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ORIGINAL CONTRIBUTIONS

# Does Eversion of the Anorectum During Restorative Proctocolectomy Influence Functional Outcome?

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**PURPOSE:** The aim of this study was to determine the effect of eversion of the anorectum during restorative proctocolectomy (RP) for ulcerative colitis on functional outcome. **METHODS:** One hundred seventeen patients underwent RP with stapled end-to-end ileal pouch-anal anastomosis (EEA), without resection of the anal mucosa. Sixty-four underwent EEA with eversion of the anorectum, and 53 underwent EEA without eversion. Each patient underwent paired studies of anorectal function before and a median of 12 months after RP. **RESULTS:** One year after RP, median (interquartile range) maximum resting pressure was 69 (range, 51-88) cmH<sub>2</sub>O in those patients who underwent eversion *vs.* 80 (range, 64-90) cmH<sub>2</sub>O in patients without eversion ( $P < 0.04$ ). Threshold sensation in the upper, middle, and lower thirds of the anal canal were 9.1, 7.4, and 6.8 mA after eversion *vs.* 6.9, 4.9, and 3.8 mA without eversion ( $P = 0.003$ ,  $P < 0.001$ ,  $P < 0.001$ , respectively). Before operation, all patients had a rectoanal inhibitory reflex; however, after RP, 54 of 64 patients in the eversion group and 50 of 53 patients with a stapled EEA without eversion had an inhibitory reflex ( $P =$  not significant). Leakage of mucus was experienced by 11 patients who underwent eversion, compared with 9 patients without eversion. Fifty-six of 64 patients with eversion could defer defecation for more than 30 min compared with 43 of 53 patients without eversion. Twenty-two of 64 patients in the eversion group retained perfect discrimination between flatus and feces compared with 38 of 54 without eversion ( $P < 0.001$ ). Level of the anastomosis was 1 (range, 0.5-3) cm above dentate line after eversion compared with 1.5 (range, 0-6) cm without

eversion. **CONCLUSION:** Clinical outcome after RP with eversion was not as good as outcome after stapled EEA without eversion. Such a conclusion requires confirmation in a prospective control trial. [Key words: Inflammatory bowel disease; Surgery; Anorectal eversion]

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Eversion of the anorectum as a means of facilitating a low enteroanal anastomosis has been described by several clinicians.<sup>1-4</sup> All reported satisfactory anorectal function, but none studied the effect of eversion on anal sphincteric function in the laboratory or compared this function with controls. Anorectal eversion is used in the course of restorative proctocolectomy for ulcerative colitis to facilitate more accurate citing of the double-stapled ileoanal anastomosis. Although preliminary results with this technique were promising,<sup>5</sup> concern remains about possible damage to the anal sphincter or its nerve supply and potential for impairment of anal continence. Aim of this study was to examine the precise effect of eversion of the anorectum on motor, sensory, and reflex functions of the anal sphincter, to correlate findings with clinical results, and to compare these with a large control group of patients who were undergoing re-

storative proctocolectomy with a stapled ileoanal anastomosis fashioned without eversion.

## PATIENTS AND METHODS

One hundred seventeen patients (51 male, 66 female) were studied. Each patient underwent restorative proctocolectomy for ulcerative colitis (73 W, 26 J, and 18 S reservoirs). Sixty-four patients underwent restorative proctocolectomy (RP) with a stapled end-to-end anastomosis with eversion of the anorectum, and 53 had a standard stapled end-to-end anastomosis without eversion. Details of patients are shown in Table 1.

### Operative Technique of Anorectal Eversion and End-to-End Ileoanal Anastomosis

The rectum was mobilized by close perimuscular dissection as far as the upper anal canal, then transected at mid-rectal level. Stay sutures were inserted, and the anorectal stump was everted from the anus. Strong distal traction on the anorectal stump provided a clear display of the dentate line and anal columns and allowed a TA30™ or TA55™ (Auto Suture, Ascot, United Kingdom) linear stapler to be placed accurately across the anorectal stump 1.5 to 2 cm above the dentate line. The anorectal sleeve was then transected at this level to produce a blind anal stump, which returned to the pelvis when the stapler was removed. A PREMIUM CEEA™ (Auto Suture) stapling device was used to fashion an end-to-end anastomosis approximately 1 to 1.5 cm above the dentate line.

**Table 1.**  
Details of Patients

	EEA Plus Eversion	EEA
No.	64	53
Age (yr)	32 (26–41)	38 (29–44)
Sex, M:F	28:36	23:30
Diagnosis		
UC	60	52
Crohn's	2	0
Indeterminate	2	1
Reservoir design		
S-pouch	0	18
J-pouch	23	3
W-pouch	41	32

Median (interquartile range); UC = ulcerative colitis; Indeterminate = indeterminate colitis; Crohn's = Crohn's disease; EEA = end-to-end ileal pouch-anal anastomosis.

## Assessment of Clinical Outcome

Quality of anal continence was assessed by direct questioning of patients about fecal leakage, anal soreness, their ability to defer defecation, and whether they could discriminate with perfect confidence between flatus and feces and thus release flatus without fear of fecal leakage.

### Laboratory Studies

Each patient underwent paired studies of anorectal function before and 12 months after operation or after closure of their defunctioning ileostomy. Anal sphincter pressure was measured by the station pull-through technique<sup>6</sup> at 1-cm intervals throughout the length of the anal canal. Sensation was assessed by measuring threshold electrosensitivity of the anal mucosa in the upper, mid, and lower anal canal (determined by anal manometry) by means of a bipolar constant current stimulator probe lubricated with a solution of KY jelly and normal saline in equal quantities.<sup>7,8</sup> Pouch-anal inhibitory reflex was assessed by measuring response of the upper anal sphincter to distention with air of a balloon cited within the pouch at a rate of 1 ml per second. A twenty percent decrease in pressure was taken to denote a positive reflex.<sup>8</sup>

### Statistical Analysis

All grouped data were expressed as median (interquartile range). Groups were compared by means of the Mann-Whitney *U* test for unpaired data. Nominal data was analyzed by Fisher's exact test.<sup>9</sup>

## RESULTS

### Anal Pressure

Before operation, maximum anal resting pressures of the two groups of patients were 91 (interquartile range, 73–116) cm of water compared with 87 (interquartile range, 76–100) cm of water (*P* = not significant (NS)). However, after operation, median maximum anal resting pressure in the group of patients who underwent eversion was 69 (interquartile range, 51–88) cmH<sub>2</sub>O compared with 80 (interquartile range, 64–90) cmH<sub>2</sub>O in those patient who had a stapled end-to-end ileal pouch-anal anastomosis (EEA) without eversion (*P* < 0.04). Maximum squeeze pressures in the two groups before RP were 144 (interquartile range, 116–189) cm of water and 140 (interquartile range, 112–183) cm of water (*P* = NS), and after RP they were 150 (interquartile range, 109–189) cm of

water and 132 (interquartile range, 100–159) cm of water ( $P = NS$ ). Anal resting pressure profiles in the two groups of patients before and after operation are shown in Figures 1 and 2.

### Anal Sensation

Threshold sensation in the upper, mid, and lower anal canal before and after operation is shown in Figures 3 and 4. Before operation, the group who subsequently underwent eversion had sensation that was significantly less acute than the group who underwent EEA without eversion. This difference persisted after RP.

### Rectoanal Inhibitory Reflex

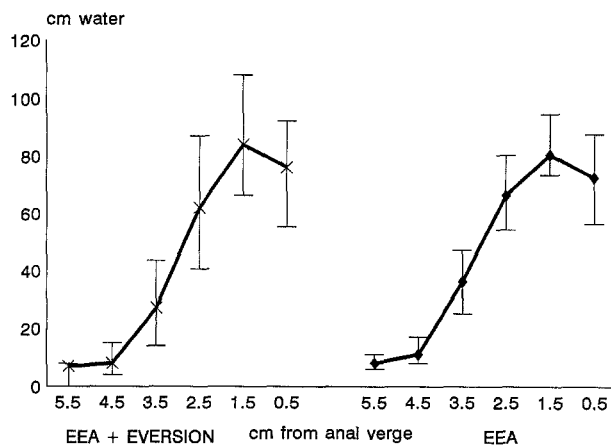
All 117 patients were shown to have a rectoanal inhibitory reflex before RP. One year after RP, rectoanal inhibitory reflex was clearly demonstrable in 54 of 64 patients in the eversion group and 50 of 53 patients with a stapled EEA without eversion ( $P = NS$ ).

### Clinical Results

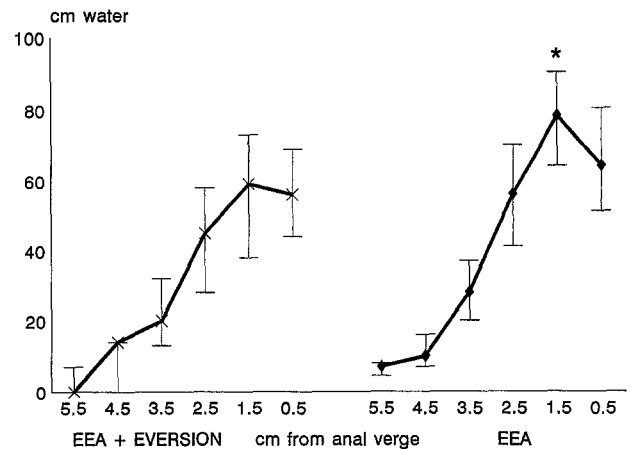
Clinical results are summarized in Table 2.

### DISCUSSION

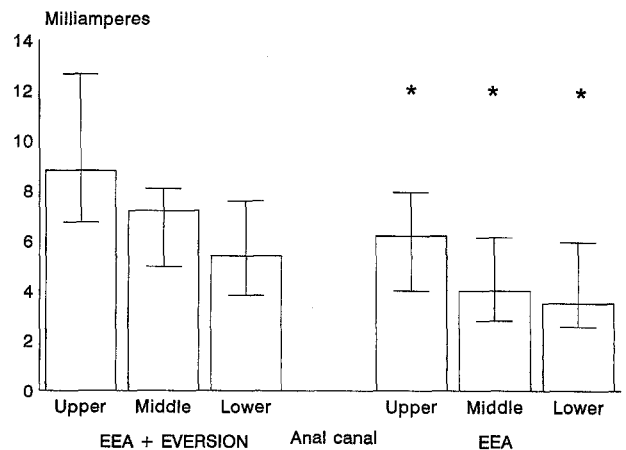
Increasing acceptance of restorative proctocolectomy with a stapled end-to-end ileoanal anastomosis without excision of the anal mucosa has led to an increased awareness of the need for construction of the ileal pouch-anal anastomosis accurately, at a level



**Figure 1.** Resting anal pressure profiles before restorative proctocolectomy in 64 patients with eversion of the anorectum and in 53 patients without eversion ( $P =$  not significant). EEA = end-to-end ileal pouch-anal anastomosis.

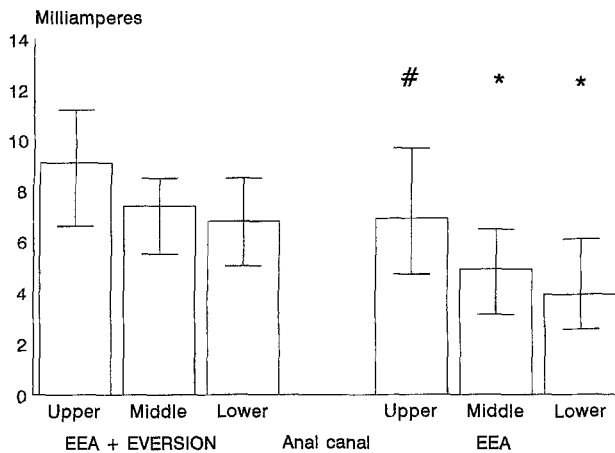


**Figure 2.** Resting pressure profiles after restorative proctocolectomy. Patients who underwent eversion of the anorectum had significantly lower resting anal pressure ( $*P < 0.04$ ). EEA = end-to-end ileal pouch-anal anastomosis.



**Figure 3.** Sensation within the anal canal before restorative proctocolectomy. Threshold for sensation was significantly higher in patients who underwent eversion of the anorectum ( $*P < 0.001$ ) at all levels within the anal canal. EEA = end-to-end ileal pouch-anal anastomosis.

of 1 to 1.5 cm above the dentate line. The main disadvantage of this technique is possible retention of inflamed rectal-type mucosa if the anastomosis is constructed too high above the dentate line and with it the local or systemic manifestations of colitis.<sup>10</sup> Such a scenario is most likely in heavily built male patients with a narrow pelvis, in whom accurate transection of the anorectal sleeve is especially difficult. In theory, eversion of the anorectum, a technique that was first described in the surgical treatment of children with Hirschsprung's disease<sup>2</sup> should overcome this difficulty;<sup>3, 4, 11</sup> however, concern remains among many surgeons about possible damage that may be produced by such forcible traction, either directly by



**Figure 4.** Sensation within the anal canal after restorative proctocolectomy. Patients who underwent eversion had significantly higher sensory thresholds (# $P = 0.003$ ; \* $P < 0.001$ ). EEA = end-to-end ileal pouch-anal anastomosis.

**Table 2.**  
Clinical Functional Results

	EEA Plus Eversion	EEA
No. of patients	64	53
Bowel frequency per 24 hours	5 (4-6)	4 (3-5)
Nocturnal	0 (0-1)	0 (0-1)
Defer defecation >30 minutes	56	43
Discriminate flatus/feces confidently	20	39*
Leakage of mucus or feces	11	6

Median (interquartile range); EEA = end-to-end ileal pouch-anal anastomosis.

\*  $P < 0.001$ .

trauma to its musculature or indirectly by damage to its nerve or blood supply.<sup>4</sup>

Certainly, the goal of an anastomosis cited accurately was achieved more often in patients who were undergoing eversion with an ileoanal anastomosis at 1 (range, 0.5-3) cm above the dentate line compared with 1.5 (range, 0-6) cm in patients without eversion. However, it is apparent from physiologic results that a price was incurred in terms of motor, sensory, and reflex function. The importance of a strong anal sphincter has been demonstrated by results of many studies.<sup>6, 12, 13</sup> Before restorative proctocolectomy, both groups of patients had normal anal resting pressure profiles. One year after restorative proctocolectomy, again both groups of patients had essentially normal anal resting pressure profiles, although there was a significant reduction in maximum resting pressures in those patients who underwent eversion of the anorectum in the course of restorative proctocolec-

tomy. Maximum voluntary squeeze pressures did not differ significantly either before or after operation. Internal anal sphincter is responsible for approximately 85 percent of anal resting pressure,<sup>14, 15</sup> and voluntary squeeze pressure is generated by external anal sphincter. Decrease in resting pressure after restorative proctocolectomy in patients undergoing eversion of the anorectum group implies, therefore, that there has been damage to the internal component of the anal sphincter.

It is of note that before operation, sensation was significantly worse throughout the length of the anal canal in those patients who subsequently underwent eversion of the anorectum compared with those patients who subsequently underwent a standard end-to-end anastomosis without eversion. Why this should be is not clear. Median age of the two groups did not differ significantly, 32 years in the eversion group *vs.* 38 years for patients without eversion. More female patients underwent RP with eversion of the anorectum, but again the difference in numbers is not significant. One year after restorative proctocolectomy, this difference in sensory thresholds remained.

Clinical outcome in all 117 patients was satisfactory; all were continent, although a minority in both groups experienced leakage of mucus. However, the ultimate criterion of the quality of anal sphincter proprioception is the ability to discriminate between flatus and feces; in this regard, patients who underwent eversion fared significantly worse. One might, therefore, expect to observe alteration in reflex function after restorative proctocolectomy with eversion of the anorectum. Before restorative proctocolectomy, all patients had a rectoanal inhibitory reflex. One year after restorative proctocolectomy with eversion, this reflex was demonstrable in 54 patients (84 percent) compared with 50 patients (94 percent) who underwent restorative proctocolectomy without eversion. Although this difference did not reach statistical significance, we feel that this aspect of anal sphincter physiologic function deserves closer examination because clinical results in terms of discrimination suggest there must be a quantitative difference in reflex function to explain this clinical finding.

## CONCLUSION

All forms of sphincter-saving surgery achieve gross anal continence. However, if our goal is to be perfect anal continence, the operative technique

would appear to be of crucial importance. We showed previously that a stapled end-to-end anastomosis produced clinical results far superior to that observed after endoanal anastomosis with mucosal proctectomy. Clinical outcome after RP by the eversion technique is better than was observed after RP with mucosectomy and end-to-end anastomosis but not as good as outcome after stapled end-to-end anastomosis without eversion.<sup>5</sup> Such a conclusion requires confirmation in a prospective randomized control trial. If perfect continence is to be the goal, an end-to-end anastomosis without eversion appears to produce the best functional result, although this may be offset if any inflamed rectal mucosa is retained. If this is difficult technically, for example, in a man with a narrow pelvis, a stapled end-to-end anastomosis with eversion still appears to be superior to an end-to-end anastomosis with a mucosectomy.

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