

Meta-analysis of Randomized Studies Evaluating Chewing Gum to Enhance Postoperative Recovery Following Colectomy

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Objective: To compare outcomes following abdominal surgery with or without the use of chewing gum in the early postoperative period.

Data Sources: MEDLINE, Embase, Ovid, and Cochrane databases.

Study Selection: Randomized controlled trials reporting 1 or more outcomes related to functional postoperative recovery. Study quality was assessed using a validated scale.

Data Extraction: Time to the first passage of flatus, time to first bowel movement, and length of postoperative stay.

Data Synthesis: Five trials (158 patients) satisfied the inclusion criteria. Time (in days) for the patient to pass flatus (weighted mean difference [WMD], -0.66; 95% confidence interval [CI], -1.11 to -0.20; $P=.005$) and the time until the first bowel movement (WMD, -1.10;

95% CI, -1.79 to -0.42; $P=.002$) were significantly reduced in the chewing gum group compared with controls. However, both of these results demonstrated significant heterogeneity. Postoperative length of stay was also reduced in the chewing gum group by longer than 1 day (WMD, -1.25; 95% CI, -3.27 to 0.77; $P=.23$); however, this result was not statistically significant. This result was significant when studies that explicitly included patients with stomas being formed during the surgery were excluded (WMD, -2.46; 95% CI, -3.14 to -1.79; $P<.001$), with no significant heterogeneity.

Conclusions: Chewing gum may enhance intestinal recovery following colectomy and reduce the length of hospital stay. Owing to the potential for substantial cost savings, larger-scale, blinded, randomized controlled trials with placebo arms are warranted.

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THE ADVENT OF LAPAROSCOPY and enhanced-recovery protocols in colorectal surgery has regenerated interest in enhancing bowel function and postoperative recovery following abdominal procedures.¹ Besides these perioperative tools and strategies, other methods have been used to improve the time for patients to recover intestinal function. These have included prokinetic agents,¹ antibiotics,² and opioid antagonists.³ However, significant costs are associated with the use of all of these. In England, there were more than 31 000 colorectal resections performed from 2004 to 2005.⁴ Hospital event statistics document the range of mean length of stay for these patients at 13 to 26 bed-days.⁴ Currently, in the National Health Service, 1 bed-day costs £200 (\$388),⁵ thus making prolonged postoperative stays a possibly significant financial burden for health care providers. A 1-day benefit for patients

treated in England alone would save the National Health Service £6.2 million (\$12.0 million) on the basis of these figures.

Chewing gum has been used in the past to improve postoperative recovery from tonsillectomy with negative results.⁶ Recently, there have been several small randomized studies evaluating the effect of chewing gum on postoperative recovery in patients undergoing colorectal surgery with differing conclusions,⁷⁻¹¹ but the potential benefits have generated considerable public and media attention.^{12,13} The potential cost savings from the reduction of even 1 postoperative day compared with the cost of several sticks of chewing gum are huge and have even bigger cost implications for a health care provider as large as the National Health Service. New technology has helped to reduce the extent of surgical trauma but involves training, equipment, and capital investment. This may not be practical or sustainable for providers in less affluent nations.

The aim of our study was to use meta-analytical techniques with data from randomized controlled trials to assess the effect of chewing gum postoperatively on patients who underwent colectomy. The end points assessed were return to normal bowel function and length of postoperative stay.

With increasing pressure on limited health care resources and continually needing to improve the quality of patients' perioperative experience, interventions with the potential to limit the discomfort of postoperative ileus and reduce the length of postoperative stay are welcomed. We have reviewed the current evidence from randomized controlled trials comparing outcomes between patients undergoing colonic resection with or without the use of chewing gum in the early postoperative period and have shown that benefits are offered in resolving ileus. Although the results of this meta-analysis suggest a benefit in length of stay for the chewing gum group, this outcome only achieved statistical significance on subgroup analysis. To show a statistically significant difference of 1.25 days (at $P=.05$) between the 2 groups with 80% power, a traditional randomized controlled trial would require 80 patients in each arm.

Postoperative ileus is regarded as an inevitable response to the trauma of abdominal surgery and is a major contributing factor to postoperative pain and discomfort associated with abdominal distension, nausea, vomiting, and cramping pain.²⁴ In the United States, the problem has been estimated to account for up to \$1 bil-

lion in health care expenditure.²⁵ In a study by Schuster et al,¹¹ based on an estimate of \$0.04 per stick of chewing gum, an outlay of \$47 531 (£25 569) per year in gum would save \$118 828 000 (£63 922 107) annually (based on an estimate of 79 219 colectomies per year in the United States at a mean hospital cost of \$1500 [£807] per day).

Healthy bowel function is a result of the combination of many factors, including the enteric and central nervous systems, hormonal influences, neurotransmit-

ters, and local factors including inflammatory pathways.²⁶ Those factors promoting ileus in the postoperative patient are exacerbated because the mechanisms governing gastrointestinal motility in the fasted state are blunted compared with those following a meal. Animal studies have illustrated how the degree of surgical manipulation is directly related to the degree of postoperative ileus,²⁷ implying that extensive surgical procedures in which substantial amounts of tissue trauma are inevi-

table, such as colectomies, will be associated with high levels of postoperative ileus. Additional problems in the postoperative patient include the need for analgesia; the amount of morphine used has previously been shown to strongly correlate with the time to the return of small intestinal motility.²⁸ The potential benefits of thoracic epidural anesthesia in reducing ileus have been assessed and include a reduction in the need for parenteral morphine as well as achieving blockade of the thoracolumbar sympathetic outflow, which inhibits gastrointestinal motility while leaving the craniosacral parasympathetic innervation (stimulatory to gut function) intact.²⁹ Randomized trials have shown significant reductions in the length of postoperative ileus in patients treated with thoracic epidural anesthesia compared with morphine in the form of patient-controlled anesthesia.³⁰ Pharmacological adjuncts that have been evaluated in relation to improving postoperative intestinal function in randomized controlled trials include cisapride (which showed significant benefits but has subsequently been withdrawn owing to an adverse effect profile),³¹ erythromycin (no significant benefit),² and peripherally acting μ -opioid receptor antagonists (shown to offer significant benefits in resolving ileus and reducing length of hospital stay).^{3,32}

The variety of potential targets for interventions to reduce ileus and the length of hospital stay has led several authors to promote the use of multimodal rehabilitation strategies,¹ which may include the use of drugs,³³ epidural anesthesia, and early feeding.^{34,35} Although early feeding has been shown to reduce the length of stay for patients when used alone³⁶ or as part of a multimodal program,¹ a failure to tolerate such strategies in up to 20% of patients has been reported.³⁷ The potential for failure of early feeding underlies studies to investigate gum chewing as a form of "sham feeding," which is thought to be effective by direct cephalic-vagal stimulation, the triggering of gastrointestinal hormone release, and increasing the production of both saliva and pancreatic secretions.⁷

Advantages of our study include the identification of evidence concerning the effectiveness of postoperative gum chewing from 5 randomized trials, all reporting outcomes on patients undergoing colonic resection, with consistency in reported end points between them. We have shown that despite variation in findings from individual studies, overall the published evidence supports the hypothesis that gum chewing reduces the duration of postoperative ileus, as represented by the time to passage of flatus and first bowel movement. Although there was a mean reduction in length of stay of longer than 1 day in the chewing gum group, this did not reach statistical significance, and thus we cannot rule out the possibility that the observed reduction was due to chance. This may represent insufficient power to detect a significant difference for this outcome. A power calculation suggested that 80 patients in each arm would be required to show a significant difference of 1.25 days, which is greater than the combined populations of all studies on this subject. Quah et al¹⁰ powered their study to detect a 2-day difference in time to return of flatus or bowel movements on the basis that a shorter time would unlikely be clinically significant. We would challenge this view on economic terms

at least. A reduced length of stay, of even 1 day, for an intervention with extremely low cost and no reported adverse effects would represent substantial savings for the National Health Service when applied to the entire United Kingdom population.

Disadvantages of our meta-analysis are reflected mainly in the heterogeneity between studies. Despite assessing outcomes only in patients undergoing colonic surgery, there are differences in methodologies that might explain the heterogeneity. The inclusion of patients with defunctioning or end stomas may have affected the length of stay outcomes as well as the assessment of times until the passage of flatus and bowel motions. Studies have highlighted that stoma formation tends to negate the benefits of strategies to reduce the length of hospital stay.³⁸ This is underlined by the fact that when the studies that included some patients who definitely underwent stoma formation were excluded, a statistically significant reduction in length of stay was shown, and heterogeneity for all outcomes was either absent or reduced. In addition, despite looking for evidence of the effects of chewing gum on recovery from abdominal surgery, it is important to note that all included studies reported on outcomes following colorectal surgery, making the results more representative of the outcomes following colorectal procedures.

In conclusion, we feel that the current evidence suggests that gum chewing following abdominal surgery offers significant benefits in reducing the time to resolution of ileus; however, the studies are insufficiently powered to identify a significant benefit in length of stay. The potential benefits to individual patients, in health economics terms, are such that a well-designed, large-scale, blinded, randomized, controlled trial with a placebo arm is warranted to answer the question of whether gum chewing can significantly reduce the length of stay after abdominal surgery or whether it merely represents a placebo effect.

RESULTS

STUDY CHARACTERISTICS

In each trial, sugarless gum was chewed 3 times a day following surgery, and the duration of chewing ranged from 5 to 45 minutes.⁸⁻¹⁰ In all 5 studies, the perioperative treatment of patients was identical between the study and control groups.

In none of the analyzed studies were any adverse events caused by the use of chewing gum. In 1 study, 14 of 16 patients described a subjective benefit from the gum in keeping the mouth moist following surgery, while 13 of 16 were satisfied by the freedom to chew gum in the postoperative period.¹⁰

RESULTS FROM OVERALL META-ANALYSIS

SUBGROUP ANALYSIS

Table 2 & Figure 2

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