

Citations (4) References (49) Abstract Decreased mobility and negative effects of poor functional status (FS) significantly reduce the quality of life in individuals with lower extremity amputation (LEA).L functional mobility test (L Test) The L test, which assesses basic mobility skills in individuals with a unilateral LEA, is a modified version of the TUG.Published 2021 May 19 Copyright (C) 2021 The Author(s) Published by JOSAM This is an open access article distributed under the terms of the Creative Commons Attribution–NonCommercial–NoDerivatives License 4.0 (CC BY–NC–ND 4.0) where it is permissible to download, share, remix, transform, and buildup the work provided it is properly cited.Review DOI: 10.28982/josam.789623 1 Hacettepe University, Faculty of Physical Therapy and Rehabilitation, Ankara, Turkey 2 Karamanoglu Mehmetbey University, Faculty of Health Science, Department of Physiotherapy and Rehabilitation, Karaman, Turkey ORCID ID of the author(s) NTY: 0000–0002–2404–2884 HK: 0000–0001–5971–7274 FGY: 0000–0002–1160–979X Corresponding Author Nazim Tolgahan Yildiz Hacettepe University, Faculty of Physical Therapy and Rehabilitation, 06100 Samanpazari, Cankaya, Ankara, Turkey E–mail: tolgafty@gmail.com ?Different tests and measurements such as observational gait analysis, footprint method, kinematic and kinetic analysis, electromyographic analysis (dynamic EMG), 2MWT, 6MWT, 10MWT, TUG and L Test are used to evaluate gait in individuals with LEA.544 Outcome measures used in lower extremity amputation: Review of clinical use and psychometric properties Nazim Tolgahan Yildiz 1, Hikmet Kocaman 2, Fatma Gul Yazicioglu 1 How to cite: Yildiz NT, Kocaman H, Yazicioglu FG. Outcome measures used in lower extremity amputation: Review of clinical use and psychometric properties.It has been reported that internal consistency (Cronbach alfa: 0.67) and test–retest reliability (ICC: 0.82) are high, and external construct validity, convergent and discriminant validity are supported by other scales.With the data obtained from these evaluations, information about the spatiotemporal parameters of gait (stance phase symmetry, single/double stride length, stride width) and functional gait performance (gait velocity, cadence, maximum gait velocity) is obtained [43].In the kinematic analysis, which examines the movements of the body in space, the joint angles, angular, linear velocity and acceleration of the body, pelvis, legs, and feet in three planes are measured and the results are recorded as numerical data.ResearchGate Logo Discover the world's research 25+ million members 160+ million publication pages 2.3+ billion citations Join for free Public Full–texts 3 10.28982–josam.789623–12709 07.pdf Content uploaded by Hikmet Kocaman Author content Content may be subject to copyright.Keywords: Amputation, Lower extremity, Outcome assessment, Health care, Psychometrics Introduction With the increased prevalence of vascular disease and increased life expectancy, lower extremity amputation (LEA) has become a prominent issue.Evaluation in intra–rater reliability is done by looking at the intraclass correlation coefficient (ICC) if the measurement values are numeric, and by looking at the kappa coefficient of Cohen if the measurement values are categorical.In inter–rater reliability, the measurement values are evaluated by looking at the ICC if they are numerical, while in categorical terms, the alignment between the evaluators' measurements is expressed as a percentage.Performance–based outcome measures Amputee mobility predictor (AMP) The scale, which evaluates the ambulatory potential of individuals with AEA, is available in two versions, with a prosthesis (AMP–Pro) and prosthesis–free (AMP–noPRO) use.The scale, which has high construct validity and concurrent validity with the 6–Minute Walk Test

(6MWT), has been reported as valid and reliable for the evaluation of functional ambulation in individuals with LEA. Kinematic and kinetic analysis The inability of the human eye to detect movements taking place within milliseconds has been instrumental in the development of computer-aided analysis methods that provide objective and numerical information. Abstract Decreased mobility and negative effects of poor functional status (FS) significantly reduce the quality of life in individuals with lower extremity amputation (LEA). Since the decrease in mobility and negative effects of poor functional status (FS) in individuals with LEA will significantly affect the quality of life of the individual, these parameters should be evaluated in detail and FS should be revealed. Therefore, the data obtained from the self-report measures may not be a true reflection of the FS. Factors such as culture, language, educational background, cognitive impairment, and depression affect the person's responses to self-report measures [7]. It has been found reliable in individuals with transtibial and transfemoral LEA (ICC for test-retest reliability: 0.91, Cronbach alpha for internal consistency: 0.95). It has been reported that its internal consistency is high (Cronbach alpha; HADS-D: 0.67–0.90, HADS-A: 0.68–0.93), its validity is supported by other scales, and it has sufficient sensitivity and specificity [17]. However, the subjective side (depend on the evaluator's experience), the inability to quantify the results, the difficulty in identifying the primary causes of gait disorder are the weaknesses of this method. The reviewed OMs in this study indicate the most common clinical measures that can be used for assessing the functional abilities and the quality of life in individuals with LEA during the treatment process. The scales and assessment methods used in clinical and academic studies must be valid and reliable to obtain accurate results. Satisfaction with the prosthesis questionnaire (SATPRO) SATPRO consists of 15 items with triple Likert scale that evaluate the satisfaction of the individuals with the prosthesis. With the loss of receptors that provide proprioceptive information from joints and other structures, the amount of proprioceptive input that provides information about the movement and position of the prosthetic limb in space decreases. Using these methods, the components of gait (joint angle, strength, moment) that cannot be perceived with the eye can be recorded, converted to numerical data, and the resulting data can be compared in repeated evaluations. It is easy to use and interpret in the clinic, where the many maneuvers and gait capacity required for mobility can be measured numerically in individuals with unilateral LEA. It has been reported to have high intra-rater ($r = .93$) and inter-rater ($r = .96$) reliability and convergent and divergent validity in individuals with LEA [22]. Amputee body image scale (ABIS) ABIS evaluates the situations and experiences that the individual with amputation feels and perceives about her body and consists of 20 items. It has been reported that both LCI and LCI-5 exhibit sufficient internal consistency, test-retest reliability and construct validity [23]. Trinity amputation and prosthesis experiences scales (TAPES) It is used to determine the level of prosthesis compatibility and evaluate the functional level. The test-retest reliability (ICC: 0.50–0.85) and internal consistency (Cronbach alpha: 0.78–0.98) scale is suitable for use in individuals with LEA [9]. Internal consistency (Cronbach alpha: 0.90), test-retest reliability (ICC: 0.97) are reported to be high, valid and reliable [28, 29]. Inter-rater reliability (ICC: 0.94) and internal consistency (Cronbach Alpha: 0.82) were high in individuals with LEA. 6MWT has been defined as a reliable measure of functional capacity [37] and indicator of energy expenditure [38] in individuals with LEA. With advances in technology, portable tools such as pulse oximeter, which measures blood

pressure, heart rate and oxygen saturation, and telemetry electrocardiography, which monitors heart rhythms, can be used during walking tests. Assessment of gait is of great importance in the determination of deviations from normal walking, planning and implementation of appropriate treatment approaches and determining the effectiveness of treatment [42].

Gait analysis by footprint method In this analysis, the participant is asked to walk at his or her walking speed on a flat 10-meter tracer ground to determine the time–distance characteristics of gait. The multiplicity of available criteria, when coupled with the concept of multidimensional FS, complicates the selection of appropriate OMs for use with this population. The multiplicity of available criteria, when coupled with the concept of multidimensional FS, complicates the selection of appropriate OMs for use with this population. However, the use of outcome measures (OMs) by clinicians is limited due to insufficient knowledge of valid and reliable OMs. However, it is worth noting the need for a study that provides up-to-date and detailed information on the clinical usefulness and psychometric properties of these OMs. The World Health Organization (WHO) has developed classification systems to ensure the integrity of concepts and standardize measurement within the healthcare profession following this paradigm shift. FS covers a range of functional areas including individual's thoughts, feelings and overall health-related quality of life, including physical functions such as step activities and walking, the ability to work and maintain a job, psychosocial and emotional functions [5]. Performance-based measures enable more objective data to be obtained and have the potential to provide quantitative data that enable quantitative analysis as well as evaluating the change in FS [8].

Reliability, defined as the consistency of repetitive measurements, is the feature of obtaining similar results from repeated measurements in the same sample. It consists of two separate sections that measure the cognitive and emotional aspects of depression (HADS–D) and anxiety (HADS– J Surg Med. Special interest group for amputee medicine (SIGAM) It is a scale consisting of 21 items used to evaluate mobility level in individuals with LEA. Internal consistency (Cronbach alpha: 0.95) and test–retest reliability (ICC: 0.77) were high in individuals with LEA. The predictive validity of the scale was examined and found to have a high correlation with PEQ–MS (r: 0.73), ABC (r: 0.76), TUG (r: 0.67) and 2MWT (r: 0.73) [14]. The second part consists of eight items that evaluate daily prosthesis use time, general health, physical capacity, phantom limb pain, and residual limb pain [25].

Comprehensive high activity mobility predictor (CHAMP) CHAMP is a performance-based outcome measure improved for evaluating high-level mobility capacity. It consists of One-Leg Stand Test, Edgren Side Step Test, T-test, and Illinois Agility Test, which measure physical performance parameters such as balance, postural stability, coordination, strength, speed, and agility. Anaerobic capacity is assessed by the Wingate Test and The Vertical Jump Test, which includes submaximal loading [35]. In the evaluation of exercise capacity in individuals with AEA, Single-Leg Bicycle Ergometer Test, Arm Ergometer Test, Combined Arm and Leg Ergometer Test and Treadmill Test are used. VO₂max measured in these tests is expressed in milliliters/kilograms/minute (ml/kg/min) [36]. In observational analyses, the analysis can be done in conjunction with video recording, as it is difficult to simultaneously study moving body segments during gait.

Electromyographic analysis (Dynamic EMG) The muscle activity that occurs during gait is recorded through surface electrodes. In dynamic EMG, EMG signals from electrodes are transmitted to the computer via wired or wireless systems. These signals are processed with special software and

converted into numerical data that provide information about the timing and duration of contraction of muscles. In gait analysis, when dynamic EMG is used in conjunction with kinematic data, it can be determined which muscles show how much activity in which phase of the gait cycle. Considering all these, the current FS should be evaluated using valid and reliable outcome measures (OMs). This review is designed to provide up-to-date information on clinical suitability and psychometric properties of OMs used in individuals with LEA. Considering all these, the current FS should be evaluated using valid and reliable outcome measures (OMs). This review is designed to provide up-to-date information on clinical suitability and psychometric properties of OMs used in individuals with LEA. In Australia, 3,400 LEAs are performed every year due to diabetes mellitus, which amounts to 12 amputations per 100,000 people [1].

In the literature, the sources that provide information about the OMs used in the LEA field are limited, and many of the commonly used OMs are not included in the available sources. The capacity, capability, and performance parameters existing in ICF provide important information about the FS of the individual. Self-reporting measures include surveys and interviews and do not require extensive additional training for practitioners. Reliability types are test-retest, parallel forms, split half, intra-rater and inter-rater reliability, and Cronbach alpha. The scale, which has high test-retest reliability, internal consistency, and validity, has been reported as suitable for clinical use [14].

Socket comfort score (SCS) It has been reported that 50% of transfemoral amputees and 70% of transtibial amputees use their prosthesis at least seven hours a day. Prosthesis evaluation questionnaire-mobility scale (PEQ-MS) Mobility Scale (PEQ-MS) is a combination of PEQ's ambulation and transfer subscales. Houghton score (HS) It evaluates the use of prosthesis and mobility with the prosthesis in individuals with LEA. Locomotor capability index (LCI) It evaluates locomotor skills and level of independence in individuals with LEA. It has been reported that the scale has minimum floor and ceiling effect, high internal consistency (Cronbach alpha: 0.72–0.86), high reliability and validity [9, 25, 26].

Orthotics prosthetics users survey (OPUS) OPUS consists of four components. The prosthetic satisfaction and prosthetic service satisfaction components are evaluated with 10 and 11 items, respectively, with a four-point rating [27].

Mobility questionnaire for lower extremity prosthesis users (PLUS-M) PLUS-M is a 44-item mobility scale developed for individuals with LEA and using prosthesis. In the study where the construct validity of the short form was examined, there was a strong correlation between PLUS-M and PEQ-MS score (r : 0.81); a medium J Surg Med. It has been reported to be safe, valid and reliable in assessing high-level mobility in individuals with LEA [32, 33]. The scale has high convergent validity with the ABC scale (r : 0.63), PEQ-MS scale (r : 0.58), 2MWT (r : 0.68) and L Functional Mobility Test (L Test) (r : -0.80).

Evaluation of cardiovascular functions Cardiovascular capacity is classified as aerobic and anaerobic capacity. The amount of oxygen consumed per minute per kilo during maximum exertion is called maximum oxygen consumption capacity (VO_{2max}). 2MWT is suitable for clinical use with the advantages of short application time, less fatiguing, high reliability (ICC: 0.90–0.96) [39] and sensitive to changes [21]. The ability of the individual to gait is adversely affected if he is unable to adequately perceive the position of his prosthesis in space. As a result of abnormal gait, functional capacity decreases and energy consumption increases. Thus, changes in joint angle, speed and acceleration can be calculated in addition to temporal and spatial characteristics during gait. The fact that the

measurements are not purposeful makes the obtained results (evidence) and consecutively treatments unreliable. Numerous OMs are used to evaluate the FS of individuals with LEA. Resources providing information about OMs used in the domain of LEA are limited in the literature. The fact that the measurements are not purposeful makes the obtained results (evidence) and consecutively treatments unreliable. Numerous OMs are used to evaluate the FS of individuals with LEA. Resources providing information about OMs used in the domain of LEA are limited in the literature. Clinicians not only determine the effectiveness of their interventions using the OMs but also show the positive effects of the intervention to the patient and third parties [3]. The abundance of existing measures complicates the selection of appropriate OMs used in this population [4]. This review was designed to provide up-to-date information on clinical use suitability and psychometric properties of OMs used in LEA. Functional status Health professions have become responsible not only for the treatment of acute diseases but also for the management of chronic diseases and disability. The need to record changes in the FS when combined with the complexity and diversity of the FS has led to the development of numerous OMs [6]. Outcome measures used in lower extremity amputation 1.2021;5(5):544–549.2021;5(5):544–549.??2.[34].3.548 4.