



Investigation of satisfaction with orthoses and its relationship to duration of use in individuals with different orthotic devices

Kamil YILMAZ^{1,*}, Osman KARACA²

¹Department of Orthotics and Prosthetics, Faculty of Health Sciences, Ondokuz Mayıs University, Samsun, Türkiye

²Department of Physiotherapy and Rehabilitation, Faculty of Health Sciences, KTO Karatay University, Konya, Türkiye

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Abstract

Dissatisfaction with orthosis use can lead to discontinuation and prevent treatment from being fully effective. This study aimed to investigate user satisfaction levels with orthoses used on various body parts and to determine their relationship with the duration of orthosis use. Seventy-eight orthotic users with a mean age of 12.45 ± 10.1 years participated in this observational study. Satisfaction was assessed using the Quebec User Evaluation of Satisfaction with Assistive Technology (QUEST 2.0) questionnaire, which includes subsections for device satisfaction, service satisfaction, and a total score, and the Satisfaction Evaluation Survey (SES). The QUEST results indicated a mean device satisfaction score of 4.20 ± 0.75 , service satisfaction of 4.38 ± 0.77 , and a total score of 4.26 ± 0.73 , while the SES score averaged 13.95 ± 5.48 . No significant differences were observed in satisfaction levels between lower extremity and trunk orthosis users ($p > .05$), or between ankle-foot orthosis and scoliosis brace users ($p > .05$). Weak positive correlations were observed between daily orthosis wearing time and the QUEST subsections for device satisfaction ($r = .364$, $p = .001$), service satisfaction ($r = .281$, $p = .014$), and total score ($r = .385$, $p = .001$), while a weak negative correlation was noted with SES scores ($r = -.306$, $p = .007$). Overall, participants reported high satisfaction with their orthoses, regardless of the body part supported, with a weak correlation observed between daily wearing time and satisfaction levels.

Keywords: satisfaction, orthosis, QUEST questionnaire, assistive technology, orthotic devices

1. Introduction

Orthoses are external devices that are usually used for a temporary condition or period of time for various purposes such as maintaining joint mobility, supporting weak musculature or correcting deformities (1). They are used to treat a wide range of problems and are classified according to anatomical site, type of material used, purpose of application or mechanism of action. Orthoses, which are widely used in different designs and features for the lower limbs, upper limbs, and trunk, are also an important part of the rehabilitation process (2). According to the data obtained from the Directorate of Social Security Institution, it has been reported that a total of 19,381 orthoses were manufactured in Turkey between 2006 and 2011, including 9,588 lower extremity, 8,214 spine, and 1,579 upper extremity orthoses (3).

Satisfaction is defined as the customer's experience after receiving a product or service and indicates the harmony of the service or product with needs and expectations. Satisfaction with orthosis or prosthesis refers to the matching of users'

expectations and experiences with both the devices they use and the service they receive from experts and/or centers in this process (4).

Patient satisfaction is an important factor in treatment compliance (5). Some researchers believe that social and economic factors, as well as aesthetic elements and comfort, affect the level of satisfaction with orthosis and prosthesis and may increase patients' compliance with the treatment (6). Sometimes dissatisfaction with assistive devices such as orthoses due to pain, aesthetic concerns, skin irritation, etc. may cause the orthosis not to be used or the treatment not to be performed as desired. A study has shown that 60% of patients using thoracolumbar sacral orthosis after spinal fracture would prefer not to use the brace if given the option, and 73% of patients removed the brace earlier than recommended (7). In a study investigating the satisfaction of ankle-foot orthosis (AFO) users, it was reported that more than one-third of the participants did not like the appearance of the orthosis and

responded negatively due to pain, discomfort, abrasion or irritation (8). In addition, it has been observed that brace treatment has negative effects on quality of life and treatment satisfaction in terms of psychological, motor, social and school environment in patients with adolescent idiopathic scoliosis (9). Tezel et al. investigated AFO satisfaction in children with cerebral palsy and reported that among the reasons for not using orthosis, the reasons such as finding the orthosis unattractive and difficult to use were frequently cited (10). On the other hand, there are also studies where orthotic satisfaction levels were found to be high (11-14).

Assessing the satisfaction levels of individuals using orthoses, identifying the underlying causes of dissatisfaction, and implementing targeted improvements are expected to positively impact both treatment adherence and overall therapeutic outcomes. Despite its clinical significance, limited research has been conducted in Turkey to evaluate the satisfaction levels of orthotic users. The primary aim of this study was to assess satisfaction levels associated with orthoses used for different anatomical regions and to examine the relationship between the duration of orthosis use and satisfaction scores. Furthermore, understanding how daily orthosis usage impacts satisfaction is crucial, as it provides insights into the factors influencing compliance and the overall success of orthotic interventions. We hypothesized that satisfaction levels might differ based on the anatomical region of orthosis use and that a potential correlation might exist between satisfaction scores and the duration of use.

2. Materials and Methods

2.1. Study Design and Participants

In this study, which was planned as an observational research, 78 orthosis users between the ages of 2-60 years participated. The study population consisted of orthotic users treated in Special Education and Rehabilitation Centers, hospitals and branch centers in Konya between September 2023 and January 2024. Data were collected from a total of 8 different institutions.

Voluntary individuals who had been using orthotics for at least one month were included in the study, while individuals who had been using orthotics for less than one month and were unwilling to complete the questionnaires required for the study were excluded.

GPower 3.1.9.2. program was used to decide the sample size. Based on the QUEST questionnaire service satisfaction score of the study conducted by Magnusson and Ahlström, the effect size was calculated as 0.81 (13). For this effect size and 95% statistical power (alpha: 0.05, beta: 0.05), a total of 68 orthotic users should be included in the study. To increase the power of the study and to compensate for possible missing data, 78 people were included in the study.

2.2. Demographic Data

Demographic and clinical characteristics including age, gender, height, weight, total and daily orthosis wearing time,

and type of orthosis were recorded.

2.3. Quebec User Evaluation of Satisfaction with Assistive Technology (QUEST 2.0) Questionnaire

The QUEST questionnaire is a standardized and widely used questionnaire developed in 1996 to assess satisfaction with the use of assistive technology devices (15,16). The 12-item questionnaire includes 8 items about the characteristics of the device and 4 items about the assistive technology service. For children (under 12 years old, in this study) and those unable to complete the questionnaire, it is filled out by their parents. Responses are rated on a 5-point Likert scale for satisfaction (1=not at all satisfied and 5=very satisfied). The questionnaire has 3 scores: device satisfaction, service satisfaction and total score. Individuals/parents who answer the questionnaire are finally asked to select and mark 3 items that are important to them out of 12 items (17). Turkish adaptation of the questionnaire was conducted by Yurt et al. (1) According to the average of the scores obtained from the questionnaire, 1-1.49 was interpreted as not satisfied at all, 1.5-2.49 as not satisfied, 2.5-3.49 as somewhat satisfied, 3.5-4.49 as quite satisfied and 4.5-5 as very satisfied.

2.4. Satisfaction Evaluation Survey (SES)

The survey developed by Erel, and colleagues is structured according to the Likert scale, comprising 7 questions related to orthotic acceptance, satisfaction, and adherence to the recommended program. Responses are 5-point scale, and the order of the options is from best to worst. The best possible score is 7 and the worst possible score is 35 (18). The scores obtained as a result of the survey were interpreted as very satisfied between 7-10.49, quite satisfied between 10.5-17.49, somewhat satisfied between 17.5-24.49, not satisfied between 24.5-31.49 and not satisfied between 31.5-35.

2.5. Statistical Analysis

Data analysis was performed using the statistical package program SPSS 25 (IBM Inc., Armonk, NY, USA). Numbers, percentages, mean, standard deviation, median and interquartile values were used to evaluate the data. The conformity of the variables to normal distribution was determined by Kolmogorov-Smirnov test and visual methods. Comparison of the differences between the two groups was performed using the Mann-Whitney U test since parametric pretest conditions were not met. The relationship between two continuous variables was examined using Spearman's rho correlation test since the necessary conditions for parametric testing were not met. The correlation coefficient (r) was interpreted as very weak (.00-.25), weak (.26-.49), moderate (.50-.69), strong (.70-.89) and very strong (.90-1.0) (19). A level of $p < .05$ was considered statistically significant.

3. Results

A total of 78 orthosis users participated in the study, with a mean age of 12.45 ± 10.1 years. 78.2% (n=61) of the questionnaires were completed by a parent, while 21.8% (n=17) were completed by the user themselves. Of the orthosis

users, 57.7% were female and 42.3% were male. The mean QUEST questionnaire device satisfaction score was 4.20 ± 0.75 , service satisfaction score was 4.38 ± 0.77 and total score was 4.26 ± 0.73 . The mean SES score was 13.95 ± 5.48 . There were 43 orthosis users under the age of 12 and 35 users aged 12 and above, with similar orthosis satisfaction scores ($p > .05$).

Total duration of orthotic use was 59.97 ± 65.12 months and daily orthosis wearing time was 7.71 ± 6.16 hours. The daily orthosis wearing time was significantly shorter among users under the age of 12 ($p < .001$). Demographic data, questionnaire satisfaction scores and duration of orthosis use are given in Table 1.

Table 1. Participants' demographic data, questionnaire satisfaction scores and duration of orthosis use

		Min	Max	Mean	SD	p
Age (years)	All subjects (n=78)	2.00	60.00	12.45	10.10	
BMI (kg/m2)	All subjects (n=78)	6.49	30.12	17.61	4.87	< .001
	Age < 12 years (n=43)	6.49	24.32	14.79	3.79	
	Age > 12 years (n=35)	14.81	30.12	20.77	3.93	
QUEST Questionnaire Device satisfaction score	All subjects (n=78)	1.00	5.00	4.20	0.75	.829
	Age < 12 years (n=43)	1.00	5.00	4.18	0.84	
	Age > 12 years (n=35)	2.75	5.00	4.23	0.63	
QUEST Questionnaire Service satisfaction score	All subjects (n=78)	1.00	5.00	4.38	0.77	.887
	Age < 12 years (n=43)	1.00	5.00	4.34	0.82	
	Age > 12 years (n=35)	2.50	5.00	4.42	0.72	
QUEST Questionnaire Total score	All subjects (n=78)	1.00	5.00	4.26	0.73	.774
	Age < 12 years (n=43)	1.00	5.00	4.21	0.81	
	Age > 12 years (n=35)	3.00	5.00	4.32	0.62	
Satisfaction Evaluation Survey score	All subjects (n=78)	7.00	29.00	13.95	5.48	.471
	Age < 12 years (n=43)	7.00	26.00	14.23	5.30	
	Age > 12 years (n=35)	7.00	29.00	13.60	5.76	
Total duration of orthosis use (month)	All subjects (n=78)	5.00	276.00	59.97	65.12	.286
	Age < 12 years (n=43)	5.00	96.00	37.89	23.60	
	Age > 12 years (n=35)	6.00	276.00	86.73	86.68	
Daily orthosis wearing time (hours)	All subjects (n=78)	0.85	24.00	7.71	6.16	< .001
	Age < 12 years (n=43)	1.00	23.00	5.48	4.51	
	Age > 12 years (n=35)	0.85	24.00	10.62	6.83	
Gender		n		%		
	Female	45		57.7		
	Male	33		42.3		

$p < .05$: Bold, statistically significant differences, n: Number of participants, Min: Minimum, Max: Maximum, SD: Standard Deviation, BMI: Body Mass Index, QUEST: Quebec User Evaluation of Satisfaction with Assistive Technology, Mann-Whitney U Test.

Cerebral palsy (n=33), scoliosis (n=16) and foot deformity (n=11) were the most common reasons for orthotic use. Most patients with cerebral palsy were level III (n=10) and IV (n=9) according to Gross Motor Function Classification (GMFC). AFO (n=49), scoliosis brace (n=16) and knee-ankle-foot orthosis (KAFO) (n=5) were the most commonly used orthoses (Table 2).

The three items that the participants considered most important in the QUEST questionnaire regarding orthosis and service satisfaction were usefulness, comfort, and ease of use, respectively. The three least important items were repair/service, weight of the orthosis and service until the orthosis was received (Table 3).

The number of people who had previously discontinued orthosis use for any reason was 15. Of these, 40% (n=6) stated

that they had discontinued orthosis use because it was uncomfortable, 26.6% (n=4) because it was incompatible and 13.3% (n=2) because they did not want to accept it. In addition to its unaesthetic appearance and rigid structure, non-orthosis reasons were other reasons for discontinuation of orthosis use.

There was no difference in satisfaction with lower extremity and trunk orthoses ($p > .05$). There was also no difference between the satisfaction levels of the most commonly used AFO and scoliosis brace ($p > .05$) (Table 4).

There was a weak positive correlation between the daily orthosis wearing time and device satisfaction ($r = .364, p = .001$), service satisfaction ($r = .281, p = .014$) and total score ($r = .385, p = .001$) and a weak negative correlation with SES ($r = -.306, p = .007$) (Table 5).

Table 2. Distribution of diagnoses and types of orthoses used among participants

	n	%
Diagnosis		
Cerebral palsy	33	42.3
Scoliosis	16	20.5
Foot deformity	11	14.1
Gait disorder	5	6.4
Spina Bifida	3	3.8
Epilepsy	3	3.8
Developmental retardation	2	2.6
Other diagnoses	5	6.4
Type of orthosis		
AFO	49	62.8
Scoliosis Brace	16	20.5
KAFO	5	6.4
Insoles	3	3.8
Orthopedic shoes	2	2.6
Other orthoses	3	3.8
Total	78	100

n: Number of participants, AFO: Ankle-foot orthosis, KAFO: Knee-ankle-foot orthosis

Table 3. Items that participants found most important in the QUEST questionnaire regarding orthosis and service satisfaction

Questionnaire content	n	%
Dimension	17	21.8
Weight	11	14.1
Adjustments	14	17.9
Robustness and safety	34	43.6
Durability	20	25.6
Ease of use	36	46.2
Comfort	40	51.3
Effectiveness	64	82.1
Service until delivery	12	15.4
Repair/Service	10	12.8
Professional Service	17	21.8
Regular follow-up services	14	17.9

n: Number of participants

4. Discussion

In our study, we investigated user satisfaction with orthoses used for various body parts, and additionally examined the relationship between the duration of orthosis usage and satisfaction levels. Our findings revealed a relatively high level

of satisfaction with orthoses. However, no significant differences was observed in satisfaction levels among orthoses employed for different body regions. On the other hand, we found a weak, albeit significant, correlation between daily orthosis wearing time and satisfaction levels.

Orthoses play a crucial role in addressing various health conditions by maintaining joint mobility, supporting weak muscles, immobilizing affected areas, reducing energy expenditure, and correcting deformities (1). The appropriate use of orthoses directly affects the success of the treatment or rehabilitation process. However, various reasons may affect the appropriate use of orthoses. The occurrence of pain, discomfort, tissue damage in the usage area (8), the appearance of the orthosis (8,10), usage difficulties (10), and various psychological factors (9) adversely affect user satisfaction during utilization. In our study, when we looked at both the QUEST questionnaire device satisfaction (4.20 ± 0.75), service satisfaction (4.38 ± 0.77) and total score (4.26 ± 0.73) and SES results (13.95 ± 5.48), we concluded that the users were quite satisfied with their orthoses. Magnusson and Ahlström have investigated prosthetic-orthotic user satisfaction in Sierra Leone and Malawi using the QUEST questionnaire, concluding that all participants were quite satisfied with their orthoses, with device scores averaging 3.8 ± 0.7 and service scores averaging 4.0 ± 1.0 (13). Chen et al. have conducted a similar study in Taiwan, reporting that users were quite satisfied with their orthoses, with QUEST questionnaire scores of 3.74 ± 0.64 for the device, 3.56 ± 0.76 for the service, and a total score of 3.67 ± 0.64 (2). The results of our study are in line with the results of both studies.

There are several studies in the literature in which satisfaction was evaluated using different questionnaires. In a study conducted in Japan in which compliance and satisfaction with lower extremity prosthesis-orthotics were evaluated with a numerical rating scale, the mean satisfaction score was 8.5/10 (14). Another study in the Netherlands evaluated service satisfaction at prosthetic-orthotic facilities using a modified SERVQUAL questionnaire, with an average service score of 8.1 (20). In another study investigating prosthesis-orthotics satisfaction in Iran, according to the results of the Orthotics and Prosthetics Users' Survey questionnaire (OPUS), the average device satisfaction was reported as 74.00 ± 19.80 and the average service satisfaction as 72.12 ± 15.90 (11). The literature generally shows high satisfaction levels with orthoses. However, this should not be taken to mean that there is no need to increase satisfaction with orthosis use or that there is nothing else to be done. In order to increase device satisfaction, which is lower than service satisfaction, prosthesis-orthotics manufacturers can be contacted, and various improvements can be made by taking into account the problems and wishes of the patients.

Table 4. Comparison of satisfaction levels according to anatomical regions and most commonly used orthosis types

	Lower limb Orthoses (n=61) Mean ± SD Median (Q1-Q3)	Body Orthoses (n=17) Mean ± SD Median (Q1-Q3)	p	Ankle-foot Orthosis (n=49) Mean ± SD Median (Q1-Q3)	Scoliosis Brace (n=16) Mean ± SD Median (Q1-Q3)	p
QUEST device satisfaction	4.13 ± 0.81 4.18 (3.75-4.87)	4.44 ± 0.44 4.50 (4.15-4.75)	.240	4.15 ± 0.69 4.12 (3.75-4.87)	4.41 ± 0.43 4.50 (4.07-4.71)	.304
QUEST service satisfaction	4.30 ± 0.82 4.50 (3.75-5.00)	4.65 ± 0.50 4.75 (4.37-5.00)	.201	4.28 ± 0.71 4.25 (3.75-5.00)	4.63 ± 0.51 4.75 (4.31-5.00)	.139
QUEST total score	4.18 ± 0.78 4.25 (3.71-4.90)	4.54 ± 0.41 4.62 (4.37-4.81)	.136	4.17 ± 0.69 4.18 (3.65-4.87)	4.51 ± 0.41 4.59 (4.37-4.75)	.134
Satisfaction Evaluation Survey score	14.10 ± 5.65 14.00 (9.00-18.00)	13.41 ± 4.96 12.00 (9.50-16.50)	.689	14.47 ± 5.72 14.00 (9.50-18.00)	13.81 ± 4.83 12.00 (10.25-17.25)	.760

p < .05: Bold, statistically significant differences; SD: Standard Deviation; n: Number of participants, Q1: Quartile 1; Q3: Quartile 3, QUEST: Quebec User Evaluation of Satisfaction with Assistive Technology, Mann-Whitney U Test.

Table 5. The relationship between QUEST questionnaire scores and SES scores and orthosis wearing time

	Total duration of orthosis use		Daily orthosis wearing time	
	r	p	r	p
QUEST device satisfaction	-.041	.734	.364 ^a	.001
QUEST service satisfaction	.071	.549	.281 ^a	.014
QUEST total score	.004	.972	.385 ^a	.001
Satisfaction Evaluation Survey score	-.086	.468	-.306 ^a	.007

p < .05: Bold - statistically significant, Spearman's correlation coefficient, r: correlation coefficient, ^a: Weak correlation (.26-.49), QUEST: Quebec User Evaluation of Satisfaction with Assistive Technology.

In our study, we found that the three most important items related to orthosis and service satisfaction were effectiveness, comfort, and ease of use, respectively. In the study conducted in Sierra Leone and Malawi, all participants reported that access to repair and service, regular follow-up services and device durability were the three most important items, respectively. On the other hand, these items were also found to be the most important items in Malawi, while regular follow-up services, access to repair and service, and comfort of devices were found to be the three most important items in Sierra Leone (13). In the study conducted in Taiwan, the three most important items were comfort, durability-safety and cost, respectively (2). These differences across studies may stem from the socioeconomic and healthcare infrastructure disparities between regions. For example, in low-income countries like Sierra Leone and Malawi, the emphasis on repair and service access likely reflects the scarcity of healthcare resources and the difficulties users face in accessing follow-up services. In contrast, in higher-income settings, factors such as comfort and ease of use may take precedence due to the greater availability of healthcare services and follow-up care. Our findings, which prioritize effectiveness, comfort, and ease of

use, align with the basic principles necessary for orthosis functionality and user adherence. In our study, the three least important items in order of importance were repair/service services, weight of the orthosis and service until the orthosis was delivered. In the Taiwan study, the three least important items were the service until the device was received, adjustments and regular follow-up services (2). It seems that each user decides on the items that they find important considering the problems they experience with orthotic use. In our study, effectiveness, comfort, and ease of use, which were considered important by the users, are actually the basic elements necessary to use an orthosis. As we have seen in previous studies, the discomfort of the orthosis to the user (8) and difficulties in use (10) are among the most common reasons for not using orthosis in the clinic. In this study, similar to other studies, we learned that 10 out of 15 people who had previously discontinued the use of orthosis for any reason made this decision due to the discomfort and incompatibility of the orthosis. In low-income countries such as Sierra Leone and Malawi, access to repair and servicing, regular follow-up services and device durability are the three most important items, possibly reflecting the challenges of access to services

in these countries. The data obtained from the study confirms this idea. It was reported that 39 percent of the patients participating in the study had no income and only one fifth had a regular income (13).

The type of orthosis used, duration of use, or reasons for orthosis use are likely to affect satisfaction levels. Although the purposes, mechanisms of action, and materials of the orthoses differ, the satisfaction levels associated with their use remain a clinically intriguing topic. In our study, we compared the satisfaction scores of the most commonly used lower limb orthoses and trunk orthoses, as well as AFOs and scoliosis braces. However, we did not observe significant differences in either comparison. On the other hand, Chen et al. concluded that satisfaction scores were different between orthosis types. The individuals who participated in this study used various orthoses, including foot orthosis (FO), AFO, KAFO, hip-knee-ankle-foot orthosis (HKAFO), spinal brace and pressure garment. However, the main reason for this difference was that the satisfaction scores of individuals using pressure garments were higher. No difference was found in the comparison of other orthosis types other than pressure garments. Therefore, the results obtained from the two studies are parallel. One of the other possible reasons that may affect satisfaction is the duration of orthosis use. Chen et al. stated that the longer the duration of orthotic use, the lower the satisfaction scores (2). In another study, it was stated that patients who received service for less than one year had higher service satisfaction levels when the time elapsed after the service was taken into consideration (11). In our study, we did not make a comparison between satisfaction scores according to the duration of orthosis use because the duration of orthosis use was very wide range. On the other hand, we investigated the relationship between the duration of orthosis use and satisfaction scores. While we did not find a relationship between total duration of orthosis use and satisfaction scores, we found a weak relationship between daily orthosis use time and satisfaction scores. Similar to our study, Çankaya et al. did not find a relationship between total orthosis use time and orthotic satisfaction scores in their study, while they found a weak relationship between daily orthosis use time and satisfaction scores (21). It is seen that the orthosis users participating in both studies have similar characteristics such as age and BMI averages, the most common reasons for orthosis use (SP), the most commonly used orthotic types (AFO), and the rate of completion of the questionnaires by a parent (78.2-82.9%). On the other hand, the mean daily orthosis wearing time was 7.71 ± 6.16 hours in our study and 5.22 ± 4.04 hours in the other study. The similarity in demographic data may have led to similar results. A possible factor for the increased satisfaction scores of orthosis users could be the comfort provided by the orthoses. As a reflection of comfort, an increase in the daily orthosis wearing time can be expected.

In the light of the data we obtained, the hypothesis that there may be a difference between the satisfaction levels of

orthosis used in different body parts, which is a part of our hypothesis, was rejected, on the contrary, the hypothesis that there may be a relationship between the duration of orthosis use and satisfaction scores was confirmed.

Our study has certain limitations. Different types of orthoses are designed for various purposes and are used for varying durations. For instance, a scoliosis brace may be used for a different period compared to an AFO or an insole. Additionally, the materials used in orthosis fabrication can vary significantly, ranging from rigid to semi-rigid or soft. Some orthoses are intended for use only while lying down, whereas others are designed for outdoor activities. These numerous variables could potentially influence satisfaction scores. It is a limitation of this study, as well as many previous studies on orthosis satisfaction, that such factors were not or could not be fully accounted for.

According to our results, users were quite satisfied with their orthoses. This satisfaction did not differ according to the body parts, or the type of orthosis used. In addition, we found a weak correlation between daily orthosis use time and orthosis satisfaction scores. We believe that regular evaluation of user satisfaction levels of orthoses used in the treatment and rehabilitation of many problems by both manufacturers and other health professionals and elimination of the detected negativities will contribute positively to the success of the treatment.

Conflict of interest

The authors declare no potential conflicts of interest regarding this article.

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Authors' contributions

Concept: K.Y., O.K., Design: K.Y., O.K., Data Collection or Processing: K.Y., O.K., Analysis or Interpretation: K.Y., O.K., Literature Search: K.Y., O.K., Writing: K.Y., O.K.

Ethical statement

Before the start of the study, ethics committee approval was obtained from the ethics committee of KTO Karatay University Faculty of Medicine on 21.09.2023 with the number 2023/035. Written informed consent was obtained from the participants who were informed about the study and the study was conducted in accordance with the Declaration of Helsinki.

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