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Effects of different physiotherapy practices on pain and functionality in patients with myofascial pain syndrome

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Abstract

The purpose of the present work was to compare the efficacy of trigger point-focused ultrasound therapy and kinesio taping in patients with myofascial pain syndrome. Forty-five patients diagnosed with myofascial pain syndrome were enrolled and divided into three groups by simple randomization. The first group received ultrasound on trigger points, the second group underwent kinesio taping, and the third group received placebo ultrasound therapy. In addition to these applications, conventional treatment (Hotpack, Transcutaneous Electrical Nerve Stimulation) was applied to all groups. All applications were performed in 15 sessions, five days a week, over three weeks. Cervical range of motion, pain status, pressure pain threshold, and functional status/disability were evaluated before and following the treatments by a standard goniometer, Visual Analogue Scale (VAS), algometer, and Neck Disability Index, respectively. VAS values decreased and algometer values increased in all groups following the treatment ($p<0.05$). No difference was found between the ultrasound and control group or the kinesio taping and control group in the inter-group comparison of VAS and algometer ($p>0.05$), while the ultrasound group values were higher in comparison with the kinesio taping group ($p<0.05$). Total limitation of the ROM of the neck decreased in all three groups after treatment ($p<0.05$). In the inter-group comparison, the kinesio taping group was better in comparison with the other groups ($p<0.05$). The intra-group comparison for patients' functional status and algometer values detected an enhancement in all three groups, whereas the inter-group comparison showed that the ultrasound group was better in comparison with the other groups ($p<0.05$). We think that trigger point ultrasound therapy can be added to the treatment programme to decrease pain and increase functionality, and kinesio taping can be added to the treatment programme to increase the normal ROM in patients with myofascial pain syndrome.

Keywords: Myofascial pain syndrome, static ultrasound, pain, kinesio tape

Introduction

The continuously developing technology and the technological opportunities it has created have led to an increase in sedentary lifestyles, resulting in the emergence of musculoskeletal problems [1]. Myofascial pain syndrome (MPS) is among the most frequently observed reasons for musculoskeletal pain [2]. MPS represents a chronic pain syndrome and musculoskeletal disease characterised by hypersensitive points named trigger points in muscle and connective tissue, which cause pain with palpation, and signs and symptoms, including pain, spasm, stiffness, sensitivity, loss of strength, fatigue, reduced normal joint range of motion (ROM), and not often autonomic dysfunction [3,4]. The diagnosis of MPS is made on the basis of a detailed anamnesis and physical examination findings; there is no definitive diagnostic algorithm. The diagnostic criteria comprise physical examination findings. Other diseases are excluded by laboratory, electrophysiological examination and imaging methods [1,4]. The purpose of treating MPS is to relieve pain, ensure appropriate posture, flexibility, full joint ROM, and sufficient muscle strength for the impacted muscle, and reduce the possibility of recurrence by eliminating the causative factors [5-7]. Joint ROM, pressure-pain threshold, and Neck Disability Index, (NDI) are frequently used assessments in neck patients. Two types of approaches are used in treating MPS: non-invasive and invasive. Non-invasive techniques include transcutaneous electrical nerve stimulation (TENS), massage, ultrasound (US), superficial heat agents (hot pack), laser, exercise, ischemic compression, stretching, and spray. Invasive techniques include

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acupuncture, local anaesthetic trigger point injection, botulinum toxin trigger point injection, and dry needling practices [8]. Although these approaches can be applied as a treatment programme in various combinations to treat MPS, there is insufficient evidence for the appropriate treatment programme [9,10]. Different treatment approaches are used to treat MPS, such as manual therapy methods, medical classical massage, electrotherapy, hydrotherapy practices, posture exercises, strengthening and stretching exercises, myofascial stretching, dry needling and acupuncture, botox, medical treatment, and ergonomic changes. However, psychological support and combating the causative factors are required in addition to these methods [11]. The purpose of the "kinesio taping" technique, whose use has increased significantly in the last decade in the musculoskeletal system and myofascial pain and which is a novel treatment option, is to support the tissue that allows the body to move due to its thin and elastic structure and relieve the pressure in the neural and sensory receptors in the tissue. Studies have demonstrated that due to the decreased pressure, blood and lymph circulation increases, the healing process in MPS is accelerated, and pain decreases [12]. Recent studies have started to include trigger point US therapy among the practices for pain management. The literature review shows that studies conducted using the trigger point US technique (static ultrasound) are effective on trigger points in MPS [13,14]. However, no research comparing the efficacy of kinesio taping and Static US therapy in patients with MPS has been found.

The purpose of the present research was to compare the impacts of kinesio taping and trigger point US therapy applied to trigger points in addition to the conventional physiotherapy programme for patients with MPS on joint ROM limitation, pressure pain threshold, and neck disability level.

Material and Methods

This prospective randomised controlled trial aimed to compare the impacts of kinesio taping and trigger point US therapy applied to trigger points, as well as standard physiotherapy treatments, in patients with MPS on joint ROM total limitation, pressure pain threshold, and neck disability level. Individuals were informed about the research purpose, its duration, treatments, and evaluations to be performed prior to the study and signed a voluntary consent form. The ethical approval was received from the Non-Interventional Research Ethics Committee of Hasan Kalyoncu University, the Faculty of Health Sciences, with permission numbered 2017/05 on 02.05.2017.

The research involved individuals aged between 18-60 and diagnosed with MPS. Individuals diagnosed with cervical disc herniation, limitation of neck ROM, advanced cervical osteoarthritis, radiculopathy or myelopathy, fibromyalgia, and rheumatic disease, having undergone cervical or shoulder surgery, having received physical therapy within the last six months, and having kyphosis or scoliosis were excluded from the research. Sixty-one individuals who agreed to take part in the research were evaluated. According to the initial evaluation results, eight individuals not meeting the inclusion criteria were excluded from the research. We calculated the sample size based on power analysis (G*power version 3.1.9.2, Axel Buchner, Universität Kiel) with a large effect size of d: 0.8. With two-sided test (alpha=5%, power=95%), we estimated that based on the headache frequency variable, nine people were determined per group [15]. The remaining 53 participants were assigned to three groups by using a simple randomization closed envelope method, US group (Group 1) (n=17), kinesio taping group (Group 2) (n=18), and control group (Group 3) (n=18). Eight participants were excluded from the research since they did not continue the exercise programme during the intervention. Therefore, the work was completed with 45 individuals in total: 15 in the US group, 15 in the kinesio taping group, and 15 in the control group (Figure 1). All groups included in the study underwent conventional physiotherapy. Conventional physiotherapy included 15 minutes of TENS, 15 minutes of hot pack application, posture exercises, and stretching exercises for the pectoralis major and minor muscles applied to all individuals for 5 days a week. In addition to conventional treatment, the US group underwent a total of 5 minutes of trigger point US therapy, with at least 10 seconds on each trigger point and at 1.5 watt/cm^2, as five sessions per week for three weeks. The other trigger point was switched to when the patient felt heat during the US application. In the kinesio taping group, in addition to conventional treatment, kinesio tape was applied to the upper part of the trapezius muscle using I-tape and muscle technique application, 3 sessions per week for 3 weeks to provide inhibition. The control group underwent only conventional physiotherapy. The same physiotherapist treated individuals in all groups.

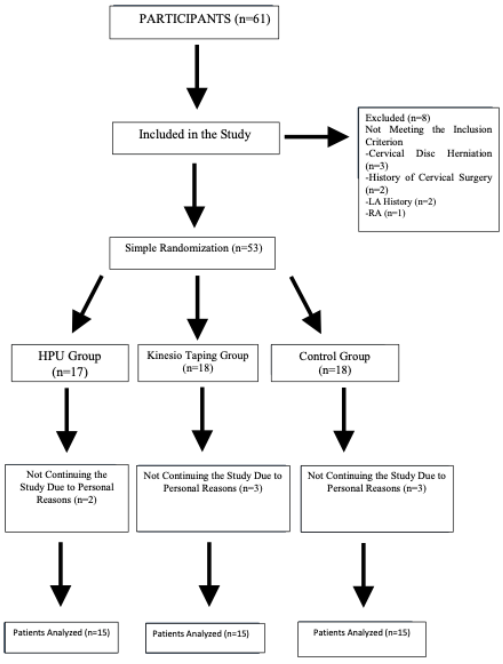

Figure 1. Flowchart

The initial evaluations of the individuals enrolled in the research were performed immediately before the treatment programmes.

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The study was terminated by performing the second evaluation of all individuals at the end of the third week.

The individuals' cervical flexion, extension, lateral flexion, and rotation normal ROM was assessed by a clinical goniometer, pain intensity was measured by the Visual Analogue Scale (VAS), pressure pain threshold values were evaluated by an algometer (Baseline Evaluation Instruments: Fabrication Enterprises, USA), and patients' functional status was measured by the NDİ [16-19].

Clinical Goniometer: The patients' cervical normal ROM was measured using a clinical goniometer (Baseline Evaluation Instruments: Fabrication Enterprises, USA) for flexion, extension, lateral flexion, and rotation movements, with patients sitting upright in a chair [15].

Visual Analogue Scale: The VAS evaluated neck pain intensity at rest (ICC validity coefficients of 0.79 and 0.97, respectively). The patients were requested to mark their pain levels on the Visual Analogue Scale (VAS) 0-10 centimetres (cm) in length. The value of the marked point was measured using a 100-mm ruler. On the scale, zero refers to "no pain," and 10 refers to "unbearable pain" [17].

Algometer: The patients' pain sensitivity to pressure was evaluated using algometer. Three measurements were made on the trigger points in the trapezius muscle prior to and following the treatment, and the average of the measurements was taken. Before the measurement, the points where the trigger points were located were marked, and the algometer was placed at a right angle to the said points. The patients were asked to indicate the moment they first felt the pain, the value on the screen was read, and the pain threshold was recorded in pounds (1 kg=2.2 pounds). In the sensitivity and specifi city analysis of diagnosis by the pressure algometer, a case where the threshold was ≤3 kg, or the diff erence in threshold between both sides was ≥2 kg, was considered MPS as based on Fischer's method [18,19].

Neck Disability Index: The "Neck Disability Index" (NDI) measures the degree of neck disability and the impacts of pain on daily living. The NDI is a self-reported questionnaire with 10 questions related to pain disability in the neck region. Each item can receive a score from 0 to 5 (0=no disability and 5=full disability), and the sum of the scores determines the level of disability. More specifically, higher scores imply greater disability. The scoring disability interpretation was: 0–4=none; 5–14=mild; 15–24=moderate; 25–34=severe; over 34=complete [20].

The 'Shaphiro-Wilk' test investigated the data's conformity to a normal distribution, and the "Kruskal-Wallis" and "All Pairwise" multiple comparison tests were utilised for the purpose of comparing non-normally distributed variables in three independent groups. The ''Wilcoxon signed-rank'' test was employed for non-normally distributed variables when comparing the dependent groups at two different times. The ''Chi-square'' test was conducted with the objective of testing the relationships between categorical variables. As descriptive statistics, mean±standard deviation was presented for numerical variables, while number and percentage values were presented for categorical variables. For statistical analysis, SPSS for Windows version 22.0 package programme was utilised, and p=0.05 was regarded as statistically significant.

Results

In our research, which compared the impacts of kinesio taping and trigger point US therapy applied to the trigger points of patients with MPS on pressure pain threshold, total ROM limitation, and neck disability , all individuals in the three groups had similar age, sex, and body mass index (BMI) values (p>0.05) (Table 1).

The pre-treatment ROM limitation values of the patients were similar in all groups, except for the right rotation direction (p>0.05). After the treatment, whereas a difference was revealed between the groups in the right and left rotation and lateral flexion values (p<0.05), no difference was observed between the groups in the other directions (p>0.05) (Table 2). Upon comparing the groups for the right lateral flexion, left lateral flexion, right rotation, and left ROM, a decrease in favour of the kinesio taping group was identified (p=0.001, p=0.045, p=0.003, p=0.016).

The groups' pre-treatment pain intensity, pressure pain threshold, and NDI values were similar (p>0.05). The intra-group comparison of the patients' pain intensity values found a decrease in the pain intensity of all three groups following the treatment (p<0.05) (Table 3). A difference was revealed in the inter-group comparison of pain intensity following the treatment (p<0.05) (Table 4). The pairwise group comparisons found no difference between the US and kinesio taping group (p>0.05) while identifying a difference between the US and control group in favour of the US group (p<0.05).

Table 1. Groups' distribution in terms of age, BMI, and sex

	Group 1 (n=15)		Group 2 (n=15)		Group 3 (n=15)		Chi-square	p*
	Mean±Std. deviation		Mean±Std. deviation		Mean±Std. deviation			
Age	37±8.8		39.3±12.3		38.4±11		0.240	0.887
	Group 1 (n=15)		**Group 2 (n=15)**		**Group 3 (n=15)**		**Chi-square**	**p***
BMI	23.25		23.98		24.50		.536[a]	0.765
Sex	**Female**	**Male**	**Female**	**Male**	**Female**	**Male**		
	7 46.7%	8 53.3%	9 60.0%	6 40.0%	9 60.0%	6 40.0%	0.720[a]	0.698

*p<0.05, Kruskal-Wallis Test, *p<0.05 Chi-square test, BMI: body mass index, * Group 1 (HPU), Group 2 (Kinesio Taping), Group 3 (Control)

Table 2. Intra- and inter-group comparison of the normal joint movement total limitation

Normal joint movement	Group 1 (n=15)				Group 2 (n=15)				Group 3 (n=15)				Inter-group comparison Pre-treatment-Post-treatment	
	Pre-treatment	Post-treatment	Z	P*	Pre-treatment	Post-treatment	Z	P*	Pre-treatment	Post-treatment	Z	P*	Kruskal-Wallis	P*
Flexion	14.53±12.96	5.40±5.08	-2.94	**.003***	3.87±3.56	1.73±2.71	-2.83	**.005***	7.07±5.73	4.87±4.57	-2.67	**.007***	5.784	0.055
													4.616	0.099
Extension	11.87±11.09	6.93±8.48	-1.72	**.008***	3.67±3.96	2.60±2.97	-2.22	**.026***	6.93±4.98	4.53±4.26	-2.81	**.005***	5.253	0.072
													1.747	0.417
Lat. Flex. (Right)	9.27±9.35	2.53±4.02	-2.94	**.003***	9.13±4.36	7.93±3.90	-2.22	**.026***	4.07±4.53	2.80±4.02	-2.38	**.017***	8.824	0.082
													14.258	**0.001**
Lat. Flex. (Left)	6.80±7.40	1.33±2.82	-2.67	**.008***	6.47±5.68	5.27±5.11	-2.21	**.027***	4.07±4.13	2.20±3.97	-2.55	**.011***	2.008	0.366
													6.214	**0.045**
Rotation (Right)	8.33±6.50	2.93±3.58	-2.82	**.005***	9.60±4.63	7.80±4.21	-2.39	**.017***	6.00±4.04	3.20±2.96	-2.97	**.003***	6.054	**0.048**
													11.382	**0.003**
Rotation (Left)	8.73±7.46	2.53±4.03	-2.80	**.005***	9.93±8.51	6.73±4.43	-2.37	**.018***	5.07±4.01	5.53±3.50	-2.35	**.011***	3.976	0.137
													8.238	**0.016**
Total Lim.	61.60±45.09	21.67±22.39	-3.06	**.002***	42.67±21.25	32.07±15.44	-3.18	.001	33.20±24.	21.13±20.48	-2.93	**.003***	4.550	0.103
													4.636	0.098

*p<0.05 Wilcoxon Signed-Ranks Test intra-group comparison, *p<0.05 Kruskal-Wallis Test inter-group comparison, * Group 1 (HPU), Group 2 (Kinesio Taping), Group 3 (Control)

Table 3. Intra-group comparison of the VAS, algometer, and neck disability index measurements

VAS	Group 1 (n=15)				Group 2 (n=15)				Group 3 (n=15)			
	Pre-treatment	Post-treatment	Z	P*	Pre-treatment	Post-treatment	Z	P*	Pre-treatment	Post-treatment	z	P*
VAS	6.30±2.07	3.35±1.45	3.40	.001	5.57±1.81	3.82±1.79	3.40	.001	6.04±1.13	4.90±1.38	2.67	0.07
Algometer trigger point 1	15.00±6.53	29.27±9.11	-3.41	0.001	14.33±5.01	21.13±6.88	-3.30	-0.001	19.27±9.95	25.40±10.88	-3.41	**0.001**
Algometer trigger point 2	17.33±7.41	33.80±14.18	-3.40	0.001	14.40±4.98	22.87±7.70	-3.30	-0.001	19.40±9.56	25.33±12.00	-3.41	**0.001**
NDI	3.40±0.91	2.07±0.26	-3.12	0.002	3.13±0.92	2.60±0.51	-2.53	0.011	2.87±0.92	2.53±0.92	-2.23	**0.025**

*p<0.05 Wilcoxon Test, VAS: Visual Analog Scale, NDI: Neck Disability Index, * Group 1 (HPU), Group 2 (Kinesio Taping), Group 3 (Control)

Table 4. Inter-group comparison of the VAS, algometer, and neck disability index measurements

		Group 1 (n=15)	Group 2 (n=15)	Group 3 (n=15)	Chi-square	p*
		Mean±Std. deviation	Mean±Std. deviation	Mean±Std. deviation		
VAS	**Pre-treatment**	6.30±2.07	5.57±1.81	6.04±1.13	0.993	0.609
	Post-treatment	3.35±1.45	3.82±1.79	4.90±1.38	6.873	**0.032**
Algometer Trigger point 1	**Pre-treatment**	15.00±6.53	14.33±5.01	19.27±9.95	1.751	.417
	Pre-treatment	29.27±9.11	21.13±6.88	25.40±10.88	5.998	.050
Algometer Trigger point 2	**Pre-treatment**	17.33±7.41	14.40±4.98	19.40±9.56	2.88	.236
	Pre-treatment	33.80±14.18	22.87±7.70	25.33±12.00	4.677	.096
NDI	**Pre-treatment**	3.40±0.91	3.13±0.92	2.87±0.92	2.310	0.31
	Pre-treatment	2.07±0.26	2.60±0.51	2.53±0.92	7.537	**0.02**

*p<0.05 Kruskal-Wallis Test, VAS: Visual Analog Scale, NDI: Neck Disability Index, * Group 1 (HPU), Group 2 (Kinesio Taping), Group 3 (Control)

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In the intra-group comparison of the patients' pressure pain threshold values, an increase in the pressure pain threshold of all groups was identified after the treatment ($p<0.05$) (Table 3). Upon comparing the groups after the treatment for both trigger points, the pressure pain threshold values were found to be similar in all groups ($p<0.05$) (Table 4).

The intra-group comparison of neck disability revealed a decrease in the post-treatment NDI values in all groups ($p<0.05$). Upon comparing the post-treatment NDI values, a difference between the groups was found ($p=0.02$) (Table 4). In the pairwise comparisons of the NDI values, a decrease was observed in favour of the US group when the US and kinesio taping groups were compared ($p<0.05$). No difference was identified when comparing the US group to the control group and the kinesio taping group to the control group ($p>0.05$).

Discussion

This work aimed to investigate the effectiveness of trigger point US and kinesio taping applied in addition to the conventional physiotherapy programme in patients with MPS. Considering the pain threshold and VAS measurements of the trigger points, pressure pain threshold values increased, while pain intensity decreased following the treatment applied to all groups. US therapy was found to be effective on pressure pain threshold, pain intensity, and NDI values compared to other treatments.

The study in which Ünalan et al. compared the classical ultrasound and high-power ultrasound (HP) techniques for trigger point treatment in MPS indicated a more significant decrease in pain intensity in the HPU group. Concerning the pain threshold measurements of the trigger points in our study, pressure pain threshold values increased following the treatment applied to all groups. In the inter-group comparison, while no difference was determined between the US and control group and between the kinesio taping and control group, the values of the US group were significantly higher in comparison with the kinesio taping group. The treatment approaches in pain management also include the HPU technique. When we reviewed the literature, we observed that this technique was in the form of applications on trigger points in MPS. A study by Gariboğlu et al. compared the efficacy of HPU therapy applied to trigger points in 125 patients with MPS with conventional treatment methods, and all treatments utilised in the present work were found to be effective in treating MPS. The reason for this is that the nerve tissue absorbs US energy more than muscles and warms up, thus relieving pain and spasms. Researchers consider HPU an effective, quickly applicable, reliable, and easy treatment modality applied to trigger points in patients with MPS and think that it will be frequently used in the following years since it is non-invasive [21].

In a case report published by F. Murob Garcia, a V-shaped kinesio tape was applied to the right deltoid muscle of a 20-year-old female patient with limited movement in her shoulder due to MPS. After the tape remained on the patient for two days, an increase was observed in her shoulder ROM measurements, and it was reported that the patient's pain decreased after nine days [22]. The research by Thelen et al. titled "The Clinical Efficacy of Kinesio Tape for Shoulder Pain" evaluated the short-term impacts of this practice. Patients were assessed prior to and after taping, and their shoulder ROM, VAS, shoulder pain, and disability scores were evaluated. The study obtained painless abduction measurements after taping in the kinesio taping group [23,24]. The decrease in pain values in our research is parallel to the literature data. The absence of a controlled study conducted to date with the objective of comparing the efficacy of kinesio taping and HPU therapy in treating MPS constitutes the original aspect of our research.

A study by Garipoğlu et al. compared HPU therapy applied to trigger points in MPS with conventional treatment methods. Neck ROM was assessed. The study found it to be effective in MPS treatment [21]. The increase in ROM provided by both kinesio taping and HPU therapy in our research supports studies in the literature. However, no study has compared the superiority of the two treatment modalities to each other. Consequently, the intra-group comparison obtained statistically significant results for the neck ROM in all three groups in all parameters. The inter-group comparison demonstrated the superiority of the kinesio taping group in right-left lateral flexion and right-left rotations. The conclusion we will reach here is that kinesio taping contributes to eliminating the joint ROM limitation, one of the MPS symptoms, and can be implemented as a supportive treatment in addition to physical therapy modalities and exercise programmes, especially due to the support of painless posture and positive impacts on ROM after the practice.

In the research conducted by Dündar et al. on patients with cervical myofascial pain, 15 sessions of laser treatment were applied to trigger points in the treatment group five days a week for three weeks. Isometric and stretching exercises were given to both groups. The patient's pre- and post-treatment pain, active cervical joint ROM , and neck disability were assessed. After four weeks, a statistically significant enhancement was recorded in all parameters in both groups, but no significant difference was identified between the groups [25]. In this study, the functional status of the patients was assessed using the NDI, and a statistically significant decrease in NDI scores was observed in all three groups following the intervention. The inter-group comparison showed that the values of the US group decreased statistically significantly in comparison with the kinesio taping group, which can be attributed to the reduced pain and improved functionality in the US group. The inter-group comparison showed that the values of the US group decreased statistically significantly in comparison with the kinesio taping group, which can be attributed to the reduced pain and improved functionality in the US group.

The increase in the normal joint ROM provided by both kinesio taping and US therapy supports research in the literature. However, no study has compared the superiority of the two treatment modalities to each other. Consequently, the intra-group comparison obtained statistically significant results for the neck ROM in all three groups in all parameters.

The inter-group comparison demonstrated the superiority of the kinesio taping group in right-left lateral flexion and right-

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left rotations. The conclusion we will reach here is that kinesio taping contributes to eliminating the joint ROM limitation, one of the MPS symptoms, and can be implemented as a supportive treatment in addition to physical therapy modalities and exercise programmes, especially due to the support of painless posture and positive impacts on ROM after the practice.

Conclusion

Kinesio taping effectively reduced limitations in normal joint ROM in patients with MPS. On the other hand, trigger point US therapy effectively decreased pain and enhanced functionality.

The pain threshold measurements of trigger points were found to increase effectively in all groups. We recommend that these practices be added to the treatment programmes for pain, limitation in joint ROM , and functional status in patients with MPS.

We think that trigger point US therapy can be added to the treatment programmes for the purpose of decreasing pain parameters and increasing functionality, and kinesio taping can be added to the treatment programmes to change the joint ROM limitation parameters.

Further studies comprising a greater number of cases and extending treatment and follow-up periods may prove beneficial.

Conflict of Interests
The authors declare that there is no conflict of interest in the study.

Financial Disclosure
The authors declare that they have received no financial support for the study.

Ethical Approval
Ethics Approval: This study protocol was approved by the Non-Interventional Research Ethics Committee of Hasan Kalyoncu University, Faculty of Health Sciences (number: 2017/05 date: 02.05.2017.

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