**EFFECT OF GUM CHEWING ON RECOVERY AFTER SURGERY FOR
COLORECTAL SURGERY PATIENTS: A RANDOMISED CONTROLLED TRIAL**

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ABSTRACT

The aim of this study was to determine the role of chewing gum in bowel functions after left colon and/or rectal surgery. In this randomized controlled study, the sample consisted of adult patients who had undergone elective open left colon and/or rectal surgical interventions under general anesthesia. The sample comprised 17 patients in the experimental group and 17 patients in the control group. The patients in the experimental group chewed a sugar-free gum after removal of their nasogastric tubes, three times a day for 45 minutes from the first post-operative morning until they had first flatus. Routine care was maintained for the patients in the control group until their first flatus. The effects of chewing gum on the length of time until first flatus, the first defecation in the post-operative period and the discharge of patients were investigated. The patients in the experimental group had flatus and defecation earlier and the duration of their hospital stay was shorter than those of the control group patients. It was found that gum chewing as a physiological method promote the early initiation of bowel functions, and consequently, shortens the hospital stay after elective left colon and/or rectal surgery.

Keywords: Chewing gum; post-operative period; colorectal surgery; gastrointestinal motility

Introduction

Patients usually have difficulty in first flatus and experience abdominal distention or paralytic ileus following major abdominal surgeries. Factors such as fluid-electrolyte imbalance, delayed feeding, the use of general anesthetics and narcotic analgesics, and an increase in post-operative sympathetic activity due to stress cause abdominal distention. Stressors such as post-operative pain, suppressing the urge to defecate, and the use of bedpans cause stress responses, and as a result, can cause abdominal distention (Asao et al., 2002; Kumar, Kumari, Kumar, & Raj, 2018).

Prolonged abdominal distention or paralytic ileus following surgery negatively affect the patient's quality of life, prolongs the length of hospital stay and causes an increase in healthcare costs. Therefore, findings indicating the beginning and ending of paralytic ileus or prolonged abdominal distention should be carefully followed up by the nurse (Vásquez, Hernández, & Garcia-Sabrido, 2009; Stewart, & Waxman, 2009; Kobayashi, Masaki, Kogawa, Matsuoka, & Sugiyama, 2015).

Background

Among the interventions intended to increase early bowel activity after surgery, early feeding has been proven to shorten the time until the start of intestinal motility and first flatus. It reduces the risk of infection, and length of hospital stay (Asao et al., 2002; Gustafsson et al., 2013; Gnanarani, Mathew, & Venkatesan, 2018; Mahmoud, & Mohammad, 2018). Chewing gum has been described as some sort of “sham feeding” because even though there is chewing activity, no food is actually delivered to the stomach (Asao et al., 2002). Results of studies conducted with patients who had undergone colectomy surgeries show that chewing gum after surgery accelerated the re-initiation of bowel movements, shortened the length of hospital stay and increased satisfaction of patients (Asao et al., 2002; Topcu, & Oztekin, 2016; Mahmoud, & Mohammad, 2018; Gnanarani, Mathew, & Venkatesan, 2018; Manzoor, Hameed, Tayyab, Nawaz, & Afzal, 2019).

In order to prevent post-operative ileus, the Enhanced Recovery after Surgery Society has given some recommendations on elective colonic surgery patients. These include chewing gum after surgery, not using pro-kinetic agents and nasogastric decompression, using mid-thoracic epidural analgesia and a low-dose laxative like magnesium oxide, and avoiding fluid overloading during and after surgery (Gustafsson et al., 2013).

Chewing gum after major abdominal surgeries, such as a colectomy, has emerged as a simple, different and safe practice that promotes the early initiation of bowel movements and stimulates intestinal motility. Moreover, it has also been emphasized in many studies that chewing gum has no side effects (Asao et al., 2002; Gustafsson et al., 2013; Topcu, & Oztekin, 2016; Mahmoud, & Mohammad, 2018; Manzoor, Hameed, Tayyab, Nawaz, & Afzal, 2019).

In a study by Gnanarani et al. (2018), 30 patients who had undergone open abdominal surgery were given chewing gum, and 30 patients were given routine care. This study found that in the experiment group, the time of bowel sounds returning was six hours shorter, and first flatus of patients was six hours shorter than the times it took in the control group. In another study by Kobayashi et al. (2015) with patients who were diagnosed with left-sided colorectal cancer, the first bowel movement, the post-operative length of hospital stay, and the total length of hospital stay of the gum-chewing group were 22 hours, 3.9 days, and 14.4 hours shorter, respectively, than the control group. In a study by Tufail et al. (2019) with patients who chewed gum after having undergone cesarean sections, the time before hearing intestinal sounds, the time of first flatus, and the time until hospital discharge were shorter than those of the control group.

In Turkey, chewing gum is not used in all surgical clinics as a routine practice for early return of bowel functions after abdominal surgery. Nurses in our country ambulate the patients as soon as possible after surgery, per the doctor's request, administer intestinal stimulants containing sodium phosphate, glycerol, etc., and have the patients perform active or passive in-bed exercises. To the best of our knowledge, chewing gum after left colon and/or rectal surgeries has not been investigated previously in Turkey.

As emphasized in the 2012 International Council of Nurses theme, nurses require evidence-based, reliable, cheap, useful, and easy initiatives in order to reduce negative effects of the

problems experienced by patients (WHO, 2012). Within this scope, post-operative gum chewing is currently popular. This approach is thought to ensure an early recovery and a shorter hospital stay. In addition, it is believed that this study will be an impetus for other studies with different patient populations. The aim of this study was to determine the role of chewing gum in bowel functions after left colon and/or rectal surgery.

Methods

Study Design and Sample

This experimental study was a randomized controlled trial conducted in the general surgery clinics of a University Hospital in Ankara, Turkey from May 24, 2010 to June 6, 2011. This study was conducted to determine the effects of chewing gum on the length of time until first flatus in the post-operative period in patients who had undergone left colon and/or rectal surgical interventions. The effects of gum chewing on the length of time until the first defecation in the post-operative period and the discharge of each patient were also investigated.

In the general surgery clinics of this University Hospital, oral feeding was started approximately two to five days after bowel functions begin in the post-operative period following left colon and rectal surgeries. Unless the doctors had requested otherwise, no food or drink was given to the patients in the post-operative period until first flatus. The sample size calculation was done using the Number Cruncher Statistical System (NCSS) – Power Analysis and Sample Size (PASS) 2006 software. In accordance with the prior data (Vásquez, Hernández, & Garcia-Sabrido, 2009; Parnaby, MacDonald, & Jenkins, 2009), the main parameter, first flatus, was accepted as 70 ± 20 hours for the control group and 55 ± 20 hours for the experimental group. Based on the results of a study by Watson et al. (2008), if 17 patients were to be included in each group and the difference in times until first flatus between the

experimental and control groups was estimated to be 20 hours, the alpha level of the study would be 0.05 and power of the study would be 81%. On this basis, we included a total of 34 patients in the study sample: 17 in the experimental group and 17 in the control group (Figure 1).

The study sample included adult patients (40 years of age or older) who agreed to join the study; had undergone elective open left colon and/or rectal surgical interventions under general anesthesia; did or did not have stomas in the post-operative period; had benign or malign formations in the left colon and/or rectum; could tolerate chewing gum in the post-operative period; did not have any mental disorders or difficulty in communicating; and were grade I or II of the American Society of Anesthesiologists (ASA) Physical Status Classification System: “*ASA Physical Status I: A normal healthy patient, ASA Physical Status II: A patient with mild systemic disease*” (American Society of Anesthesiologists Physical Status Classification System, 2012). Patients excluded from the study were as follows: those who had initially agreed to join the study but wanted to leave for some reason; those who could not tolerate chewing gum in the post-operative period; those who had undergone a C-section, hysterectomy or extensive intra-abdominal surgery; those who had a history of metastatic disease or inflammatory intestinal disease; those who used medicines for systemic diseases which could affect bowel functions; those who had any kind of complications after the surgery; and those who were grade III, IV or V of the ASA Physical Status Classification System: “*ASA Physical Status III: A patient with severe systemic disease, ASA Physical Status IV: A patient with severe systemic disease that is a constant threat to life, ASA Physical Status V: A moribund patient who is not expected to survive without the operation*” (American Society of Anesthesiologists Physical Status Classification System, 2012). Four patients had not met the inclusion criteria, three patients declined to participate, and one patient had undergone surgery due to a traffic accident and was in the intensive care unit.

Forty-one patients were randomly assigned to the groups. Three patients from the experimental group and two patients from the control group decided to leave the study and two patients who did not want to chew gum due to nausea were excluded from the study.

Data Collection Instruments

To collect the data, the Introductory Information Questionnaire and Patient Follow-up Form were used, which were developed by the researchers. Patient characteristics such as age, gender, ASA grade, presence of systemic disease, continuous use of medications, pre-operative serum electrolytes levels, the duration of surgery, medications used in the post-operative period, the presence of stoma, nasogastric tube (NGT), epidural catheter and corset were collected on the Introductory Information Questionnaire. Information about the times of first flatus and defecation and the length of time until discharge was collected on the Patient Follow-up Form.

Randomization and Data Collection Methods

A pre-application was conducted to test the feasibility of the recruitment process, data collection process, study instruments and intervention process with two patients from the experimental group. Participant responses toward the data collection instruments generally indicated that the questionnaires were understandable.

Patients who fulfilled the inclusion criteria and agreed to join the study were stratified according to age and sex and were randomized by researchers according to days: odd days for the experimental group and even days for the control group. After randomization, a chi-square test was used to verify the homogeneity of the experimental and control groups according to age and sex. There was no statistically significant difference in age or gender between the groups ($p > 0.05$; Table 1).

The experimental group consisted of patients who chewed gum and received routine care, and the control group consisted of patients who received only routine care. Routine care included that which all patients receive after operations under general anesthesia: no food or drink is given to the patients in the post-operative period until first flatus is observed; patients are helped to stand up at the eighth hour following surgery and corsets are provided for patients with larger incision areas; patients have a NGT, epidural catheter and drain when they come out of surgery; the NGT is removed on the first day and epidural catheters are removed on the second day following surgery. In addition, a clear diet is given to patients during the day after first flatus. If patients tolerate a clear diet (no nausea and vomiting), they can begin a full liquid diet the next morning and then a soft food diet the following evening.

The left colon and/or rectal surgeries are performed by the same team every Monday and Wednesday at the hospital where the study was conducted. Eligible patients were selected at the clinics on Sundays and Tuesdays, and the patients were informed about the study both verbally and in writing. In these interviews, information on patients who agreed to join the study was acquired from their files. On the first morning following surgery, patients in the experimental group were given sugar-free gum after their NGTs were removed. They were instructed to chew the gum for 45 minutes and were again given sugar-free gum to chew for 45 minutes on the same day at 16:00 and 20:00. On the second morning following surgery, patients were given sugar-free gum at 09:00, 16:00 and 20:00, and this was continued until the patients had first flatus. The gum used in this study was mastic flavored sugar-free gum that is commercially available in the market. Patients in the experimental group chewed their first gum an average of 18.3 ± 2.5 hours after the surgery. Also, these patients chewed an average of 4.9 ± 1.7 pieces of gum until they had first flatus.

Patients in the control group received routine care only until they had first flatus. The first flatus, defecation and discharge times for both patient groups were recorded in the data

collection form. The first flatus and defecation times were determined by the patients' reports. Except for questions, all information on the data collection forms was obtained from patient files.

Ethics Approval

Upon receiving necessary written consent, the study was approved by the Hacettepe University Scientific Research Evaluation Committee; Management Department and General Surgery Department of the University Hospital conducted this study. All of the patients participating in the study were informed about the study and their written consent was taken.

Data Analysis

Statistical analyses of the study data were performed using the Statistical Package for Social Sciences (SPSS) version 15.0. Chi-square, Fisher's exact chi-square, Student-t, and Mann-Whitney U tests were performed to determine whether or not there were any significant differences between the lengths of time until initial flatulence, defecation and discharge for the experimental and control group patients. Descriptive data of the study were evaluated using sample size (N), mean, standard deviation (SD) and percentages.

Study Limitations

There were two limitations of this study. First, it was conducted in only one hospital in Turkey. Second, the sample size of this study was limited because of the limited number of cases that were performed in the clinic. Therefore, the results cannot be generalized to all patients undergoing colorectal surgery.

Results

Statistical analyses showed that both the control and experimental groups did not differ significantly in terms of age, gender, ASA grade, presence of systemic disease, continuous use of medications due to systemic diseases, and consumption of potassium chloride (Potasyum Klorür; Galen), magnesium (Magnezyum Sulfat; Galen), calcium (Calcium-Picken; Adeka), opioids (Aldolan; Liba) and Nonsteroidal Anti-Inflammatory Drugs (NSAIDs) (Diclomec; Mecom and Tilcotil; Roche) in the post-operative period ($p>0.05$; Table 1 and Table 2). Although it is not shown in the table, the mean age was 56.47 ± 9.77 for the experimental group and 55.12 ± 11.05 for the control group. In addition, there was no statistically significant difference between the experimental and control groups in terms of the pre-operative serum calcium, sodium, potassium and phosphorus levels; duration of surgery; consumption of multivitamins (Cernevit; Eczacıbaşı-Baxter), nutritional solutions (Tracutil; B.Braun), metamizole sodium (Novalgin; Sanofi Aventis), antibacterial infusions (Cefamezin; Eczacıbaşı), and antiemetic medications (Metpamid; Yeni) in the post-operative period; stoma, NGTs, epidural catheters and presence of corsets during initial ambulation ($p>0.05$).

There was a statistically significant difference between the experimental and control group patients in terms of first flatus, defecation, and length of time until discharge ($p<0.05$; Table 3). The mean first flatus time of the experimental group patients who were given gum in the post-operative period was 47.3 ± 13.9 and that of the control group patients was 62.9 ± 18.4 hours after surgery ($p=0.009$; Table 3). The mean first defecation time of the experimental group patients was 55.8 ± 14.9 hours after surgery and that of the control group patients was 81.6 ± 15.7 hours ($p<0.001$; Table 3). When the discharge times of patients were examined, the mean discharge time of patients in the experimental group was 108.1 ± 31.8 hours, while it was 142.6 ± 38.1 hours for the control group patients ($p=0.009$; Table 3). Consequently, the experimental group patients who were given gum in the post-operative period had first flatus and defecation earlier and had quicker discharge times than the control group patients.

Discussion

Problems related to the gastrointestinal system (GIS), such as abdominal distention and ileus, can often develop in the early post-operative periods in patients who undergo abdominal surgery. These problems can cause patients to experience difficulty in first flatus or defecation. Certain measures are recommended in order for the bowel functions to initiate in the early post-operative period. These include not using NGTs routinely after surgery; not administering thoracic epidural anesthesia; using NSAIDs instead of sympatholytic and parasympatholytic agents and systemic opioids; massaging the abdominal area; and ensuring early ambulation and feeding. In addition to these, it is emphasized that chewing gum in the post-operative period speeds up bowel functions (Gustafsson et al., 2013; Gnanarani, Mathew, & Venkatesan, 2018; Mahmoud, & Mohammad, 2018). In many studies, it has been reported that chewing gum in the post-operative period speeds up first flatus and defecation without any side effects and consequently, allows for early discharge of patients (Ngowe, Eyenga, Kengne, Bahebeck, & Sosso, 2010; Nimarta, & Shruti, 2013; Mahmoud, & Mohammad, 2018; Yenigul, Aydogan-Mathyk, Aslan-Cetin, Yazici-Yilmaz, & Ayhan, 2019).

When the first flatus times in the post-operative period were compared, it was determined that the first flatus times of the experimental group patients were 15.6 hours earlier than the control group patients (Table 3). This average time difference between the experimental and control group patients helped the experimental group patients feel much better. In a study by Asao et al. (2002) investigating the effects of chewing gum on bowel functions in the post-operative period, it was found that patients who chewed gum had first flatus at an average of 50.4 hours, and patients who received routine care had first flatus at an average of 76.8 hours. These findings are in parallel with the findings in our study. Chewing gum is thought to

promote earlier bowel functions without any oral feeding by stimulating the cephalic vagal reflex and secretions that allow GIS motility.

When the post-operative times of first defecation were compared, it was determined that the first defecation times of the experimental group patients were 25.8 hours earlier than those of the control group patients (Table 3). This difference between the experimental and control group patients could be due to the experimental group's shorter time for first flatus. In a study by Watson et al. (2008) investigating the efficacy of chewing gum after intestinal resection, the duration of defecation was determined to be an average of 74 hours in the post-operative period for the gum chewing group, while it was 112.5 hours for the non-gum chewing group. Again, in a study by Topcu et al. (2016) with patients who had undergone elective laparoscopic colectomy due to colorectal cancer, the average duration of defecation for the gum-chewing group was determined to be 3.0 days, while it was 5.7 days for the group that received routine care. According to our findings, the post-operative durations of defecation in the gum-chewing group were shorter than the findings of Watson (2008) and Topcu (2016). It can be said that the earlier flatus caused earlier defecation for the chewing gum group in the post-operative period.

When the discharge times of patients were compared, it was determined that discharge times of the experimental group patients were 34.5 hours earlier than the control group patients (Table 3). In a study by Kumar et al. (2018) with patients who had undergone abdominal surgery, the average hospital stay was determined to be 11.9 days for the gum-chewing group, while it was 12.6 days for the non-gum-chewing group, which shows similar findings to ours. In a study by Choi et al. (2011), chewing gum was determined to shorten the duration until first flatus and bowel movement; however, no effects were observed on the duration of hospital stay. The findings of our study show that the experimental group patients had first

flatus and defecation earlier than the control group patients, and therefore, they were discharged earlier.

In our sample, 94.1% of the patients were operated on due to tumoral formations. Antineoplastic treatment, usually the primary choice of treatment, often causes development of feeding disorders and suppression of the immune system. In addition, a delay in the start of bowel functions can occur in response to tampering with the bowels during surgery, the development of inflammatory responses in the bowels, surgical stress, general anesthesia, and the use of opioids. Any of these factors can also cause certain additional problems to develop. These would include the inability to have first flatus and defecation in the early post-operative period, pain, delays in wound healing, and an increased risk of hospital-acquired infections. These situations cause increases in care and treatment costs by prolonging the hospital stay. It is thought that ensuring the first flatus and defecation in the early post-operative period will shorten the hospital stay. Shortening hospital stays helps reduce patient care costs, speeds up the processes for patients waiting for treatment, reduces the time lost at work for patient and family members, reduces the costs of transport and accommodation for patients' relatives, and reduces the development of potential psychological problems.

Variables that might affect bowel movements for both groups (descriptive characteristics; pre-operative serum electrolyte levels; presence of NGTs, epidural catheters, stomas and corsets during initial ambulations in patients in the post-operative period and post-operative treatments) did not affect first flatus, defecation and discharge times ($p>0.05$).

To reduce the length of the stay in hospital and increase patient satisfaction in patients undergoing colon and/or rectal surgery, healthcare providers are struggling to provide interventions that will facilitate optimal patient outcomes. Therefore, as a low-cost, easy-to-utilize physiological method, chewing gum helps bowel functions to be initiated earlier in the post-operative periods, and consequently, shortens the patient's stay at the hospital. Findings

of this study can assist nurses and other healthcare providers for faster recovery of the patients.

Conclusion

This study found that gum chewing after left colon and/or rectal surgeries had a positive effect on bowel functions in the post-operative period and on the length of hospital stay. We believe that our study will provide the impetus for conducting even more detailed studies with larger sample sizes and different patient populations on the use of chewing gum to stimulate first flatus in the early post-operative period.

Acknowledgment

The authors thanks to Sezai Leventoglu, MD, Prof. because of his support for performing the study.

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Figure 1. Participant flow chart following consolidated standards of reporting. Adapted from “CONSORT 2010 Statement: Updated Guidelines for Reporting Parallel Group for Randomised Trials” by Schulz K. F., Altman D. G., & Moher D., 2010, *British Medical Journal London*, 340, 698–702. Doi: 10.1136/bmj.c332. Copyright 2010 by the CONSORT.

The article is the authors’ original work. The manuscript has not been previously published and is not being concurrently submitted elsewhere. The authors approve the content of the manuscript. They declare that they have no conflict of interests. Neither the research nor the preparation of the article was financially supported. As a summary article, we believe that it is useful for nurse researchers and clinical nurses.

TABLES

Table 1. Descriptive Characteristics of Patients

Descriptive Characteristics	Experimental Group (N = 17)		Control Group (N = 17)		<i>Statistical Outcome</i>
	<i>N</i>	<i>%</i>	<i>N</i>	<i>%</i>	
Age					
40-64 years	14	82.3	12	70.6	$\chi^2 = 0.654$
65-80 years	3	17.7	5	29.4	$p > 0.05$
Sex					
Female	8	47.1	10	58.8	$\chi^2 = 0.118$
Male	9	52.9	7	41.2	$p > 0.05$
Systemic Disease					
Yes	8	47.1	11	64.7	$\chi^2 = 0.477$
No	9	52.9	6	35.3	$p > 0.05$
Continuous Use of Medicine					
Yes	8	47.1	10	58.8	$\chi^2 = 0.118$
No	9	52.9	7	41.2	$p > 0.05$
ASA Physical Status Classification System Grade					
ASA 1	8	47.1	10	58.8	$\chi^2 = 0.118$
ASA 2	9	52.9	7	41.2	$p > 0.05$

* Fisher's Exact Chi-Square Test was used.

Table 2. Consumption of Medicines in the Post-operative (PO) Period

PO Medications	Experimental Group (N = 17)		Control Group (N = 17)		Statistical Outcome
	N	%	N	%	
Potassium Chloride					
Given	4	23.5	8	47.1	$\chi^2 = 1.159$
Not Given	13	76.5	9	52.9	$p > 0.05$
Magnesium					
Given	6	35.3	7	41.2	$\chi^2 = 0.000$
Not Given	11	64.7	10	58.8	$p > 0.05$
Calcium					
Given	6	35.3	7	41.2	$\chi^2 = 0.000$
Not Given	11	64.7	10	58.8	$p > 0.05$
Opioid					
Given	12	70.6	12	70.6	$\chi^{2*} = 0.000$
Not Given	5	29.4	5	29.4	$p > 0.05$
NSAID					
Given	14	82.3	15	88.2	$\chi^{2*} = 0.234$
Not Given	3	17.7	2	11.8	$p > 0.05$

* Fisher's Exact Chi-Square Test was used.

Table 3. Length of Time until Initial Flatulence, Defecation and Discharge Following Surgery

Time Until Flatulence, Defecation and Discharge (Hours)	Experimental Group (N = 17)	Control Group (N = 17)			<i>Statistical Outcome</i>
	<i>Mean ± SD</i>	<i>Min - Max</i>	<i>Mean ± SD</i>	<i>Min - Max</i>	
Flatulence	47.3 ± 13.9	21.0 -	62.9 ±	26.0 -	t = -2.800
		75.5	18.4	103.5	p < 0.05
Defecation	55.8 ± 14.9	33.5 -	81.6 ±	51.5 -	t = -4.940
		89.5	15.7	112.5	p < 0.05
Discharge	108.1 ± 31.8	74.0 -	142.6 ±	91.5 -	u = 68.500
		163.5	38.1	234.5	p < 0.05

Figure 1. CONSORT Flow Diagram of Participants