Quality of Life Evaluation Through a Single-Item "Daily Prosthesis Usage Time" in Individuals with Lower-Limb Amputation

Semra Topuz, PT, PhD, Özlem Ülger, PT, PhD, Yavuz Yakut, PT, PhD, Gül Yazıcıoğlu, PT, PhD

ABSTRACT

Introduction: The purpose of this study was to identify the relation of daily prosthesis usage time (DPUT) of individuals with amputation with quality of life (QoL) questionnaires.

Methods: The research was carried out on 125 individuals with amputation. Prosthetic-related parameters were searched, as well as demographic data. A generic (Nottingham Health Profile [NHP]) questionnaire and a questionnaire specific to individuals with amputation (Trinity Amputation and Prosthesis Experience Scales [TAPES]) QoL measurements were used.

Results: Ninety-one males and 28 females with a mean age of 42.4 ± 14.7 years participated in the study. The average DPUT was 11.1 ± 4.4 hrs/d. Study results showed that there was significant correlation between both of the QoL questionnaires (NHP and TAPES) and DPUT. High correlation was determined between DPUT and NHP total score and NHP-Pain, and very high correlation was found between DPUT and NHP–Physical Activity subscale. A moderate negative correlation was found between DPUT and NHP–Energy Level, NHP–Emotional Reaction, NHP–Social Isolation, and NHP–Sleep. A moderate negative correlation was found between DPUT and TAPES–Activity Restriction. A high correlation was found between DPUT and residual limb pain, prosthetic satisfaction, time interval after amputation, and number of prosthetic fittings. A moderate correlation was found between DPUT and walking aids, whereas a poor relationship was shown between phantom pain and DPUT.

Conclusions: This study showed that "the average DPUT" may be used in terms of short assessment of QoL of individuals with amputation. The outcomes of this study pointed out that especially prosthetic-related parameters affected the QoL in individuals with amputation. In problems resulting from routine assessment and questionnaires having so many items, a single-item question, "the average DPUT," may be used effectively in a shorter period and is helpful for organizing a rehabilitation program.

Clinical Relevance: A single-item question, "The average daily prosthesis usage time (DPUT)," be used effectively in a shorter assessment of quality of life of individuals with amputation and is helpful for organizing a rehabilitation program. (*J Prosthet Orthot.* 2022;34:241–245)

KEY INDEXING TERMS: quality of life, lower-limb amputation, daily prosthetic use time, questionnaire, single item

Amputations from different lower-limb levels not only restrict daily living activities but also create impairments presenting difficulties in coping with social and psychological problems. Because of constraints in walking and other ambulation activities, quality of life (QoL) is also affected.[1–6] It was stated that individuals with lower-limb amputation have more emotional and social problems when compared with healthy volunteers of similar age and gender, and it was stated that focusing on rehabilitation practices on improving mobility could increase the overall QoL.[4] Reintegration to normal living after rehabilitation using properly fitted prostheses generally improves the QoL by adapting the individual with amputation to everyday activities. Research reports also state that demographic characteristics and amputation-related factors are also effective in determining or predicting the functional use of the prostheses.[7–19] Determining the most effective factor on function is consequential for professionals working in prosthetics.

Generic questionnaires and questionnaires specific to persons with amputation are used in researching factors affecting life quality of individuals with amputation.[20] Objective feedback from these questionnaires can only be achieved if there is sufficient time, experienced health professionals, and educated persons with amputation. In the lack of these criteria, simple and reliable parameters are required.

There are studies on valid evaluation of QoL and health status in diseases such as cancer, spinal cord injury, and heart disease with the use of a single-item question.[12–23] It has also been stated that the use of the visual analog scale is effective in determining the QoL of patients for those with chronic medical problems and amputation.[24–27]

One factor that can influence the QoL in individuals with amputation is the duration of daily prosthesis use. Our experience shows that individuals with lower-limb amputation with a longer

SEMRA TOPUZ, PT, PhD; are affiliated with the Hacettepe University, Faculty of Physical Therapy and Rehabilitation, Ankara, Turkey.

YAVUZ YAKUT, PT, PhD, is affiliated with the Hasan Kalyoncu University, Faculty of Health Sciences, Department of Physiotherapy and Rehabilitation, Gaziantep, Turkey.

GÜL YAZICIOĞLU, PT, PhD, is affiliated with the Hacettepe University, Faculty of Physical Therapy and Rehabilitation, Ankara, Turkey.

Disclosure: The authors declare no conflict of interest. Authors state no funding was received.

Correspondence to: Özlem Ülger, PT, PhD, Hacettepe University, Faculty of Physical Therapy and Rehabilitation, 06100, Altındağ, Ankara, Turkey; email: ozlemulger@yahoo.com

daily prosthesis usage time (DPUT) do better in terms of psychosocial, physical, and activity level. However, it is often difficult to assess individuals with amputation in terms of these factors because of lack of time and lack of material in the clinical setting. In addition, because amputation is a permanent disability, the QoL evaluation of patients with questionnaires at intervals after prosthesis and rehabilitation applications may be time-consuming and may cause reluctance because of the lengthy questions. Beyond these, questions will be familiar in time, and this factor leads patients to be bored with the questionnaire.

For this reason, our hypothesis was to investigate whether the QoL can be determined through a single-item question as "daily prosthesis usage time" or not. The purpose of the study was to identify the relation of DPUT, using generic QoL questionnaires and questionnaires specific to individuals with amputation.

METHODS

Patients with lower-limb amputation were reviewed from the Prosthetics and Biomechanics Department of Hacettepe University database. Three hundred ten individuals with lower-limb amputation whose informative data were obtained from the database were invited to participate in the study. The research was carried out on 125 patients with amputation who accepted participation in the investigation. Statistical data of 119 participants were used to reach an outcome (Figure 1). The inclusion criteria were having a lower-limb amputation and being older than 18 years, being literate, and having participated in a prosthetic rehabilitation program, and using the prosthesis for at least 1 year. Individuals who did not agree to participate were excluded from the study. All participants gave their informed written consent before their inclusion in the study. The study was approved by the Medical Ethics Committee of Hacettepe University (HEK 09/168).

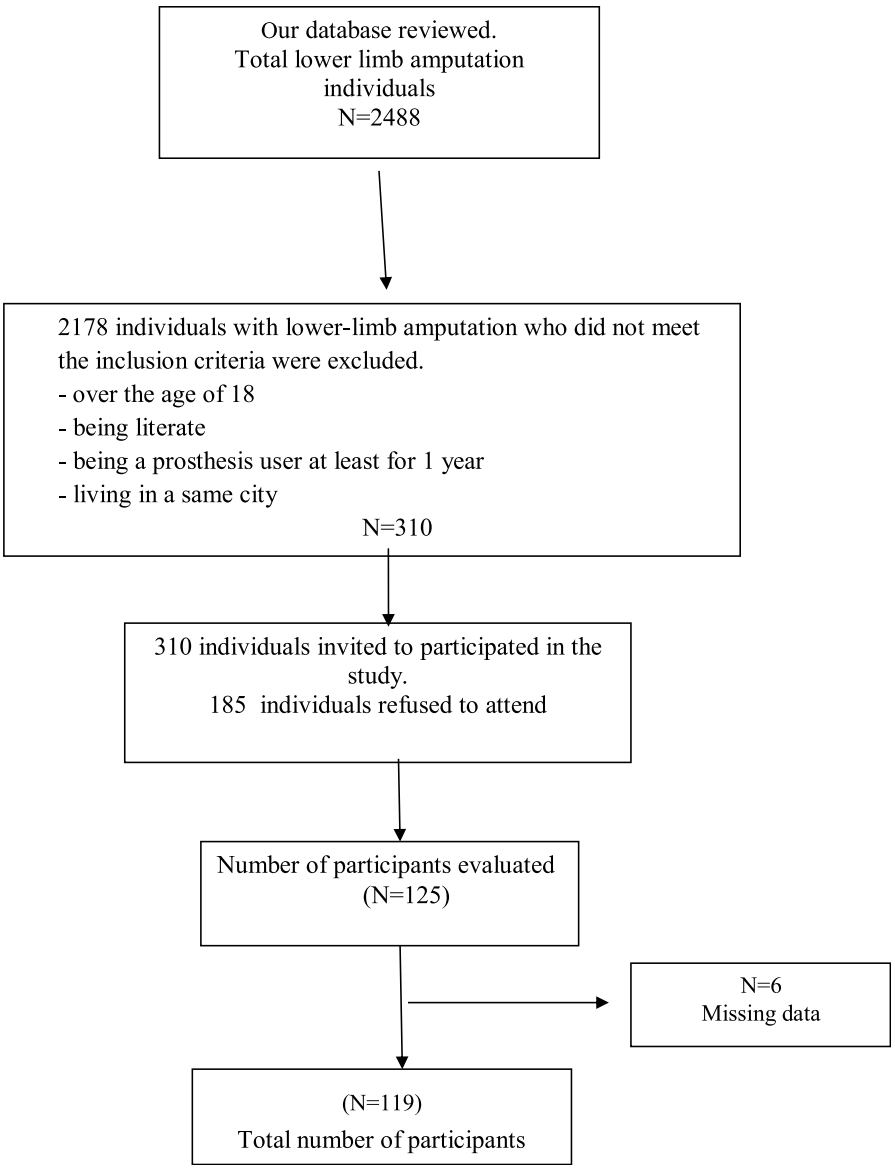

Figure 1. Flow diagram of the participants.

Residual-limb pain, phantom pain, prosthetic satisfaction, time interval after amputation, DPUT, number of prosthetic fittings, and walking aid usage were searched, as well as demographic data including age, sex, and amputation cause and level.

Residual-limb and phantom pain were recorded as "existing" or "nonexisting," whereas a visual analog scale was used to assess prosthetic satisfaction. The subjects indicated their level of prosthetic satisfaction on a 10-cm line on which 10 denotes "extreme satisfaction" and 0 "extreme dissatisfaction."[28–30]

Nottingham Health Profile (NHP), which is mostly preferred among generic health questionnaires, and the Turkish version of Trinity Amputation and Prosthetic Experiences Scale (TAPES), which is specific to individuals with amputation, were used in this study.[31] The Turkish version of the NHP was used with permission. This survey includes the following six subdomains: energy level (NHP-EL), physical activities (NHP-PA), pain (NHP-P), sleep (NHP-S), emotional reaction (NHP-ER), and social isolation (NHP-SI). The sum of the scores of each subdomain equals to 100 (poor QoL).[32]

The TAPES comprises two parts. The first part consists of the three subscales as psychosocial adjustment (PSA), activity restriction (AR), and satisfaction with the prosthesis (SWP). The second part of the TAPES determines the average duration of daily prosthesis use, general health status, and physical capabilities. The higher score of these subscales indicates better PSA, increased restriction in performing activities, and greater satisfaction with artificial limb, respectively.[1]

STATISTICAL ANALYSIS

Data were analyzed through the Statistical Package for the Social Sciences program (SPSS 15.0, demo; SPSS Inc, Chicago, IL, USA). Measurable variables were stated with mean and standard deviation, whereas categorical data were given by percentages. Relation between the variables of nonparametric group were done by Spearman correlation analysis. The correlation for this study was about $r = 0.26$ with $\alpha = 0.05$ and $\beta = 0.20$. Sample size was found 123.

RESULTS

A total of 119 individuals with lower-limb amputation (91 male and 28 female) with a mean age of 42.4 ± 14.7 years participated in the study. The majority of the participants (54.6%) had transtibial amputation, 24.4% of the participants had transfemoral amputation, 4.2% had knee disarticulation, 8.4% had bilateral lower-limb amputations, 2.5% of the participants had hip disarticulation, and 5.9% had partial foot amputation. It was observed that 78 participants (65.5%) were not using walking aids, whereas 41 participants (34.5%) could walk with canes or crutches.

The leading amputation cause was determined to be trauma (49.6%), followed by peripheral vascular diseases (25.2%). Congenital limb loss (15.1%) and cancer (6.7%) placed in the third and fourth rows, whereas the other reasons for amputations showed a percentage of 3.4. The mean time interval after amputation was found to be 15.8 ± 12.7 years, whereas the number of prostheses was 4.5 ± 3.6 in this period. The average daily prosthetic use time was determined to be 11.1 ± 4.4 hrs/d.

Fifty-four patients experienced from residual limb pain, and 42 patients had phantom pain. Average prosthetic satisfaction was determined to be 6.78 ± 2.79.

There was moderate negative correlation between DPUT and NHP total score ($r = -0.519$, $P < 0.001$) and NHP-P ($r = -0.486$, $P < 0.001$); good negative correlation between DPUT and NHP-PA subscale ($r = -0.615$, $P < 0.001$). A low-to-moderate negative correlation was found between DPUT and NHP-EL ($r = -0.332$, $P < 0.001$), NHP-S ($r = -0.315$, $P < 0.001$). A low-to-moderate negative correlation was found between DPUT and TAPES AR ($r = -0.335$, $P = 0.021$) (Table 1).

A moderate correlation was found between DPUT and prosthetic satisfaction ($r = 0.516$, $P < 0.001$), time interval after amputation ($r = 0.415$, $P < 0.001$), and number of prosthetic fittings ($r = 0.402$, $P < 0.001$). A low-to-moderate correlation was found between DPUT and residual-limb pain ($r = -0.351$, $P < 0.001$) and walking aids ($r = -0.300$, $P = 0.001$), whereas a poor relationship was shown between phantom pain and DPUT ($r = -0.237$, $P < 0.05$) (Table 2).

DISCUSSION

With this study, it was concluded that "DPUT" can be used to evaluate the QoL of individuals with lower-limb amputation with a single question.

There are several studies investigating factors effective on the life quality of persons with amputation using different questionnaires.[24,33–36] Because of the evaluation of demographic characteristics, QoL is more negatively affected in females with amputation when compared with males.[6,37,38] It has been previously stated that the most important predictor

Table 1. The correlation between DPUT and QoL

N = 119		NHP (EL)	NHP (P)	NHP (ER)	NHP (SI)	NHP (S)	NHP (PA)	NHP Total	TAPES-PSA	TAPES-AR	TAPES-SWP
DPUT	*r*	−0.332	−0.486	−0.247	−0.277	−0.315	−0.615	−0.519	0.192	−0.335	−0.029
	P	<0.001[b]	<0.001[b]	0.007[a]	0.002[a]	<0.001[b]	<0.001[b]	<0.001[b]	0.195	0.021[a]	0.844

[a]$P < 0.05$.

[b]$P \leq 0.001$.

r, Spearman correlation; NHP, Nottingham Health Profile; EL, energy level; P, pain; ER, emotional reaction; SI, social isolation; S, sleep; PA, physical activity; TAPES, trinity amputation and prosthesis experience scales; PSA, psychosocial adjustment; AR, activity restriction; SWP, satisfaction with the prosthesis; DPUT, daily prosthesis usage time; QoL, quality of life.

Table 2. The amputation-related factors associated with daily prosthesis use time

N = 119		Residual Limb Pain	Phantom Pain	Prosthetic Satisfaction	Time Interval After Amputation	The Number of Prosthesis	Walking Aid
DPUT	*r*	–0.351	–0.237	0.516	0.415	0.402	–0.300
	P	<0.000	0.009[a]	<0.001[b]	<0.001[b]	<0.001[b]	0.001[b]

[a]$P < 0.05$.
[b]$P \leq 0.001$.
r, Spearman correlation; DPUT, daily prosthesis usage time.

of QoL is "age,"[6,24,39] and that there is a strong relation between education level and QoL.[39,40]

The effect of demographic characteristics on life quality is shown to be poor,[41,42] whereas strong factors are stated to be prosthetic-related parameters.[35,37,40,43]

When the total score of NHP was investigated, it can be thought that prosthetic-related parameters such as prosthesis usage time are the factors affecting life quality. A good relation prominently existed between the NHP physical activity subscale and DPUT. Assessing the TAPES with DPUT showed a low-to-moderate correlation with the TAPES-AR subdomain. The association of activity-related subscores with daily prosthesis use in both generic questionnaires and questionnaires specific to individuals with amputation can be explained by the necessity of using a prosthesis to perform activities. As the duration of prosthesis use increases, the decrease in activity limitation affects the QoL positively.

Already, various factors are shown to be vital in functional prosthetic use, but the time interval after amputation and prosthetic rehabilitation to adapt the person with amputation to the prosthesis in this interval is of great importance. Beyond this, it is stated that independence and QoL were extensively affected by the time interval after amputation.[33,34,36] According to our experience, it was observed that individuals with amputation who had good adaptation to prostheses could be more independent by increasing their DPUT. As the DPUT is related to the increased time interval after amputation, this brings an added value to our findings.

Phantom pain and residual-limb pain affects functional prosthetic use. Pain leads to activity limitations causing diminishing in walking distance and time. In the case of pain, individuals with amputation could not perform the ambulatory activities sufficiently.[18,34,35,44] Outcomes of the study presented here also enhance this statement. If DPUT increases, because of the stresses acting on the residual limb, atrophy of residual limb muscles could exist with the requirement of a socket change that is the reason of the rise in prosthetic fitting numbers. Therefore, it can be postulated that number of prosthetic fittings increases when the DPUT lengthens.

Because the DPUT presented a correlation both with NHP and TAPES, it can be seen as the most significant factor related with QoL. Increase in DPUT is therefore an indicator of decreasing activity limitations, improving social participation, and QoL.

QoL is known to be affected by residual-limb pain, phantom pain, time interval after amputation, number of prosthetic fittings, and the usage of walking aids related with daily prosthetic use time.[24,33–36] Consequently, it can be stated that DPUT is correlated with both generic questionnaires and questionnaires specific to individuals with amputation and is an effective indicator for QoL.

CONCLUSIONS

Outcome of the study pointed out that a question of "DPUT" could be asked for receiving information about life quality of persons with amputation who were provided with a prosthesis or will be fitted with a new one and will receive rehabilitation. The feedback from the question will be cardinal in planning an extensive prosthetic rehabilitation program to improve DPUT, functional capabilities, social participation, and finally QoL.

In the authors' opinion, QoL of individuals with lower-limb amputation can be assessed through a single-item question by rehabilitation-related health care professionals because of easy use in clinical settings. In problems resulted from routine assessment and questionnaires having so many items, a single question can be used effectively in a shorter period and a rehabilitation program can be organized practically.

REFERENCES

1. Gallagher P, MacLachlan M. The development and psychometric evaluation of the Trinity Amputation and Prosthesis Experience Scales (TAPES). *Rehabil Psychol* 2000;45:130–155.
2. Deathe B, MacLachlan M. The status of outcome measurement in amputee rehabilitation in Canada. *Arch Phys Med Rehabil* 2000; 83:912–918.
3. Pohjolainen T, Alaranta H. Predictive factors of functional ability after lower-limb amputation. *Ann Chir Gynaecol* 1991;80:36–39.
4. Pell JP, Donnan PT, Fowkes FG, Ruckley CV. Quality of life following lower limb amputation for peripheral arterial disease. *Eur J Vasc Surg* 1993;7:448–451.
5. Schoppen T. *Functional outcome after a lower limb amputation* [Thesis]. Groningen the Netherlands: University of Groningen; 2002.
6. Demet K, Martinet N, Guillemin F, et al. Health related quality of life and related factors in 539 persons with amputation of upper and lower limb. *Disabil Rehabil* 2003;25:480–486.
7. Pernot HF, de Witte LP, Lindeman E, Cluitmans J. Daily functioning of the lower extremity amputee: an overview of the literature. *Clin Rehabil* 1997;11:93–106.
8. Holden JM, Fernie GR. Extent of artificial limb use following rehabilitation. *J Orthop Res* 1987;5:562–568.

9. Gauthier-Gagnon C, Grisé MC, Potvin D. Enabling factors related to prosthetic use by people with transtibial and transfemoral amputation. *Arch Phys Med Rehabil* 1999;80:706–713.
10. Gauthier-Gagnon C, Grisé MC, Potvin D. Predisposing factors related to prosthetic use by people with transtibial and transfemoral amputation. *JPO* 1998;10:99–109.
11. Geertzen JH, Martina JD, Rietman HS. Lower limb amputation. Part 2: rehabilitation—a 10-year literature review. *Prosthetics Orthot Int* 2001;25:14–20.
12. Gallagher P, MacLachlan M. Positive meaning in amputation and thoughts about the amputated limb. *Prosthetics Orthot Int* 2000; 24:196–204.
13. Pohjolainen T, Alaranta H, Kärkkäinen M. Prosthetic use and functional and social outcome following major lower limb amputation. *Prosthetics Orthot Int* 1990;14:75–79.
14. Dillingham TR, Pezzin LE, MacKenzie EJ, Burgess AR. Use and satisfaction with prosthetic devices among persons with trauma-related amputations: a long-term outcome study. *Am J Phys Med Rehabil* 2001;80:563–571.
15. Gallagher P, MacLachlan M. Adjustment to an artificial limb a qualitative perspective. *J Health Psychol* 2001;6:85–100.
16. Legro MW, Reiber G, del Aguila M, et al. Issues of importance reported by persons with lower limb amputations and prostheses. *J Rehabil Res Dev* 1999;36:155–163.
17. Pohjolainen T. A clinical evaluation of stumps in lower limb amputees. *Prosthetics Orthot Int* 1991;15:178–184.
18. Gallagher P, Allen D, Maclachlan M. Phantom limb pain and residual limb pain following lower limb amputation: a descriptive analysis. *Disabil Rehabil* 2001;23:522–530.
19. Williamson GM, Schulz R, Bridges MW, Behan AM. Social and psychological factors in adjustment to limb amputation. *J Soc Behav Pers* 1994;9:249–268.
20. Condie EG, Scott HG, Treweek S. Lower limb prosthetic outcome measures: a review of the literature 1995 to 2005. *J Prosthet Orthot* 2006;18(6):13–45.
21. Jang Y, Hsieh CL, Wang YH, Wu YH. A validity study of the WHOQOL-BREF assessment in persons with traumatic spinal cord injury. *Arch Phys Med Rehabil* 2004;85:1890–1895.
22. Skevington SM, Lotfy M, O'Connell KA, WHOQOL Group. The World Health Organization's WHOQOL-BREF quality of life assessment: psychometric properties and results of the international field trial. A report from the WHOQOL group. *Qual Life Res* 2004;13:299–310.
23. The WHOQOL Group. Development of the World Health Organization WHOQOL-BREF quality of life assessment. *Psychol Med* 1998;28:551–558.
24. Van der Schans CP, Geertzen JH, Schoppen T, Dijkstra PU. Phantom pain and health-related quality of life in lower limb amputees. *J Pain Symptom Manage* 2002;24:429–436.
25. de Boer AG, van Lanschot JJ, Stalmeier PF, et al. Is a single-item visual analogue scale as valid, reliable and responsive as multi-item scales in measuring quality of life? *Qual Life Res* 2004;13:311–320.
26. Ferrans CE. Differences in what quality-of-life instruments measure. *J Natl Cancer Inst Monogr* 2007;(37):22–26.
27. Sloan JA, Loprinzi CL, Kuross SA, et al. Randomized comparison of four tools measuring overall quality of life in patients with advanced cancer. *J Clin Oncol* 1998;16:3662–3673.
28. Legro MW, Reiber GD, Smith DG, et al. Prosthesis evaluation questionnaire for persons with lower limb amputations: assessing prosthesis-related quality of life. *Arch Phys Med Rehabil* 1998;79:931–938.
29. Ali S, Abu Osman NA, Naqshbandi MM, et al. Qualitative study of prosthetic suspension systems on transtibial amputees' satisfaction and perceived problems with their prosthetic devices. *Arch Phys Med Rehabil* 2012;93:1919–1923.
30. Pruitt SD, Varni JW, Seid M, Setoguchi Y. Prosthesis satisfaction outcome measurement in pediatric limb deficiency. *Arch Phys Med Rehabil* 1997;78:750–754.
31. Topuz S, Ülger Ö, Yakut Y, Gül Şener F. Reliability and construct validity of the Turkish version of the Trinity Amputation and Prosthetic Experience Scales (TAPES) in lower limb amputees. *Prosthet Orthot Int* 2011;35(2):201–206.
32. Kücükdeveci AA, McKenna SP, Kutlay S, et al. The development and psychometric assessment of the Turkish version of the Nottingham Health Profile. *Int J Rehabil Res* 2000;23(1):31–38.
33. Zidarov D, Swaine B, Gauthier-Gagnon C. Quality of life of persons with lower-limb amputation during rehabilitation and at 3-month follow-up. *Arch Phys Med Rehabil* 2009;90:634–645.
34. Sinha R, van den Heuvel WJ, Arokiasamy P. Factors affecting quality of life in lower limb amputees. *Prosthet Orthot Int* 2011;35(1):90–96.
35. Sinha R, Van Den Heuvel WJ. A systematic literature review of quality of life in lower limb amputees. *Disabil Rehabil* 2011;33(11):883–899.
36. Dajpratham P, Tantiniramai S, Lukkanapichonchut P. Health related quality of life among the Thai people with unilateral lower limb amputation. *J Med Assoc Thai* 2011;94(2):250–255.
37. Eiser C, Darlington A-SE, Stride CB, Grimer RJ. Quality of life implications as a consequence of surgery: limb salvage, primary and secondary amputation. *Sarcoma* 2001;5:189–195.
38. Hagberg K, Brånemark R. Consequences of non-vascular transfemoral amputation: a survey of quality of life, prosthetic use and problems. *Prosthet Orthot Int* 2001;25:186–194.
39. Nagarajan R, Clohisy DR, Neglia JP, et al. Function and quality-of-life of survivors of pelvic and lower extremity osteosarcoma and Ewing's sarcoma: the childhood cancer survivor study. *Br J Cancer* 2004;91:1858–1865.
40. Walters AS, Williamson GM. Sexual satisfaction predicts quality of life: a study of adult amputees. *Sex Disabil* 1998;16:103–115.
41. Behel JM, Rybarczyk B, Elliot TR, et al. The role of perceived vulnerability in adjustment to lower extremity amputation: a preliminary investigation. *Rehabil Psychol* 2002;47:92–105.
42. Deans SA, McFadyen AK, Rowe PJ. Physical activity and quality of life: a study of a lower-limb amputee population. *Prosthet Orthot Int* 2008;32:186–200.
43. Tangelder MJ, McDonnel J, van Busschbach JJ, et al. Quality of life after infrainguinal bypass grafting surgery. Dutch Bypass Oral Anticoagulants or Aspirin (BOA) study group. *J Vasc Surg* 1999;29:913–919.
44. Chen MC, Lee SS, Hsieh YL, et al. Influencing factors of outcome after lower-limb amputation: a five-year review in a plastic surgical department. *Ann Plast Surg* 2008;61(3):314–318.