ORIGINAL ARTICLE

Gum Chewing Reduces Ileus After Elective Open Sigmoid Colectomy

Rob Schuster, MD; Nina Grewal, MD; Gregory C. Greaney, MD; Kenneth Waxman, MD

Hypothesis: Gum chewing after elective open colon resection may stimulate bowel motility and decrease duration of postoperative ileus.

Design and Setting: Prospective, randomized study in a community-based teaching hospital.

Patients: Thirty-four patients undergoing elective open sigmoid resections for recurrent diverticulitis or cancer.

Main Outcome Measures: First feelings of hunger, time to first flatus, time to first bowel movement, length of hospital stay, and complications.

Results: A total of 34 patients were randomized into 2 groups: a gum-chewing group (n=17) or a control group (n=17). The patients in the gum-chewing group chewed sugarless gum 3 times daily for 1 hour each time until discharge. Patient demographics, intraoperative, and postoperative care were equivalent between the 2 groups. All gum-chewing patients tolerated the gum. The first passage of flatus occurred on postoperative hour 65.4 in the gum-chewing group and on hour 80.2 in the control group (P=.05). The first bowel movement occurred on postoperative hour 63.2 in the gum-chewing group and on hour 89.4 in the control group (P=.04). The first feelings of hunger were felt on postoperative hour 63.5 in the gum-chewing group and on hour 72.8 in the control group (P=.27). There were no major complications in either group. The total length of hospital stay was shorter in the gum-chewing group (day 4.3) than in the control group (day 6.8), (P=.01).

Conclusions: Gum chewing speeds recovery after elective open sigmoid resection by stimulating bowel motility. Gum chewing is an inexpensive and helpful adjunct to postoperative care after colectomy.

Arch Surg. 2006;141:174-176

Postoperative ileus is common after abdominal operations, including colectomy.[1] After colon resection, there is a period of time for most patients before normal intestinal function returns. The stress of surgery, pain, and bowel paralysis all contribute to this delay. Prolonged delay in bowel function (ileus) may lead to lengthened hospital stay, hospital-acquired infections or complications, and pulmonary compromise. Patients with postoperative ileus have symptoms of pain, distention, and emesis. Treatment may be required, including nasogastric tube decompression, fluid and electrolyte replacement, and analgesia. As a result, the length of hospitalization may be lengthened leading to increased cost. One estimate of the cost of postoperative ileus in the United States has put the figure at $750 000 000 annually.[2]

Because of the significant implications of ileus after colectomy, surgeons have devised strategies in an attempt to minimize postoperative ileus. A study by Stewart et al[3] showed that early feeding after colectomy hastened hospital stay. Choi et al[4] showed that early feeding after open colon resection was safe and resulted in earlier hospital discharge. 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.[5] An alternative approach to stimulate bowel function in the postoperative period following partial colon resection is sham feeding in the form of gum chewing. Asao et al[5] found earlier return of bowel function and a trend toward earlier hospital discharge in patients who chewed gum after laparoscopic colectomy. Gum is postulated to activate the cephalic-vagal reflex, which is usually enhanced by food, and to increase the production of gastrointestinal hormones associated with bowel motility.[5] The purpose of our study was to compare patients who chewed gum after elective open colon resection with a control group and to measure the return of bowel function and appetite, length of hospital stay, and complications.

Author Affiliations:
Department of Surgery,
Santa Barbara Cottage Hospital,
Santa Barbara, Calif.

©2006 American Medical Association. All rights reserved.
Downloaded From: http://archsurg.jamanetwork.com/ on 10/31/2014

Table 1. Patient Demographics

Characteristic	Control Group (n = 17)	Gum-Chewing Group (n = 17)
Mean (SD) age, y	63 (8.5)	60 (6.1)
Female-male ratio	5:12	6:11
Indications for surgery		
Recurrent diverticulitis	13	14
Carcinoma	4	3
Previous operations	2	3

Table 2. Operative Findings

Characteristic	Control Group (n = 17)	Gum-Chewing Group (n = 17)	*P* Value
Mean (SD) duration of surgery, min	115 (50)	108 (39)	.82
Mean (SD) blood loss, mL	110 (45)	119 (57)	.91
Intraoperative complications	0	0	1
Extensive adhesiolysis	0	0	1

Table 3. Postoperative Care and Findings

Characteristic	Control Group (n = 17)	Gum-Chewing Group (n = 17)	*P* Value
Postoperative analgesia			
Epidural	8	7	.84
Subcutaneous local infusion pumps with PCA	9	10	.84
Mean (SD) amount of parenteral narcotics received (morphine sulfate, mg)	77.9 (27.2)	81.0 (31.1)	.82
Minor complications			
Rapid atrial fibrillation	1	1	. . .
Ileus	1	0	. . .
Mean (SD) time of first feelings of hunger, h	72.8 (31.1)	63.5 (10.4)	.27
Mean (SD) time of first flatus, h	80.2 (19.1)	65.4 (14.8)	.05
Mean (SD) time of first bowel movement, h	89.4 (24)	63.2 (5.4)	.04
Mean (SD) length of hospital stay, d	6.80 (1.38)	4.30 (0.43)	.01

Abbreviation: PCA, patient-controlled analgesia.

METHODS

This study was a randomized prospective trial. Patients eligible for participation were those who were scheduled for elective sigmoid colon resection for recurrent diverticular disease or cancer, and those who consented preoperatively to participate in this trial. Following informed consent, patients were randomly assigned to chew gum or not to chew gum after their operation. Randomization was achieved by using a sequential, randomized card-pull design. Gum chewing began the morning of postoperative day 1. Patients chewed sugarless gum (one stick) 3 times daily in the morning, afternoon, and evening. The patients' nurses filled out a written log to record the following: times of gum chewing and time of first flatus, bowel movement, and return of appetite. Patient demographics, operative, and postoperative findings were recorded. Statistical analysis for continuous variables was performed using a 2-tailed *t* test. Statistical significance was considered at the level of $P<.05$ for all compared variables.

RESULTS

A total of 34 patients participated in the study. Seventeen patients were randomized to the non–gum-chewing group and 17 patients were in the gum-chewing group. There were no differences in age, sex, indications for surgery, or previous surgeries (**Table 1**). Intraoperative findings and postoperative course were also not different between the 2 groups (**Table 2**). Eight patients in the control group and 7 patients in the gum-chewing group had epidural analgesia postoperatively. The remaining patients in each group had subcutaneously placed local anesthetic infusion pumps with additional patient-controlled analgesia with morphine sulfate. The type of postoperative analgesia was chosen by the attending surgeons' practice. No difference was seen in the amount of parenteral narcotics received between the 2 groups. All gum-chewing patients completed their course of gum chewing until bowel function. All gum-chewing patients tolerated the gum. Mobilization for all patients began on the first postoperative day. The first feelings of hunger were felt on postoperative hour 63.5 in the gum-chewing group and on hour 72.8 in the control group ($P=.27$). The first passage of flatus was seen on postoperative hour 65.4 in the gum-chewing group and on hour 80.2 in the control group ($P=.05$). The first bowel movement was on postoperative hour 63.2 in the gum-chewing group and on hour 89.4 in the control group ($P=.04$).

There were no surgical complications in either group. Minor complications occurred in 3 patients. Two patients (one in each group) experienced rapid atrial fibrillation controlled with medications and diuresis. One patient in the control group experienced postoperative ileus and required nasogastric tube decompression for 2 days with resolution. No patient in either group required admission in the perioperative period defined as the 1-month follow-up. The total length of hospital stay was shorter in the gum-chewing group (day 4.3) than in the control group (day 6.8) ($P=.01$), (**Table 3**).

COMMENT

Postoperative hospital stays after elective sigmoid colon resections are reported as lasting between 4 to 12 days.[2] Lengthy hospital stays increase costs and may be associated with an increased risk of nosocomial complications. One factor that often contributes to prolonged hospital stay after colectomy is paralytic ileus. The etiology of postoperative ileus remains controversial. Bowel motility is suppressed postoperatively owing to sympathetic hyperactivity and increased concentrations of circulating catecholamines.[6] Pacemaker dysfunction owing to bowel manipulation is another postulated mecha-

©2006 American Medical Association. All rights reserved.
Downloaded From: http://archsurg.jamanetwork.com/ on 10/31/2014

nism of postoperative ileus.[7] In addition, electrolyte abnormalities, peritoneal and/or retroperitoneal irritation, and narcotic analgesia effects may contribute to postoperative ileus.[8] The focus of more recent studies has been on neural and humoral factors. Vasoactive intestinal peptide directly inhibits smooth muscle contraction in the intestine, and levels of it are increased after operation.[9] In addition, pain increases the release of substance P, which is also known to inhibit bowel motility.[10,11] Operations also inhibit the promotility hormones gastrin, neurotensin, and pancreatic polypeptide.[8]

Sham feedings and the action of chewing stimulate bowel motility by a cephalic-vagal mechanism and have been shown to increase levels of neural and humoral factors that subsequently increase function in several different segments of the gastrointestinal tract.[12-15] Early postoperative feeding may stimulate bowel motility,[16] however, many patients fed early after colectomies do not tolerate this. In a study where patients were given water 4 hours postoperatively, 20% of these patients did not tolerate the intervention.[3] However, gum chewing was shown to enhance bowel function after laparoscopic colectomy.[5] Gum chewing may activate both the cephalic-vagal mechanism and increase the levels of promotility factors without the consequences of early feeding, which may not be tolerated. These mechanisms have yet to be revealed.

Our data show that bowel function after elective open sigmoid colectomy was enhanced in several different ways. Flatus has been previously shown to return an average of 96 hours after elective open colectomy, but returned in 65 hours in our gum-chewing patients.[17] In our patients, gum chewing decreased the time to flatus by 14.8 hours, feelings of hunger by 9.3 hours (not significant), bowel movement by 26.2 hours, and hospital stay by 59.8 hours. Patients who chewed gum were found to leave the hospital earlier but they were not informed of this possibility before the study. Although the groups were small, our data show statistical significance in time to flatus, time to bowel movement, and length of hospital stay.

Gum chewing is extremely cost-effective. Using a recent estimate of 79 219 colectomies performed each year with an average hospital room fee of $1500 per day, decreased hospital stays in the United States would save $118 828 000 annually.[18,19] The cost of gum is 4 cents per stick. Chewed 3 times daily for an average of 5 days for 79 219 colectomies, the cost of gum would amount to $47 531 per year.

The action mechanism of gum chewing is presumed to be the direct stimulation of the cephalic-vagal system and resultant increased levels of neural and humoral hormones that stimulate bowel motility in the stomach, small bowel, and colon. Measuring levels of catecholamines, vasoactive intestinal peptide, substance P, gastrin, neurotensin, and pancreatic polypeptide in patients who chew gum after gastrointestinal surgery might explain these mechanisms more thoroughly and would be an interesting future study. It is also possible that alternatives to chewing sugarless gum could be more effective. For example, might gum containing sugar, different flavors, or different textures be even more efficacious?

We conclude that gum chewing early in the postoperative period following elective partial sigmoid colon resections hastens time to bowel motility and ability to tolerate feedings. This inexpensive and well-tolerated treatment resulted in earlier hospital discharge.

Accepted for Publication: March 3, 2005.
Correspondence: Kenneth Waxman, MD, Department of Surgical Education, P.O. Box 689, Santa Barbara Cottage Hospital, Santa Barbara, CA 93102 (kwaxman@sbch.org).
Previous Presentation: This study was presented at the Annual Meeting of the Western Surgical Association; November 9, 2004; Lake Las Vegas, Nev.

REFERENCES

1. Kehlet H. Review of postoperative ileus. *Am J Surg*. 2001;182(5A Suppl):3S-10S.
2. McFadden DW, Zinner MJ. Manifestations of gastrointestinal disease. In: Schwartz SI, ed. *Principles of Surgery*. 6th ed. New York, NY: McGraw-Hill; 1994:1015-1042.
3. Stewart BT, Woods RJ, Collopy BT, et al. Early feeding after elective open colorectal resections: a prospective randomized trial. *Aust N Z J Surg*. 1998;68:125-128.
4. Choi J, O'Connell TX. Safe and effective early postoperative feeding and hospital discharge after open colon resection. *Am Surg*. 1996;62:853-856.
5. Asao T, Kuwano H, Nakamura J, et al. Gum chewing enhances early recovery from postoperative ileus after laparoscopic colectomy. *J Am Coll Surg*. 2002;195:30-32.
6. Smiddy FG. *The Medical Management of the Surgical Patient*. Chicago, Ill: Yearbook Medical Publishers; 1976:69-70.
7. Mamel JJ. Gastric emptying disorders. In: Nord HJ, Brady PG, eds. *Critical Care Gastroenterology*. New York, NY: Churchill Livingstone; 1982:113-28.
8. Resnick J, Greenwald DA, Brandt LJ. Delayed gastric emptying and postoperative ileus after nongastric abdominal surgery: part I. *Am J Gastroenterol*. 1997;92:751-762.
9. Deloof S, Croix D, Tramu G. The role of vasoactive intestinal polypeptide in the inhibition of antral and pyloric electrical activity in rabbits. *J Auton Nerv Syst*. 1988;22:167-173.
10. Hasler WL. Pharmacotherapy for intestinal motor and sensory disorders. *Gastroenterol Clin North Am*. 2003;32:707-732.
11. Green DW, Gomez G, Greeley GH. Gastrointestinal peptides. *Gastroenterol Clin North Am*. 1989;18:695-733.
12. Miedema BW. Methods for decreasing postoperative gut dysmotility. *Lancet Oncol*. 2003;4:365-372.
13. Soffer EE, Adrian TE. Effect of meal composition and sham feeding on duodenojejunal motility in humans. *Dig Dis Sci*. 1992;37:1009-1014.
14. Stern RM, Crawford HE, Stewart WR, et al. Sham feeding: cephalic-vagal influences on gastric myoelectric activity. *Dig Dis Sci*. 1989;34:521-527.
15. Basse L, Hjort Jakobsen D, Billesbolle P, et al. A clinical pathway to accelerate recovery after colonic resection. *Ann Surg*. 2000;232:51-57.
16. Bradshaw BG, Liu SS, Thirlby RC. Standardized perioperative care protocols and reduced length of stay after colon surgery. *J Am Coll Surg*. 1998;186:501-506.
17. Milsom JW, Bohm B, Hammerhofer KA, et al. A prospective, randomized trial comparing laparoscopic versus conventional techniques in colorectal cancer surgery: a preliminary report. *J Am Coll Surg*. 1998;187:46-54.
18. Hyman N. How much colorectal surgery do general surgeons do? *J Am Coll Surg*. 2002;194:37-39.
19. Chelluri L. Hospital costs in patients receiving prolonged mechanical ventilation: does age have an impact? *Crit Care Med*. 2003;31:1746-1751.

©2006 American Medical Association. All rights reserved.
Downloaded From: http://archsurg.jamanetwork.com/ on 10/31/2014