RESEARCH ARTICLE

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Effect of Cold Therapy on Pain, Trismus, and Swelling After Third Molar Surgery

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Objective: This study was conducted to evaluate the effectiveness of local cold therapy in reducing pain, swelling, and trismus after third molar surgery.

Materials and Methods: Patients who required surgical removal of third molars and met the study criteria were randomly divided into two groups: The cold therapy and the control groups. Patients in the cold therapy group were ordered to use ice packs on the surgical site intermittently after the extraction of the impacted third molar. This first application was followed by the surgeon and was repeated for postoperative day 1. Patients in the control group did not apply cold therapy. Pain, swelling, and trismus were evaluated pre- and postoperatively, and the results were compared between groups. Pain was measured at the 4th, 8th, and 12th hours and on the 1st, 2nd, 5th, and 7th days. The amount of swelling and trismus on postoperative days 2 and 7 and the patients who did not receive cold therapy versus those who received cryotherapy were evaluated.

Results: The intensity of pain, swelling, and trismus did not differ significantly between the two groups ($p>0.05$), except on day 2, when the cold therapy group had a lower pain score than the control group ($p<0.05$).

Conclussion: Thus, it was concluded that cold therapy had no beneficial effect on postoperative complications of impacted third molar surgery.

Key Words: *Cold theraphy, third molar, pain, swelling, trismus*

Üçüncü Molar Cerrahisi Sonrası Soğuk Tedavisinin Ağrı, Trismus ve Şişme Üzerine Etkisi

Amaç: Bu çalışmada amaç gömülü üçüncü molar diş cerrahisi sonrası lokal soğuk terapinin ağrı, şişlik ve trismusun azaltılmasındaki etkinliğini değerlendirmektir.

Gereç ve Yöntem: Gömülü alt üçüncü büyük azı dişlerinin cerrahi olarak çıkarılması gereken ve çalışma kriterlerini karşılayan hastalar rastgele iki gruba ayrıldı. Soğuk terapi grubundaki hastalara gömülü üçüncü büyük azı dişleri çekildikten sonra aralıklı olarak ameliyat bölgesine cilt üzerinde buz paketleri kullanmaları söylendi. Bu ilk uygulama cerrah tarafından takip edildi ve ameliyat sonrası 1 gün boyunca tekrarlandı. Kontrol grubundaki hastalara soğuk terapi uygulanmadı. Ameliyat öncesi ve sonrası ağrı, şişlik ve trismus değerlendirildi ve sonuçlar gruplar arasında karşılaştırıldı. Ağrı 4., 8., 12. saat, 1., 2., 5. ve 7. günlerde ölçüldü. Postoperatif 2. ve 7. günlerdeki şişlik ve trismus miktarı, soğuk tedavi almayan ve kriyoterapi uygulanan hastalar değerlendirildi.

Bulgular: Soğuk terapi grubunun kontrollerden daha düşük ağrı skoruna sahip olduğu 2. gün ($p<0.05$) dışında, soğuk terapi alan hastalar ve kontroller arasında ağrı, şişlik ve trismus yoğunluğu anlamlı farklılık göstermedi ($p>0.05$).

Sonuç: Bulunan tek fark 2. gündeki ağrı olduğu için gömülü üçüncü molar dişin çekimi sonrası soğuk terapi postoperatif komplikasyonlar üzerinde faydalı bir etkisinin olmadığı sonucuna varıldı.

Anahtar Kelimeler*: Soğuk terapi, üçüncü molar, ağrı, şişlik, trismus*

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Introduction

Third molar surgery is a commonly used prophylactic procedure for problems caused by dental caries, periodontal diseases, or the narrowness of space between adjacent teeth. Nevertheless, although the surgical procedures are carefully performed, trismus, edema, and inflammatory reactions may result causing pain. These postoperative reactions are the expected inflammatory responses to the tissue trauma caused by surgery. They often result in discomfort to the patient and may affect his or her daily activities (1, 2). Cold therapy has been used since the time of Hippocrates of Classical Greece for therapeutic aims to decrease the temperature of the skin and subcutaneous tissues after traumatic applications. Thus, the application of cold therapy is recommended for patients after third molar surgery because the local cooling causes vasoconstriction and is expected thereby to control inflammation and bleeding (3–7). However, certain recent studies have reported its effectiveness in reducing pain and edema, whereas others have shown otherwise. Therefore, theories about the use of cold therapy after impacted third molar surgery remain uncertain. This study aimed to investigate the effect of cold therapy on pain, swelling, and trismus after third molar surgery.

Materials and Methods

Research and Publication Ethics: This study protocol was approved by Kahramanmaras Sutcu Imam University, Faculty of Clinical Research Ethics Committee, Kahramanmaras, Turkiye (18 September 2019, 2019/17, Protocol Number: 02).

A prospective randomized controlled clinical trial was designed to test the efficacy of cold therapy after the extraction of an impacted third molar. All patients were aged between 18 and 45 years, did not have any systemic diseases, did not smoke or had any allergies to any drug. They were randomly allocated into two groups (cold therapy and control). The cold therapy group included patients who applied an ice pack on the surgical site, whereas the control group did not apply. Immediately after the operation, the patients with ice packs were instructed to apply them on the surgical site as much as it could be tolerated, intermittently for 30 minutes (Figure 1). This application was done repeatedly for 24 hours at home. All surgeries were performed by the same surgeon. After explaining the purpose and procedure of the study to the patients, their written informed consent was obtained. Preoperative data were obtained from each subject including demographic information (age, gender) and type of impaction.

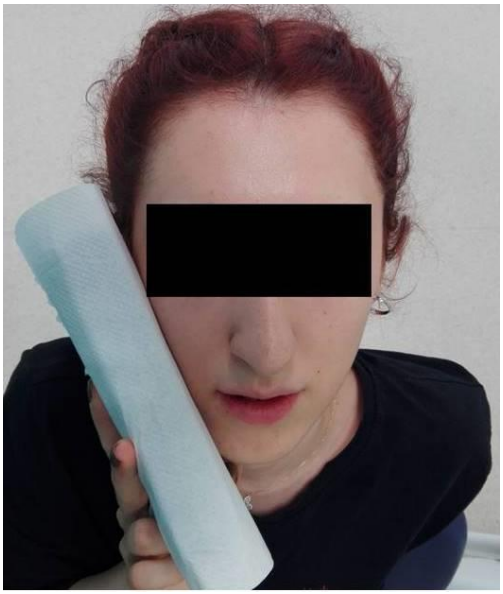

Figure 1. Cold theraphy application.

All impacted teeth were extracted by the same surgeon under local anesthesia (2% lignocaine hydrochloride with 1:80,000 epinephrine). Inferior alveolar nerve, lingual nerve, and buccal nerve blocks were achieved. The surgeon used the envelope mucoperiosteal flap in all extractions (Figure 2). Osteotomy was performed under 0.9% saline irrigation using tungsten carbide rods and fissure burs. After extracting the tooth, the flap was repositioned and sutured. All patients were given the same standard postoperative instructions: 5 days of antibiotics (amoxicillin, 625 mg twice daily), 3 days of analgesics (paracetamol, 500 mg three times daily), and mouthwash (0.12% chlorhexidine, twice a day). Using the same method, the same surgeon evaluated the subjects for facial swelling on the 2nd and 7th days, mouth-opening ability on the 2nd and 7th days, and pain at the 4th, 8th, and 12th hours and on the 1st, 2nd, 3rd, 5th, and 7th days.

Figure 2. Surgical mucoperiosteal flap during the removal of the impacted third molar.

Postoperative pain was assessed using the visual analog scale (VAS) (from 0=no pain to 10=maximum severity of pain); the measurement of pain was rated by the patient and reported postoperatively at the 4th, 8th, and 12th hours and on the 1st, 2nd, 3rd, 5th, and 7th days.

Three measurements of facial width (for facial edema) were taken using a measuring tape before the operation: from the angle of the mandible to the lateral canthus of the eye, from the tip of the tragus to the soft tissue pogonion, and from the tragus to the corner of the mouth. The total of the measurements was recorded in centimeters. The measurements were taken again on the 2nd and 7th days after the operation, and the differences in the measurements between the 2nd day and before the operation and between the 7th day and before the operation were recorded.

For the evaluation of trismus, the surgeon recorded the patient's maximum distance between the incisal edges of the upper and lower incisors using a digital caliper (Mitutoyo Corporation, Kawasaki, Japan) before the operation and on the 2nd and 7th days postoperatively.

Statistical Analysis: Statistical analysis was performed using IBM SPSS Statistics. The appropriateness of the normal distribution of the parameters was assessed using the Kolmogorov–Smirnov test. A Student's t-test was performed for the parameters, showing a normal distribution. Continuous data were presented as mean ± standard deviation values, and numerical measurements were presented as median, minimum, and maximum values. A statistical significance level of 95% was adopted.

Results

The study included 81 patients who met the inclusion criteria and agreed to participate, 74 of which participated in all stages of the study. Therefore, their data were included in the final analysis. The cold therapy group included 26 women and 11 men, a ratio of 2.36:1, whereas, the control group included 24 women and 13 men, a ratio of 1.84:1. The mean age (±SD) of the patients was 25.5±4.71 years and 24.5±5.68 years for the control and cold therapy groups, respectively. The type of impaction was vertical (43.2%), mesioangular (31.1%), horizontal (20.3%), or distoangular (5.4%).

The mean pain scores reported for the cold therapy and control patients at the 4th, 8th, and 12th hour postoperatively were 3.90±1.96 and 4.57±1.88, 3.46±2.01 and 3.84±1.99, and 2.95±2.13 and 3.35±2.21, respectively. On postoperative days 1, 2, 3, and 5 the scores were 2.65±2.00 and 2.97±1.97, 1.05±0.94 and 2.08±1.75, 1.08±1.14 and 0.92±1.34, and 0.60±0.90 and 0.41±0.76, respectively. The score was 0.00 in the control and cold therapy groups on the 7th postoperative day. As can be seen in Table 1, no statistically significant difference was found between the cold therapy and control groups in terms of pain score, except on day 2, when the cold therapy group had a lower pain score than the control group.

Table 2 shows that the mean mouth opening was 44.3±5.55 mm and 46.0±5.54 mm preoperatively in the cold therapy and control groups, respectively; on the 2nd and 7th postoperative days, it was 34.7±8.90 mm and 38.0±7.70 mm and 43.8±5.50 mm and 46.0±5.40 mm, respectively. No statistically significant difference was found for trismus between the cold therapy and control groups.

In Table 3, the mean amount of swelling in the cold therapy and control groups was 11.44±3.94 mm and 10.32±3.80 mm on the 2nd postoperative day and 0.15±0.38 mm and 0.07±0.24 mm, on the 7th postoperative day, respectively. No statistically significant difference between the groups was noted in terms of percentage swelling.

Table 1. Pain score of the controls and cold application groups

Datas	Groups	Mean	Std. Dev.	P*
Pain 4. Hour	Control (N=37)	4.57	1.88	0.134
	Cold application (N=37)	3.90	1.96	
Pain 8. Hour	Control (N=37)	3,84	1,99	0.419
	Cold application (N=37)	3.46	2.01	
Pain 12. Hour	Control (N=37)	3.35	2.21	0.425
	Cold application (N=37)	2.95	2.13	
Pain 24. Hour	Control (N=37)	2.97	1.97	0.484
	Cold application (N=37)	2.65	2.00	
Pain 2. Day	Control (N=37)	2.08	1.75	**0.003**
	Cold application (N=37)	1.05	0.94	
Pain 3. Day	Control (N=37)	0.92	1.34	0.577
	Cold application (N=37)	1.08	1.14	
Pain 5. Day	Control (N=37)	0.41	0.76	0.331
	Cold application (N=37)	0.60	0.90	
Pain 7.Day	Control (N=37)	0.0	0.0	0.099
	Cold application (N=37)	0.0	0.0	

*Student T test

Table 2. Mouth opening of the controls and cold application groups

Datas	Groups	Mean	Std. Dev.	P*
Mounth opening post op.	Control (N=37)	46.0	5.54	0.175
	Cold application (N=37)	44.3	5.55	
Mouth opening post op. 2. day	Control (N=37)	38.0	7.70	0.094
	Cold application (N=37)	34.7	8.90	
Mouth opening post op. 7. day	Control (N=37)	46.0	5.40	0.087
	Cold application (N=37)	43.8	5.50	

*Student T test.

Discussion

Third molar surgery can cause pain, swelling, and trismus due to the trauma that occurs in soft tissues and bone structures in the oral cavity (1). Cold therapy is recommended at the site to prevent these postoperative complications. It is the simplest and oldest method of treating tissue damage caused by surgery, having been used since the time of Hippocrates (1, 3). However, recent researchers have raised doubts about whether cold therapy has an effect.

Researchers assumed that the beneficial effects of cold treatment are derived from various physiological processes, such as decreased enzyme activity, reduced blood flow with vasoconstriction, restricting the extravasation of blood to surrounding tissues, reducing edema and inflammation, deceleration of tissue metabolism, and reduction of nerve conduction (4–8). Courage and Huebsch (9) reported that the application of cold therapy after third molar extraction effectively reduced pain and swelling. Similarly, in their study on patients who had a bilaterally impacted third molar, 10.

Laureano Filho et al. (10) showed that cold therapy reduced serious side effects, such as postoperative pain and swelling. However, they reported that cold therapy did not affect trismus. They further observed that the reduction in pain on the side treated with cold therapy may be related to psychological factors as the patient is aware of which side surgery was performed and cold therapy applied. Forouzanfar et al. (11) showed that compression (with or without cold therapy) was a good method of treating patients following impacted third molar surgery. They reported that ice application controls inflammation and bleeding. In addition, they argued that compression with ice reduces the excitability of free nerve endings and peripheral nerve fibers, thereby raising the pain threshold. This result is the outcome of any dermal stimulation resulting from compression, which stimulates A-beta fibers (11–15). However, whether the reduction in pain is due to cold therapy or compression is unclear. Compression alone and compression with cold therapy can produce similar results, as partially explained by a vasoconstrictive effect. This effect occurred in Forouzanfar et al. (11)'s study A-beta fibers owing to the compression of force applied to the tissue, which in turn compressed the vascular system feeding the area. As a result, blood flow to that area decreased. They hypothesized that decreased blood flow in the surgical field will decrease the flow of inflammatory and pain receptors. The placebo effect on pain of compression and ice compression therapy methods is not clear. In the late 1970s, Levine et al. noted that placebo analgesia is a result of endorphin production in the CNS13 and that the placebo effect on the operative side may result in the release of endorphins. Hence, compression or ice compression is administered based on the assumption that the placebo effect is equal in both treatment methods and that the same physiological processes reduce pain (16). Bastian et al. explained that the successful application of ice after impacted third molar surgery to help reduce pain and muscle spasm, as well as swelling and inflammation, was attributable to its vasoconstrictive effect. They also stated that this reduction in pain was probably due to a combination of the modified inflammatory response, which consisted of freezing, and the extinction of peripheral nerve endings (17). In a study examining the effect of cold therapy after impacted tooth surgery, Ibunkle et al. reported that the subjects reported less postoperative pain, swelling, and difficulty in opening the mouth, thus leading to a better quality of life compared with subjects not using cold therapy. The perception of reduced pain intensity observed among the subjects receiving cold therapy may be due to the direct effect of cold therapy on nerve conduction and inflammation. Cold therapy raises the threshold of pain fibers and decreases the rate of nerve conduction (5). When the limited results of this study were evaluated, statistically significantly less pain was experienced in the patient group that applied cold therapy on the 2nd postoperative day, compared with the control group.

Certain studies indicate that cold therapy is an inexpensive, harmless, and effective method of treating pain and swelling, whereas other studies find its ineffectiveness. Among these, Van der Westhuijzen et al. did not find a statistically significant benefit for patients who received cold therapy compared with those who did not, in terms of pain, swelling, and trismus in the first 24 hours after third molar extraction and low-dose analgesic/anti-inflammatory treatment. They also reported that uninterrupted cold therapy for 15 minutes and longer may cause tissue death due to prolonged vasoconstriction, ischemia, and capillary thrombosis. Because of the large vascular network in the oral and maxillofacial areas, these adverse effects have a low likelihood of occurring, but the possibility should not be ignored (4). The present study has shown that cold therapy may reduce pain on the 2nd day. However, when the data obtained from the patients on other days were evaluated, no statistically significant difference could be detected between the control and treatment groups. Consistent with Forsgren et al. (18) and Zandi et al. (1), the present investigation did not show useful effects of cold therapy on pain, swelling, and trismus postoperatively. The ineffectiveness of cold therapy may have three explanations. First, a cold application on the skin does not reduce the temperature in deep tissues. Cold experienced in the buccal fat pad in the subcutaneous tissues and high vascularization in the facial area does not pass into the deep tissues. Second, the analgesic/anti-inflammatory drugs taken by the patient mask the possible positive effects of cold application. Third, the ineffectiveness is due to the possible placebo effect shown in studies where cold application has a positive effect (1, 4, 18).

In conclusion, cold therapy is a simple and affordable treatment frequently ordered by oral and maxillofacial surgeons and dentists to reduce pain, swelling, and trismus after dentoalveolar surgeries. This study has shown that cold therapy reduces pain on postoperative day 2 only and has no effect at any other

time or on trismus and swelling. We conclude that the benefit of cold application is still doubtful; thus, further studies are required to resolve conflicting results.

Conflict of Interest: The authors declerate there is no conflict of interest.

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