ORİJİNAL ARAŞTIRMA ORIGINAL RESEARCH

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Shoulder-type Pain Formation After Spinal Anesthesia and the Effect of Non-invasive Method on Pain Reduction

Spinal Anestezi Sonrası Gelişen Omuz Tipi Ağrı Oluşumu ve Non-invaziv Yöntemin Ağrının Azaltılmasına Olan Etkisi

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ABSTRACT Objective: The effect of maternal up-head position on post-operative shoulder type pain (STP) during cesarean performed with spinal anesthesia and we planned it as a randomized controlled experimental study to evaluate the effectiveness of non-pharmacological methods in treatment. **Material and Methods:** Four hundred primiparous pregnant women who would undergo cesarean surgery with spinal anesthesia in the obstetrics service of a Private Nisa Hospital in İstanbul between February and August 2019 were included in the study. The participants were divided into two groups as head up position (n=200) and horizontal position (n=200) by simple random method. Dry hot application (n1=50 experimental group) and non-steroidal anti-inflammatory drug (NSAID) gel application (n2=50 control group) were performed to 100 patients who developed STP in the post-operative period. Pain assessment before and after the procedure was performed with Visual Analog Scale (VAS). **Results:** When the groups are examined according to the maternal position, it was found that the incidence of STP in the horizontal position (31.5%) was higher than the head up 400 position (18.5%) (p<0.03). STP was 76% in the right arm, 6% in the left arm, and 18% in both arms (p<0.001). It was found that women with local dry hot application to shoulder pain had lower VAS 2 pain scores (1.62±1.44) than the group with NSAI gel application (2.32±1.64) (p<0.05). **Conclusion:** When STP developed after cesarean section was examined according to the maternal position during surgery; the pain was found to be less in the head up 400 position than in the horizontal position. Local dry hot application was found to be more effective in reducing pain in the acute period compared to NSAID gel application in patients with STP after surgery.

Keywords: Shoulder type pain; cesarean section; anesthesia spinal

ÖZET Amaç: Spinal anestezi ile gerçekleştirilen sezaryen sırasındaki maternal baş yukarı pozisyonun post-operatif omuz tipi ağrı (OTA)ya etkisi ve tedavide farmakolojik olmayan yöntemlerin etkinliğini değerlendirmek amacıyla randomize kontrollü deneysel bir çalışma olarak planladık. **Gereç ve Yöntemler:** İstanbul'da Özel Nisa Hastanesi kadın doğum servisinde Şubat-Ağustos 2019 tarihleri arasında spinal anestezi ile sezaryen ameliyatı olacak 400 primipar gebe çalışmaya alındı. Katılımcılar basit rastgele yöntemle baş yukarı (n=200) ve yatay pozisyon (n=200) olmak üzere 2 gruba ayrıldı. Ameliyat sonrası dönemde OTA gelişen toplam 100 hastaya kuru sıcak uygulama (n1=50 deney grubu) ve non-steroidal anti-inflamatuar ilaç (NSAİİ) uygulama (n2=50 kontrol grubu) yapıldı. İşlem öncesi ve sonrası ağrı değerlendirme Görsel Kıyaslama Ölçeği (GKÖ) ile gerçekleştirildi. **Bulgular:** Gruplar maternal pozisyon şekline göre incelendiğinde; yatay pozisyonda OTA'nın görülme sıklığının (%31,5), baş 400 yukardaki pozisyona (%18,5) göre daha fazla olduğu saptanmıştır (p<0,03). OTA sağ kolda %76, sol kolda %6, her 2 kolda %18 oranında görülmektedir (p<0,001). Omuz ağrısına lokal kuru sıcak uygulama yapılan kadınların GKÖ 2 ağrı puan ortalamalarının (1,62±1,44), NSAİİ jel uygulaması yapılan gruba göre (2,32±1,64) daha düşük olduğu tespit edilmiştir (p<0,05). **Sonuç:** Sezaryen sonrası gelişen OTA ameliyat sırasındaki maternal pozisyon şekline göre incelendiğinde; ağrının baş 400 yukardaki pozisyonda yatay pozisyona göre daha az olduğu saptanmıştır. Ameliyat sonrası OTA gelişen hastalarda lokal kuru sıcak uygulamanın NSAİİ jel uygulamaya göre akut dönem ağrıyı azaltmada daha etkin olduğu tespit edilmiştir.

Anahtar Kelimeler: Omuz tipi ağrı; sezaryen; spinal anestezi

One of the most common surgical procedures for women is cesarean section.[1] An average of 18,5 million cesarean surgeries are carried out annually in developed and developing countries.[2,3] Although cesarean surgery is performed in cases where the life of the mother and baby is in danger, more bleeding,

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pain, shoulder-type pain (STP), atalectasi, wound infection, wound opening, gastrointestinal problems can be seen.[4,5] The selection of the type of anesthesia during cesarean surgeries (CSs) takes place due to many reasons such as emergency cesarean, patient's request and indications for surgery. When the literature is examined, among the reasons why spinal anesthesia is preferred compared to general anesthesia; rapid onset of anesthesia, deep sensory block, use of a lower dose of anesthetic drug, less toxic effects of these drugs used and accordingly, there are many advantages such as low dose of anesthetic agent to the baby, avoiding tracheal intubation, less risk of aspiration, conscious mother and establishing a more comfortable interaction with the baby in the postpartum period.[6,7]

According to the results of the recent studies, STP, mostly seen after laparoscopic surgeries, is very common after CS.[4,8-10] Abedian et al. in 2010 and Zirak et al. reported that shoulder pain was more common after cesarean surgeries compared to normal vaginal birth.[4] In our country, Çift et al. studied 300 postpartum women in the post-operative period, and had STP in 43.9% of women with general anesthesia and 26.6% of women with spinal anesthesia.[10] Although the formation mechanism of STP is not known exactly, pneumoperitoneum occurs as a result of the accumulation of some CO_2 and other gases in the peritoneal cavity. STP occurs due to peritoneal and diaphragmatic stretching and carbon dioxide insufflation due to phrenic nerve irritation in the postoperative period.[11-13] This type of pain is described by women as sharp and deep pain that begins in the shoulder area that disappears within 2-3 days after the operation, spreads to the neck or felt at the bottom of the diaphragm.[4]

Postpartum period is a period when the mother feels most sensitive emotionally, psychologically and physically. This pain experienced by the woman in the postpartum period can negatively affect both her own care and her baby's care.[14,15] For this reason, it is necessary to provide a quality reduction of pain after cesarean surgery as healthcare professionals, both for human and medical reasons.[14] Pharmacological and non-pharmacological methods are used to reduce pain. When the literature is examined, it is stated that the non-pharmacological methods used in reducing STP include hot application (dry hot, hot water), massage or drinking hot tea or hot water with fresh lemon.[4]

In this study, the importance of maternal head-up position in STP developing after CSs performed under spinal anesthesia was emphasized and we planned it as a randomized controlled experimental study to evaluate the effectiveness of dry hot treatment, a non-pharmacological method.

MATERIAL AND METHODS

The Clinical Research Ethics Committee of Istanbul Medipol University approved the study. The management of Private Nisa Hospital where the study was to be conducted gave its written permission to conduct the study before the data collection phase. After the participants were informed about the purpose of the study, their written consent was obtained (date: 19.12.2018/reference number: 10840098-604.01.01-E.53501). All the procedures were performed in accordance with rules regarding studies involving human participants by taking into account the ethical standards of the institutional and/or national research committee and the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

The members of the study consisted of pregnant women who applied for cesarean to the obstetrics department of Private Nisa Hospital. The average number of deliveries performed in this hospital with an annual cesarean (spinal or general anesthesia) is 3,600 on average. Annual average number of pregnant women who undergo cesarean section with spinal anesthesia varies around 1,200-1,500. The data of the study were collected between February and August 2019. Raosoft sample size calculator program was used to calculate the sample size (http://www.raosoft.com/samplesize.html). In this regard, the sample size was found to be 348 pregnant women (n=174) (α=0.05, 1-β=0.95). It was decided to select the sample as 400 pregnant women (n=200) with the idea that there might be losses in the cases.

Women who complied with the study criteria signed the consent form knowing that they could

withdraw from the study at any time. Primiparous women who would undergo cesarean with spinal anesthesia were allocated to 2 groups. Those with an even numbered protocol number were operated in a horizontal position (n=200). Those with odd numbered protocol number were operated in the head up (40 degrees) position (n=200). These experimental (head up) and control (horizontal position) groups were registered by the researchers in a list. Spinal anesthesia was given by the anesthesiologist in the midline approach and sitting position, 7.5-10 mg 0.5% bupivacaine + 20-25 μg fentanyl was administered intrathecally at the level of L3-L4 or L4-L5 from the inter-vertebral area, with the Quincke needle size of 25-27 gauge. The desired sensory block level was T4-T6. If hypotension or bradycardia occurred, 10 mg iv ephedrine or 0.5 mg atropine sulfate were administered, respectively. The operations were carried out by a specialist doctor working in the same maternity clinic. Lower segment cesarean section was performed in all patients with pfannenstiel skin incision. 10 IU of Synpitan forte (oxytocin 5 IU/mL, Deva, Turkey) as an intravenous bolus was administered just before placental delivery in both groups. The uterus was repaired as a single coat with 1.0-vicryl suture. Visceral and parietal peritoneum were repaired. Rectus sheath and skin were repaired. All patients were given a single dose of antibiotic prophylaxis Cefozin 2 g (Cefazolin 1 g, Bilim İlaç, Turkey) before the operation 1.5 mg/kg pethidine was administered intramuscularly in all patients for postoperative analgesia. Then, according to the routine hospital protocol while 20 IU Synpitan forte (oxytocin 5 IU/mL, Deva, Turkey) in 1,000 mL of 5% dextrose saline was infused to the participants at 40 drops per minute for 240 ninutes after surgery.

Ten patients with shoulder pain were treated with dry hot application (heated towel) and the other 10 patients with shoulder pain were treated with nonsteroidal anti-inflammatory drug (NSAID) gel (Diclomec gel 1.16%/50 mg, Diclofenac, Abdi Ibrahim, Turkey) application and the effectiveness of the application was understood. Then the study was started.

Women who had STP after surgery were assigned into experimental and control groups based on the patient protocol number. Those with double protocol number were included in the experimental group and those with single protocol number were included in the control group. Those in the experimental group were treated with dry hot application (heated towel), those in the control group were treated with NSAID gel application (Figure 1). Randomization sequence was created using the computer-based random number generator with a 1:1 allocation (https://stattrek.com/statistics/random-number-generator.aspx#error) (Figure 1).These intervention and control groups were enrolled into a list by the researchers. To avoid bias and to standardize the surgical procedure, all the participants were operated by the same surgeon (Figure 1).

Inclusion criteria for the study: Being between 20-40 years old, 36-42. Gestational week and single pregnancy, being the first pregnancy, getting a score of 4 and above on the Visual Analogue Scale (VAS), giving a cesarean delivery with spinal anesthesia.

Exclusion criteria were as follows: Patients undergoing cesarean delivery under general anesthesia previous vertical uterine incision, having had multiple cesarean surgeries, a history of major abdominal operation, patients with chronic STP and chronic pain syndrome. Having chronic disease (diabetes mellitus, thyroid dysfunction, hypertension, cardiovascular problem), poor obstetric history (placenta previa, albatio placenta, coagulation disorder, etc.), regular medication, having any problems preventing communication, having psychiatric treatment, infection having a risk of bleeding or complications during surgery, post-operative ileus development.

DATA COLLECTION FORMS

Maternal Information Form was developed by researchers in line with the literature. The form contains 23 questions in which shoulder pain is evaluated and that defines socio-demographic characteristics. VAS: It was first developed and used by Bond and Pilowsky in 1966. It is a 10 cm scale that expresses “painless” on one end of the VAS and “worst pain” on the other. Pain-free: 0 cm, slight pain: 0.5 cm 3.0 cm, moderate pain: 3.5 cm-6.5 cm and severe pain: 7.0 cm-10.0 cm in the VAS assessment.[15] It is considered to be the most suitable scale for the determination of acute pain severity due to its rapid results and easy to understand. Turkish adaptation of the scale was carried out by Aydın et al.[16]

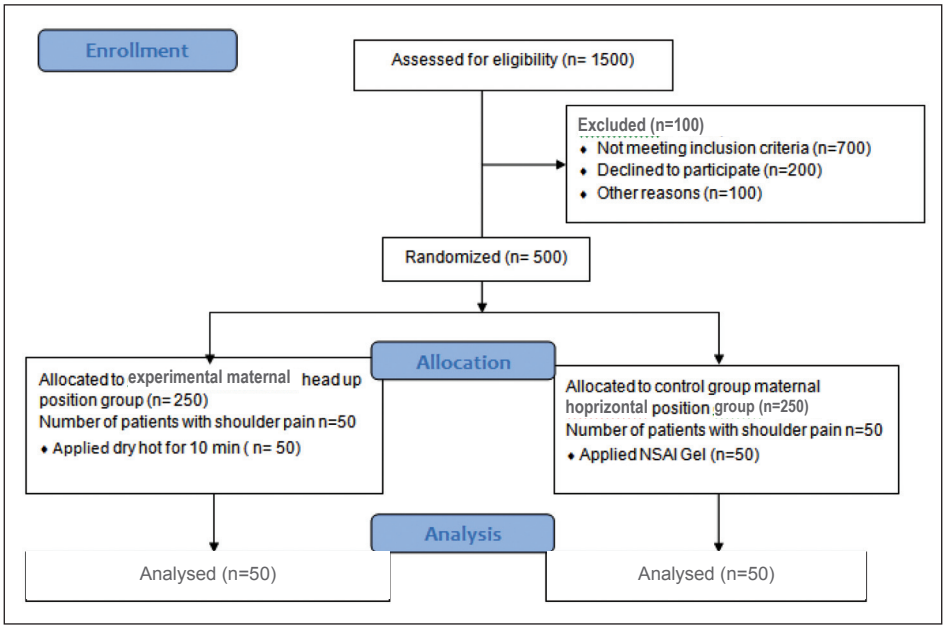

FIGURE 1: Flow chart.

In our study, Cronbach alpha value of VAS was found to be 0.760 in terms of reliability.

APPLICATION STEPS

Maternal Information Form: The form was filled in approximately 10 minutes by face-to-face interview before the cesarean surgery.

Evaluation of VAS: All participants were informed about the use of VAS after cesarean section. Research is that if the records of VAS are done on the same scale, it can see the severity of pain that the person has evaluated before and cause her to make a mistake while performing the next pain assessment.[17] Therefore, in the study, a separate form was used for each pain assessment of the participants. In studies aiming to standardize the VAS, vertical VAS was used in this study, since the vertical version was more easily understood by the participants.

Experimental and control groups were informed about the procedures to be performed before the application. Women with STP in the post-operative period were asked to mark the number of their pain compared to the VAS. Non-pharmacological and pharmacological treatments were applied to women with a VAS score of 4 and above.

1. Hot-applied experimental group: In the first 12 hours after the operation, dry hot application was performed once with a heated towel for 10 minutes in the women who received a VAS score of 4 or above and had STP.

2. Gel-treated control group: NSAID gel (diclofenac sodium) was applied once to the women who received a VAS score of 4 or above and had STP in the first 12 hours after surgery.VAS values of women in the experimental and control groups were evaluated before and after the procedure (pre-procedure=VAS 1, 20 minutes after the procedure=VAS 2). Then, the results between the groups were evaluated statistically.

STATISTICAL ANALYSIS

SPSS 22.0 software (SPSS, Inc., Chicago, IL, USA) was used for data analysis. Whether the distribution of the variables in this study is normal or not is examined with the Kolmogorov-Smirnov test and, t-test was used in independent groups to compare normally distributed data between groups. Paired t-test was used in the dependent groups before and after intra-group comparisons. In the analysis of categorical data, chi-square test was used. The significance level was taken as $p<0.050$.[18]

TABLE 1: Comparison of socio-demographic and determinative characteristics of the groups.

	Hot application (n=50)		Gel NSAID application (n=50)		p value*
Age (year)	29.48±5.53		28.54±4.34		0.271
Height (cm)	163±4.89		162±3.94		0.476
Weight (cm)	78.74±8.08		77.03±6.30		0.086
	n	**%**	**n**	**%**	
Education status					
High school and below	17	50	17	50	1.000
University	33	50	33	50	
Family type					
Nuclear family	50	50	50	50	1.000
Income status					
Middle	50	50	50	50	1.000
Gestation week					
36-38 week	3	27.3	8	72.7	0.110
39-42 week	47	52.8	42	47.2	
Does the pain affect breastfeeding your baby?					
Yes	6	51.6	15	48.4	0.829
No	34	49.3	35	40.7	
Does the pain affect your personal care?					
Yes	7	43.8	9	56.2	0.585
No	43	51.2	41	48.8	

NSAID: Non-steroidal anti-inflammatory drug. Mean±SD χ^2 chi-square test statistics; *n (%).

RESULT

When the study groups are examined in terms of socio-demographic and determinative features; according to age, height, weight, education status, income status, family type and gestation week, the groups had similar characteristics. When the groups treated with hot and NSAID gel were compared in terms of breastfeeding and performing their own self-care, depending on the pain they felt, there was no significant difference between the groups (p>0.050, Table 1).

When the groups are analyzed by maternal position; the frequency of pain in the horizontal position (31.5%) was found to be higher than the head up 40 degrees position (18.5%) (p<0.030, Table 2). STP was observed in 76% in the right arm, 6% in the left arm and 18% in both arms (p<0.001). It was found that there was no significant difference between the position type given during spinal anesthesia and the areas where shoulder pain developed after surgery developed in groups where dry hot and NSAID gel was applied (p>0.050, Table 3).

TABLE 2: Comparison of maternal position and frequency of shoulder pain.

	Shoulder pain +		Shoulder pain -		
	n	**%**	**n**	**%**	**p value**
Horizontal position	63	31.5	137	68.5	**0.030**
Head up 40 degrees position	37	18.5	163	81.5	

χ^2: Chi-square test statistics; *n (%).

When the mean scores of pain (VAS) that the warm and NSAID gel treated groups felt after the procedure were compared, there was a statistically significant difference between the groups while there was no statistically significant difference between the groups before the procedure in terms of VAS 1 values (p>0.050, Table 4). The mean scores of women with hot application after the procedure (VAS 2) (1.62±1.44) were found to be lower than the NSAID gel application group (2.32±1.64) (p<0.050, Table 4). In the intra-group comparison, it was found that the mean score (1.62±1.44) of the VAS-2 pain after the procedure was statistically significantly lower than that of the VAS-1 (4.8±1.01). In the gel-treated group,

TABLE 3: Maternal position during surgery, frequency of shoulder pain and treatment.

	Hot application*	Gel NSAID application*	Total*	p value
Horizontal position	**n (%)**	**n (%)**	**n (%)**	
Yes	31 (62.0)	32 (64.0)	63 (63.0)	0.836
No	19 (38.0)	18 (36.0)	37 (37.0)	
Head up 400 position				
Yes	19 (38.0)	18 (36.0)	37 (37.0)	0.836
No	31 (62.0)	32 (64.0)	63 (63.0)	
Shoulder pain				
Right arm	34 (68.0)	42 (84.0)	76 (76.0)	0.173
Left arm	4 (8.0)	2 (4.0)	6 (6.0)	
Right and left arm	12 (24.0)	6 (12.0)	18 (18.0)	

NSAID: Non-steroidal anti-inflammatory drug. χ^2; Chi-square test statistics, *n (%).

TABLE 4: Comparison of VAS scores between groups.

VAS evaluation time	Hot application (n=50) $\overline{X}$±SS	Gel NSAID application (n=50) $\overline{X}$±SS	t*	p value
Before the procedure: VAS 1	4.8±1.01	5.2±1.16	1.562	0.121
After the procedure: (20 minute): VAS 2	1.62±1.44	2.32±1.64	2.262	**0.026**
t**	20.186	16.430		
p value	**<0.001**	**<0.001**		

NSAID: Non-steroidal anti-inflammatory drug; VAS: Visual Analogue Scale. *t-test in independent groups; **t-test in dependent groups.

it was found that the mean VAS-2 pain score after the procedure was statistically significantly lower compared to the pre-procedure (p<0.050, Table 4).

DISCUSSION

When the groups were analyzed by maternal position, the frequency of pain in the horizontal position (31.5%) was found to be higher than the head up 40 degrees position (18.5%) (Table 2). STP was observed in 76% of the right arm, 6% of the left arm and 18% of both arms (p<0.001). While there was no significant difference between the pre-treatment groups in patients with STP in terms of VAS 1 values, it was found that the average post-procedure VAS 2 values of women with dry hot application were lower than the group with NSAID gel application.

STP developing after abdominal surgery is considered reflective pain. The anatomical basis of pain is the phrenic and supraclavicular nerves, the two branches of the brachial plexus. During laparoscopic surgery, diaphragmatic muscle and phrenic nerve can be chemically or physically stimulated with CO_2 gas.[11] Sub-diaphragmatic effusion can also play a role in this type of pain.[19] STP was found to be more frequent and severe in laparoscopic operations.[8,20,21] It has been reported that procedures that reduce the tension and irritation of the diaphragmatic muscle can reduce the severity of STP that develops after laparoscopic surgery.[22-26] Diaphragmatic irritation due to blood or amniotic fluid accumulating in the subdiafragmatic region is thought to occur in STP formation developing after cesarean section.[11,27,28] In addition, post-operative shoulder pain may be aggravated with external compression and intra-operative position can lead to ischemia in the brachial plexus between the first rib and the clavicle, caudade pressure due to the shoulder support significantly compresses and stretches, and can lead to ischemia in the brachial plexus.[27] It is also reported that in operations where the operation time lasts more than 45 minutes, the shoulder joint remains immobile in the same position for a long time, and the probability of STP increases in patients due to stretching in the arms and soft tissues.[29] In this study, the operation time in all patients was less than 45 minutes. In order to reduce

STP caused by shoulder immobility and soft tissue strain in patients, the arm laces that provide arm stabilization were freed intermittently and shoulder joint mobility was provided.

In the study of Zirak et al. evaluating STP after cesarean delivery in 200 nulliparous patients, they found the frequency of shoulder pain after cesarean section to be 39.5%. They concluded that STP was more common in patients undergoing cesarean under general anesthesia than in patients undergoing cesarean under spinal anesthesia.[4] In the studies of Cift et al. evaluated 300 primiparous pregnant women in the postpartum period, the frequency of STP after cesarean was 37.5%. The incidence of STP was found more frequently in patients with general anesthesia than spinal anesthesia.[10] In another study, patients with epidural-spinal combination anesthesia had a lower rate of STP in the head-up position than in the horizontal position during cesarean section.[28] These three studies have shown that in patients undergoing cesarean section with spinal anesthesia, amniotic fluid and blood-induced diaphragmatic irritation are less and post-operative STP develops less.[28] In our study, similar to these studies, post-operative STP was found less in patients with maternal head position during surgery.

Unlike the studies investigating STP that developed after abdominal surgeries, the efficacy of pharmacological and non-pharmacological treatment methods in STP was compared in our study. When the literature is examined, as a non-pharmacological method, warm, cold, menthol to the skin, vibration, massage and touch with peripheral techniques such as intra-muscular injection, dry needle intra-muscular injection, long-term exercise program, listening to music and cognitive strategies can be applied.[30,31] Dry hot treatment has been found to be very successful in chronic back pain, neck pain, fibromyalgia and knee pain.[32,33] In our study, it was similar to these studies. Although there was no difference between the VAS pain score before the procedure in patients who developed post-operative STP, local dry warm application was found to be more effective in reducing shoulder pain compared to NSAID gel application in the acute period.

Our study had some strengths; when the literature is examined, there is no study evaluating the post-operative STP decreasing effect of the maternal head-up position in the cesarean operation performed under spinal anesthesia and the efficacy of the dry hot application method in treatment. The limitation of our study is that a single dose of dry hot application and a decrease in pain after 20 minutes were evaluated. We propose other studies that evaluate the effect of hot application on long-term pain by repeating several times.

CONCLUSION

When STP developed after cesarean section performed under spinal anesthesia was examined according to the maternal position during surgery, it was found that the incidence of pain was lower in the head up 40º position than in the horizontal position. Local dry hot application was found to be more effective in reducing pain in the acute period compared to NSAID gel application in patients who developed STP after surgery. We propose other studies that evaluate the effect of hot application on long-term pain.

Source of Finance

During this study, no financial or spiritual support was received neither from any pharmaceutical company that has a direct connection with the research subject, nor from a company that provides or produces medical instruments and materials which may negatively affect the evaluation process of this study.

Conflict of Interest

No conflicts of interest between the authors and / or family members of the scientific and medical committee members or members of the potential conflicts of interest, counseling, expertise, working conditions, share holding and similar situations in any firm.

Authorship Contributions

Idea/Concept: *Derya Kanza Gül;* ***Design:*** *Derya Kanza Gül, Ayça Solt Kırca;* ***Control/Supervision:*** *Derya Kanza Gül;* ***Data Collection and/or Processing:*** *Derya Kanza Gül, Ayça Solt Kırca;* ***Analysis and/or Interpretation:*** *Derya Kanza Gül, Ayça Solt Kırca;* ***Literature Review:*** *Derya Kanza Gül;* ***Writing the Article:*** *Derya Kanza Gül;* ***Critical Review:*** *Ayça Solt Kırca;* ***References and Fundings:*** *Derya Kanza Gül;* ***Materials:*** *Derya Kanza Gül.*

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