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Gum-chewing after elective laparotomy with gut anastomosis in surgical patients

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Abstract

Background: Gum-chewing has been listed as one of many factors that contribute to enhancing recovery after laparotomy due to its effects on postoperative ileus.

Objectives: The aim of the study was to compare gum-chewing against controls on the reduction of postoperative ileus among patients undergoing elective laparotomy.

Methodology: Consenting patients who had elective laparotomy with gut anastomosis in the Surgical wards of Nnamdi Azikiwe University Teaching Hospital(NAUTH), Nnewi were randomised into Gum-chewing group and Control/ traditional delayed feeding group. In the first Group patients' Naso gastric tubes(NGT) were left insitu as they chewed gum 3 times a day from 1DPO. Patients in the second group were used as controls and were managed in the traditional way-nil by mouth until passage of flatus or faeces. Assessed outcome measure was time from completion of surgery to passage of flatus and faeces.

Results: During the study period, December 2014 to November 2016 (2 years), 70 consenting patients who had elective laparotomy in the Surgical wards were randomised into the two groups- Group 1 (n=34) and group 2 (n=36). The groups were similar in terms of gender, age, surgical procedures, and co morbidity. The age range was 20-81 years. The time from completion of surgery to first passage of flatus was 3.07days for Group 1 and 3.92days for Group 2. Time from completion of surgery to first passage of stool was 4.00days for Group1 and 4.76days for Group2. Time to flatus and faeces was significantly shorter in the Gum-chewing group compared to Controls (p0.05 for both). There were no significant differences noted in the complication rates among the groups.

Conclusion: Gum-chewing reduced the length of postoperative ileus significantly

Keywords: Laporotomy; Ileus; Anastomosis; Gum-chewing.

1. Introduction

Malnutrition is a major factor in the development of post-operative complications and outcome of surgical operations. It is estimated that as many as 40% of hospitalized patients may be malnourished[1]. A proportion of surgical patients may be malnourished on admission. The majority of patients however experience nutritional depletion during the course of their hospital admission from perioperative starvation, surgical stress and the subsequent increase in metabolic rate.

A major deterrent to postoperative nutrition is Postoperative ileus (POI). It is defined as the transient inhibition of normal gastrointestinal motility following abdominal surgery, typically lasting for 3-5 days[2]. It is an inevitable response

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to surgical trauma where the different areas of gastrointestinal tract resume function at different times[2]. After surgery, inhibited motility of the GIT is related to disorganized electrical activity and lack of coordinated propulsion[3, 4]

In recent years, the use of chewing gum has emerged as a new and simple modality for decreasing POI[5]. It acts by stimulating intestinal motility through cephalic vagal reflex and by increasing the production of gastrointestinal hormones associated with bowel motility[2]. This is achieved without actually having the presence of food in the gastrointestinal tract- 'sham feeding'. Cephalic-vagal stimulation from chewing alone gives rise to propulsive and hormonal gastrointestinal activity similar to that seen with normal eating[6]. This provides the benefits of gastrointestinal stimulation without the complications associated with feeding[7]. Gum chewing has the advantage of being inexpensive, well tolerated and widely available[7].

Aim and objectives

The aim of the study was to compare gum-chewing against controls on the reduction of postoperative ileus among patients undergoing elective exploratory laparotomy with gut anastomosis admitted through Surgical clinics. Post-operative ileus was assessed by duration from end of surgery to passage of flatus and faeces

Specific objectives included

- To assess time from end of surgery to passage of first flatus and faeces in patients on gum-chewing protocols and controls
- To compare patient satisfaction for each intervention using simple YES or NO answer questions.

2. Material and methods

The study was conducted over a period of 2 years, from December 2014 to November 2016. Subjects considered for the study were all consecutive patients admitted through surgical clinics in Nnamdi Azikiwe University Teaching Hospital (NAUTH) Nnewi, who had elective laparotomy with gut anastomosis. Only Adult patients, 18 and above, patients who gave consent were selected. Exclusion criteria included- Laporotomy in patients who had no gut anastomosis; Patients who did not consent, were unwilling, or unable to accept randomization e.g. senile dementia, confusion, encephalopathy; Patients with high risk of aspiration (for which patient is admitted to ICU) - coma, patients requiring respiratory support; Patients with deranged SEUC results; Patients with objective evidence of severe sepsis or multiple organ dysfunction. All study protocols and informed consent forms were approved by the Research and Ethical Committee of N.A.U.T.H. Written informed consent was obtained from considered subjects who were then included in the study having met inclusion criteria.

Clinical assessment included a detailed history and physical examination. Patients were adequately investigated and lesions localized using abdominopelvic ultrasound scan,computerized tomography scan of abdomen , colonoscopy or barium studies. Serum electrolytes, Urea and Creatinine (SEUC) estimations were done ensuring normal results. Haemograms were also performed ensuring a Hb of above 10g/dl. Patients with jaundice were optimized to Childs Pugh class B or better. All patients were ASA 4 or better and had normal SEUC.

All laparotomies were done by a Senior Resident General Surgeon or a Consultant General Surgeon. General anaesthesia with endotracheal intubation was used for all cases. Each anastomosis was done in two layers using synthetic absorbable Polyglactin 910 Vicryl 2/0 sutures, batch number HB2471. Time at end of abdominal wound closure was documented. Intramuscular Pentazocine 30mg 8hourly was used for all patients for analgesia. Each enrolled subject was allocated a number in a concealed sequence in a computer-generated randomization plan known as Stratified randomization sampling (strata software) to ensure that the population in the two groups were similar.

Each patient was randomized to either- Gum-chewing group (Group 1, n = 40) or the Control / Traditional delayed feeding group (Group 2, n= 40) by the above-mentioned software and allocated by the researcher. The nature of the study did not allow blinding after application of the assigned intervention postoperatively. To accurately monitor the time of first flatus and faeces, patients were educated on the methodology of the study and were instructed to notify nurses or study investigators immediately after they passed gas. They were given pieces of paper pasted beside them to write down the time or have a care-giver or knowledgeable relative or staff do this.

Intervention was commenced once patient had fully recovered from effects of anaesthesia. The patients were reviewed three times daily assessing for ileus symptoms, complications and to specifically collect data. A standard proforma was used for recording each patients details. The participants were followed up until discharged from hospital.

2.1. Group 1 patients (Gum-chewing group)

Nasogastric tube was left insitu until passage of flatus as noted by the patient. Patients were offered sugar-free chewing gum- Xylitol gum (Lotte). This was supplied to patients 3 times a day at 8:00 am, 1:00 pm, and 6:00 pm, starting 12hrs. after surgery and after full recovery from effects of anaesthesia. The duration of gum chewing was 1 hour. Gum chewing was discontinued following the first passage of flatus from the bowel. Compliance was monitored by counting and recording the number of sticks remaining with the patient during recording of vital data observations. The nasogastric tube was removed after the passage of first flatus and graded oral intake allowed thereafter.

2.2. Group 2 patients (Control group)

Nasogastric tubes were left insitu until passage of flatus. They were on nil per os and were started on clear oral fluids only on passage of faeces with progression to normal diet as tolerated. All patients were maintained on I.V. fluids and broad spectrum antibiotics. Patients were monitored additionally for nausea, vomiting, abdominal distention, abdominal wound dehiscence, anastomotic dehiscence by the researcher and trained medical personnel. Patients were additionally observed for complications of nasogastric intubation- blockage, severe throat discomfort, dislodgement, nasal trauma at reintubation. The primary end point in the study was time to first postoperative passage of flatus, this being a surrogate marker for recovery from postoperative ileus. Secondary end points include time to first defecation and tolerance of feeding protocol.

3. Results

Over a period of 2years, December 2014 to November 2016 a total of 80 patients fit the inclusion criteria and were recruited, forty (40) patients in each group.

Ten (10) patients, who failed to complete the study, were excluded. Three (3) patients died, 2 belonged to the Control Group and died of pulmonary embolism and renal failure. The last one was from the Gum-chewing group and died of cardiac arrest. Seven (7) patients were non-compliant with the feeding protocols- two of them were from the Control group and 5 from the gum-chewing group. Seventy (70) patients completed the study as shown in Table1.

Table 1 Number of patients in each group

Group	No. of patients
Group 1	34
Group 2	36
Total	70

The age range of the subjects was 20-81 years. Mean age of 56.24± 15.77years. No significant difference was noted among the groups. Sex incidence for the groups was as follows: 18 male: 16 female in Group 1 and 17 male: 19 female in Group 2 (Table 2).

Table 2 Group distribution based on gender

Group	Gender	Frequency	Percent
Late feeding (Grp 2)	Female	17	47.2
	Male	19	52.8
	Total	36	100.0
Gum-chewing (Grp 1)	Female	16	47.1
	Male	18	52.9
	Total	34	100.0
Total		70	100

Table 3 Anatomical region of surgeries in both groups

Group	Nature of surgery	Frequency	Percent %
Late feeding (Grp 2)	Colonic surgery	21	58.3
	Small gut surgery	11	30.6
	Gastroduodenal surgery	4	11.1
	Total	36	100.0
Gum (Grp 1)	Colonic surgery	21	61.8
	Small gut surgery	10	29.4
	Gastroduodenal surgery	3	8.8
	Total	34	100.0
Total		70	100

Main indications for surgery in both groups were colostomies, pancreatic cancer, caecal / ascending colonic cancer, sigmoid tumour, gastric tumours, omental and mesenteric tumours. The commonest operations performed were Colostomy reversals with colo-colonic anastomosis; gastrojejunostomy and cholecystojejunostomy (double bypass); right hemicolectomy. Anatomical distribution of surgeries in each group is as shown in Table 3.

The mean duration of operation was 128 ± 45.13minutes in Group 1 and 108.32 ± 31.15 minutes in Group 2 (Table 4). In terms of co-morbid disease (Table 5), in Groups 1 and 2, 5(14.7%) and 3(8.3%) patients had Diabetes mellitus respectively; 6(16.7%) had hypertension in each group; 2(5.5%) had both Diabetes mellitus and hypertension in each group, 1 patient had Kochs disease in Groups 1 and none in Group 2. No significant difference in the co-morbid disease was noted among the groups.

The main outcome measure, time from abdominal wound closure to first passage of flatus was significantly shorter in the Group 1 patients as opposed to Group 2 (4717.21±1007.96 vs. 5362.36±1114.25, p0.05), Table 6. Also the time to passage of faeces was shorter in Group 1 as opposed to Group 2 (5928.68±1339.81 vs. 6587.58±1254.92 p0.011), Table 7. Tables 8and 9 show outcome in days.

Table 4 Mean duration of surgery

Group	Mean duration of surgery in minutes	F*	P value
Group 1	128.51 ± 45.13	2.730	0.07
Group 2	108.32 ± 31.15		

F* = one way Analysis of variance

Table 5 Co morbid disease

Co morbidity	Gum-chewing Grp1 (%)	Late feeding Grp 2 (%)
Diabetes mellitus	5 (14.7%)	3 (8.3%)
Hypertension	6 (16.7%)	6 (16.7%)
Diabetes mellitus + Hypertension	2 (5.5%)	2 (5.5%)
Kochs diseases	1 (2.77%)	0 (0%)
Total P=0.10	14	11

Table 6 Mean time to passage of flatus in minutes

Group	Mean time in Minutes ± standard Deviation	P value*
Group 2 vs Control	4717.21±1007.96 5362.36±1114.25	0.05

Table 7 Mean time to passage of faeces in minutes

Group	Mean time in Minutes ± standard Deviation	P value*
Group 2 vs Control	5928.68±1339.81 6587.58±1254.92	0.011

Table 8 Time to passage of flatus in days

Group	Mean time in minutes ± standard variation	Time in days
Gum-chewing	4717.21 ±1007.96	3.07
Late-feeding	5362.36 ±1114.25	3.92

Table 9 Time to passage of faeces in days

Group	Mean time in minutes ± standard variation	Time in days
Gum-chewing	5928.68±1339.81	4.00
Late-feeding	6587.58±1254.92	4.76

There were no statistically significant differences noted in the complication rates among the groups **(Table 10)**. Postoperative complications observed were abdominal distension, nausea, vomiting, NGT-related complications-blockage, dislodgement, severe throat discomfort. There was no anastomotic dehiscence in any of the groups.

Table 10 Observed complications

Type of complication	Group 1	Group 2	P value
Nil complication	26	22	0.078
Complications*	8	14	0.084
Vomiting	3	4	
Abdominal distension	1	2	
Anastomotic dehiscence	0	0	
Blocked nasogastric tube	5	6	
Dislodged tube	3	4	
Nasogastric tube trauma	0	1	
Severe throat discomfort	1	4	

*Some patients had more than 1 complication

In Group 1, 8 patients (Table 11) had complications. Five patients had blocked nasogastric tubes, one of them had associated abdominal distension while 3 altogether had vomiting. The tubes needed suction, readjustment or replacement, which relieved symptoms. Three (3) patients had dislodged nasogastric tubes, 1 of these had a prior block. NGTs were reinserted after couselling and reassurance. One (1) complained of severe throat discomfort but completed the study without event.

In the Late feeding group, 13 patients had complications (Table12). Six (6) patients had blocked nasogastric tubes; two had associated abdominal distension and vomiting. These nasogastric tubes were suctioned, readjusted or removed and reinserted. There were 4 dislodged tubes in the group; one was pulled out following severe throat discomfort; three dislodged spontaneously; one patient sustained nasal haemorrhage during attempt at reinserting. Two other patients complained of severe throat discomfort and one of vomiting which resolved spontaneously.

Table 11 Group 1 complications

Complication	**Number of patients**
Vomiting & blocked NGT	3
Abdominal distension & blocked NGT	1
Dislodged NGT	2
Dislodged, blocked NGT	1
Severe throat discomfort	1
Anastomotic dehiscence	0
Total	8

Table 12 Late feeding group complications

Complication	**Number of patients**
Vomiting	1
Blocked NGT	3
Vomiting & blocked NGT	1
Vomiting, abdominal distension & blocked NGT	2
Dislodged NGT	2
Severe throat discomfort	2
Severe throat discomfort & dislodged NGT	1
Dislodged NGT & trauma	1
Anastomotic dehiscence	0
Total	13

In our assessment of patient satisfaction during the feeding protocols, patients were asked if they would allow similar postoperative management next time (as depicted in **Table 13**). In Group 1, 19 patients (55.9%) said 'NO' to a similar protocol in future, while 21 patients (61.8%) would not recommend to a friend or relative. In the Late feeding group, 25 patients (69%) said 'NO' to a similar protocol in future and 26 (72%) would not recommend to a friend or relative.

Table 13 Patient satisfaction with each feeding protocol

Question	Gum	Late feeding	P value*
Would you allow similar post op management in case of repeat surgery?			
Yes	15	13	0.04
No	19	25	
Would you recommend similar post-op management for a relative or friend?			
Yes	13	10	0.03
No	21	26	

*significant at ≤0.05

4. Discussion

Early studies on the effect of gum-chewing on postoperative recovery assessed colorectal malignancies. These earlier studies showed that these protocols were safe and can be tolerated by the majority of patients, improving post operative recovery by reducing time to resolution of postoperative ileus[8]. More recent studies have assessed patients with a wide variety of gastrointestinal conditions- small intestinal and hepatobilliary pathologies including malignant and benign lesions with similar outcome. Our study assessed large and small gut pathologies including hepatobiliary and has shown reduction in time to resolution of ileus.

Length of time from abdominal closure to first passage of flatus in the gum-chewing group was 3.07 ± 0.7 days and 3.92 ± 0.77 days in the control. Time from abdominal closure to first passage of stool was 4.0 ± 0.93 days in the gum-chewing group and 4.76 ± 0.82 days in the control group. This differences were statistically significant and are similar to previous studies[9-11]. With these results our study showed that duration of post operative ileus was reduced significantly by postoperative chewing of sugarless gum.

Chewing gum postoperatively is a form of Sham feeding which refers to a method wherein food is prevented from entering the stomach and although people can see, smell, and chew the food, they do not swallow the food rendering the protocol free of the anxiety some surgeons feel towards early postoperative enteral feeding. Similar to oral food ingestion, gum-chewing is known to stimulate vagal nerves, which subsequently increases gastric and bowel motility, by increasing the secretion of plasma gastrin, neurotensin, and pancreatic polypeptides[12]. Thus gum chewing directly augments intestinal stimulation through gastrointestinal releasing hormones and increasing saliva and pancreatic juices and subsequently promotes ileus recovery[13]. In particular, chewing gum is convenient, inexpensive, and easy to implement[14]. Previous studies had observed gum chewing to be beneficial to postoperative patients as it kept the mouth moist after surgery[13] and also stimulates the secretion of saliva that generates nitrous oxide in sufficient amounts to provide host defense to the pathogens in the mouth and gut[15]. Our findings were consistent with the results of the systematic review and meta-analysis by Noble[16] which suggested significant reduction in POI, a substantial benefit of a simple intervention where chewing gum helps to stimulate bowel motility and avoids the unwanted side effects of feeding a recovering bowel such as vomiting. Another systemic literature review and meta-analysis by Su'a et al[17] of 12 randomised controlled studies showed a small benefit in reducing time to flatus and time to passage of bowel motion following surgery. The authors felt this benefit was of limited clinical significance especially because early feeding is now common in Early recovery after abdominal surgery (ERAS) protocols. The authors also opined that patients who cannot tolerate early feeding seem most likely to be those who would benefit. Results of our study differ from results of work done by Quah[6], Matros[18], Jernigan et al[19] who found no statistically significant difference in time to first flatus following abdominal surgery. This might have been a result of their small sample sizes.

Patient satisfaction was better with gum-chewing than with controls in our study as assessed by simple YES/NO answer questions. This was similar to a previous study[20] in which gum-chewing resulted in a significantly reduced length of time from surgery to passage of flatus and faeces and a high patient satisfaction illustrated by visual analog scale scores. Another previous study also showed a reduction in duration of POI and a higher patient satisfaction in the gum-chewing group than controls using a 5 point Linkert scale[21].

There were no statistically significant differences in overall complication between the groups. This was consistent with findings of Dag et al[22], Han-Geurts et al[23] and Koukouras et al[24]. Fourteen (14) patients had complications in the Late group while 8 patients had complications in the Gum-chewing group p0.084. In both groups, there were also nasogastric

tube complications. Koukouras et al[24], Cutillo[25] and Nathan[26] reported high incidences of sore throat and nasogastric discomfort in the traditional feeding group undergoing nasogastric decompression. In the gum-chewing group in our study, 6 patients (15%) were excluded for poor compliance. Eight (8) patients (23%) had complications which were not attributable directly to gum-chewing. Complication rates were similar to rates obtained in studies by Quah et al[6] and Matros et al[18], 24% and 21% respectively. None of the complications were attributable to the gum chewing in both studies.

Prolonged abdominal surgeries have been known to increase the duration of POI. The mean duration of surgery was 128.51±45.13mins for the Gum-chewing group and 118.32±mins for the Control group. These results are comparable with most of the previous studies[27, 28]

The study was time-bound and conducted over a two year period. A much longer duration of study with a larger sample size would draw more meaningful conclusions from the study. With a much larger sample size, same surgeries may be compared, instead of fewer patients with varied operations. Outcomes will be better compared.

5. Conclusion

Our study established that gum chewing reduced the length of postoperative ileus significantly. This finding could have a major clinical impact since gum chewing is relatively harmless and cheap while postoperative ileus has a significant impact on healthcare. The finding may have major consequences since this is an inexpensive, physiological and safe way to ameliorate a significant problem.

Early patient recovery and subsequent discharge following early resolution of postoperative ileus may have multiple benefits—including cost effectiveness and improved efficiency of the healthcare system in the face of low hospital capacity, poor health-care facilities, overwhelmed medical workforce in a resource-limited country like Nigeria.

Recommendations

- Larger and non time-bound multi-Centre studies should be carried out comparing the different feeding protocols among large groups of patients.
- Enhanced recovery after surgery (ERAS) protocols, which are evidence-based management strategies known to improve postoperative outcome, should be adopted in our practice.

Compliance with ethical standards

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Disclosure of conflict of interest

No conflict of interest.

Statement of ethical approval

The study was approved by the Research and Ethics committee of Nnamdi Azikiwe University Teaching Hospital, Nnewi Nigeria.

Statement of informed consent

Informed consent was obtained from all the patients used in the study.

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