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A Contributing Approach to The Management of Pain and Anxiety Associated with Tube Thoracostomy: Chewing Gum

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ABSTRACT

Gum chewing improves the mood of individuals and also relieves stress and anxiety. Considering the vicious circle between anxiety and pain, gum chewing may help to break this circle and control the pain caused by invasive procedures. This study aims to investigate whether chewing gum can help relieving pain and anxiety associated with tube thoracostomy application.

A pre-test/post-test control group design was used in this quasi-experimental study, which included 46 patients who were applied tube thoracostomy. The patients were assigned to the gum-chewing group and the control group. Patients' pain and anxiety levels were assessed at the 2nd hour following the analgesic application performed after tube thoracostomy and once again 30 minutes after this assessment. The data were analyzed using percentage, frequency, mean, independent and paired samples t-tests.

There was a difference between the chewing gum group and the control group in terms of changes in pain and anxiety. In the second evaluation made after chewing gum, it was determined that the pain and anxiety levels of the gum chewing group were significantly relieved.

In management of the pain and the anxiety levels resulting from tube thoracostomy, chewing gum may help to eliminate the vicious circle between pain and anxiety and so reduce pain and anxiety. Chewing gum, as a simple and affordable nursing intervention contributing to pain and anxiety management, should be included in care practices for relieving pain and anxiety after thoracic invasive interventions.

Keywords: Anxiety, Acute Pain, Medical-Surgical Nursing

Introduction

"Tube thoracostomy", is performed after the surgical interventions applied to the thorax and for the treatment or correction of acute and chronic problems occurring in cases such as pneumothorax, penetrating and blunt chest traumas, hemothorax, chylothorax, pleural effusion, empyema, bronchopleural fistula, chemical pleurodesis for benign and malignant conditions.(1) Patients' lack of information about the procedure causes to experience anxiety more intensely associated with tube thoracostomy application, and increased anxiety causes also the pain resulting from this intervention to be affected negatively.(2,3,4) Considering the interaction between anxiety and pain, the importance of the nursing interventions related to the pain management in the care of the patients undergoing tube thoracostomy becomes apparent.

As a personal and subjective experience, pain can be an important cause for anxiety and increased anxiety causes patients to experience more intense pain.(5,2) It is seen that many pharmacological or non-pharmacological methods are used for relieving acute pain occurring after invasive procedures and surgery.(6,7) While gum chewing, which can be applied as a non-pharmacological method, is used to reduce both pain and anxiety, various results have been obtained regarding the effectiveness of gum chewing in pain management.(8-10) Although the research results report that chewing gum improves the mood of individuals and reduces stress and anxiety, (8,10) it is noteworthy that there are no studies in the literature examining whether chewing gum can be an effective method in reducing acute pain and

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related anxiety after tube thoracostomy. The aim of this study, which is thought to contribute to the literature, is to investigate whether chewing gum helps control acute pain and anxiety caused by tube thoracostomy application.

Materıals and Methods

Design and Sample: The research is in the category of analytical research. A pretest-posttest control group design was used in this quasi-experimental study. It was carried out with 46 patients who were applied tube thoracostomy and treated in the thoracic surgery unit of a university hospital in northwestern Turkey from February 2017 to February 2019.

The sample size was calculated by using the G*Power (3.1.9.4). As a result of the analysis applied with the mean and standard deviations in the study results of Ciğerci and Özbayır(5), it was found that each group should comprise of at least 23 patients (46 patients in total) at 0.99 effect size, 95.4% power and alpha 0.05. In order to avoid potential sample loss, 48 patients, 24 patients in each group, were assigned to the study. Two patients in the experimental group were excluded from the sample because they did not accept chewing gum during the data collection process. Consequently, the study was conducted with 46 patients (gum-chewing group: 22, control group: 24). Patients who fulfilled the sampling requirements and were accepted to participate in the study were chosen using a convenience sample method. Patients were assigned to the gum-chewing group (n=22) and the control group (n=24).

Inclusion Criteria: Patients who were included in the study were 18 years old or older, they accepted to participate in the study, had no speech issues or chewing disorders, had been applied a tube thoracostomy with local anesthesia, and volunteered to chew gum. Patients who underwent tube thoracostomy due to spontaneous pneumothorax and met the inclusion criteria were included in this study.

Exclusion Criteria: It had been planned to exclude patients who developed complications due to local anesthesia or tube thoracostomy during or after the procedure. However, no patient developed complications. As a result, 22 patients who agreed to chew gum were included in the chewing gum group, and 24 patients who did not accept chewing gum were included in the control group, and the study was completed.

Data Collection and Instruments: A personal information form was used to gather data on the patients' demographic and health-related features, the State Anxiety Inventory was used to detect anxiety levels, and a numerical pain scale (0-10) was used to determine patients' pain levels.

The Personal Information Form: The Personal Information Form consists of 9 questions. The questions cover demographic features of the patinets incuding their age and gender, and the data regarding their health such as surgical and tube thoracostomy experience, their pain levels in prior experiences, satisfaction of pain management in these experiences and current pain intensity. The numerical pain scale consists of numbers from 0 (no pain) to 10 (unbearable pain) to rate pain severity.

State and Trait Anxiety Inventory: The scale, which was developed with two factors based on the concept of anxiety and includes 40 items, consists of two parts. First 20 items of the scale measure the state anxiety level, while items from 21 to 40 measure the trait anxiety level.

The State Anxiety Inventory, which was used in the research, assesses how a person feels at a certain time and under certain circumstances. In the response of the scale, one of the preferences from not at all (1), somewhat (2), moderately so (3), and very much so (4) is expected to be marked according to the severity of emotions, thoughts, and/or behaviors. For the calculation of the scale, the total score of the reversed statements was subtracted from the total score of the direct statements, 50 the invariant value of the state anxiety scale was applied to the score obtained such that the state anxiety score is attained.

Ethical Considerations: The Research Ethics Committee of the University reviewed the study and approved it by giving the protocol number 2016/185. The Declaration of Helsinki, Good Clinical Practice Guidelines, and the Ethics Committee requirements were taken into account during the study process. The research was performed based on the written approval from the hospital's Thoracic Surgery Department. Before the study, patients were informed about the purpose and methodology of the study, and that they could leave the study without stating a reason, as well. Arterwards, their written consents were obtained.

Procedure: The researcher detected patients who met the sampling criteria and were hospitalized due to pleural effusion and spontaneous pneumothorax and would have been applied tube

thoracostomy. And then, the aim and implementation of the study were explained to the patients, and patients who accepted to participate in the research were included in the study. Patients who volunteered to chew gum were assigned to the gum-chewing group and the patients who reported that they did not want to chew gum were assigned to the control group.

After obtaining patients' consent to take part in the research, they were informed about the application of tube thoracostomy and prepared for the procedure in the intervention room at the clinic. Vital signs, consciousness levels, and oxygen saturation of the patients were monitored before, during, and after the procedure. After the application area was determined, tube thoracostomy was applied under local anesthesia. The same, short-acting local anesthetic (2% Lidocaine, 2.5 mg/kg) was used in all patients for local anesthesia.

Patients were wound-treated after application of the tube thoracostomy, and Lornoxicam, a non-steroidal anti-inflammatory analgesic agent was administered as 8 mg/2 ml IV for pain control. After the analgesic application, patients were transferred to their rooms to rest and during the times their vital signs, oxygen saturation, and complications were monitored. At the 2nd hour following the analgesic application performed after the procedure, anxiety levels of all the patients included in the research were assessed using STAI, and the numerical pain scale was used for evaluating pain intensity. The reason for performing the pain and anxiety assessment 2 hours after the analgesic administration was to prevent the effect of local anesthesia, which wears off approximately in 1,5-2 hours after the administration, from impacting the pain perception and also to prevent the negative effect of pain on the anxiety with the analgesic effect, which reaches the maximum plasma concentrations approximately in 1-2 hours following the administration.

It is mentioned in the literature that chewing gum for 3-15 minutes facilitates cognitive functions, and for 30 minutes it might have beneficial effects on affect.(10-12) Based on this information, after the first evaluation of pain and anxiety, patients in the gum-chewing group were given sugar-free gums and requested to chew these gums for 15 minutes and afterwards to rest in their rooms for another 15 minutes. In order to avoid suppressing the metallic taste sensation in the mouth, which is one of the early findings of local anesthetic toxicity, attention was also paid to the fact that the gums were without sugar and aroma. Gums that have the same features were given to the patients. After chewing the gum, patients' pain intensity and anxiety levels were assessed once again.

Pain and anxiety levels were assessed in the control group at the 2nd hour following the analgesic application, and 30 minutes after this initial assessment the pain and anxiety were re-assessed. All evaluations regarding the pain and anxiety monitored within the scope of the research were carried out in the rooms of the patients and while they were resting.

Data Analysis: In data evaluation, SPSS (Statistical Package for the Social Science) for Windows 23 was used for statistical analyses. Mean, frequency, and percentage were used for patients' characteristics. The suitability of the variables for normal distribution was examined with the Kolmogorov-Smirnov test and it was seen that the data showed normal distribution. Mann-Whitney U test was used to determine the differences in patients' characteristics and pain and anxiety levels according to groups. Wilcoxon (Paired Sample) T-test was used to determine the differences between the pain and anxiety levels in repeated measurements. The findings were assessed at a confidence interval of 95%, with $p < 0.05$ being considered significant.

Results

The mean age of the patients involved in the study was 60.13 (13.98), 71.7% were male, 65.2% had a previous surgical experience and 73.9% had tube thoracostomy experience. The highest pain intensity experienced by the patients after the previous surgery was 5.85 (2.95) and the lowest pain intensity was 2.40 (2.32). Patients' pain level at the 2nd hour after tube thoracostomy application was 5.26 (1.95) and their anxiety level was 42.54 (5.17). The subsequent pain level of the patients was 4.52 (2.24) and the anxiety level was 42.04 (5.15). In terms of patients' characteristics, pain and anxiety levels, there was no statistically significant difference between the gum-chewing and control groups (Table 1).

The pain level experienced by the patients in the gum-chewing group at the 2nd hour after tube thoracostomy application was 5.45 (1.22) and the anxiety level was 42.68 (5.55), the pain level was 4.04 (2.10) and the anxiety level was 40.59 (5.24) fifteen minutes after the end of chewing gum. It was found that there were statistically significant differences between the pain intensity and anxiety

Table 1. Characteristics of Patients in Gum-Chewing and Control Groups

		Total (n=46)		Gum-chewing Group (n=22)		Control group (n=24)		
Characteristics		n	%	n	%	n	%	p*
Gender	Female	13	28.3	7	31.8	6	25	0.608
	Male	33	71.7	15	68.2	18	75	
Presence of surgical experience	Yes	30	65.2	12	54.5	18	75	0.146
	No	16	34.8	10	45.5	6	25	
Presence of chest tube experience	Yes	12	26.1	7	31.8	5	20.8	0.397
	No	34	73.9	15	68.2	19	79.2	
		Mean±SD	Min-Max	Mean±SD	Min-Max	Mean±SD	Min-Max	p**
Age		60.13±13.98	18-84	57.18±10.20	27-71	62.83±16.48	18-84	0.174
The highest level of pain experienced in the past surgical experience		5.85±2.95	0-10	6.63±2.94	0-10	5.31±2.93	0-10	0.261
The lowest level of pain experienced in the past surgical experience		2.40±2.32	0-9	2.81±2.44	0-8	2.12±2.27	0-9	0.457
The highest level of pain experienced in the past tube thoracostomy experience		7.27±1.48	4-9	6.85±1.67	4-9	8.00±0.81	7-9	0.239
The lowest level of pain experienced in the past tube thoracostomy experience		3.54±2.65	1-9	4.14±3.23	1-9	2.50±0.57	2-3	0.351
Pain level before the gum chewing		5.26±1.95	0-9	5.45±1.22	3-8	5.08±2.44	0-9	0.515
Pain level after the gum chewing		4.52±2.24	1-9	4.04±2.10	1-8	4.95±2.33	1-9	0.172
Anxiety level before the gum chewing		42.54±5.17	32-55	42.68±5.55	32-53	42.41±4.90	33-55	0.864
Anxiety level after the gum chewing		42.04±5.15	30-52	40.59±5.25	30-50	43.37±4.80	36-52	0.067

*Pearson Chi-Square, **Independent Samples t-test

level of the patients in the gum-chewing group before and after chewing gum ($p<0.01$). Pain and anxiety reduced after chewing gum (Table 2).

In the control group, patients' first and the second pain levels were 5.08 (2.44) and 4.95 (2.33), and anxiety levels were 42.41 (4.90) and 43.37 (4.80), respectively. Patients' pain and anxiety levels had no statistically significant difference (Table 2).

In the gum-chewing group, the pain level decreased by 1.41 (2.01) points, and the anxiety level decreased by 2.09 (4.67) points. In the control group, it was found that the pain level decreased by 0.13 (1.70) points and the anxiety level increased by 0.96 (3.46) points. In terms of changes in pain and anxiety levels, there was a statistically significant difference between the gum-chewing and control groups ($p<0.05$) (Table 2).

At the end of the study, it was found that the power of this study to detect a reduction in pain was 74,1%, and to detect a reduction in anxiety was %79.7.

Table 2. Pain and Anxiety Levels in Gum-Chewing and Control Groups before and after Implementation of the Gum-Chewing

	Gum-chewing group					Control Group				
	Before the Gum-Chewig	After the Gum-Chewig	Reduction (95%C)	t	p	Before the Gum-Chewig	After the Gum-Chewig	Reduction (95%C)	t	p
Pain Level (Mean± SD)	5.45±1.22	4.04±2.10	1.40±2.0 (0.51 to 2.30)	3,279	0.004*	5.08±2.44	4.95±2.33	0.13±1.70 (-0.59 to 0.84)	0.360	0.722
Anxiety Level (Mean± SD)	42.68±5.55	40.59±5.25	2.09±4.67 (0.02 to 4.16)	2.100	0.048**	42.41±4.90	43.37±4.00	-0.96±3.45 (-2.42 to 0.50)	-1.358	0.188

Paired Samples t-test, * p<0.01, ** p<0.05, CI: Confidence Interval

Discussion

The reciprocal interaction between pain and anxiety, in which individual characteristics also play a role, can be triggered by various surgical procedures. High anxiety and pain levels can also increase the complication rate of surgical procedures. Various medical and conventional non-medical methods are used to control anxiety and pain before the procedure.(13) The positive effects of chewing gum on the patient's stress, pain and anxiety levels are mentioned in studies. Other proven benefits are on cognitive functions, memory and alertness.(14-16) Anxiety exprienced before tube thoracostomy application, which is a surgical procedure frequently applied in thoracic surgery, and pain management during the procedure are important in terms of patients' comfort and the success of the procedure. Initially, by reviewing the literature, we were able to evaluate the effect of chewing gum on acute pain and anxiety caused by tube thoracostomy.

Chewing gums may cause neurotransmission effects that have an impact on pain and anxiety. Kamiya et al.(17) have shown that providing a higher activation of the ventral prefrontal cortex, chewing gum contributes to greater activity in the dorsal raphe nucleus of the serotonergic neurons and so decreases nociceptive reflexes.[17,18] So chewing gum can reduce pain and anxiety with these mechanisms.

Also chewing and clenching may have effect on relieving stress and ensure relaxation. It has been reported that chewing gum regularly for 2 weeks may lead to significant decreases in anxiety, depression, weakness, and confusion symptoms. Salivary cortisol, whose level increases by chewing activity, is another contributor to the reduction of pain and anxiety.(19,20) However, chewing gum for a long period should not be encouraged because it may cause complaints of fatigue and pain in the masticatory muscles.(9) Another possible positive effect is on oral and dental care. In the study of Topcu et al.(21), chewing gum effects were researched during intravenous cannulation in Turkish children. They reported that chewing gum was associated with lower pain scores. However, chewing gum may also have some negative effects in the long term such as increase in the feeling of nausea, fatigue, pain in neck-facial muscles, risk of aspiration in elderly patients.(9) In our study, pain and anxiety levels reduced after chewing gum in the acute period after tube thoracostomy without any complications.

Although many methods such as cold application, music therapy, breathing exercises, and lidocaine spray have been tried to reduce anxiety and pain levels following chest tube removal, in the literature there wasn't any non-medical method researched for decreasing pain and anxiety levels during tube thoracostomy application. The studies suggested that in addition to pharmacological medications, non-pharmacological interventions can help to reduce pain and anxiety.(22,23) In terms of changes in pain and anxiety levels following tube thoracostomy application, there

was a statistically significant difference between the gum-chewing and control groups in our study.

Otomaru et al.(7), Weijenberg et al.(9) and Kamiya et al.(17) state in their studies that chewing gum positively affects pain, stress, and anxiety. Topcu et al.(21) also report in their study carried out with children that gum chewing is effective in the management of pain occurring while establishing vascular access. On the other hand, Lewkowski et al.(24) emphasize in the results of their study with children that there is no interaction between gum chewing and pain.

It is stated that there is a relationship between chewing gum, which is thought to be an effective intervention in eliminating the vicious circle between pain and anxiety by ameliorating the mood and increased cerebral blood flow and that gum chewing improves psychological stamina against anxiety.(7,25,26) In the studies examining the effect of gum chewing on human psychology as well as on pain and anxiety, it is reported that gum chewing has a positive effect on pain and anxiety.(16,18,21) It is stated that rhythmic mouth movements occurring while gum chewing boost the production of serotonin which has significant effects on anxiety and stress.(24,25,28)

Although researches examining the effectiveness of gum chewing on reducing anxiety and pain have been performed, it is noteworthy that these studies were carried out particularly with children, and the number of researches looking at the contribution of gum chewing to control acute pain in adult patients is insufficient.(16,29-31) Based on our findings; chewing gum can be an effective method in reducing acute pain and related anxiety following tube thoracostomy.

Limitations: It should be accepted that this research has a number of limitations such as limited sample size and only the post-procedure comparison of pain and anxiety levels. Additionally, both the limited number of the patients and chewing inability or refusing to chew, due to oral and dental problems of the patients, limited the randomization practice in the study.

Conclusions: While no non-medical method was mentioned in the literature to decrease pain and anxiety levels during tube thoracostomy application, decreased pain and anxiety levels with chewing gum after tube thoracostomy are important and promising findings for pain management in this study. Based on the research findings, it can be said that chewing gum can be an effective method in reducing acute pain and related anxiety. In this direction, it can be recommended to use chewing gum as an affordable and safe method in nursing care applied after invasive interventions that cause acute pain and increase anxiety. It is also recommended to conduct new studies with a larger sample to investigate the effectiveness of chewing gum on pain and anxiety in different invasive procedures.

Author Contributions: All authors were responsible for the study conception and design. A.G.I. and F.Y. were involved in participant selection and performed the data collection. S.Y.T. contributed to the analysis of the data and interpretation. S.Y.T. and F.Y contributed drafting of the article. All of the authors critically revised the manuscript, discussed the results and commented on the manuscript and approved the final version to be published.

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