

# The Effect of Chewing Gum on Improving Bowel Activity during the Postoperative Period in Patients Undergoing Total Knee Arthroplasty: A Randomized Controlled Trial

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## ABSTRACT

**Introduction:** Postoperative constipation significantly impacts the quality of life during the immediate postoperative period. Non-pharmacological interventions are preferred so that we can reduce the use of synthetic drugs and their complications. This study evaluates the effect of using chewing gum over the perioperative period on improving bowel activity during the postoperative periods in patients who underwent total knee replacement (TKR).

**Materials and methods:** A prospective randomized controlled trial was conducted on 252 patients who underwent TKR between December 2020 and August 2021. Only patients having a natural defecation pattern preoperatively and not suffering from any diseases affecting bowel movements were considered. The Patients were classified into two groups, and computer-generated numbers did the randomization. The postoperative analgesia and rehabilitation protocol were the same for both groups. The sugar-free chewing gum (for better glycemic control) was given to the study group to chew for approximately 15 min every 6th hour from shifting out of the operation theater until the first stool was passed. For the control group, 200 mL of warm water (37 degrees) was given every 6th hour from shifting out of the operation theater until the first stool was passed. The patients were asked whether they passed 1st flatus or 1st stool at fixed intervals.

**Results:** The first flatus was passed on the day of surgery by 71% of patients from the study group and 50% from the control group. The first stool was passed postoperative day 1 by 71% of patients from the study group and 20% from the control group. These differences are statistically significant.

**Conclusion:** Chewing gum significantly improved bowel activity in postoperative TKR patients and would be a safe, effective, non-pharmacological method for decreasing postoperative constipation.

**Keywords:** Bowel activity, Sugar-free chewing gum, Postoperative constipation, Total knee replacement.

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## BACKGROUND

Total knee replacement or TKR is one of the most successful surgery in patients with advanced arthritis. Long-term patient satisfaction after TKR is associated with patient expectation, pain relief and functional recovery.<sup>1</sup> Postoperative analgesia, effective management of sleep disturbances, early recovery of bowel activity, and compliance with rehabilitation pose additional challenges in improving patient satisfaction and long-term functional outcomes.<sup>1</sup> Opioids are an integral part of multi-modal analgesia in the management of postoperative pain after TKR, which carries an undesirable side effect of constipation.<sup>2</sup> Postoperative constipation is defined as the absence of fully satisfying bowel movement within the first three postoperative days.<sup>3</sup> Up to 65% of total hip and knee replacement patients experience some degree of constipation postoperatively.<sup>3</sup> Causes include intraoperative medications, postoperative opioid analgesics, decreased bowel mobility, electrolyte imbalance and decreased oral intake. For the treatment of constipation, various pharmacological methods are used, including Bisacodyl and polyethylene glycol powder. To prevent the complications of these medications and to reduce the cost of treatment, non-pharmacological interventions can be used. Commonly employed non-pharmacological interventions are abdominal massage and chewing sugar-free gum. Liu Q et al. found that chewing sugar-free gum can reduce post-colorectal surgery ileus.<sup>4,5</sup> Recently published four meta-analyses on the effect of chewing gum on bowel movements concluded that chewing gum significantly

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shortened the time to first flatus and bowel movements.<sup>6-9</sup> However, all these studies were performed in patients undergoing colorectal surgery and this may be an overgeneralization as the paralytic ileus is a known complication of these surgeries. The uniqueness of our study is that this is the first randomized controlled trial evaluating the role of chewing gum in improving bowel activity during the postoperative period in TKR patients.

## MATERIALS AND METHODS

### Trail Design and Participants

In this prospective randomized controlled trial, consecutively operated 252 patients of either sex who underwent TKR between

December 1, 2020, and August 31, 2021, were screened for eligibility. A total of 14 patients with difficulty in chewing and dental prosthesis, 2 patients with impaired mental status (1 on anti-depressants and 1 with Parkinson's disease), 15 patients with a history of constipation, 6 patients with opioid-induced nausea and vomiting and 12 patients who did not give consent to participate were excluded from the study. Hence, the remaining 200 patients were evaluated in this study. Patients were grouped into two of 100 each using computer-generated numbers. Due to the nature of the study, randomized groups were not blinded as the patients, family members, and the physician could notice chewing gum. No additional laxatives were given to both groups of patients.

The consultant orthopedic surgeon performed all the surgeries. All unilateral TKR were performed under spinal anesthesia and infiltration between the popliteal artery and capsule of the knee (IPACK). All bilateral TKR cases were performed under combined spinal epidural anesthesia. For postoperative analgesia, all unilateral TKR cases had femoral nerve catheter infusion and all bilateral TKR cases had epidural infusion. The rehabilitation protocol was the same for all patients. Physiotherapy started on the same day after 6 h from surgery. Assisted ambulation was carried out from postoperative day one.

**Intervention**

The sugar-free (for glycemic control) chewing gum was given to the study group to chew for approximately 15 min every 6th hour from shifting out of the operation theater until the first stool was passed. For the control group, 200 mL warm water (37 degrees) at room temperature was given every 6th hour from shifting out of the operation theater until the first stool was passed. The patients were asked whether they passed 1st flatus or 1st stool at fixed intervals. No laxatives were given to the patients during the study periods.

**Statistical Methods**

Quantitative data was expressed as mean ± SD in numbers, mean and percentages. Independent t-test and chi-square test are applied. p-values of < 0.05 were considered statistically significant. All the data were analyzed by an independent external statistician who was blinded to the study method using the SPSS 16.0 version.

**RESULTS**

Among the participants, there were no significant differences in demographic factors other than body mass index (Table 1). The study group (group I) consisted of 55 males and 45 females, whereas in the control group (group II) there were 57 males and 43 females. So there were no significant differences in sex distribution also (Table 2). From the study group, 11 patients underwent bilateral TKR, 26 patients of left TKR and 63 patients of right TKR. From the control group, 11 patients underwent bilateral TKR, 6 patients of left TKR, and 83 patients of right TKR (Table 3). In group I, 90 patients had osteoarthritis and 10 patients had rheumatoid arthritis. Likewise, in the control group, 89 patients had osteoarthritis and 11 patients had rheumatoid Arthritis (Table 4). The first flatus was passed on the day of surgery by 71% of patients from the study group and 50% from the control group. The first stool was passed postoperative day one by 71% of patients from the study group and 20% from the control group. These differences are statistically significant (Table 5 and Fig. 1).

**DISCUSSION**

This study shows a statistically significant difference among both groups in the time at which the first flatus and first stool are passed.

**Table 1: Demographic factors**

Variables	N	Mean	Std. Deviation	t-value	p-value
<b>Age</b>					
Group I	100	63.65	9.635	0.56	0.58
Group II	100	64.37	8.639		
<b>Height</b>					
Group I	100	158.95	8.160	1.94	0.054
Group II	100	156.95	6.283		
<b>Weight</b>					
Group I	100	72.12	9.100	0.64	0.53
Group II	100	72.89	7.919		
<b>BMI</b>					
Group I	100	28.8173	5.09232	4.2	0.0001*
Group II	100	26.1902	3.65946		
<b>Sex</b>					
	Female	Male	Total		
Group I	57	43	100		
Group II	55	45	100		0.77
	112	88	200		

Note: \*' denotes significance at a 5% level of significance

**Table 2: Sex distribution between groups**

Sex	Group I	Group II	Total
F	57 (57%)	55 (55%)	112 (56%)
M	43 (43%)	45 (45%)	88 (44%)
Total	100 (100%)	100 (100%)	200 (100%)

**Table 3: Percentage of patients undergoing unilateral vs bilateral (B/L) TKR in both groups**

Surgery	Group		Total
	Group I	Group II	
B/L TKR	11 (11%)	11 (11%)	22 (11%)
L TKR	26 (6%)	6 (26%)	32 (16%)
R TKR	63 (63%)	83 (83%)	146 (73%)
Total	100 (100%)	100 (100%)	200 (100%)

**Table 4: Percentage of patients with osteoarthritis vs rheumatoid arthritis in both groups**

Diagnosis	Group		Total
	Group I	Group II	
OA	90 (90%)	89 (89%)	179 (89.5%)
RA	10 (10%)	11 (11%)	21 (10.5%)
Total	100 (100%)	100 (100%)	200 (100%)

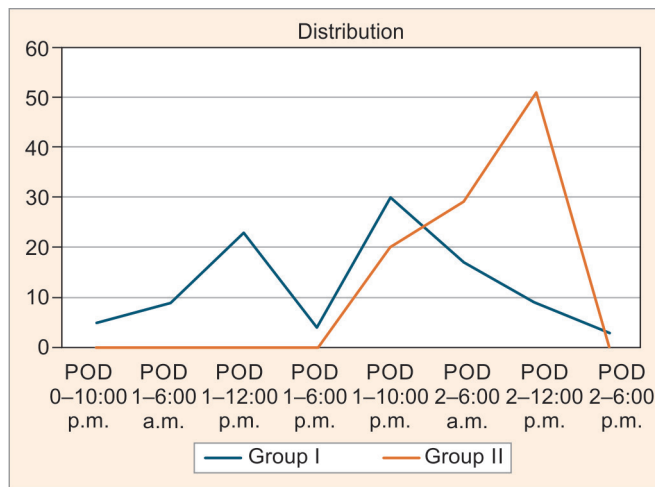
The results of this study show that chewing gum significantly improves bowel activity during the immediate postoperative period in patients undergoing TKR. The exact underlying mechanism of how chewing gum improves bowel activity is uncertain. It seems to be multi-modal that the chewing process may trigger the cephalic vagal stimulation of the gastrointestinal tract, stimulating bowel motility.<sup>10,11</sup> One possibility is that chewing may act as sham feeding, which stimulates the motility of the stomach, duodenum, and rectum.<sup>12</sup> The process of chewing can trigger the release of GI hormones which increases the secretion of saliva, gastrin, pancreatic juice and neurotensins.<sup>3</sup> There are few studies on postoperative



**Table 5:** Results of passing first stool in patients of both groups

Stool	Group I	Group II	Total
POD 0–10:00 p.m.	5 (5%)	0 (0%)	5 (2.5%)
POD 1–6:00 a.m.	9 (9%)	0 (0%)	9 (4.5%)
POD 1–12:00 p.m.	23 (23%)	0 (0%)	23 (11.5%)
POD 1–6:00 p.m.	4 (4%)	0 (0%)	4 (2%)
POD 1–10:00 p.m.	30 (30%)	20 (20%)	50 (25%)
POD 2–6:00 a.m.	17 (17%)	29 (29%)	46 (23%)
POD 2–12:00 p.m.	9 (9%)	51 (51%)	60 (30%)
POD 2–6:00 p.m.	3 (3%)	0 (0%)	3 (1.5%)
Total	100 (100%)	100 (100%)	200 (100%)

$\chi^2 = 78.5; p = 0.0001$ \*(significant)



**Fig. 1:** Results of passing first stool in patients of both groups

ileus (POI) in arthroplasty patients. Parvizi et al.<sup>13</sup> evaluated the incidence and risk factors for postoperative ileus after arthroplasties and found that there is an occurrence of 0.7%. The risk factors for developing POI were the older age-group, males, and a prior history of abdominal surgery and hip arthroplasty. They also found that the dose and type of narcotic medications used had no effect on this.

In a review by Bederman et al.,<sup>14</sup> who underwent either total hip or total knee arthroplasty, 0.32% developed postoperative ileus, which lasted for more than 3 days in 46% of patients. The mean age of the patients was 69.1 years, and 70% were male. Among the arthroplasty cases, the highest incidence was for revision hip arthroplasty (5.6%), followed by the bilateral knee arthroplasty cases. Cha et al.<sup>15</sup> conducted a similar study in post-total hip replacement patients and found that there was a significant reduction in the incidence of constipation.

Postoperative gastrointestinal hypo-motility is not an uncommon complication in arthroplasty patients. It impacts the patient's sense of well-being in the immediate postoperative period. So, an attempt to diagnose and treat this is warranted.

Due to the nature of the study, randomized groups were not blinded as the patients, family members, and the physician could notice chewing gum. There is a minimal chance of performance bias, which we neglected in this study.

## CONCLUSION

Chewing gum significantly improved bowel activity in postoperative TKR patients and would be a safe, effective, non-pharmacological method for decreasing postoperative constipation. This would be a widely available and well-tolerated solution to ameliorate an old problem.

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