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Research

The Effect of Thirst, Dry Mouth, Mouth Taste, and Bad Mouth Odor in Laparoscopic Cholecystectomy Patients: A Randomized Controlled Trial

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A B S T R A C T

Purpose: This study aimed to determine the effect of menthol ice application on thirst, dry mouth, mouth taste, and bad mouth odor in patients who underwent laparoscopic cholecystectomy in the postoperative period.
Design: The study was conducted as a randomized controlled trial with an experimental design.
Methods: The study sample consisted of 90 patients who underwent laparoscopic cholecystectomy and met the inclusion criteria. Patients were divided into three groups by randomization program. Patients in the menthol ice and ice popsicle (ice prepared with drinking water only) group were administered menthol ice/ice popsicle (10 mL) twice at 20 minutes intervals. Patients in the control group did not receive any intervention. Routine practices of the clinic were performed by the nurses of the general surgery clinic. Postoperative thirst intensity, severity of dry mouth, bad taste, and bad odor in the mouth were evaluated at 0, 20, and 40 minutes.
Findings: No statistically significant difference was found between the sociodemographic and clinical characteristics of the patients in the control group, menthol ice group, and ice popsicle group ($P > .05$). A statistically significant difference was found between the 3 groups in terms of thirst intensity and severity of dry mouth at times at the 20th and 40th minutes after the application ($P < .01$). We found a statistically significant difference between the bad taste and bad odor sensation scores of the patients in the control and intervention groups at the 20th and 40th minutes after the application ($P < .05$).
Conclusions: The study concluded that menthol ice and ice popsicle application are effective strategies to reduce the intensity of thirst, severity of dry mouth, bad taste, and bad odor in postoperative patients.

The prevalence of postoperative thirst is 75%, with an intensity of 6.7 and 8.9 on a verbal numerical scale ranging from 0 to 10 points.[1,2] Despite this, dehydration is downplayed without intervention by the surgical team. Factors such as preoperative fasting period, blood loss, dehydration, drugs that cause decreased oral cavity moisture and suppress salivation (atropine, scopolamine, glycopyrrolate), opioids, long surgical and tracheal intubation time, prolonged oxygen therapy are important in patient dehydration.[3–9] Osmotic thirst occurs when surgical intervention stimulates the secretion of antidiuretic hormone (arginine vasopressin [AVP]) to dilute the increased osmolality and increase water reabsorption. Hypovolemic thirst also occurs with the release of angiotensin II in response to hypovolemia caused by intraoperative bleeding and exposure of the body's internal structures to the environment.[10,11]

The thirst management model includes identification of thirst (eg, dryness of the tongue, lips, mouth, and throat, salivation and thick saliva, bad taste in the mouth and desire to drink water, decreased sense of taste, difficulty swallowing and speaking), measurement of thirst, safety assessment for thirst management and implementation of thirst-quenching strategies.[12]

Scientific advances in explaining the preabsorption mechanism for thirst satiation show a new strategy.[13] There are strategies that focus on use of the cooling effect to provide preabsorption saturation.[1,14–20] In the literature, there are cold application strategies to quench the thirst of surgical patients.[1,3,14,21] In studies using

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menthol ice to quench postoperative thirst, menthol ice was found to be effective in reducing thirst intensity and discomfort.[19,22–24] In a study evaluating thirst and the condition of the oral cavity after laparoscopic cholecystectomy,[14] there was a significant decrease of 7.88 in thirst intensity in patients treated with saline solution and frozen gauze. In the postabdominal surgery period, results showed that ice cold normal saline with menthol-added significantly reduced thirst intensity.[24]

Menthol ice gives a feeling of coolness and is perceived as a pleasurable state due to the activation of both thermoreceptors and taste buds.[8,25,26] It is a harmless, cost-effective, and feasible method.[23,27] Serato et al[19] found that menthol ice popsicle applied to patients undergoing laparoscopic bariatric surgery was effective.

Patients who have undergone abdominal surgery are at high risk for thirst and dry mouth for various reasons.[18] Laparoscopic cholecystectomy has a low risk of complications and is a minimally invasive procedure that usually requires hospitalization for less than 24 hours.[28] However, laparoscopic procedures have disadvantages such as more difficulty controlling bleeding, inflammation, and adhesions making the procedure more complicated. Patients may require open abdominal surgery, so they experience dehydration because the preoperative fasting period is as long as patients who do undergo abdominal surgery.[24,29] Therefore, this study was conducted to determine the effect of menthol ice application on patients undergoing laparoscopic cholecystectomy surgery on thirst, dry mouth, mouth taste, and bad breath.

Methodology

Study Design

The study was a randomized controlled trial.

Study Setting

The study was conducted between December 17, 2021, and April 6, 2022, in the general surgery clinic of Health Sciences University Prof. Dr Süleyman Yalçın City Hospital with 33 beds and 12 nurses. Patients who were followed up in the postanesthesia care unit after laparoscopic cholecystectomy surgery were taken to the general surgery clinic after the effect of the anesthesia wore off, and clinical follow-up was performed.

Subjects

The study population consisted of patients who underwent laparoscopic cholecystectomy. In this study, 129 patients who met the inclusion criteria were evaluated. Twenty-five patients did not meet the inclusion criteria, eight patients refused to participate, and six patients withdrew. The study was completed with 90 patients.

Power analysis was performed using the G*Power (v3.1.7) program to determine the sample size. Using Cohen's effect size coefficients, according to the calculation made by assuming that the "Thirst and Thirst Characteristics Assessment Form" scores would have a huge effect size (d = 0.8) between at least two independent groups, it was calculated as at least 26 patients in the groups at $\alpha = 0.05$ level. We included 30 patients for each group considering that there might be data loss.

Inclusion and Exclusion Criteria

Inclusion criteria included those undergoing laparoscopic cholecystectomy surgery with general anesthesia, aged 18 to 65 years with a surgical fasting time of at least 4 hours, classified as Class I, II, or III by the American Society of Anesthesiologists (ASA), receiving intraoperative opioids or anticholinergics, consent to the evaluation of the Safety Protocol for Thirst Management (SPTM), who expressed thirst spontaneously or verbally, or had a thirst intensity of four or more on the Visual Comparison Scale (VCS) when asked. Patients with menthol allergy, persistent lesions on the oral mucosa, restricted eating and swallowing, nausea and vomiting, Sjögren's syndrome, altered state of consciousness after surgical intervention, and acute confusion were excluded.

Randomization

To determine the study groups, a block randomization list for three groups was created using a web-based randomization program (GraphPad Software, Inc). The number of subjects in each group was determined as 30. The Consort flow diagram of the study was as follows (Figure 1).

Interventions

Preparation of the Ice

The mixture for menthol ice was prepared in an authorized pharmacy according to the formulation recommended by Serato et al[19] (ultra-filtered water [1,000 mL], 0.05% [5 mg] menthol, 0.05% [5 mg] saccharin, and 2% [200 mg] ethyl alcohol). Only drinking water was used to prepare ice popsicles. A silicone ice mold was used for ice making. Freezing was performed on the day before the administration. Before starting the freezing process, necessary hand hygiene was ensured, and disposable nonsterile gloves were worn. A freezing stick was dipped into the silicone container to enable the patients to control the intensity of the cold given by the ice. The ice mold was then sealed and stored in the freezer in the General Surgery Clinic.

Menthol Ice/Ice Popsicle Volume Determination

For safety reasons, menthol ice and the ice popsicle were prepared at an equal volume limit (10 mL).[22,27,19] Evidence suggests that the risk of broncho-aspiration is minimal when the stomach volume is up to 50 mL or up to 1.5 mL/kg, as the stomach volume is absorbed over time and water has a half-life in the stomach of approximately 15 minutes.[22,30,31]

Data Collection Procedure

Patients were cared for by the same health care team member. After the postoperative patients were admitted to the general surgery clinic, the SPTM was applied by the investigator when the thirst was questioned or when the patient expressed thirst spontaneously. After the SPTM safety protocol was approved, thirst intensity, dry mouth, bad taste, and bad odor were measured at time Z0. Patients in the intervention group with a thirst intensity of four points and above were administered the first menthol ice or ice popsicle. The researcher stayed with the patients until they finished the menthol ice or ice popsicle. Thirst intensity, dry mouth, bad taste, and bad odor were measured 20 minutes after the first intervention (at time Z1), and the second menthol ice or ice popsicle was administered. The researcher stayed with the patients until they finished the menthol ice or ice popsicle. Twenty minutes after the second intervention (at time Z2), only thirst intensity, dry mouth, bad taste, and bad odor were measured, and no menthol ice or ice popsicle application was performed. Patients controlled their contact with the menthol ice or ice popsicle according to their sensitivity, and the duration of intake varied from person to person according to their sensitivity.

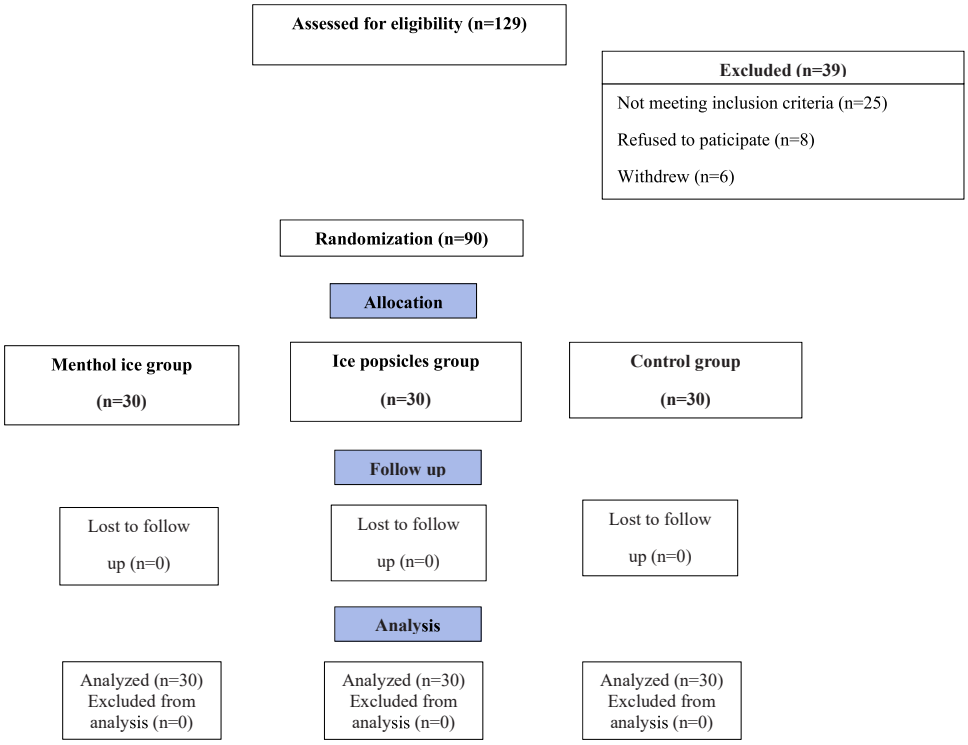

Figure 1. Study flow diagram.

Patients in the control group did not undergo any intervention. Routine practices of the clinic were performed by the nurses of the General Surgery Clinic. They offered patients gauze soaked in drinking water when they were thirsty. The same procedure was carried out when the control group was thirsty. The researcher obtained data on thirst intensity, dry mouth, bad taste, and bad odor at Z0, Z1, and Z2. After each assessment, the researcher stayed with the patient until the end of the study to make sure that the patients in the intervention and control groups did not take anything by mouth and to observe the patient.

Patient Introduction Form

The Patient Introduction Form was prepared by the researchers according to the literature. The form included patients' gender, age, educational status, presence of chronic diseases, continuous medication use, smoking status, and previous surgical experience.[7,19,27,32]

Outcome Measurements

Evidence suggests that an increase in plasma osmolarity and a decrease in vasopressin are associated with thirst perception measured by numerical scales.[10] Since thirst, like pain, is a state of discomfort that includes subjective experiences expressed by the individual, it is appropriate and safe to use the VCS to assess thirst.[2–4,16,19,22,23] Scoring on the scale from 0 (no thirst) to 10 (worst perceived thirst) is provided by the answer to the question "How would you rate your thirst right now?".[7] This approach has been extensively applied and reported to be valid.[33,34] In this randomized study, thirst intensity and thirst characteristics related to dry mouth, bad taste, and bad smell were measured. The assessment of the variables was performed with the VCS, which consists of a line divided into equal intervals between 0 and 10 values and is widely used in the assessment of subjective characteristics.

Ethical Consideration

Scientific Research permission was obtained from Istanbul Medipol University Noninterventional Clinical Research Ethics Committee (Number: E-10840098, Date: August 24, 2021) and Istanbul Provincial Health Directorate (Number: E-15916306, Date: December 17, 2021) and informed consent was obtained in writing from the patients.

Data Analysis

Number Cruncher Statistical System 2007 program was used for statistical analysis of the data. Descriptive statistical methods were used to evaluate the data. The compatibility of quantitative data with normal distribution was tested by the Shapiro-Wilk test. Mann-Whitney U test was used for comparisons between two groups for quantitative variables that were not normally distributed, and the Kruskal-Wallis test and Dunn-Bonferroni test were used for comparisons between more than two groups. One-way analysis of variance and Bonferroni corrected pairwise evaluations were used for comparisons of quantitative variables with normal distribution between more than two groups. Friedman Test was used for intragroup comparisons of quantitative variables that did not show normal distribution, and the Wilcoxon signed-ranks test with Bonferroni correction was used for the evaluation of pairwise comparisons. Fisher-Freeman-Halton exact test was used to compare qualitative data. Cohen's Effect Size was used to evaluate the effects between groups. Spearman correlation analysis was used to evaluate the relationships between quantitative variables. Statistical significance was accepted as $P < .05$.

Results

The descriptive characteristics of the patients included in the study are shown in (Table 1). We found no statistically significant

difference between the groups according to age, gender, educational status, presence of chronic disease, continuous drug use, smoking, previous surgical experience, surgical fasting times for solid foods, surgical fasting times for liquid foods, ASA scores, and drugs used in the surgical process. The groups were homogeneous, and the groups could be compared ($P > .05$).

There was no statistically significant difference between the groups according to thirst intensity, dry mouth, taste, and odor scores at Z0 ($P > .05$). There was a statistically significant difference between the thirst intensity and dry mouth scores at Z1 and Z2 in the control and intervention groups ($P < .01$). A statistically significant difference was found between the control and intervention groups in terms of bad taste and bad odor scores at Z1 and Z2 ($P < .05$). This difference was due to the control group. The bad taste and bad odor scores of the patients in the menthol ice group at Z1 and Z2 were significantly lower than those in the control group and the ice popsicle group ($P < .05$) (Table 2).

According to the pairwise comparison of the groups, there was no statistically significant difference between the thirst intensity, dry mouth, bad taste, and bad odor scores at Z0 ($P > 0.05$). At Z1 and Z2, there was a statistically significant difference between the thirst intensity, dry mouth, bad taste, and bad odor scores of the control group-menthol ice group patients and the control group-ice popsicle group patients ($P < .01$). Although there was no statistically significant difference between the thirst intensity, dry mouth, and bad taste scores of the patients in the ice popsicle or menthol ice group ($P > .05$), it can be said that menthol is clinically more effective according to Cohen's r value. There was a statistically significant difference between the bad odor scores of the patients in the ice popsicle or menthol ice group, and menthol ice was found to be more effective in reducing thirst intensity ($P < .01$) (Table 3).

Discussion

In relation to thirst and thirst characteristics, dry mouth, bad taste and bad odor in the mouth is a subjective experience, a multifaceted symptom, and an unusual and strange sensation that is influenced by various environmental and individual factors, including cognitive, sensory, social and cultural variables, living habits, personal health status.[12,15,23,35] The etiology of postoperative thirst is multifaceted.[7] In laparoscopic cholecystectomy, which is a minimally invasive abdominal surgery method, the preoperative fasting period is as long as the patients who will undergo abdominal surgery, since the patients are told that open abdominal surgery may be required and general anesthesia will be given. The fasting period causes intense thirst in the postoperative period.[24]

In our study, thirst intensity, dry mouth, bad taste in the mouth, and bad odor scores started to decrease in the intervention groups at Z1. Sebaee and Elhadary[24] found that menthol-added frozen saline reduced thirst intensity in the early postoperative period in patients undergoing abdominal surgery. Karthick et al[23] reported that menthol ice reduced the intensity of thirst 1 hour and 2 hours after application in patients undergoing abdominal surgery and reported a change in oral condition. Serato et al[19] compared menthol ice with ice popsicles in patients

Table 1
Comparison of Descriptive and Clinical Characteristics of Patients by Groups (N = 90)

Characteristics	Control Group (n = 30) Mean ± SD	Menthol Ice Group (n = 30) Mean ± SD	Ice Popsicles Group (n = 30) Mean ± SD	*P*
Age in years	47.43 ± 13.58	47.13 ± 12.25	48.23 ± 10.42	[b]*0.974*
Surgical fasting time for solid foods (hours)	14.57 ± 3.25	13.60 ± 2.66	13.60 ± 2.40	[c]*0.307*
Surgical fasting time for liquid foods (hours)	12.90 ± 2.73	11.38 ± 2.36	12.12 ± 2.24	[c]*0.062*
	n(%)	n(%)	n(%)	
Gender				
Female	22 (73.3)	22 (73.3)	22 (73.3)	[a]*1.000*
Male	8 (26.7)	8 (26.7)	8 (26.7)	
Education status				
Literate	0 (0)	2 (6.7)	3 (10.0)	[a]*0.799*
Primary School	15 (50.0)	12 (40.0)	12 (40.0)	
Middle School	3 (10.0)	3 (10.0)	2 (6.7)	
High School	7 (23.3)	7 (23.3)	5 (16.7)	
University and postgraduate	5 (16.7)	6 (20.0)	8 (26.7)	
Presence of chronic disease				
No	17 (56.7)	21 (70.0)	17 (56.7)	[a]*0.509*
Yes	13 (43.3)	9 (30.0)	13 (43.3)	
Continuous drug use				
No	18 (60.0)	17 (56.7)	17 (56.7)	[a]*1.000*
Yes	12 (40.0)	13 (43.3)	13 (43.3)	
Smoking				
No	24 (80.0)	18 (60.0)	19 (63.3)	[a]*0.229*
Yes	6 (20.0)	12 (40.0)	11 (36.7)	
Past surgical experience				
No	13 (43.3)	13 (43.3)	10 (33.3)	[a]*0.687*
Yes	17 (56.7)	17 (56.7)	20 (66.7)	
ASA				
ASA 1	9 (30.0)	8 (26.7)	7 (23.3)	[a]*0.961*
ASA 2	19 (63.3)	19 (63.3)	21 (70.0)	
ASA 3	2 (6.7)	3 (10.0)	2 (6.7)	
Anesthetics and other drugs used				
Anticholinergic	26 (86.7)	21 (70.0)	19 (63.3)	[a]*0.104*
Benzodiazepine	29 (96.7)	30 (100)	30 (100)	[a]*1.000*
Opioid	30 (100)	30 (100)	30 (100)	-
Neuromuscular block	30 (100)	30 (100)	30 (100)	-
Hypnotic	30 (100)	30 (100)	30 (100)	-
İnhalation	30 (100)	30 (100)	30 (100)	-
Diuretic	0 (0)	0 (0)	0 (0)	-

[a]Fisher-Freeman Halton Test, [b]Kruskal-Wallis Test, [c]One-way ANOVA.
ASA, American Society of Anesthesiologists.

Table 2
Comparison of Thirst Intensity, Dry Mouth, Taste and Odor Scores at Different Moments by Groups (N = 90)

	Control Group (n = 30) Mean ± SD/ *(min-max)*	Menthol Ice Group (n = 30) Mean ± SD/ *(min-max)*	Ice Popsicles Group (n = 30) Mean ± SD/ *(min-max)*	*P*	*Cohen's r*
Thirst intensity					
Z0	6.73 ± 1.78 6.5 (4-10)	7.07 ± 1.57 7 (4-10)	7.23 ± 1.77 6.5 (5-10)	[c]*0.518*	*0.121*
Z1	7.23 ± 1.52 7 (4-10)	3.80 ± 1.94 3.5 (1-8)	4.17 ± 2.07 4 (1-9)	***[c]0.001***	***0.640***
Z2	7.73 ± 1.86 8 (4-10)	2.53 ± 2.40 2 (0-10)	3.13 ± 2.92 2.5 (0-10)	***[b]0.001***	***0.693***
Dry Mouth					
Z0	7.67 ± 2.15 8 (3-10)	6.93 ± 2.52 7 (0-10)	7.67 ± 1.73 8 (5-10)	[b]*0.481*	*0.149*
Z1	7.87 ± 1.96 8.5 (5-10)	4.20 ± 2.37 4 (0-9)	4.90 ± 2.04 5 (1-8)	***[c]0.001***	**0.866**
Z2	8.20 ± 1.81 9 (5-10)	2.67 ± 1.94 3 (0-7)	3.63 ± 2.86 3 (0-10)	***[b]0.001***	**0.779**
Bad Mouth Taste					
Z0	2.93 ± 3.12 2.5 (0-10)	3.57 ± 3.20 4 (0-9)	2.47 ± 3.43 0 (0-10)	***[b]0.324***	***0.139***
Z1	3.03 ± 3.44 2 (0-10)	1.00 ± 1.86 0 (0-8)	1.80 ± 2.44 0 (0-8)	***[b]0.049****	***0.303***
Z2	2.93 ± 3.54 1 (0-10)	0.30 ± 0.95 0 (0-4)	1.33 ± 2.19 0 (0-8)	***[b]0.001***	***0.405***
Bad Mouth Odor					
Z0	1.87 ± 3.01 0 (0-10)	1.23 ± 2.37 0 (0-7)	3.13 ± 3.64 1 (0-10)	*0.096*	0.253
Z1	2.03 ± 3.17 0 (0-10)	0.27 ± 0.78 0 (0-3)	1.87 ± 2.34 0.5 (0-6)	***[b]0.005***	**0.327**
Z2	1.70 ± 2.84 0 (0-10)	0.03 ± 0.18 0 (0-1)	1.27 ± 2.16 0 (0-8)	***[b]0.005***	**0.328**

[b]Kruskal-Wallis Test, [c]One-way ANOVA Test, Cohen's Effect Size *P < ,05.
**P < ,01.
Z0 (first intervention).
Z1 (20 min after the first intervention).
Z2 (20 min after the second intervention).
Significant values less than $p < 0.05$ are in bold.

Table 3
Comparison of Thirst İntensity, Dry Mouth, Taste and Odor Scores at Different Moments According to Dual Groups (N = 90)

	Control-Menthol ice group		Control- Popsicle ice group		Menthol ice Ice popsicle	
	Cohen's r	*P*	*Cohen's r*	*P*	*Cohen's r*	*P*
Thirst intensity						
Z0	-	*1.000*	-	*1.000*	-	*0.784*
Z1	*1.968*	*0.001***	*1.685*	*0.001***	-	*1.000*
Z2	*2.422*	*0.001***	*1.879*	*0.001***	-	*1.000*
Dry Mouth						
Z0	-	*0.767*	-	*1.000*	-	*1.000*
Z1	*1.688*	*0.001***	*1.485*	*0.001***	-	*0.620*
Z2	*2.948*	*0.001***	*1.910*	*0.001***	-	*0.771*
Bad Mouth Taste						
Z0	-	*1.000*	-	*1.000*	-	*0.400*
Z1	*0.734*	*0.043**	*0.412*	*0.616*	-	*0.707*
Z2	*1.015*	*0.001***	*0.544*	*0.235*	-	*0.181*
Bad Mouth Odor						
Z0	-	*0.501*	-	*1.000*	-	*0.099*
Z1	*0.762*	*0.039**	*0.057*	*1.000*	-	*0.006***
Z2	*0.830*	*0.011**	*0.170*	*1.000*	-	*0.022**

Cohen's Effect Size *P < ,05.
**P < ,01.
Z0 (first intervention).
Z1 (20 min after the first intervention).
Z2 (20 min after the second intervention).

undergoing laparoscopic bariatric surgery and found a significant decrease in thirst intensity, hydration, dry mouth, and taste at three moments in patients in the intervention and control groups. Conchon et al[22] found that menthol ice reduced thirst intensity and discomfort in the early postoperative period. Doğan[36] found that menthol chewing gum was effective on thirst intensity in patients undergoing abdominal surgery. Puntillo et al[33] found that the application of an intervention package including oral swabs, water sprays, and menthol-based lip moisturizer reduced thirst intensity and distress in intensive care patients. Oh et al[17] examined the effect of flavored mouthwash, cold water mouthwash, and wet gauze application on thirst, bad breath, and sore throat after spine surgery and reported that rinsing the mouth with flavor solution at 30, 60, and 90 minutes was more effective than cold water and wet gauze application. Cold strategies reduce thirst by acting on oral thermoreceptors to activate brain regions responsible for thirst satiety.[13,37] This allows the individual to feel satiated by oral cooling without consuming large amounts of fluids. [8,25]

According to the pairwise comparison of the groups, there was no statistically significant difference between the thirst intensity, dry mouth, bad taste, and bad odor scores at Z0 (P > .05). At Z1 and Z2, there was a statistically significant difference between the thirst intensity, dry mouth, bad taste, and bad odor scores of the control group-menthol ice group patients and the control group-ice popsicle group patients (P < .01). Although there was no statistically significant difference between the thirst, dry mouth, and bad taste scores of the patients in the ice popsicle-menthol ice group (P > .05), it can be said that menthol is clinically more effective according to Cohen's r value. There was a statistically significant difference between the bad odor scores of the patients in the ice popsicle-menthol ice group (P < .01).

At Z1 and Z2, menthol ice and ice popsicle reduced thirst intensity, dry mouth, bad taste, and bad odor sensation, and although there was no difference between the thirst, dry mouth, and bad taste scores of the patients in the ice popsicle-menthol ice group, we think that menthol is clinically more effective according to Cohen's r value. The fact that menthol ice is more effective than ice popsicles in eliminating bad odor in the mouth is consistent with the literature.[17] Conchon and Fonseca[1] examined the effect of water and ice application on thirst after surgery and reported that ice cubes were 37.8% more effective than water in quenching thirst. Moon et al[16] found that gauze soaked with cold water (control group) and gauze soaked with cold saline solution (experimental group) were effective in reducing thirst. Cho et al[14] found that there was a significant decrease of 7.88 in thirst intensity in patients treated with saline solution and frozen gauze after laparoscopic cholecystectomy. Aroni et al[3] applied water and ice at room temperature to patients in the early postoperative period and reported that the decrease in thirst intensity of patients in the ice group was higher than that of the water group. Eren[32] examined the effect of oral ice and water application on thirst after surgery and found that oral ice application is a highly effective and reliable application in the management of moderate and severe thirst. Lee et al[7] applied ice, room temperature water, and an oral humidifier in the management of postoperative thirst and found that ice and room temperature water were superior to oral humidifiers. Oztas and Oztas[18] found that spraying cold water was effective on thirst and dry mouth. Both alternative strategies were found to be effective in reducing thirst. Based on the literature, we concluded that the effect in the groups is similar because oropharyngeal thermoreceptors are activated by both cold and menthol, stimulating the saturation mechanism before absorption.[8,25,33] Our research is important in terms of showing that menthol ice application is effective and supports the literatüre.[19,22–24]

The symptom of dry mouth associated with dehydration can lead to discomforts such as the burning of the tongue, decreased taste sensation, and difficulty swallowing and speaking. Saliva flow and production are stimulated by cold temperatures to moisturize the mucosa.[8,10,15] In a study by Puntillo et al[33] in which an intervention package including oral swabs, water sprays, and menthol-based lip moisturizer was applied in

surgical, neurology, and cardiovascular intensive care unit, patients' dry mouth was significantly reduced compared to patients receiving normal care.[33] Zhang et al[20] found that vitamin C sprays, mint water mouthwash, and lip moisturizer relieved dry mouth in intensive care patients. Serato et al[19] found that menthol ice packs were higher than nonmenthol ice packs on thirst intensity, dryness, and especially taste improvement in the oral cavity.

In our study, menthol ice and ice popsicle application were effective in reducing the bad taste sensation in the mouth. Serato et al[19] reported that the improvement in taste was higher after 30 minutes of the first intervention of the menthol ice pack. In the Doğan[36] study, some patients in the menthol chewing gum group stated that a pleasant taste remained in their mouths. Products containing menthol or cooling agents are perceived as invigorating or arousing, and this is linked to their effects on TRPM8 cation channels.[25] This result is thought to be due to the fact that menthol is obtained from natural sources and has a pleasant aroma.[38]

When salivary flow decreases, the self-cleaning mechanism of the mouth disappears, and the microorganisms responsible for bad breath change toward gram-negative bacteria.[39] Postoperative halitosis is associated with dry mouth and occurs as a result of intubation, decreased salivation due to bleeding, anticholinergics and opioids used in the surgical process, preoperative fasting period, and prolonged oral intake after surgery.[17,32] In our study, we found that postoperative ice popsicles and menthol ice reduced the feeling of bad odor in the mouth. Since the bad breath scores of the patients who received menthol ice at Z1 and Z2 were significantly lower than those of the patients who received ice popsicles, menthol ice application is more effective in eliminating bad breath. Oh et al[17] found that flavored mouthwash provided better oral health by reducing the patient's bad breath, and mint was found to be effective in eliminating bad odors. Eren[32] found that water and ice application in the early postoperative period had a positive effect on the feeling of bad odor in the mouth. This positive effect of menthol ice can be explained by increased saliva flow through stimulation of the salivary glands and the antiseptic and antimicrobial effect of menthol.[17,40]

Limitations and Generalizability of the Study

The effect of environmental temperature and humidity on thirst could not be evaluated, and fluid balance was not a variable considered in the study. The study was planned in four time periods, and due to the Covid-19 pandemic, was reduced to two applications to limit contact. Since the duration of anesthesia of the patients was equal, this variable was not included in the evaluation. Information about the duration of the surgical operation could not be obtained and therefore was excluded from the table. The study was planned to take place in the PACU. However, due to the insufficient number of beds, the patient who woke up from anesthesia was sent to the General Surgery Clinic where the study took place. Culturally, the effect of ice application on the immunity of the patient could not be demonstrated in this study.

Conclusions

This study concluded that menthol ice and ice popsicles reduced thirst intensity, dry mouth, bad taste, and bad odor in postoperative patients. Although menthol products were not more effective than nonmenthol products, the results confirm that menthol-related cold strategies can benefit perioperative patients in terms of thirst intensity, dryness, and taste in the oral cavity. Menthol ice was confirmed to be more effective than nonmenthol products in eliminating bad breath odor. In cases of laparoscopic cholecystectomy surgery, water restriction persists not only during anesthetic recovery but also in the late postoperative period. The realization that it is possible to safely quench the patient's thirst with a small amount of fluid by activating preabsorption satiety with cold and menthol strategies points to an innovative application for nursing care.

Declaration of Competing Interest

The authors declare no actual or potential conflict of interest.

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