using a conventional mechanical-knee prosthesis rather than advanced microprocessor-controlled components (12-16).

The improvement in Timed Up and Go performance reflects better integrated transfer ability, turning, gait initiation, walking control, and functional mobility. At baseline, the patient required close supervision during ambulation and transfers, which was consistent with reduced residual limb strength, impaired balance, inefficient gait, and fear of falling. After rehabilitation, she progressed to independent walking with a cane for community distances and independent basic activities of daily living. This improvement may be partly related to task-specific gait practice, repeated transfer training, and progressive exposure to functional mobility tasks, although kinematic variables, lower-limb strength testing, and objective gait parameters were not measured. Therefore, the observed mobility gain should be interpreted as a clinically relevant functional improvement rather than direct evidence of a specific biomechanical mechanism (14-17).

Walking endurance improved substantially, with the 6-Minute Walk Test distance increasing by 138 meters over the 12-week period. This change is important because transfemoral ambulation generally requires greater energy expenditure than able-bodied walking and is more demanding than transtibial ambulation due to loss of the knee joint, reduced prosthetic control, and increased reliance on proximal musculature (3,4). In the present case, graded walking practice and low-impact aerobic conditioning were incorporated alongside gait re-education, which may have contributed to improved walking tolerance. However, cardiopulmonary fitness, perceived exertion, energy cost, and daily step count were not directly assessed, so the endurance improvement should be interpreted through the measured walking-distance outcome rather than inferred physiological adaptation (7, 12, 18-20).

Balance improvement was also evident, with the Berg Balance Scale score increasing from 29/56 to 43/56. This finding is clinically relevant because older lower-limb amputees are vulnerable to balance impairment, fear of falling, reduced confidence, and restricted community participation (5,6). The rehabilitation program included supported and progressive balance activities, including weight shifting, reaching tasks, perturbation-based activities, turning practice, and transition from parallel-bar activities to less restricted environments. These task-oriented balance strategies may have helped the patient improve postural control during functional activities. Nevertheless, the case did not include a specific fear-of-falling scale, fall diary, balance confidence questionnaire, or instrumented postural-control assessment; therefore, the relationship between balance improvement and fall-risk reduction cannot be confirmed directly (19).

The AMPPro score increased from 26/47 to 37/47, indicating improved prosthetic mobility and functional capacity with the prosthesis. This improvement is consistent with the intervention emphasis on prosthetic loading, knee control, step symmetry, safe turning, transfer practice, and prosthetic education. Prosthetic education was an important component because independent donning and doffing, skin monitoring, awareness of prosthetic fit, and safety precautions are essential for older amputees with vascular and diabetic comorbidities. Although advanced prosthetic components may improve function in selected patients, this case suggests that functional improvement remains achievable with a conventional mechanical-knee prosthesis when rehabilitation is individualized, supervised, and progressively advanced according to patient tolerance and safety (9). This is particularly relevant in clinical settings where access to advanced prosthetic technology may be limited.

The findings should be interpreted within the limitations of a single-case report. The design does not allow causal inference, statistical comparison, or generalization to all older adults with transfemoral amputation. The manuscript reports baseline and 12-week outcomes only, without long-term follow-up to determine whether gains were sustained. In addition, pain intensity, residual limb skin status, prosthetic comfort, adverse events, adherence rate, home exercise compliance, fear of falling, quality of life, and patient satisfaction were not quantitatively reported. Objective strength testing, gait analysis, metabolic-cost assessment, and community participation measures were also not included. These omissions limit the ability to identify which intervention components contributed most strongly to recovery and whether improvement transferred fully into daily community mobility (11).

Despite these limitations, the case provides a useful clinical example of structured prosthetic rehabilitation in an older transfemoral amputee with vascular comorbidity. The use of standardized outcome measures strengthens interpretability and allows the patient's recovery trajectory to be described across multiple functional domains. Future studies should include larger samples, longitudinal follow-up, standardized intervention dosage, adverse-event reporting, patient-reported outcome measures, and comparative evaluation of prosthetic componentry and rehabilitation strategies. Such work would help clarify predictors of sustained mobility, independence, and safe community ambulation in geriatric transfemoral amputees.

CONCLUSION

A 12-week supervised, progressive prosthetic rehabilitation program was associated with improved functional mobility, walking endurance, balance, prosthetic mobility, transfers, ambulation status, and independence in basic activities of daily living in this older adult with unilateral transfemoral amputation. Timed Up and Go performance improved from 34 to 19 seconds, 6-Minute Walk Test distance increased from 110 to 248 meters, Berg Balance Scale score increased from 29/56 to 43/56, and AMPPro score increased from 26/47 to 37/47. Although findings from a single case cannot be generalized or interpreted causally, this report supports the potential value of individualized, goal-oriented, task-specific prosthetic rehabilitation for improving functional performance in geriatric transfemoral amputees using conventional mechanical-knee prostheses.

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