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The Continuity of Orthosis Use by Paraplegics which Had Been Prescribed During In-Patient Rehabilitation

Paraplejiklerde Hastanede Rehabilitasyon Sırasında Reçetelenen Ortezlerin Kullanım Devamlılığı

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Abstract

Objective: Orthoses, such as hip-knee-ankle-foot orthosis, metal or plastic ankle-foot orthosis, and posterior shell; and aids, such as crutches, Lofstrand forearm orthosis, walkers, canes, and wheelchairs, providing locomotion are frequently used in the rehabilitation of spinal cord injury. This study aimed to assess orthosis usage habits and to determine the problems related to orthosis in spinal cord injury patients after discharge from inpatient rehabilitation.

Material and Methods: Seventy-one patients were reviewed initially from hospital records. Forty-six patients [34 males (74%), 12 females (26%)] were available for telephone interviews to complete a questionnaire.

Results: The mean age was 35±12.9 years; the mean duration from injury was 43±27 months. The mean orthosis usage index (duration of orthosis use/the duration of prescription of orthosis) was 0.7±0.3. Among the 41 patients who were given orthoses, 30 patients (73%) used their orthosis, and 11 patients (27%) did not use their orthosis. The ratio of terminating orthosis use was significantly higher in patients with incomplete spinal cord injury (82%) when compared to patients with complete injury (18%) (p=0.038). The ratio of modifying the orthosis (53%) was significantly higher in the orthosis user group than in the non-user group (9%) (p=0.014). In the logistic regression analysis, the presence of sacral sparing was found to be influential toward the direction of decreasing orthosis use (p=0.040). Most of the reasons for terminating orthosis use were modifiable factors, such as spasticity, tightness or wearing out the orthosis, and psychological disturbances.

Conclusion: Our results suggest that there is a greater possibility for terminating orthosis use in patients with sacral sparing. Modification of the orthosis is a necessity for regular orthosis users. The wheelchair is the main form of locomotion and is regularly used by spinal cord injury patients.

Key Words: Spinal cord injury, paraplegia, orthosis, rehabilitation

Özet

Amaç: Omurilik yaralanmalı bireylerin rehabilitasyonunda kalça diz ayak bileği ayak ortezi, metal veya plastik ayak bileği-ayak ortezi, posterior shell gibi ortezler, koltuk değneği, kanadyen, walker, baston gibi el destekleri, lokomasyonu sağlayan tekerlekli iskemleler sıkça kullanılmaktadır. Bu çalışmada hastanede rehabilitasyon uygulanmış omurilik yaralanmalı bireylerin, taburculuk sonrasındaki ortez kullanımı alışkanlıklarını değerlendirmeyi ve ortezlerle ilgili yaşanan sorunları ortaya koymayı amaçladık.

Gereç ve Yöntemler: İlk olarak yetmiş bir hastanın hastane kayıtları incelendi. Telefonla ulaşılabilen 46 hastayla [34 erkek (%74), 12 kadın (%26)] sorgulama formuna dayanarak görüşüldü.

Bulgular: Yaşları (ortalama±SD), 35±12,9 yıl; olay süreleri 43±27 aydı. Ortalama ortez kullanım indeksi (ortez kullanım süresi/ortezin reçete edilme süresi) 0,7±0,3'tü. Ortez verilmiş 41 hastadan ortezini kullananların oranı %73 (n:30), kullanmayanların oranı ise %27 (n:11) idi. Ortez bırakma oranı, inkomplet omurilik yaralanmalı hastalarla (%82) komplet yaralanmalılar (%18) karşılaştırıldığında belirgin olarak yüksekti (p=0,038). Ortezde değişiklik yapma oranı ortezini kullanan grupta (%53) ortezini kullanmayanlara (%9) göre belirgin yüksekti (p=0,014). Lojistik regresyon analizinde sakral korunmanın varlığı ortez kullanımını azaltıcı yönde etkili bulundu (p=0,040). Ortezi bırakma nedenlerinin çoğunluğu spastisite, ortezin sıkı veya eskimiş olması, psikolojik rahatsızlık gibi değiştirilebilir nedenlerdi.

Sonuç: Bizim sonuçlarımız, sakral korunması olan hastaların ortez kullanımını sonlandırma ihtimallerinin daha fazla olabildiğini ve ortezlerde yapılan değişikliklerin ortezini düzenli kullanan hastalar için bir gereklilik olduğunu düşündürmektedir. Tekerlekli sandalye, ambulasyonun temel şeklidir ve omurilik yaralanmalı hastalar tarafından düzenli olarak kullanılmaktadır.

Anahtar Kelimeler: Omurilik yaralanması, parapleji, ortez, rehabilitasyon

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Introduction

The aims of spinal cord injury (SCI) rehabilitation are to increase physical activity and the independence of the patient (1). Leg braces and assistive devices provide joint stability for joints that can not be moved voluntarily and when muscle strength is not sufficient to support upright posture during walking and standing in patients with SCI (2). Standing upright and therapeutic ambulation are useful for the trabecular bone (3), bowel, bladder function, digestion, sleep, well-being, pain, and fatigue (4) and also decrease the risk of pressure ulcers (5). The sensory input that arises from load-bearing on the lower extremity stimulates weak muscles that do not contribute to contraction during voluntary movement (2). Although orthoses are needed and used by patients with SCI, there are some disadvantages, such as high energy consumption and slower walking speed (6). Wheelchair use is an alternative form of mobility, offering the acquisition of new skills in a seated position (2). Patients with SCI are usually satisfied with their wheelchair (7).

It has previously been reported that patients with a complete lesion between T1-T6 do not use their orthosis, while patients with a lesion between T7-T11 use their orthosis only for standing purposes (8). In another study of 43 spinal cord injury patients who were given a gait orthosis, an abandonment rate of 65% was reported. The lack of functionality, psychological effects, and the need for supervision and help were the main reasons for terminating orthosis use (9). In the literature, the ratio of abandonment of lower extremity braces has been reported to be 31%-65% for lower extremity braces, including long leg braces and short leg braces, 25%-34% for the reciprocating gait orthosis (RGO), and 40% for parawalkers (9-15). The follow-up periods differed between 6 months and 25 years in these studies. The factors related to ongoing orthosis use also do not have a consensus (10-14). The ability to climb stairs and the quality of walking related to the activities of daily living were correlated with the use of a device, while difficulties during riding on a wheelchair, lengthy application and removal time, not being practical, requiring too much energy to walk with, not feeling safe, pressure sores, worsening spasms, not fitting properly, broken hip or leg, improper environment, and shoulder problems were some of the problems reported about orthosis use (11,13). There are also reports that have found no factor related to non-use of the devices (14,16).

In clinical practice, an abandoned orthosis is a frequent observation, and the factors related to terminating orthosis use are not clear in the literature. The aim of this study was to assess paraplegic patients, to evaluate ongoing usage of the orthosis that is prescribed during inpatient rehabilitation at home, and to investigate the factors related to regular orthosis use versus abandonment of the orthosis after discharge. Wheelchair use and other means of locomotion were also assessed.

Material and Methods

This retrospective study was conducted at the Turkish Ministry of Health, Ankara Physical Medicine and Rehabilitation Training and Research Hospital, Second Clinic, with the approval of the institutional review board (25.06.2010/9781). The hospital data of patients with SCI below T1 who were hospitalized from 2006-2010 were assessed. Initially, the data of 71 patients were retrieved from hospital records, which included age, gender, length of hospital stay, disease duration, etiology, neurological level, completeness, AIS assessment (ASIA impairment scale), the presence of spasticity in the upper and lower extremities, clonus, ambulation type and level (therapeutic/community ambulation) at admission and discharge, the orthosis, and ambulation aid, wheelchair, or other device prescriptions during inpatient rehabilitation. Of the 71 patients, 46 were available for telephone interviews to complete a questionnaire about the potential problems that an SCI patient would meet. This questionnaire had been previously prepared by two clinicians (E.A; S.M). Two indices were defined, the 'device usage index' and 'splint usage index,' which are equal to the duration of device/splint usage (months) divided by the duration of device/splint prescription (months). With this index, we aimed to compare the patients with different durations of device prescription.

Statistical Analysis

Descriptive statistics were used to calculate mean, SD, and median values. The chi-square test was used for the comparison of dichotomous variables between orthosis/support/wheelchair users and non-users (gender, presence of sacral sparing, spasticity, clonus, modification of orthosis, ability to attach and remove by him/herself, ambulation level). Independent sample t-test was used for comparison of data with normal distribution (tested by Kolmogorov-Smirnov test), including length of stay, the time since prescription, and the duration of splint use. The Mann-Whitney U-test was used for comparison of data with a non-normal distribution, including age, time since trauma, duration of device use, time since device prescription, device usage index, splint usage index, and daily usage of splint and orthosis. Backward stepwise likelihood logistic regression analysis was performed to determine any probable risk factor that would predict regular use or termination of orthosis use. SPSS, version 15 was used for statistical analysis, and values of $p<.05$ were considered significant.

Results

Forty-six individuals with SCI [34 males (74%), 12 females (26%)] were included in the study. The mean age ± SD was 35±12.9 years; the mean length of hospital stay ± SD was 55±19 days, and the mean time passed since the trauma ± SD was 43±27 months. Twenty-one SCI cases had a complete lesion (46%), and 25 had an incomplete (55%) lesion. The number of patients with SCI classified as AIS A was 19 (41%), as AIS B was 10 (22%), as AIS C was 11 (24%), and as AIS D was 6 (13%). Lesions at T2-T10 were determined in 17 cases (37%), at T11-L2 in 24 (52%), and at L3-S3 in 5 (10%). The etiologies of SCI were as follows: car accidents (n=16, 35%), firearms injury (n=5, 11%), fall from height (n=21, 45%), and other causes (n=4, 9%). The ambulation levels at discharge were therapeutic ambulation (n=33, 72%) and community ambulation (n=13, 28%).

Table 1. Orthosis and ambulation aids of the patients who terminated orthosis use and the reasons for termination

Patient no	Neurological Level and AIS	Orthosis	Ambulation aids	Ambulation level of the patient	Reason for terminating orthosis use
Patient no 5	T9 AIS D	Hinged pAFO	LFO	Community	Improvement
Patient no 6	T11 AIS D	mAFO	LFO	Community	Tightness of the orthosis
Patient no 10	L2 AIS C	mAFO	LFO	Community	Improvement
Patient no 12	L2 AIS B	HKAFOWB	Crutch	Therapeutic ambulation	Improvement, the need for help in application and removal, weight of the orthosis, limitation of movement
Patient no 19	L3 AIS C	Hinged pAFO	LFO	Community	Tightness of the orthosis
Patient no 20	L1 AIS B	Posterior shell	-	Therapeutic ambulation	Improvement
Patient no 24	L3 AIS B	HKAFOWB	Crutch	Therapeutic ambulation	The need for help in application and removal, getting worn out, not suitable for outside
Patient no 27	T4 AIS A	HKAFO	-	Therapeutic ambulation	Terminated after fracture
Patient no 29	T12 AIS C	Posterior shell	-	Therapeutic ambulation	Tightness of the orthosis, the need for help in application and removal
Patient no 37	L3 AIS D	mAFO	Walker	Community	Spasticity, the need for help in application and removal, psychological disturbance, limitation of movement
Patient no 45	T9 AIS A	HKAFOWB	Walker	Therapeutic ambulation	Spasticity, getting worn out

AIS: ASIA impairment scale; HKAFO: hip-knee-ankle-foot orthosis; HKAFOWB: hip-knee-ankle-foot orthosis with waist belt; LFO: lofstrand forearm orthosis; mAFO: metal ankle-foot orthosis; pAFO: plastic ankle-foot orthosis

The prescribed orthoses were as follows: resting splint (n:10), hip-knee-ankle-foot orthosis (HKAFO) (long leg walking brace) [n=21, 46%; (17 (37%) with waist belt)], metal ankle-foot orthosis (short leg walking brace) (n=6, 13%), plastic ankle-foot orthosis [(n=7; hinged 5 (11%), 2 solid (4%)], and posterior shell (n=8, 17%). Five patients did not require any orthosis. The prescribed ambulation aids were as follows: Lofstrand forearm orthosis (n=13, 28%), crutch (n=7, 15%), walker (n=16, 35%), and cane (n=2, 4%). Thirty-three patients were prescribed a manual wheelchair. In addition, 8 patients obtained a motorized wheelchair on their own request.

Use of orthosis

Regular orthosis use was determined in 73% of cases (n=30), and non-use was determined in 27% (n=11). The regular users used the orthosis 5±0.3 days/week and 3±2 hours/day. The mean time since prescription of the orthosis was 29±16 months, and the duration of orthosis use was 22±15 months. The mean orthosis usage index was 0.7±0.3. Orthosis usage index=1 (patients who used their orthosis continuously) was determined in 69% of cases (n=29), and orthosis usage index=0 (patients who never used his/her orthosis) was determined in 8.7% (n=4).

Regular orthosis users used their devices inside (n=14, 30%), outside (n=2, 4%), or both inside and outside (n=14, 30%). The reasons for terminating orthosis use are summarized in Table 1.

Comparison of regular orthosis users and non-users

Patients were separated into two groups: regular orthosis users (patients who were still using their orthosis at the assessment time) and non-users (patients who had discontinued orthosis use). Although the median age of the non-user group was higher than the mean age of regular orthosis users, this was not significant (p=0.287). The median time since trauma was longer in the non-user group, but the difference was not statistically significant (p=0.359). There was no difference between the groups with respect to length of hospital stay and time since prescription of the orthosis (p=0.783 and p=0.919, respectively) (Table 2).

The dichotomous data were also compared between users and non-users (Table 3). The ratio of terminating orthosis use was significantly higher in patients with incomplete SCI (82%) when compared to patients with a complete injury (18%) (χ^2 test; p=0.038; odds ratio=5.885; 95% confidence interval, 1.082-32.014). The ratio of patients with a neurological level at T10 and above was no different from that of patients with a neurological level at T11 and below in terms of orthosis use (p=1.000).

Of the orthosis users, 16 (53%) had modified their orthosis, while only 1 patient (9%) from the non-users had made modifications. The rate of modifying the orthosis was significantly higher in the orthosis user group (p=0.014). The rate of orthosis use among patients with a therapeutic ambulation level (n=24, 80%) was higher than that of patients at the community ambulation level (n=6, 54%), but the difference was not statistically significant. The ability to apply and remove the orthosis independently was determined in 47% (n=14) of the users and 36% (n=4) of the non-users. There was no statistically significant

difference between the groups in terms of ability to independently apply and remove the orthosis (p=0.726). There were no statistical differences with respect to gender, clonus, or spasticity between the orthosis users and non-users.

Resting splint use

Resting splints were given to 13 patients. The mean duration from trauma to prescription of the resting splint was 36.3±24.2 months, and the mean duration of splint use was 21.6±21.9 months. The mean splint usage index was 0.76±0.43. The splint usage index was 1 in 10 patients (77%) and 0 in 3 patients (23%). One patient modified the splint. The splint users used their splints at least 4±3 days per week (max 5±2 days/week). Daily splint wearing duration was 5.5±5 hours. Five patients (38%) stopped using their splints for reasons of tightness (n=2), restlessness during sleep (n=1), and other reasons (n=2). Five patients (38%) were able to apply and remove the splint independently (2 terminated use), while 8 (62%) needed assistance (3 terminated use). No relationship was determined between dependence of application and removal with regular splint use (p=1.000).

Wheelchair

Regular wheelchair use was determined in 33 of 36 patients who had wheelchairs (33 manual, 3 motorized). Five patients used both manual and motorized wheelchairs. The reasons for terminating wheelchair use were not being suitable for outside use (n=1) and no longer required (n=2).

Table 2. Comparison of the data between regular orthosis users and non-users

Factors	Patients with regular orthosis use n=30	Patients who terminated orthosis use n=11	p value
Time since trauma (months) (median)	36	65	0.359
Age (years) (median)	29	38	0.287
Time since prescription of the orthosis (months) (median)	25	28	0.919
Length of hospital stay (days) (median)	57	60	0.783

Locomotion inside and outside

Locomotion outside was provided as follows: wheelchair, 31 patients (67%); walking with orthosis and ambulation aids, 4 patients (9%); walking with orthosis, 2 patients (4%); walking with ambulation aid only, 5 patients (9%); and walking independently without any aid, 2 patients (7%). Locomotion inside was provided as follows: wheelchair, 24 patients (52%); walking with orthosis and ambulation aids, 6 patients (13%); walking with ambulation aid, 5 patients (11%); independently, 2 patients; and crawling, 8 patients (17%).

Other devices used by the patients

Bathing wheelchair (n=6) and wheelchair cushion (n=2) were additional devices obtained by the patients.

Logistic regression analysis

Multivariate logistic regression analysis was performed to predict the factors that would identify the patients who would use their orthosis regularly or terminate orthosis use. The variables thought to be clinically effective in orthosis use (duration since trauma, duration of prescription of orthosis) and variables with a result of $p<0.05$ (sacral sparing) and age as a biological factor were included in the analysis. The best logistic model found, and sacral sparing appeared in this logistic model (p=0.040). The correct classification percentage of the model according to this chart was 73.2%. The chi-square value of the model was 5.133, and this value was significant (p=0.023). The presence of sacral sparing was found to be influential in the direction of decreasing orthosis use (p=0.040) (Table 4).

Discussion

In this study, the rate of termination of orthosis use was found to be 27%. This was a lower rate than in the Coghlan study, which could be related to the longer average injury duration (6.5 years). In another prospective study, the rate of abandonment of RGO (38%) was higher than that of the current study (17). This difference could be related to the higher energy requirement of RGO, and in that study, the authors also highlighted the effect of a high-prescription practice.

In the current study, the need for orthosis modification was greater among those who continued to use their orthosis. Breaking of the orthosis has not previously been found to be related to termination of orthosis use, which is a compatible finding

Table 3. Comparison of the categorical data between regular orthosis users and non-users

Factors	Patients with regular orthosis use n:30	Patients who terminated orthosis use n:11	Odds ratio (95% confidence interval)	p value
Gender (male/female)	22 (73%)/8(27%)	8 (73%)/3 (27%)	0.970 (0.205-4.588)	1.000
Sacral sparing (complete/incomplete)	17(57%)/13(43%)	2 (18%)/9 (82%)	5.885 (1.082-32.014)	0.038*
Spasticity	9 (30%)	4 (36%)	0.750 (0.175-3.215)	0.719
Clonus	5 (17%)	2 (18%)	0.900 (0.148-5.489)	1.000
Application and removal of orthosis (independent/need help)	14 (47%)/16 (53%)	4 (36%)/7 (64%)	1.531 (0.369-6.351)	0.726
Ambulation level (Community/therapeutic)	6 (20%)/20(80%)	5 (45%)/6 (54%)	3.333 (0.754-14.734)	0.103

Table 4. Results of multiple logistic regression analysis

	Odds Ratio	95% Confidence Interval	Wald	p
Step 1				
Age	1.031	0.968-1.098	0.907	0.341
Time since trauma	1.013	0.977-1.050	0.478	0.489
Time since prescription of orthosis	1.013	0.947-1.083	0.135	0.714
Sacral sparing	0.162	0.023-1.124	3.392	0.066
Constant	0.088	NA	2.971	0.085
Step 4				
Sacral sparing	0.170	0.031-0.924	4.206	0.040
Constant	0.692	NA	0.719	0.396

NA: not applicable
*p<0.05

with the current study, and repairs during orthosis use have also been seen to be necessary (13,14). Patients who were willing to continue orthosis use might have chosen to manage problems by modification of the orthosis. The reasons for the low rates of modification among non-users might have been due to a lesser need for the orthosis (improvement of condition), no opportunity for modification, or unwillingness to use the orthosis.

In the current study, the presence of sacral sparing was a predictor of terminating orthosis use. In a follow-up study of 148 complete paraplegics, Waters et al. (18) reported the importance of the initial neurological level in motor recovery. In that study, none of the patients improved with a neurological level above T9, while 38% of subjects with a neurological level at T9 and below had some improvement in hip flexors and knee extensors; 20% of the subjects with a neurological level at T12 and below had sufficient improvement in hip flexors and knee extensors to be able to walk reciprocally with crutches and orthosis. In another follow-up report of 54 incomplete paraplegics, those with muscle strength at the hip flexors and knee extensors above 2/5 in the first month were able to ambulate reciprocally with crutches and orthosis at the 1-year follow-up (19). These two studies show the potential for recovery in SCI. Patients with a lower neurological level and preserved muscle strength, in particular, have the potential for improvement. In the current study, 4 of 11 patients (36%) reported 'improvement' as a reason for terminating orthosis use. Therefore, there may be the possibility of terminating orthosis use in cases with mild neurological deficits.

Some of the reasons for terminating orthosis use were modifiable causes in the current study. The tightness of the orthosis, the weight of the orthosis, and the wearing out of the orthosis could be modified if the patients were reassessed. In addition, reasons associated with the patient could also be modified, such as spasticity, weakness, or psychological disturbance. Previously reported reasons for not using the orthosis are similar to those of the current study, such as spasms, poor fit slowness, bulkiness, difficulty of application, and removal improper environment and fracture (11,17). Problems in toileting have also been reported (17). These results indicate the importance of periodical follow-ups for SCI patients with their orthosis. This would increase the cost-effectiveness of the orthosis prescribed and could prevent musculoskeletal problems in patients without an orthosis. Similar to the results of the current study, previous studies have not shown any relationship of time since trauma, gender, lesion level, or time since application of the orthosis with the termination of orthosis use (13).

In the current study, 2 subjects who were given a hinged p-AFO did not use the orthosis. Ankle braces increase the stability of the ankle and protect the anatomic position (20). In a study of paraplegic or tetraplegic subjects with AIS impairment scale C/D, it has been shown that walking with a hinged ankle-foot orthosis increases the distance walked but has no benefits on foot clearance, compared to walking without an orthosis (21). In that study, 3 subjects used AFO for inside and outside activities, and 2 of the 3 walked with ambulation aids. Another study showed that a solid AFO increased the step length and cadence, while a hinged AFO had no benefits compared to the bare foot (22). In a biomechanical study, the leaf spring AFO decreased hip extension, ankle plantar flexion degrees, and plantar flexion power in the stance-to-swing phase and increased hip flexion degrees and ankle plantar flexion degrees in the swing-to-stance phase, and double limb support time increased with the orthosis (23). Even though the effect of AFO on the hip and knee has been studied in biomechanical studies, the long-term effects have not been well assessed in SCI. Thus, the possible long-term effects of AFO, particularly hinged AFO, must be considered well when prescribing for SCI.

Although a higher lesion level has been reported to be related to increased energy consumption and decreased gait speed, the lesion level of the current study sample was not found to be a factor related to orthosis use (24). It has been shown that a light-weight plastic AFO requires less energy expenditure and provides a higher walking velocity than a heavier AFO (25). A solid AFO is also more beneficial in terms of energy consumption (26). In the current study, there was a higher rate of continued orthosis use with pAFO (4 of 6) than with mAFO (3 of 6).

Thus, energy expenditure is another important point for consideration when prescribing an orthosis.

One of the reasons for terminating orthosis use may be an inappropriate prescription. One of the current study patients (number 24, L3 AIS B) who were given an HKAFO with a waist belt terminated orthosis use because of its unsuitability for outside use and the difficulty of application and removal. A shorter orthosis which would have been easier to apply, and remove may have been more appropriate for this patient. Another patient with a level of T12 AIS D was given a posterior shell and was still using it at the time of assessment. This patient had a recurvatum problem at the knee; so, the posterior shell might have been given to this patient to gain some time until the patient's knee flexors became stronger. He might have not required it if he could have managed to get stronger, but unfortunately, he was prescribed a genu recurvatum orthosis at the follow-up.

The higher usage rate in the current study may be a result of the advantage of being an inpatient clinic, where patient compliance might be increased by immediate solutions to some of the problems. Plassat et al. (9) assessed 43 SCI patients who had been given an orthosis, such as hip-knee-ankle orthosis, reciprocating gait orthosis, functional electrical stimulation, and hybrid orthosis. The usage rate of that study was lower than that of the current study, which may be due to approximately one-fifth of the patients not receiving a rehabilitation and exercise program. On the other hand, it has been reported that orthosis use in spinal cord injury patients is not influenced by prescription from an inpatient or outpatient clinic (10). It has also been reported that the length of training does not influence regular orthosis use (13).

The aims of orthosis use in incomplete SCI are to stabilize the knee and ankle during ambulation, to protect these joints, and to maintain correct alignment of the lower extremities (27). As patients in the current study were interviewed by telephone calls, it is not certain that there was genuine improvement in patients who reported 'improvement' as a reason for terminating orthosis use. Thus, the results reflect the patient's perspective. Deterioration of the alignment of the extremities could not be evaluated by the patient. Therefore, each patient who is given an orthosis must be informed about the aim of orthosis use to prevent termination.

Acquiring wheelchair skills is one of the targets in SCI rehabilitation (28). After an injury, a wheelchair gives the opportunity of locomotion to the disabled. Paraplegics define their wheelchairs as a part of the body (29). In the current sample, 2 patients who became able to walk after discharge stopped using their wheelchairs. One patient reported that he was not able to use the wheelchair outside because of unsuitable environmental conditions. The monitoring of environmental suitability for wheelchairs would increase the participation of SCI patients in social life.

The rate of hip knee ankle foot orthosis use was high in the patients of the current study. Locomotion can not be the reason for this high rate, because only 2 of the HKAFO users used it for locomotion outside, and 1 patient used it for locomotion inside. Although crawling was not a method of locomotion in the view of rehabilitation, 6 patients who had received an HKAFO used this method, which is probably related to the unsuitability of their homes for wheelchair use. Another factor could be the wish of patients to move independently without any devices.

The device usage index and splint usage index were defined to provide information about the time that the orthosis was actively used. It was aimed to compare different devices with each other and also to compare patients with different times since trauma or prescription of the orthosis. However, this measure may be more useful in more objective measuring methods, as it is strongly related to the time reported by the patient.

Limitations of the study

The retrospective design of this study was a limitation, as there was a dependence on hospital records, and it was not possible to report the preserved muscle groups and level changes after discharge. The disadvantages of hospital records are the lack of information and the influence of personal factors of the person taking the records. In addition, good body control and strength are important in the use of orthosis, such as KAFO (30). There was no possibility of evaluating body strength and control at the time of assessment, and it was not possible to assess the psychological status of the patients, which has been previously shown to be related to the use or rejection of RGO (16).

Another limitation of this study may be the absence of a quantitative method of measuring real orthosis wearing time. It has previously been reported that the time stated by the patient is not compatible with the real time that the orthosis is worn (31). There have been some monitorization studies to objectively evaluate the real wearing time of the orthosis, such as monitoring devices that work with pressure or temperature (32). Harvey et al. (33) measured the real wearing time of a thoracolumbosacral orthosis with four pressure-sensitive buttons, and it was reported that environmental conditions did not affect the measurements. Although there was no objective method of measuring the orthosis wearing time, this study can be considered of value, as it shows the natural behavior of patients towards wearing an orthosis. Monitoring techniques may have some problems, such as contact, moisture, etc. (33). In addition, the patient may be influenced with regard to orthosis wearing time by being in an experimental study. Experimental studies can not be conducted over long periods, as represented in this study.

Conclusion

Our results suggest that there is a greater possibility for terminating orthosis use in patients with sacral sparing, and modification of the orthosis is a necessity for regular orthosis users. Wheelchair is the main way of locomotion and is regularly used by spinal cord injury patients.

Ethics Committee Approval: Ethics committee approval was received for this retrospective study from the Institutional Review Board of Turkish Ministry of Health, Ankara Physical Medicine and Rehabilitation Training and Research Hospital (25.06.2010/9781).

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