Acta Scientific Orthopaedics (ISSN: 2581-8635)

Volume 5 Issue 8 August 2022

Case Report

Impact of Unachieved Ambulatory and participatory goals on Self-Reported Quality of Life in a Young Male Seventy Weeks After Traumatic Lower-Extremity Amputation: A Case Report

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Received: May 20, 2022

Published: July 15, 2022

Abstract

Introduction: Losing a limb is a difficult life experience that negatively impacts health-related quality of life (QoL) and limits physical function. Physical therapy following amputation can reduce functional limitations, enhance participation and improve QoL. Limited access to PT may delay attainment of mobility goals and QoL improvement. This case report explores the impact of unachieved ambulatory and participatory goals on the QoL of a young man with trans-tibial (TT) amputation who had limited access to PT.

Case Description: A 25-year-old male underwent right TT amputation and right index finger proximal interphalangeal joint amputation secondary to trauma. He was fitted with a TT prosthesis 2 months post injury and only received 2 weeks of supervised gait training. He consulted a hospital 70 weeks after his injury due to bony outgrowth in his residual limb. PT Examination revealed unmet ambulatory and participation goals, gait deviations, muscle weakness and atrophy in residual limb. Targeted muscle strengthening exercises were recommended.

Outcome: Using the Short Form-36 (SF-36) QoL questionnaire, patient reported limitations in climbing stairs, walking, lifting groceries, kneeling, and participating in vigorous activities. These activity and participation limitations are consistent with clinical findings during physical examination and suggest that unachieved goals have a negative impact on QoL.

Conclusion: Enhancing QoL is one of the key goals of prosthetic rehabilitation. The use of a patient-reported QoL measure in parallel with patient goals could aid physical therapists to determine the effectiveness of rehabilitation and tailor interventions to enable achievement of goals and reduction of barriers to better QoL

Keywords: Quality of Life; Prosthetic Rehabilitation; Activity and Participation; Patient Goals

Introduction

The loss of a limb is a difficult life experience that negatively impacts health-related quality of life (QoL), psychosocial well-being and self-esteem [1,2] and results in enduring limitations in physical function [3]. While in older individuals, amputation results more from vascular causes, trauma remains the leading cause of amputation in the younger population [4]. The effect of amputation on functional capability has been documented: when compared to controls, prosthetic users experience lower activity levels, slower walking speeds, impaired balance, increased frequency of falls, and decreased ability to navigate uneven terrain and use stairs [5]. Moreover, following lower extremity (LE) loss, individuals adapt to alterations in body image and perception of loss, and experience psychosocial issues and adjustments [1,6].

Physical therapy (PT) following LE amputation could improve physical function and QoL [7,8]. Indeed, QoL is considered an im-

portant predictor of effective prosthetic rehabilitation [2]. Generally, QoL is lower in individuals with LE amputations [9] and is inversely affected by stump and phantom pain, and reduced walking distance [2]. Conversely, young age, increased mobility, independence in activities of daily living, athletic participation, employment and good prosthetic-fit are positively associated with QoL [10-12]. Inadequate PT care may limit attainment of positive outcomes such as ambulation [13] and thereby lower QoL. This case report explores the impact of unachieved ambulatory and participatory goals on the QoL of a young man with trans-tibial amputation who had limited access to PT care.

Clinical question

What impact would non-achievement of ambulation and participation goals have on quality of life in a young male seventy weeks after traumatic lower-extremity amputation?

Case Description

A 25-year-old male of African origin (MM, weight: 69kg, height: 1.74m, body mass index: 22.8 kg/m^2) with no contributing past medical history suffered extensive soft tissue injury to his left LE and comminuted tibia and fibular fractures to his right LE due to a shell explosion on his house. Additionally, he suffered soft-tissue injury and fracture to his right index finger. He received pre-hospital emergency care at a local health center. One week after the incident, he was referred to a secondary hospital where a trans-tibial (TT) amputation was carried out on his right LE and his right index finger was amputated at the proximal interphalangeal joint. Following the surgery, MM received no PT treatment as the hospital had no physical therapist on staff. However, a visiting physical therapist advised MM on pre-prosthetic rehabilitation including stump care, proper positioning to prevent contractures, isometric exercises to maintain muscle strength and minimize atrophy, and elastic bandaging to aid healing and to shape and prepare the residual limb for prosthetic fitting.

Four weeks into the incident, MM was discharged home but still had not received proper PT care and was ambulating using a pair of axillary crutches. Two months after the injury, MM was fitted with a patellar tendon bearing trans-tibial prosthesis with a solid-ankle cushion heel (SACH) foot. He received two weeks of supervised gait training before being discharged home. Sixteen months after the incident, MM reported pain perceived to be from a growth in the tibia and fibular of his residual LE and visited a hospital. During the visit, MM was an independent community ambulator corresponding to a K-level 3 using the Medicare Functional Classification Levels [14]. MM's primary goals were to return to running and participate in group aerobic exercises.

Medical, Family and Psychosocial History

MM has no previous history of hospitalization or major injuries. Prior to the injury, he participated in recreational activities and was independent with activities of daily living and instrumental activities of daily living. MM is married with two children aged six years and one year-old. He has been unable to return to his place of domicile and family due to active conflict. At the time of this report, MM was yet to see his younger child who was born after the incident.

Examination

The examination data presented below were obtained during MM's visit to the hospital seventy weeks after his injury.

Body system, functions and structure

Apart from pain due to the bony outgrowth in the affected LE, there were no significant findings in the review of systems. MM had no pain at rest but had intermittent pain while walking long distances that was rated as 4/10 on the numeric pain rating scale. He had gait deviations: trunk flexion to the prosthetic side, uneven step length and short stance phase on the affected LE. Upon further examination, a loose socket causing poor suspension and a 5cm shortening in the prosthesis were two prosthetic factors that contributed to MM's deviations. Personal factors contributing to the deviations included weakness in the residual LE with a gross manual muscle test of 3/5 and limited pelvic rotation during ambulation. MM also had significant thigh muscle wasting in the residual limb with a 7cm difference in thigh girth determined through manual body circumference measurement [15]. The difference in muscle bulk between the LEs was a concern for MM. He requested for exercises that would address the disparity. An assessment by an orthopedic surgeon confirmed MM's notion of a bony outgrowth in the residual limb. X-ray showed bony spurs in the right tibia and fibular. MM was scheduled for osteotomy and epiphysiodesis.

Activities and Participation

MM complained of intermittent pain when walking long distances with a rating of 4/10 on the verbal pain rating scale. MM enjoys going to the gym is able to jump rope, lift weights and perform pull-ups and push-ups. However, he is unable to run and participate in group aerobic classes. He has difficulty descending stairs secondary to instability while weight-bearing on the prosthetic limb. Despite the lack of a right index finger, MM was able to write with his right hand.

Timeline

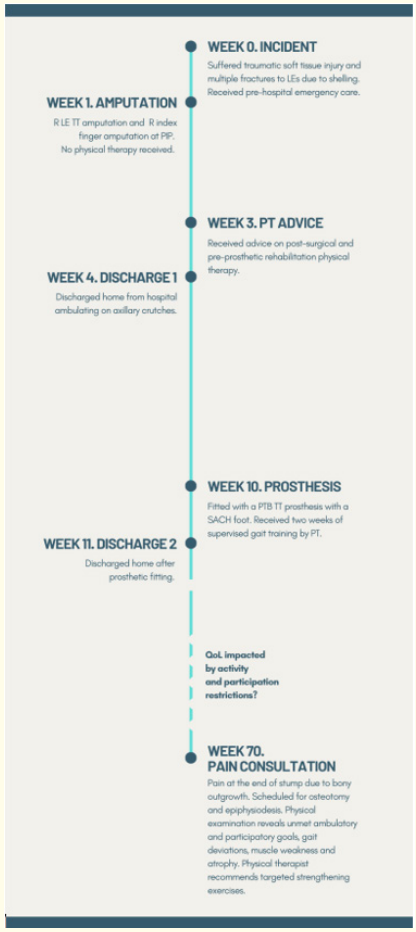

Figure 1: Timeline of key events related to the case.
LE: Lower Extremity; R: Right; TT: Trans-Tibial; PIP: Proximal Interphalangeal; PTB: Patellar Tendon Bearing; QoL: Quality of Life; SACH: Solid Ankle Cushion Heel

Physical therapy interventions

With a straight-forward diagnosis of TT amputation, MM should have received pre- and post-surgical care [16,17] and pre-prosthetic rehabilitation [16,18] during the early weeks of the injury, and subsequently, adequate post-prosthetic rehabilitation that comprised of targeted muscle strengthening, balance training, supervised walking, functional training and gait reeducation [16,19]. Such PT interventions might have prevented the development of muscle atrophy, gait and stability dysfunctions, and prepared MM for running and aerobic exercises. For persons with amputation, deficits in strength could lead to balance, endurance and mobility impairments [20]. However, because of his young age and etiology, MM's treatment goal could be to improve functional capability to an advanced ambulator corresponding to K-level 4 following 8-weeks of focused PT care [7]. Due to limited exposure to PT, the only intervention provided to MM during the visit was targeted muscle strengthening. However, the shortening and poor suspension in MM's prosthesis were corrected by a Prosthetist working in the hospital. MM reported better prosthetic-fit and reduction in pain following the adjustments.

Targeted muscle strengthening

Strengthening exercises targeting knee extensors and flexors of the residual limb were prescribed to address muscle weakness and atrophy and improve gait. This prescription is consistent with Vanicek., *et al.* [21] recommendation that included strengthening knee extensors and flexors in the affected LE while increasing eccentric hip and ankle strength in the unaffected limb as a way to increase stability and balance during single limb support on the residual limb. Moreover, to increase pelvic stability during single-leg stance on the affected LE and improve other gait parameters, isometric and concentric exercises for the right hip abductors and extensors were prescribed [22,23].

Recommended interventions

Added to muscle strengthening, balance training, gait reeducation and functional training are other PT interventions that could have been implemented for this case. Indeed, dynamic balance exercise is an essential component of prosthetic rehabilitation [19]. A rehabilitation program by Gailey., *et al.* [7] that is based on the amputee mobility predictor tool contains exercise recommendations for the impairments identified in this case. For limitations in descending stairs, wall squats and lunges are recommended while

for unequal step length, stool stepping, resisted walking, ball rolls and speed training are suggested. Additionally, through functional training, MM could have been prepared for recreational activities such as running and aerobic exercises [16]. Young individuals with unilateral trans-tibial amputation are capable of athletic performance including running [24].

Self-reported outcome measures

Self-reported QoL and functional balance were measured using the Short Form-36 (SF-36) and the Activities-Specific Balance Confidence (ABC) scale respectively. Both outcome measures have shown good psychometric properties when used for individuals with amputation [25-28]. The SF-36 is a popular health-related QoL survey that measures eight health domains including physical functioning, role limitations due to physical health, role limitations due to emotional health, energy, emotional well-being, social functioning, body pain, and general health [26,29]. Higher scores indicate better QoL [30]. The ABC scale measures, on a scale of 0-100%, self-reported balance confidence while performing several tasks, with higher scores meaning more confidence [25] MM completed both outcome measures during the hospital visit seventy weeks after his injury.

Results of the SF-36 questionnaire are presented in figure 2. MM reported that his health was somewhat better than it was one-year ago (18 weeks after the incident), rated his general health as very good, but reported limitations in climbing stairs, walking more than a mile, lifting groceries, bending or kneeling, and participating in vigorous activities such as running and strenuous sports. Additionally, MM noted role limitations due to physical health issues stating that he had accomplished less, and experienced difficulty and limitations in performing work or daily activities. However, MM recorded high scores (> 80%) for domains related to mental health: emotional well-being, social functioning, energy and role limitations due to emotional health.

On the ABC scale, MM obtained a total score of 85%. Consistent with the SF-36 results, on the ABC scale MM indicated being least confident while walking on sidewalks (60%), in a crowded mall (70%) or recovering balance after being bumped into by people (60%). To predict fall probability among LE prosthesis users, Sawers., *et al*. [31] established an ABC scale cutoff score of ≤ 80.2% (sensitivity/specificity at 95% confidence interval = 65%/78% respectively). Users scoring above the cutoff, such as MM, are presumed to be less likely to experience a fall.

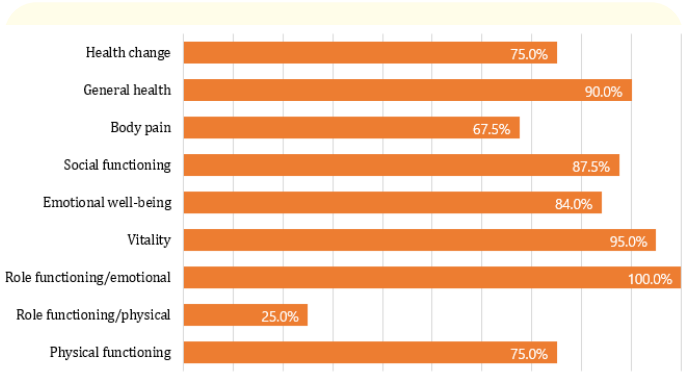

Figure 2: SF-36 Domains and Scores.

Discussion and Conclusion

The findings in this case report suggest that unmet activity and participation goals could contribute to low QoL. SF-36 results were consistent with limitations and impairments uncovered during physical examination. Moreover, the report highlights the importance of measuring QoL during prosthetic rehabilitation [32] and suggests that PT care could lead to improved QoL [7,8]. Clinical findings in this case are consistent with prior reports that persons with TT amputation have reduced muscle strength in their residual LE when compared to controls,[5] and experience difficulty maintaining equal step length due to asymmetric biomechanical attributes [33]. However, after rehabilitation, persons with TT amputation are expected to be able to run and climb stairs reciprocally [34].

Despite limited access to rehabilitation and a long-time since amputation, MM could still achieve significant improvement in mobility and function. Several years post-amputation, individuals with LE amputation could achieve higher levels of function following focused rehabilitation [7]. Persons with LE amputation increased hip flexors and extensors strength and were able to run after a 10-week hip-strengthening program [35]. Young age, TT amputation of non-vascular etiology, male gender are factors positively associated with increased gait speed in persons with LE amputation [36]. Additionally, participation in recreational activities improves persons with amputation's physical functioning and

psychological well-being, aids social reintegration and benefits the cardiopulmonary system [24]. With improved functional abilities, MM could potentially achieve his goals and experience higher QoL.

This report has some limitations. First, it is based on one encounter with the patient. Thus, the outcome of PT intervention and its effects on patient's goals and QoL are unknown. QoL was only assessed at one point in time with no baseline reference. Further, improvement in pain was not assessed. It is however expected that MM will experience less pain following adjustments to his prosthesis. Pain lasting 6 months after amputation is likely due to poor prosthetic fitting [37].

Enhancing QoL is a major goal of prosthetic rehabilitation[31] therefore, assessing QoL is highly relevant during rehabilitation [2]. The use of a patient-reported QoL measure in parallel with patient goals could help physical therapists determine the effectiveness of rehabilitation and tailor interventions to enable achievement of goals and reduce barriers to better QoL. This report illustrates the negative impact of activity and participation limitations on QoL and underscores the value of prosthetic rehabilitation to ambulatory and participatory goals achievement, and consequently, improvement in QoL.

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