Original Article

Satisfaction with Prostheses and Services in Cyclists with a Lower Limb Amputation

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Objective: To investigate the prosthetic and service satisfaction in cycling and non-cycling adults with a lower limb amputation in Thailand and to analyze factors associated with satisfaction.

Materials and Methods: Orthotics and Prosthetics Users' Survey questionnaire was given to 424 adults with uni or bilateral lower limb amputation in five public hospitals and mobile units. Associated variables in univariate analysis were entered into a multiple linear regression.

Results: Forty-five percent of participants were from the Veterans General Hospital, Bangkok. Cyclists were slightly more satisfied with the prostheses than non-cyclists, but no differences were reported for service satisfaction. In general, all participants were satisfied with the service received. Factors associated with higher prosthetic satisfaction were not using gait aids, being employed or retired, being amputated below the knee, no or basic education, and hospital delivering the prosthesis. The factor associated with higher service satisfaction was not using gait aids.

Conclusion: The results suggested that mobility independence, use of the prosthesis, and socioeconomic status may influence prosthetic and service satisfaction. Communication between people with a lower limb amputation and prosthetists, as well as follow-up after delivery may improve the prosthetic and service satisfaction. Satisfactory prostheses may increase activity participation, as seen in cyclists.

Keywords: Satisfaction, Prosthesis, Service, Cycling, Amputation, Lower limb, Transfemoral amputation, Transtibial amputation

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Satisfaction with lower limb prosthesis and prosthetic service can influence the use of the prosthesis[1-7]. Prosthetic problems can restrict physical activities[3] or sports participation[4]. In Thailand, most people with a lower limb amputation (LLA) who use their prostheses to perform daily activities are satisfied with their prostheses[1]. The extent of satisfaction is related to the type of activity[5]. People with an LLA can be satisfied with the prosthesis in one activity, such as walking but may not be satisfied with the prosthesis in another activity such as sitting[5]. Satisfaction with the prosthetic service can affect the perceived quality of the prostheses. Clients may perceive a low quality of care if they received the service from unfriendly, unkind, non-caring, or insensitive prosthetists[6].

People with a LLA cycle for transportation,

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A B C

Figure 1. Basic components of a lower limb prosthesis for below (A) and above the knee amputation (B). From the bottom to the top, components for (A) consists of a SACH foot, an exoskeletal shank laminated with socket, and a cuff suspension. (B) Consists of a SACH foot, an exoskeletal shank laminated with a weight-activated knee, an exoskeletal thigh laminated with a socket, and a Silesian belt. (C) Shows a cyclist with a transtibial prosthesis.

fun, or exercise or physical fitness rather than for competition[4,8-10]. Recreational cyclists with an LLA mainly use a walking prosthesis for cycling. Although financial issues could affect the satisfaction of the service and device[6], in Thailand, people with an LLA can obtain a basic prosthesis by using the Universal Health-care Coverage, Social Health Insurance, or Civil Servant Medical Benefit Schemes[11]. Basic components of a prosthetic lower limb usually include a solid ankle cushioned heel (SACH) foot and depending on amputation level, an exoskeletal shank, a safety knee unit, a socket, and belt suspensions (cuff or Silesian belt for below and above the knee amputation, respectively)[1] (Figure 1). However, the mechanics and design of walking prostheses may not be appropriate for cycling and can cause problems such as skin abrasion, pain, or restrict knee flexion[12].

To optimize an individual's function and lifestyle, service providers and clinicians should understand the current state of prosthetic and service satisfaction. However, the satisfaction assessment of prosthetic device and service in Thailand has not been conducted in cyclists[1,2,13]. For that reason, the present study aimed to investigate the satisfaction of people with an LLA with their prosthesis and prosthetic services in Thailand and analyze its association with recreational cycling. In addition, the researchers would analyze which factors were associated with prosthetic and service satisfaction in Thailand.

Materials and Methods

Participants and measure

People with an LLA were eligible for participation if they were 18 years or older, with a uni or bilateral LLA (from midfoot to hemipelvectomy) for at least six months, and able to read, write, and speak Thai. Sample size calculation indicated that 424 participants would be needed[14]. Participants were recruited from five major public prosthetic providers in Bangkok, including 1) Sirindhorn School of Prosthetics and Orthotics at Siriraj Hospital, 2) Veterans General Hospital, 3) Lerdsin Hospital, 4) King Chulalongkorn Memorial Hospital, and 5) Phramongkutklao Hospital. Before data collection, the research protocol was approved by the local committees (SIRB819/2560 (EC4), 611010, IRB628/60, and IRBRTA133/2561). Questionnaires were also given to eligible participants who visited the mobile units served by the Sirindhorn National Medical Rehabilitation Institute, Ministry of Public Health and Veterans General Hospital. Questionnaires included questions about participant and prosthesis characteristics, cycling participation, cycling barriers, and facilitators and satisfaction. The Orthotics and Prosthetics Users' Survey (OPUS) questionnaire was used to determine satisfaction with the prosthesis and service. OPUS is a self-reported questionnaire, with good reliability and validity[15-17], including 21 items, in which each item contains a five-point scale from 1-strongly disagree or very dissatisfied to 5-strongly agree or very satisfied.

The sum of the first nine items represents prosthetic satisfaction. The sum of item 12 to 21 represents service satisfaction. Two items related to finance were analyzed separately from prosthetic satisfaction and service satisfaction. Sum of raw prosthetic satisfaction and service satisfaction scores were used for data analyses[18-20]. Details regarding sample size calculation and questions related to cycling have been published previously[14].

Data analysis

Descriptive statistics were used to summarize the participants' characteristics, cycling participation, and satisfaction. Categorical variables were described as numbers and percentages. Continuous variables were described as mean and standard deviation (SD) or median and interquartile range as appropriate. Associations between variables and the prosthetic satisfaction and service satisfaction were analyzed. Pearson correlation coefficient were used to analyze associations between satisfaction and sample characteristics as well as the independent t-test, one-way analysis of variance (ANOVA), or Mann Whitney U test depending on the type of the data. If p-value was less than 0.1, the variable was entered in the multivariate analysis, in which p-value less than or equal to 0.05 was considered significant. All analyses were conducted using IBM SPSS Statistics, version 23.0 (IBM Corp., Armonk, NY, USA).

Results

Participants

Of the 424, two participants were excluded from the analysis since they did not have the LLA[14]. Among 422 included participants, 197 participants cycled, and 225 did not. Almost half of the responses were from the Veterans General Hospital (45.5%). Most of the other half of the participants were from the mobile units provided by Sirindhorn National Medical Rehabilitation Institute and Siriraj Hospital. Most participants were male with a unilateral LLA resulting from trauma (73.6%), lower than the knee level (72.5%), and did not use walking aids other than the prostheses (82.0%). Commonly used prostheses were exoskeleton prosthesis (57.1%), patellar tendon bearing (PTB) socket (50.9%), cuff suspension (58.8%), and SACH foot (74.9%) (Table 1). Additional details on cycling participation have been presented elsewhere(14).

Clients' satisfaction and cycling participation

The mean of total scores for prosthetic satisfaction was 34.0±4.7 and for service satisfaction was 41.2±4.3. Cyclists were more satisfied with the prostheses than non-cyclists (Table 2). For satisfaction of the service, there was no significant difference in the total scores between the group of cyclists and non-cyclists. Service satisfaction had no association with the cycling participation (Table 2). Participants were satisfied with all items of the service (Table 3).

Univariate analysis of factors relating to prosthetic satisfaction and service satisfaction

Factors positively associated with prosthetic satisfaction were cycling, no or basic education level, being retired or employed, being amputated below the knee, having an LLA from trauma, using an exoskeletal prosthetic system, not using a gait aid, having a prosthesis from hospitals, and longer time since an LLA. Factors positively associated with service satisfaction were being retired, having an LLA from trauma, using no gait aid, and having no other underlying diseases (Table 2).

Financial issues

Cyclists had significantly higher satisfaction score regarding the ability to pay for expenses and the ability to afford repairs than non-cyclists (Table 4).

Multiple linear regression of factors associated with prosthetic satisfaction and service satisfaction

All the factors associated with prosthetic satisfaction and service satisfaction were entered to the multiple regression analyses and removed backward manually if the regression coefficient was not significant or the model fit did not decrease significantly. The final model included five factors significantly related to prosthetic satisfaction (Table 5). R^2 of the model was 14.9%. Due to a small number of the sub-population of students, scores given by the students were not entered to the model. For service satisfaction the final model is summarized in Table 6. R^2 of the model was 4.8%.

Discussion

Statistical predictors of prosthesis and service satisfaction have been identified but participating in cycling was not a predictor of satisfaction. For the service satisfaction scores, both cyclists and non-cyclists were satisfied with the service they received indifferently. However, there was an association between prosthetic satisfaction in cyclists and non-cyclists, so people with higher prosthetic satisfaction tended to participate more in cycling. This result

Table 1. Participant characteristics (n=422)

Characteristics	n=422	%
Facilities		
Veterans General Hospital	192	45.5
Mobile unit	99	23.5
Siriraj Hospital	93	22.0
King Chulalongkorn Memorial Hospital	26	6.2
Lerdsin Hospital	8	1.9
Phramongkutklao Hospital	4	0.9
Sex: male	332	78.7
Age (year); median (IQR)	399	56.0 (48.0, 62.0)
Years after amputation (year); median (IQR)	127	24.0 (3.0, 33.0)
Body weight (kg); mean±SD	400	65.0±11.3
Height (cm); mean±SD	399	165.8±7.7
Body mass index (kg/m^2); mean±SD	399	23.8±3.7
Number of socks; median (IQR)	372	2 (2.0)
Summation of left and right prosthetic weight (kg); median (IQR)	236	2.1 (1.8, 3.1)
Weight of prosthesis for unilateral TT, AD, MF	162	2.0 (1.7, 2.2)
Weight of prosthesis for unilateral HD, TF, KD	65	3.5 (3.1, 4.0)
Exoskeletal weight in unilateral (kg)	122	2.0 (1.8, 2.5)
Endoskeletal weight in unilateral (kg)	97	2.5 (1.8, 3.4)
Living area		
Bangkok metropolitan	165	39.1
Other region	257	60.9
Living situation		
Alone	39	10.6
With someone	328	89.4
Education level		
No/basic education	187	44.3
High school or higher	235	55.7
Employment status		
Unemployed	105	25.4
Employed	256	61.8
Student	5	1.2
Retired	48	11.6
Monthly income		
Under 15,000 baht	157	41.4
≥15,000 baht	222	58.6
Have other disease		
Yes	221	52.4
No	201	47.6

Characteristics	n=422	%
Amputation level		
HD, TF, KD	116	27.5
TT, AD, MF	306	72.5
Amputation sides		
Bilateral amputation*	15	3.6
Unilateral amputation	407	96.4
Amputation cause		
Other	110	26.4
Trauma	306	73.6
Prosthetic system		
Exoskeletal prosthesis	221	57.1
Endoskeletal prosthesis	166	42.9
Prosthetic liner		
None	94	25.3
Pelite	258	69.5
Silicone	13	3.5
Pelite, silicone	6	1.6
Prosthetic socket		
PTB	195	50.9
PTBSC	77	20.1
PTBSCSP	5	1.3
ICS	12	3.1
QL	86	22.5
Other	8	2.1
Prosthetic suspension		
Cuff	203	58.8
Sleeve	5	1.4
Pin	3	0.9
Silesian	89	25.8
Suction	15	4.3
Other	30	8.7
Prosthetic knee joint		
Weight activate	28	14.2
Four bar linkage	58	29.4
Manual knee lock	4	2.0
Other knee joint	7	3.6
Prosthetic foot		
SACH	283	74.9
Single axis	83	22.0
ESAR	4	1.1
Other	8	2.1

IQR=interquartile range; SD=standard deviation; HD=hip disarticulation; TF=transfemoral; KD=knee disarticulation; TT=transtibial; AD=ankle disarticulation; MF=mid foot; PTB=patellar tendon bearing; PTBSC=PTB and supra condylar; PTBSCSP=PTBSC and suprapatellar; QL=quadrilateral; ICS=ischial containment; SACH=solid ankle cushion heel; ESAR=energy storage and return

Valid observations were number of participants answering the question, * Level of LLA (left-right) in 15 bilateral people with amputation are 7(TT-TT), 3(TF-TF), 1(HD-HD), 1(TT- KD), 1(TT-AD), 1(TF-TT), 1(TT-MF)

Table 2. Univariate of factors and prosthetic satisfaction and service satisfaction

Characteristics		Prosthetic satisfaction				Service satisfaction			
		n=422	Mean±SD	Test statistic	p-value	n=422	Mean±SD	Test statistic	p-value
Cycling:	Yes	181/197	34.5±4.3	t=-2.1	0.041	151/197	41.3±4.2	t=0.0	0.973
	No	196/225	33.5±5.1			164/225	41.3±4.2		
Sex:	Male	300	34.0±4.8	t=-0.3	0.784	259	41.3±4.1	t=0.7	0.510
	Female	77	34.1±4.6			58	40.9±4.8		
Living area:	Outside BMR	176	34.1±4.9	t=0.6	0.524	182	41.5±4.5	t=1.5	0.147
	Inside BMR	132	33.8±4.5			135	40.8±3.9		
Living situation:	Alone	36	34.7±4.2	t=0.8	0.398	32	42.0±4.4	t=1.0	0.315
	With someone	299	34.0±4.9			254	41.2±4.3		
Employment status:	Unemployed	88	32.3±4.6	f=7.2	0.001	68	40.0±3.2	f=3.1	0.047
	Employed	232	34.4±4.7			194	41.5±4.5		
	Retired	47	34.8±4.5			44	41.2±4.6		
Education:	No/basic education	165	34.5±5.0	t=1.8	0.068	128	41.0±4.3	t=-0.8	0.452
	Highschool/higher	212	33.6±4.5			189	41.3±4.3		
Monthly income:	Under 15,000 Baht	133	33.8±4.9	t=0.2	0.840	102	41.1±4.4	t=0.1	0.669
	≥15,000 Baht	204	33.7±4.3			176	40.9±4.1		
Amputation side:	Bilateral	14	35.2±4.6	t=1.0	0.329	11	40.8±5.0	t=-0.3	0.765
	Unilateral	363	34.0±4.7			306	41.2±4.2		
Amputation level:	HD, TF, KD	105	32.8±4.8	t=-3.0	0.003	96	40.6±3.8	t=-1.8	0.075
	TT, AD, MF	272	34.5±4.7			221	41.5±4.4		
Amputation cause:	Trauma	287	34.2±4.7	t=1.7	0.092	248	41.4±4.1	t=1.5	0.132
	Other	86	33.2±4.8			65	40.5±4.7		
Prosthetic system:	Exoskeletal	207	34.4±4.8	t=1.8	0.080	165	41.3±4.4	t=0.3	0.749
	Endoskeletal	152	33.5±4.7			136	41.1±4.0		
TT, AD, MF socket:	PTB	180	34.4±4.8	f=0.0	0.985	150	41.3±4.3	f=2.2	0.110
	PTBSC	71	34.4±4.4			51	42.3±4.2		
	PTBSCSP	4	34.0±2.9			3	37.7±4.0		
HD, TF, KD socket:	ICS	11	33.1±2.6	t=0.2	0.839	11	41.1±4.8	t=0.5	0.617
	QL	83	32.8±4.7			75	40.5±3.4		
Suspension:	Cuff	189	34.4±4.7	f=1.9	0.107	157	41.2±4.3	f=1.3	0.289
	Sleeve	5	35.4±6.8			5	44.6±5.7		
	Pin	3	34.3±0.6			3	42.3±6.5		
	Silesian	86	32.9±4.8			79	40.6±3.7		
	Suction	14	34.2±4.2			14	40.5±3.1		
Knee joint	None	275	34.4±4.7	f=3.3	0.019	6	41.5±4.4	f=2.0	0.110
	Weight activate	27	33.0±4.2			23	40.7±2.7		
	Four bar linkage	55	32.7±5.0			51	40.4±3.4		
	Manual	4	37.8±4.0			2	44.8±5.5		
Foot:	SACH	262	34.1±4.8	t=0.6	0.581	212	41.6±4.2	t=1.2	0.225
	Other foot	82	33.8±4.5			76	40.9±4.1		
Liner use:	No liner	89	33.7±5.2	t=-1.0	0.296	83	41.0±4.1	t=-0.9	0.350
	With liner	256	34.3±4.6			205	41.5±4.4		

SD=standard deviation; BMR=Bangkok Metropolitan Region; HD=hip disarticulation; TF=transfemoral; KD=knee disarticulation; TT=transtibial; AD=ankle disarticulation; MF=mid foot; BMI=body mass index; PTB=patellar tendon bearing; PTBSC=PTB and supra condylar; PTBSCSP=PTB-SC and suprapatellar, QL=quadrilateral; ICS=ischial containment; SACH=solid ankle cushion heel; ESAR=energy storage and return

Full score is 5 points for each item. Sum scores of prosthesis and service satisfaction are 45 and 50, respectively. Valid was number of participants answering the question.

Table 2. (continued)

Characteristics		Prosthetic satisfaction				Service satisfaction			
		n=422	Mean±SD	Test statistic	p-value	n=422	Mean±SD	Test statistic	p-value
Gait aid use:	No	240	34.7±4.9	t=4.0	<0.001	207	41.9±4.4	t=4.2	<0.001
	Yes	137	32.7±4.2			110	39.9±3.7		
Have other diseases:	No	178	34.4±4.5	t=1.5	0.137	148	41.7±4.2	t=2.0	0.047
	Yes	199	33.7±5.0			169	40.8±4.3		
Facility:	King Chulalongkorn Memorial Hospital	24	31.4±3.3	f=4.4	0.001	24	39.9±1.1	f=0.7	0.656
	Lerdsin Hospital	8	37.3±5.4			8	41.0±6.7		
	Mobile unit	82	32.7±4.9			43	41.2±4.3		
	Phramongkutklao Hospital	4	36.8±2.9			4	43.0±5.0		
	Siriraj Hospital	76	34.4±4.9			69	41.2±4.7		
	Veterans General Hospital	183	34.5±4.6			160	41.3±4.2		
Age (years)		357		r=0.0	0.798	297		r=-0.1	0.062
Years after amputation		112		r=0.1	0.145	97		r=-0.1	0.377
Number of socks		347		r=0.1	0.323	290		r=0.1	0.130
Sum weight of prostheses (kg)		226		r=0.0	0.629	192		r=-0.1	0.435
BMI (kg/m^2)		352		r=0.0	0.882	291		r=0.0	0.517

SD=standard deviation; BMR=Bangkok Metropolitan Region; HD=hip disarticulation; TF=transfemoral; KD=knee disarticulation; TT=transtibial; AD=ankle disarticulation; MF=mid foot; BMI=body mass index; PTB=patellar tendon bearing; PTBSC=PTB and supra condylar; PTBSCSP=PTB-SC and suprapatellar, QL=quadrilateral; ICS=ischial containment; SACH=solid ankle cushion heel; ESAR=energy storage and return

Full score is 5 points for each item. Sum scores of prosthesis and service satisfaction are 45 and 50, respectively. Valid was number of participants answering the question.

Table 3. Items scores of prosthesis and service satisfaction

	n	Mean	SD	Minimum	Maximum
Prosthesis satisfaction:					
1. My prosthesis fits well	386	3.8	0.9	2.0	5.0
2. Weight of my prosthesis is manageable	386	3.8	0.8	2.0	5.0
3. My prosthesis is comfortable throughout the day	386	3.8	0.8	2.0	5.0
4. It is easy to put on my prosthesis	387	4.0	0.6	2.0	5.0
5. My prosthesis looks good	385	3.8	0.8	2.0	5.0
6. My prosthesis is durable	384	3.9	0.7	2.0	5.0
7. My clothes are free of wear and tear from my prosthesis	385	3.8	0.9	2.0	5.0
8. My skin is free of abrasions and irritations	386	3.5	1.0	2.0	5.0
9. My prosthesis is pain free to wear	385	3.5	1.0	2.0	5.0
Service satisfaction:					
12. I received an appointment with a prosthetist within a reasonable amount of time	326	4.1	0.6	2.0	5.0
13. I was shown the proper level of courtesy and respect by the staff	325	4.3	0.5	3.0	5.0
14. I waited a reasonable amount of time to be seen	324	4.1	0.6	2.0	5.0
15. Clinic staff fully informed about equipment choices	322	4.1	0.6	2.0	5.0
16. The prosthetist gave me the opportunity to express my concerns regarding my prosthesis	322	4.0	0.7	2.0	5.0
17. The prosthetist was responsive to my concerns and questions	322	4.1	0.7	2.0	5.0
18. I am satisfied with the training I received in the use and maintenance of my prosthesis	319	4.2	0.5	2.0	5.0
19. The prosthetist discussed problems I might encounter with my prosthesis	318	4.1	0.6	2.0	5.0
20. The staff coordinated their services with my therapists and doctors	318	4.0	0.7	2.0	5.0
21. I was a partner in decision-making with clinic staff regarding my care and prosthesis	321	4.0	0.7	2.0	5.0

SD=standard deviation

Table 4. Mean difference of ability to pay for costs relating to prosthesis

Satisfaction item (valid cyclists/non-cyclists)	Cyclists (n=197)		Non-cyclists (n=225)		U	p-value
	Median	IQR	Median	IQR		
10. Can afford the out-of-pocket expenses to purchase and maintain my prosthesis (176/181)	4.0	(4.0, 5.0)	4.0	(3.0, 4.0)	18,208	0.012
11. Can afford to repair or replace my prosthesis as soon as needed (176/182)	4.0	(4.0, 5.0)	4.0	(3.0, 4.0)	18,635	0.003

IQR=interquartile range; U=Mann-Whitney U test

Full score is 5 points for each item

Table 5. Multiple regressions of factors associated with prosthetic satisfaction

Factors		Unstandardized coefficients		p-value	95% CI for B	
		B	Standard error		Lower bound	Upper bound
Constant*		33.9	1.0	<0.001	32.1	35.8
Facility:	King Chulalongkorn Memorial Hospital	–1.0	1.1	0.329	–3.1	1.1
	Phramongkutklao Hospital	3.7	2.3	0.112	–0.9	8.2
	Lerdsin Hospital	3.2	1.7	0.053	0.0	6.5
	Siriraj Hospital	1.7	0.7	0.015	0.3	3.2
	Veterans General Hospital	1.4	0.6	0.017	0.3	2.6
Employment:	Unemployed	–2.4	0.8	0.002	–4.0	–0.9
	Employed	–0.3	0.7	0.662	–1.6	1.0
Education level equal to or higher than school level		–1.1	0.5	0.025	–2.1	–0.1
Amputation level is below knee joint		1.3	0.5	0.013	0.3	2.3
Using gait aid/s		–1.7	0.5	<0.001	–2.7	–0.8

CI=confidence interval

* Reference categories were mobile unit, retired, no/basic education, and level of amputation ≥ knee level, and not using gait aid respectively, R^2=14.9%

Table 6. Multiple regressions of factors associated with service satisfaction

Factors	Unstandardized coefficients		p-value	95% CI for B	
	B	Standard error		Lower bound	Upper Bound
Constant*	41.9	0.3	<0.001	41.3	42.4
Use of gait aid/s	–2.0	0.5	<0.001	–2.9	–1.0

CI=confidence interval

* reference categories was not using gait aid, R^2=4.8%

is in line with a study revealing that utility of a prosthesis and ambulation positively correlated with the prosthetic satisfaction[1,2,21].

Cyclists and non-cyclists had different opinions on their financial abilities. Cyclists agreed that they could pay for the expenses or afford the repair of the prosthesis. In a previous study, it was found that most of the cyclists used basic prosthetic components for cycling and that higher income was a predictor of cycling participation[14]. Surprisingly, these basic prosthetic components are provided for free in all facilities involved in the present study[7], so it is unlikely that financial issues played a role in getting a prosthesis. Since 2002, Thailand has implemented Universal Health Coverage Scheme for health equity to all Thai people[11]. Mobility impaired farmers had an average monthly household income (4,466 Bath a month or about 150 USD), which is considerably lower than able-bodied individuals[13]. Another study reported that Thais with a Civil Service Scheme have

the easiest access to service, while unemployed people have the poorest access[22]. Traveling expenses are not free, so traveling expenses could be a potential hurdle for some people to visit a prosthetic service. Because the cyclists reported higher income than the non-cyclists[14], it is to be expected that people with higher income will have better abilities to pay for transportation as well, and are more likely to seek adjustments or repairs for their prosthesis. This ability could result in better fitting of the prosthesis, higher prosthetic satisfaction, and therefore an increased likelihood of cycling.

Predictors of clients' satisfaction of the device

Not using additional gait aids, and an LLA below the knee is predictor of prosthetic satisfaction. A previous prospective study found that people walking without canes or with a cane were more likely to use their prosthesis actively indoor and outdoor than people using crutches or walkers[23]. These findings are in line with a study in Thailand in which higher functional levels and prosthesis use were positively associated with prosthetic satisfaction[1]. Likewise, Thais, who are satisfied with a prosthesis, will walk independently without support or gait aids more than those Thais who are dissatisfied[7]. In conclusion, people who can walk with their prostheses independently were likely to be more satisfied with them.

Being retired or employed, a LLA level below the knee, and not using additional gait aids were factors associated with higher prosthetic satisfaction, whereas higher education level predicted lower satisfaction. In the present study, 63% of the participants were employed, which is similar to previously reported results in Thai people (67%)[24]. In addition, LLA from trauma and a longer time used were positively associated with prosthetic satisfaction in the univariate analysis. In addition, these factors were positively associated to vocational reintegration[24]. While higher educated people were more likely to be employed after an LLA[24], they rated their prosthetic satisfaction lower. It might be that people with a higher education had relatively higher expectations of their prosthesis than people with a lower education.

Being retired predicted higher satisfaction in comparison with being employed and unemployed. As there was a positive association between prosthetic satisfaction and time since an LLA, retired people might have had a longer time to adjust if they were amputated at a younger age. Unemployment participants may have limited ability to adjust to the prosthesis or function restrictions[25]. As a result, unemployed people may have difficulties or not able to use the prosthesis, so they were less satisfied with the prosthesis. Therefore, it is likely that connections exist between adjustment to the prosthesis, prosthetic use, and prosthetic satisfaction.

In comparison to the mobile unit, having a prosthesis from Lerdsin, Siriraj, or Veteran General Hospitals predicted a higher satisfaction. Higher satisfaction when the prosthesis was given from some hospitals than through a mobile unit might be a result of the inability of the mobile unit to follow-up and adjust problems later on. Because the mobile unit stays in a certain location for some weeks until the prostheses are fitted and delivered, patients might have limited access to the prosthesis adjustment or repairs later on due to a limited number of public hospitals with the prosthetic units in Thailand[13]. The ability to access prosthetic services for repairs and follow-up is important and might prove difficult in Thai people with disabilities[22]. Having a prosthesis from Phramongkutklao and King Chulalongkorn Memorial was not significantly different from the mobile unit, so other factors such as prosthetists or technicians' skills from the different facilities might also contribute to the quality of the prosthesis.

Predictors of clients' satisfaction of the service

Overall, clients were quite satisfied with the service. The scores of the total service satisfaction were about 40 for all characteristics analyzed. Mean scores of all service satisfaction items were at least 4. The use of additional gait aids was the only predictor for service satisfaction. Using gait aids could be a consequence of poor quality of a prosthesis or lower physical function. In agreement with a previous study, conditions of devices such as comfort, function or cosmetic, and the ability to walk were positively associated with satisfaction of the device and the service[17]. In contrast, a previous study found service satisfaction was different between countries due to different knowledge and skills of the technicians[26]. The researchers did not find differences in service satisfaction among Thai prosthetic facilities or the living locations.

Limitation

Several participants did not complete all prosthetic satisfaction and service satisfaction questions. Since some participants received questionnaires on the first day of their visit, did not have any prosthesis, or received the previous prosthesis from another facility,

they might not have been able to rate the satisfaction of the new prosthesis and service. Moreover, the survey is anonymous, but the questionnaires were given by the prosthetists and staffs, so this might have introduced bias by means of socially desirable answering tendencies. Participants may have been hesitating to rate their true (dis)satisfaction. Participants may also feel reluctant to report on their financial ability. While some participants may have overrated their financial abilities, some participants may have underrated it, out of fear of not obtaining financial support or a free prosthesis.

The researchers did not use the outcomes of a Rasch analysis as has been recommended[15-17] because assumptions for regression analysis could not be met. Instead, the researchers analyzed sum scores of the raw data as has been done previously[18-20]. Correlation between Rasch scores and raw scores were 0.998 and 1.000 for prosthesis and service satisfaction, respectively.

Conclusion

Higher prosthetic satisfaction was found among people who cycled. Not using any gait aid, being employed or retired, amputation below the knee, no or basic education, and facilities were the statistical predictors of higher prosthetic satisfaction. Not using gait aids and being employed or retired predicted statistically higher satisfaction in prosthesis. The results suggested that satisfaction was influenced not only by the prosthesis itself but by other factors such as adjustments and uses, mobility independence, socioeconomic situation, and well-being. Communication to understand the individual expectations and continuous follow-up for any required prosthetic adjustments could be the key to improve the prosthetic and service satisfaction. With respects to the follow-up appointments, policymakers should consider covering costs associated with traveling to prosthetic clinics at hospitals, especially for individuals who are unemployed or have low income.

What is already known on this topic?

In Thailand, the previous studies showed that people with an LLA are satisfied with their walking prostheses. However, people with an LLA also used a walking prosthesis for recreational sports such as cycling.

What this study adds?

This study investigated the satisfaction of people with an LLA with their prosthesis and prosthetic service in Thailand and analyzed its association with recreational cycling.

Cyclists were slightly more satisfied with the prostheses than non-cyclists. The findings suggest to prosthetists and rehabilitation physicians the factors that may increase the satisfaction of prosthesis and service.

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Conflicts of interest

The researchers have no conflicts of interest to disclose.

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