

## Role of Chewing Gum in Reducing Post-Operative Ileus after an Appendectomy Procedure in Paediatric Age Group

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### Original Research Article

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**Abstract:** Post-surgical procedures patient develops post-operative ileus secondary to inflammatory mediator release following intense intestinal manipulation during intraoperative period which is manifested as abdominal discomfort, bloating, constipation, belching, abdominal distension and delayed flatulence. If post-operative ileus is not resolved by 5<sup>th</sup> post-operative day, it is termed as prolonged post-operative ileus (PPOI). Chewing gums are hypothesized to accelerate gastrointestinal motility, hence may be helpful in reducing prolonged post-operative ileus. To study the role, safety and effect of chewing gum in reducing post-operative ileus after an open appendectomy procedure in paediatric age group. A double blind parallel randomised control study was conducted among 100 paediatric age patients who underwent an open appendectomy procedure with 50 patients each in control and study group over duration of 1 year from August 2016 to September 2017 in Bankura Sammilani Medical College, Bankura. Patients were equally and randomly allocated in control and study groups. Control group received the usual post-operative protocol (nasogastric tube, antibiotic coverage etc) whereas the study group in addition to usual postoperative protocol were prescribed sugar free chewing gum from 1<sup>st</sup> post-operative onwards three times a day. Both the group were monitored in terms of patient related outcomes, clinical parameters and inflammatory markers. Desired end points of time for first flatus and defecation, at least 24 hrs tolerance to solid oral feeds were considered and analysed subsequently. All analysis was done by using IBM Statistical package for the social sciences 24 and MS excel. No significant difference could be demonstrated between the two study groups in terms of age, sex, duration of surgery, intraoperative complication and patient related outcomes. Analysis of primary study variable elicits that time for first flatus, time for first defecation, time for first oral feed, total duration and length of hospital stay were marginally less in the study group in comparison to control group, however no significant difference seen in terms of first tolerated oral feed. Eleven patients in study and twelve patients in control group showed features of prolonged post-operative ileus. Marginally higher number of patients showed resolution of post-operative ileus on POD 3 and POD 4 in study group in comparison to control group, however no difference seen in overall resolution in POD 5. Four patients in the control group and 3 patients in the study group were readmitted within 30 days for various reasons viz anastomotic site leakage, intrabdominal abscess drainage and pyrexia of unknown origin. Sugar free chewing gum is a safe and effective means of reducing the length of hospital stay. It also reduces the time for first flatus and defecation and operative procedure (appendectomy in our case), however further studies must be undertaken taking more parameters into consideration.

**Keywords:** Post-operative ileus, flatus, length of hospital stay, chewing gum and appendectomy.

### INTRODUCTION

Ileus is the lack of coordinated and propulsive movements in the bowel loops leading to dilatation of

bowel loops with intraluminal gas and fluid. It is multifactorial [1]. Post-operative ileus is one of the etiological factors. Post-operative ileus is a short

duration temporary inhibition of gastrointestinal motility after prolonged operative abdominal intervention characterized by nausea, vomiting, belching, abdominal distension, pain, delayed flatus and defecation [2, 3]. Post-operative ileus duration continues till there is resumption of normal coordinated electric and motor activity in gastrointestinal tract [1]. If the duration of post-operative ileus is more than five post-operative days it is called as prolonged post-operative ileus [4, 5]. Prolonged post-operative ileus increase hospital admission days, health expenditure and hospital acquired infection [5]. It is assumed and previous trial have shown that post-operative ileus occurs predominantly after open and prolonged abdominal surgeries where there is excess bowel loop manipulation triggering the release of inflammatory mediators causing akinesia and hypomotility in the bowel loops [6-8]. Post-operative ileus and hence forth post-operative complications are managed as per post-operative protocol which includes iv fluid administration, nasogastric tube placement, early mobilization, epidural analgesia, antibiotic coverage, antiemetic and prokinetic drug as required [3,9,10]. Above management of post-operative ileus using both pharmacologic and non-pharmacologic agents as described are used in adult population. Few studies have emphasised the role of chewing gum in reducing the post-operative ileus after prolonged abdominal surgeries including open cholecystectomy and caesarean section in women. Through unknown mechanism chewing gum stimulates the cephalic phase of digestion, and decreases the gastrointestinal transit time via neuro hormonal and vagal pathways [5, 11, 12]. Some perioperative guideline even advises gum chewing as evidence based approach in pelvic and intestinal interventions for prevention of post-operative ileus. [12, 13] Even though benefits of chewing gum in the adult population have been proven, only sparse number of studies has been undertaken in paediatric age group [13-18]. Except shorter duration of hospital stay, the author in previous studies didn't register any significant difference [5]. Hence, we are undertaking this study for a better generalization in management of post-operative ileus using non-pharmacologic agents among paediatric age group. In addition to variables analysed in previous studies including time for first flatus, time for first defecation, time for first elicited bowel movement, time for continued tolerance to oral feed for more than 24 hours, we analyse the clinical variable, inflammatory mediator, patient related outcomes, pain scale and length of hospital stay [4,6,7,8]. Chewing may be taken as a safe, inexpensive and effective alternative to pharmacologic agents in managing post-operative ileus in paediatric age groups [2, 12, 13, 19]. In future further studies should be undertaken targeting the cholinergic anti-inflammatory mediators.

## MATERIALS AND METHODS

### Research hypothesis

#### Hypothesis-0

There is no difference between the gum-chewing study group and not gum chewing control groups in terms of first flatus and defecation times and length of hospital after an appendectomy procedure in paediatric age group.

#### Hypothesis-1

There is difference between the gum-chewing study group and not gum chewing control groups in terms of first flatus and defecation times and length of hospital after an appendectomy procedure in paediatric age.

A double blind parallel randomised control study was conducted among 100 paediatric age patients who underwent an open appendectomy procedure with 50 patients each in control and study group over duration of one year from August 2016 to September 2017 in Bankura Sammilani Medical College, Bankura after proper approval from institutional ethical committee.

#### Inclusion criteria

- Patient age group between 5 to 18 years of age
- Clinically and radiologically diagnosed cases of acute appendicitis, irrespective of its sub types (edematous, perforated, gangrenous and suppurative)
- Surgeon opted for open appendectomy instead of minimally invasive laparoscopic appendectomy
- Children with no communication problem that is with enough cognitive skill to communicate their patient related outcomes
- Patient consented to be a part for the entire duration of study, when explained in their mother tongue both in writing and verbally.
- Could tolerate and volunteer to chew gum.

#### Exclusion criteria

- Patient less than 5 years of age and more than 18 years of age.
- Children who were feared of swallowing the chewing gum or are unable to chew being edentulous or any other issues.
- Very sick patients admitted in intensive critical care units
- Patients with known gastrointestinal motility disorders.
- Known cardiovascular disease, severe liver and renal parenchymal disease
- Pharyngitis, esophagitis or oral infection
- Patients who received abdominal radiation in the past 6 months, underwent an earlier colorectal surgery, had colostomy or ileostomy, and were on

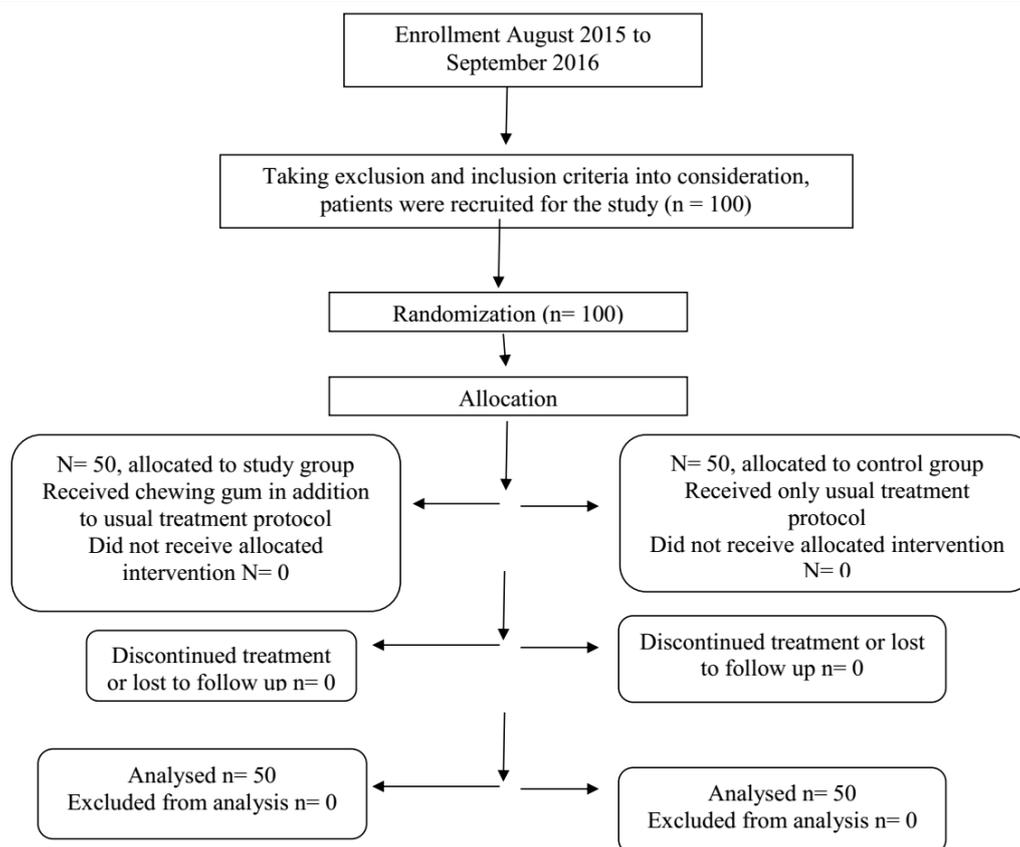
medication which could affect the bowel functions postoperatively

Maintaining confidentiality of the patient computer assisted randomization (Microsoft excel) was done in the preoperative period among patients fulfilling the inclusion criteria. Investigators, surgeons, nurses and paramedical staff were all kept blind in terms of randomization procedures. Post randomization computer printed sealed envelopes with random number from 1 to 100 on top of the envelop and treatment protocols inside were handed to each patient fulfilling the inclusion criteria. Patients were equally and randomly allocated in control and study groups. Control group received the usual post-operative protocol (nasogastric tube, antibiotic coverage, prokinetic drugs early mobilization etc) whereas the study group in addition to the above mentioned usual postoperative protocol were prescribed sugar free chewing gum of same brand and composition from 1<sup>st</sup> post-operative onwards three times a day till the day of discharge. Sealed envelope had a clear simple and local language instruction for the dose and frequency of chewing gum. Attendants of the patients were individually explained in addition to above hand-written notes. All patients in the paediatric age group were instructed to chew the chewing gum for 30 to 45 min. Both the group were monitored in terms of patient related outcomes, clinical parameters and inflammatory markers. Desired end points of time for first flatus and defecation, at least 24 hrs tolerance to solid oral feeds were considered and analysed subsequently. For this all the patient irrespective of the group allocated were given a simple easily explainable multi language questionnaire card to serially note down the time for first oral fee (liquid / solid) and when they first tolerated any solid oral feed post doctor's prescription without any untoward complication for more than 24 hours, time for passage of their first flatus, first defecation, first episode of perception of bowel movement, unusual pain, vomiting,

including all patient related outcomes. At last during successful discharge their total duration of hospital stay from the time of operation to successful discharge were noted. In addition to these, all the patients irrespective of the group allocated were tested for complete blood count and c reactive protein prior to surgical procedure, on 1<sup>st</sup>, 3<sup>rd</sup> and 5<sup>th</sup> post-operative day at the hospitals laboratory. Visual analogue scale core for pain were noted daily for each patient including those complaining for pain.

A total of 100 patients fulfilling the inclusion criteria were recruited for the study with 50 patients each randomly allocated to control and study group. During analysis all factors and variable including age, gender, intraoperative and post-operative complication (Anastomotic leakage (AL), surgical site infection (SSI), fascial dehiscence, urinary tract infection (UTI) and pneumonia) were taken into consideration and analyzed. Variables such as time for tolerating oral intake without any obvious untoward complications, time for first flatus, time for first bowel movement and length of hospital stay were measured in time unit. Primary outcome parameter was the time from surgical intervention to resolution of post-operative ileus defined and manifested by passage of flatus, defecation & tolerance to oral feeds. Secondary outcome parameters postoperative complication, post-operative morbidity, patient reported outcomes (e.g. pain, nausea, regurgitations, vomiting etc.), body temperature, heart rate, blood pressure and inflammatory markers (complete blood count and c reactive protein)

Statistical analysis- Data analysis was carried out using the Statistical Package for the Social Sciences. Variable in time units were analyzed using Kaplan and Meier survival test and continuous variable were evaluated in terms of mean difference and 95% confidence interval.



**RESULTS**

**Table-1: Preoperative and intraoperative variables**

Variables	Study Group, N= 50 Received pharmacological treatment with chewing gum	Control group N= 50 Received only pharmacological treatment
Age (years) mean	9.5	11.2
Sex		
Male	28	19
Female	22	31
Subtype of appendicitis		
• Inflammatory	02	06
• Suppurative	21	19
• Perforated	09	10
• Gangrenous	18	15
Duration of surgery(hours) mean	45 min (0.75 hours)	45 min (0.75 hours)
Intraoperative complications	3	6
>50 cc blood loss	12	15

**Table-2: Patient related outcomes**

Variables	Study Group, N= 50 Received pharmacological treatment with chewing gum	Control group N= 50 Received only pharmacological treatment
Abdominal distension	02	01
Abdominal pain	11	10
Nausea, vomiting	07	08
Fever	03	04

Values represent number

**Table-3: Assessed variable**

Variables	Study Group, N= 50 Received usual pharmacological treatment with chewing gum	Control group N= 50 - Received only pharmacological treatment	Mean difference (95% confidence interval)
Time to pass first flatus	17.02±3	21.09±3	-4.07(-4.9-3.2)
Time for first defecation	24.21±3	27.36±3	-3.15(-3.9-2.3)
Time to elicit first bowel movement	27.64±3	33.91±3	-6.27(-7.1-5.4)
Time for first oral intake (solid / liquid)	21.64±3	23.40±3	-1.76(-2.5-0.9)
Time for first oral intake tolerated for more than 24 hours without any untoward complications	32.89±3	30.96±3	1.93(1.09 < 2.7)
Length of hospital stay	58.21±5.4	64.36±4.8	0.67(-7.4-4.8)

Values represent duration in mean duration in hours and brackets indicate standard deviation

**Table-4: Duration for resolution of post-operative ileus**

Resolution of post-operative ileus on post-operative day (POD)	Study Group, N= 50 Received usual pharmacological treatment with chewing gum	Control group N= 50 - Received only pharmacological treatment	P value
POD 1	0	0	-
POD 2	2	1	<0.0001
POD 3	13	7	<0.0001
POD 4	24	21	<0.0001
POD 5	39	38	0.0141
POD 6	50	50	1.0000

**Table-5: Post-operative complication within 30 days of operative intervention**

Post-operative complication	Study Group, N= 50 Received usual pharmacological treatment with chewing gum	Control group N= 50 - Received only pharmacological treatment	P value
Fascial dehiscence	0	0	-
Intrabdominal abscess	03	04	<0.0001
Surgical site infection	12	10	<0.0001
Urinary tract infection and urinary retention	05	06	<0.0001
Readmission <30 days	04	03	<0.0001
Mortality <30 days	01	02	<0.0001

**Table-6: Inflammatory parameters**

Inflammatory parameters	Study Group, N= 50 Received usual pharmacological treatment with chewing gum	Control group N= 50 - Received only pharmacological treatment
WBC blood count (X 10 <sup>9</sup> /L)		
• preoperative	13.1	12.9
• POD 1	12.7	11.5
• POD 3	6.7	8.5
• POD 5	5.6	6.6
C reactive protein(mg/L)		
• preoperative	3.6	2.8
• POD 1	97	89
• POD 3	53	65
• POD 5	15	22

Median values

100 patients fulfilling the inclusion and exclusion criteria were recruited for the study, out of them 50 each were allocated in the study and control group as described. None of the patients were excluded from the study during the total study duration. None of the patients were lost to follow up as well. Post histopathological analysis of the resected operated specimen of appendix were classified as per into subtypes of edematous, suppurative, perforated and gangrenous as shown in table 1. No significant difference could be demonstrated between the two study groups in terms of age, sex, duration of surgery, intraoperative complication and patient related outcomes as illustrated in table 1 and 2 that is base line variable in terms patient's demographics and surgical parameters were distributed evenly between study and control group. Analysis of primary study variable as shown in table 3 elicits that time for first flatus, time for first defecation, time for first oral feed, total duration and length of hospital stay were marginally less in the study group in comparison to control group, however no significant difference seen in terms of first tolerated oral feed. Eleven patients in study and twelve patients in control group showed features of prolonged post-operative ileus. Marginally higher number of patients showed resolution of post-operative ileus on POD 3 and POD 4 in study group in comparison to control group, however no difference seen in overall resolution in POD 5 as illustrated in table 4. Postoperative complications, readmissions and mortality during the first 30 days after surgery are given in Table 5. No significant differences were found between both treatment groups. Four patients in the control group and 3 patients in the study group were readmitted within 30 days for various reasons viz anastomotic site leakage, intrabdominal abscess drainage and pyrexia of unknown origin. One patient in study group and 2 patients in control group succumbed within 30 days of surgery but were included in the study as it happened after readmission.

## DISCUSSIONS

A few studies have been conducted previously taking chewing gum as an alternative treatment in post-operative ileus. Chewing gum stimulates the cephalic phase of digestion, and decreases the gastrointestinal transit time via neuro hormonal and vagal pathways [4,11,12]. Chewing gum thus helps to tolerate oral feeds earlier, reduced complication, reduced length of hospital stays and thus optimization of material and human resources would be expected. Y. H. Ç avus oğlu *et al.* in his study conducted in 30 children with intestinal anastomosis found a significant shorter length of hospital stay in those patients who received chewing gum as part of the post-surgical treatment. However, no difference seen in the recovery of gastrointestinal function since the time to present the first bowel movement and pass first flatus was similar between the groups [20]. In the studies already mentioned and the meta-analysis published by Vasquez and cols, which

included 6 randomized clinical controlled trials, the time to pass first flatus and the time to present first bowel movement are the only variables indicated as markers of gastrointestinal function recovery [11]. Gabriela Lopez-Jaimez *et al.* included the time patients take to tolerate oral intake as another sign of post-gastrointestinal function recovery. They described and analyzed the medical treatment each patient received [21]. In our study we in addition to all previous variable also included secondary outcome parameters including postoperative complication, post-operative morbidity, patient reported outcomes (e.g. pain, nausea, regurgitations, vomiting etc.), body temperature, heart rate, blood pressure and inflammatory markers (complete blood count and c reactive protein)

## CONCLUSION

Our study is the first of its kind to evaluate the effect of chewing gum in reducing post-operative ileus in pediatric age group taking almost all possible variable into consideration including the clinical and inflammatory markers. In a small-scale study done in limited number of patients, the effect of chewing gum was seen somewhat better in the study group in comparison to the control group. Inconclusive study results seen might be attributed to the less sample size, the dose of the chewing gum and insufficient patient compliance to the allocated chewing gum. The study needs to be carried out in a more controlled setting taking large sample size and using anticholinergic drug eluded chewing gum [22].

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**Conflict of interest-**The authors declare that they have no conflict of interest.

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