

# Gum Chewing Reduces Risk of Post-Operative Ileus after Colorectal Surgeries: A Randomized Control Trial

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## 2. Keywords

Ileus; Colorectal Surgery; Chewing Gum; Time to flatus and stool

## 1. Abstract

**1.1. Introduction:** Postoperative ileus is not uncommon after abdominal operations. Various strategies have been devised to minimize postoperative ileus. Gum chewing is postulated to activate the cephalic-vagal reflex, which is usually enhanced by food, leading to increased production of gastrointestinal hormones.

**1.2. Materials and Methods:** This is a parallel design randomized controlled trial. In intervention arm chewing gum was administered to patient from the morning of post-operative day 1. Adult patients of age > 16 Years, both males and females were eligible to be included in the trial. Time to first flatus and time to first stool were the primary outcomes of interest.

**1.3. Results:** During the study period a total of 92 patients were evaluated for inclusion into study. 14 patients were excluded due to various reasons. A total of 39 patients were included in the intervention arm and 39 patients were included in the control arm for analysis. Time to passage of first flatus after surgery was  $62 \pm 14.3$  hours in control arm as compared to  $51 \pm 9.11$  hours in intervention arm. The difference was statistically significant ( $p < 0.001$ ). Similarly time to passage of first stool after surgery was  $110 \pm 15.30$  hours in control arm as compared to  $88 \pm 14.36$  hours in intervention arm and the difference was again statistically significant ( $p < 0.001$ ).

**1.4. Conclusion:** Chewing gum during the postoperative period leads to a significant reduction in time to passage of first flatus and stool following open colorectal surgery.

## 3. Introduction

Postoperative ileus is not uncommon after abdominal operations. After colon resection, there is a period of time for most patients before normal intestinal function returns. Pain, stress of surgery, and transient bowel paralysis due to handling contribute to this delay. Excessive delay in bowel function (ileus) leads to prolonged hospital stay, hospital-acquired infections and pulmonary complications [1-5]. Treatment may be required depending upon the duration of symptoms. It includes nasogastric tube decompression, fluid and electrolyte replacement, and analgesia. As a result, length of hospital stay is increased leading to increase in cost of care. Estimate of the cost of postoperative ileus

in the United States is \$750 000 000 annually. Because of these implications of ileus after abdominal surgeries, various strategies have been devised to minimize postoperative ileus. In addition to shifting to minimally invasive surgery, non-opiates analgesia and restricted post-operative fluids, early enteral feeding and sham feeding have been tried. A study by Stewart et al showed that early feeding after colectomy hastened hospital stay. Choiet al showed that early feeding after open colon resection was safe and resulted in earlier discharge from hospital. However, in the study by Stewart et al, attempts to hasten resolution of ileus after colon resections by giving water early were not tolerated by 20% of patients. An alternative approach to stimulate bowel function in the post-operative period following partial colon resection

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is sham feeding in the form of gum chewing. Asao et al found earlier return of bowel function and a trend towards earlier hospital discharge in patients who chewed gum after laparoscopic colectomy [6-10]. Gum chewing is postulated to activate the cephalic-vagal reflex, which is usually enhanced by food, and the production of gastro intestinal hormones associated with bowel motility is increased. Despite proven benefit from observational studies, there has never been a randomized controlled trial in patients who undergo open colorectal surgery.

## 4. Materials and Methods

### 4.1. Study Design

A randomized controlled trial, parallel design.

### 4.2. Procedure

We conducted a parallel design randomized controlled trial having two arms. In both the arms colorectal operative procedure was done as per need of the patient, the only difference was start of chewing the gum in post-operative period. In intervention arm chewing gum was administered to patient from the morning of post-operative day 1. One chewing gum was required to be chewed for at least thirty minutes three times a day till any of the outcomes was achieved. In the control arm no chewing gum was administered [11-16]. All the post-operative care in both arms was otherwise same. Due to nature of intervention blinding was not possible.

### 4.3. Study Sample

Patients scheduled to undergo elective colorectal surgery at Aga Khan University Hospital (AKUH) Karachi and met eligibility criteria for inclusion into trial over a period of nine months from July 2016 till March 2017.

### 4.4. Selection criteria

**4.4.1. Inclusion Criteria:** Adult patients of age > 16 Years Both males and females Scheduled to undergo elective colorectal surgery for both malignant and benign diseases.

### 4.4.2. Exclusion Criteria:

- Renal Insufficiency: Serum Creatinine > 1.5
- Hepatic Insufficiency: Known case of chronic liver disease or Total Bilirubin > 2mg/dl
- Pregnant or lactating Females
- Know bowel motility disorders
- Emergency Operations
- Current or regular use of laxatives for constipation
- Patients with known hypersensitivity to chewing gum.

- Refusal to participate in the study
- Simultaneous additional surgical procedures
- Previous abdominal operations

### 4.5. Randomization Technique

Block randomization was done. Blocks comprising of 10 participants were made. In each block randomization was done using computer generated random numbers. Whole process of randomization was done by clinical trial unit.

### 4.6. Outcome measures and assessment

**4.6.1. Post-operative Ileus:** Transient cessation of co-ordinate bowel motility after surgical intervention, which prevents effective transit of intestinal contents and/or tolerance of food intake.

**4.6.2. Time to first flatus:** This was taken as time in number of hours from end of surgery till passage of flatus. Passage of flatus was reported subjectively by the patients. Patients were instructed to make note of the time when flatus was passed first time after surgery.

**4.6.3. Time to first stool:** This was taken as time in number of hours from end of surgery till passage of stool. Passage of stool was reported subjectively by the patients. Patients were instructed to make note of the time when flatus was passed first time after surgery.

**4.6.4. Length of hospital stay:** This was taken in number of days from day of operation till day of discharge.

### 4.7. Sample size

Sample size was calculated using World Health Organization (WHO) software for sample size calculation. Based on the results of study done by Schuster R et al mean time to first flatus in gum group and control group was  $65.4 \pm 14.8$  and  $80.2 \pm 19.1$  hours, and time to first bowel movement was  $63.2 \pm 5.4$  and  $89.4 \pm 24$  hours respectively. Keeping power of study to be 80% and two sided level of significance to be 0.05, a minimum of 39 patients were required in each group for time to first passage of flatus and stool.

### 4.8. Sampling technique

Non probability consecutive sampling.

### 4.9. Settings

Study was conducted in General Surgery Section of Aga Khan University Hospital, Karachi. Patients were evaluated in clinic at the time of presentation regarding eligibility to participate in the study. After taking informed consent for participation in trial, allocation was done by the staff at clinical trial unit. After the operation, those in intervention arm were started to have chewing

gum from post-operative day 1. All the patients who fulfilled the eligibility criteria received standardized pre-operative care including full bowel preparation with colonoscopy solution a day before surgery. Oral clear liquid diet was started once flatus was passed after removal of nasogastric tube. All patients received prophylactic antibiotics at the time of induction of anesthesia, low molecular weight heparin and compression stockings. All patients received epidural analgesia intra-operatively and 48 hours postoperatively. Following the removal of epidural, patients were placed on regular paracetamol. Additional opioid or non-steroidal analgesia was provided when required. All patients received chest physiotherapy and were mobilized out of bed as soon as possible in postoperative period.

#### 4.10. Statistical Analysis

We conducted intention to treat analysis. Quantitative variable are reported as means +/- standard deviations. Qualitative variables are reported as numbers and percentages. Univariable linear regression analysis is done to assess impact of chewing gum on post-operative ileus. P value of less than 0.05 was considered as statistically significant.

#### 5. Results

Trial was conducted from July 2016 to March 2017. During the study period a total of 92 patients were evaluated for inclusion into study. 14 patients were excluded due to various reasons as given in the (Figure 1).

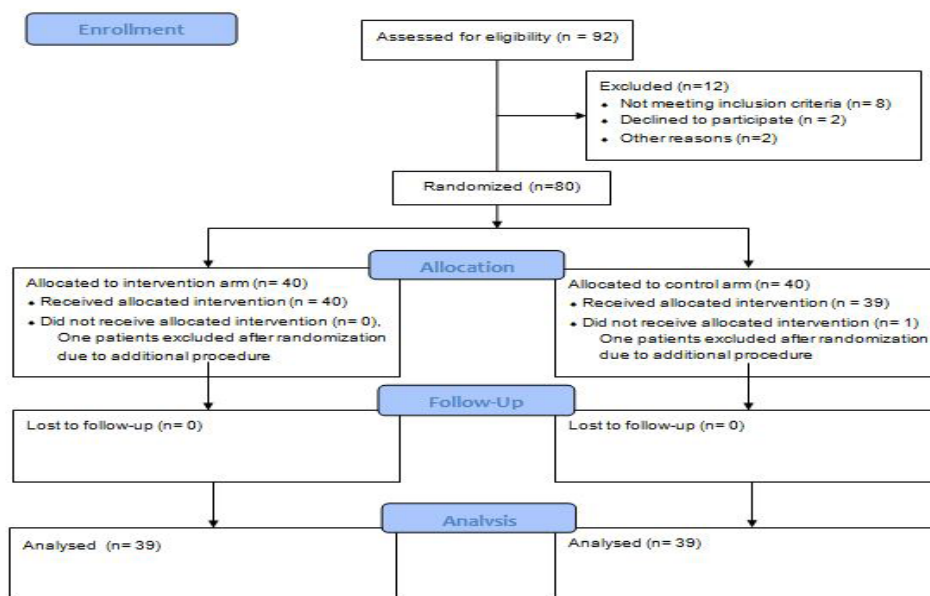


Figure1: Flow Diagram.

A total of 39 patients were included in the intervention arm and 39 patients were included in the control arm for analysis. All patients in the intervention arm completed their course of gum chewing for thirty minutes thrice daily until bowel function returned except one patient who refused to take chewing gum after the procedure. Demographic and disease related details of the patients in both arms are given in (Table 1).

Table 1: Baseline Characteristics.

Variables	Control Arm (N=39)	Intervention Arm (N=39)
Gender (Male): n (%)	20 (51)	23 (59)
Age (Years)	55.9 ± 13.5	51.9 ± 11.7
Duration of Surgery (Minutes)	214.1 ± 56.0	210.2 ± 38.1

Types of procedures performed in both arms are given in the (Table 2).

Table 2: Surgical Procedures Performed in each Arm.

Procedures Performed	Control Arm (N=39)	Intervention Arm (N=39)
Right Hemicolectomy	13	15
Left Hemicolectomy	8	7
Sigmoid Colectomy	6	4
Total Colectomy		4
Abdominoperineal Resection	5	1
Low Anterior Resection	5	7
Anterior Resection	2	7

Postoperative analgesia was provided via epidural catheter which was removed on the third post-operative day and patients were switched to paracetamol and narcotic analgesia on demand. Patients were ambulated after the removal of epidural catheter. Time to passage of first flatus after surgery was 62 ± 14.3 hours in control arm as compared to 51 ± 9.11 hours in intervention arm. The difference was statistically significant (p <0.001). Similarly time to passage of first stool after surgery was 110 ± 15.30 hours in con-

trol arm as compared to  $88 \pm 14.36$  hours in intervention arm and the difference was again statistically significant ( $p < 0.001$ ). On the other hand there was no statistically significant difference in mean length of hospital stay. Details of outcomes are as given in (Table 3).

**Table 3:** Outcome in Two Arms.

Primary End Points	Control Arm (N=39)	Intervention Arm (N=39)	P Value
Time To First Flatus (Hours)	$62 \pm 14.3$	$51 \pm 9.11$	$<0.001$
Time To First Defecation (Hours)	$110 \pm 15.30$	$88 \pm 14.36$	$<0.001$
Length Of Hospital Stay (Days)	$9 \pm 2.46$	$8 \pm 2.45$	0.077

## 6. Discussion

With increasing pressure on limited health resources and continually needing to improve the quality of patients' preoperative experience, interventions with the potential to limit the discomfort of postoperative stay are gaining popularity. Postoperative hospital stays after elective colon surgery is reported between 4 to 12 days. One factor that often contributes to prolonged hospital stay after colectomy is paralytic ileus. The etiology of ileus is multi factorial. Postoperative suppression of bowel movement is due to sympathetic hyperactivity and resulting increased concentration of circulating catecholamines. Bowel handling during surgery causing pacemaker dysfunction, electrolyte imbalances, and narcotic analgesia also contribute in postoperative ileus. Several remedies have been tried to overcome this problem after surgery including drugs, early ambulation, and removal of nasogastric tube and early feeding. Chewing gum increases intestinal motility via sham feeding by increasing the cephalic-vagal reflex and increases the levels of neuronal and hormonal factors that increase the motility of various bowel segments. Early postoperative feeding after colectomies are some-times not tolerated by the patients although presumed to be increasing the intestinal motility. In recent years, the role of gum chewing has been evaluated in various randomized control trials in gastrointestinal operations and found to be beneficial in reducing postoperative ileus. Although the evidence is based on small trials, such a potentially cheap and simple remedy could be beneficial in decreasing the financial burden on part of patient by speeding the recovery and decreasing the hospital stay. Our study revealed that bowel function as measured by time to flatus and stool is reduced after colonic surgery by gum chewing. Similar findings have been reported in other studies also, though the duration of hospital stay is known to be reduced in patients who chew gum in post-operative period, results from our study failed to achieve statistical significance. This could be due to less power for this specific outcome. Despite a large amount of supporting evidence, many other factors are considered before changing clinical practice.

## 7. Conclusion

Chewing gum during the postoperative period leads to a significant reduction in time to passage of first flatus and stool following open colorectal surgery.

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