

Biofeedback Therapy for Bowel Dysfunction Following Low Anterior Resection

Y H Ho,**FAMS, MBBS, FRACS*, M Tan,***AN*

Abstract

Faecal incontinence and intractable constipation after low anterior resection (LAR) can be refractory to expectancy and appropriate anti-diarrhoeal or laxative medications. The efficacy of anorectal biofeedback therapy (BF) in this clinical situation was prospectively assessed. Eleven patients [5 men and 6 women; mean age 64.8 years; standard error of the mean (SEM) 3.3 years] had either faecal incontinence or intractable constipation which did not settle with medications, for at least 6 months [mean 33.3 (SEM 6.1) months] after LAR. They all underwent 4 sessions of outpatient BF. Assessment was by continence questionnaire and anorectal physiology tests, which were administered before and after BF. In 6 of 6 incontinent patients, weekly incontinent episodes were decreased [14.8 (SEM 2.1) before, 1.8 (SEM 0.8) after; $P<0.05$] and anti-diarrhoeal drug requirements were reduced (needed in 6 before, 0 after; $P<0.05$) after BF. In the 5 intractable constipation patients, the weekly stool frequency was improved [3 (SEM 0.5) before, 8.9 (SEM 1.6) after; $P<0.05$] after BF. There were no significant changes in the anorectal physiology parameters after BF. At a mean follow-up of 12.9 (SEM 1.6) months, there were no regressions or complications. BF is a safe option for refractory bowel dysfunction following LAR.

Ann Acad Med Singapore 1997; 26:299-302

Key words: Colon, Continence, Rectum, Surgery

Introduction

Disturbed bowel function after colorectal surgery can be very distressing to the patient. Faecal incontinence or intractable constipation is particularly likely after low anterior resection (LAR). It is estimated that after LAR, 13% to 80% of patients may have impaired continence,^{1,4} and 28.4% may have severe constipation.¹ Although the majority improve satisfactorily within 6 months of surgery,⁴ some patients remain very disturbed by the poor bowel function. In these cases, even large doses of anti-diarrhoeal or laxative medications, as appropriate, do little to alleviate the problem.

Biofeedback therapy (BF) has recently been shown to be effective in treating certain types of faecal incontinence⁵⁻⁸ and intractable constipation.⁹⁻¹⁵ This is a specific form of behaviour modification which aims to control bodily function.¹⁶ However, there is inadequate data concerning BF in the management of faecal incontinence and intractable constipation after LAR. Therefore, we prospectively assessed the efficacy of BF in managing such problems in patients after LAR. The effects of BF on the anorectal manometry findings were also monitored.

Materials and Methods

Patients

Eleven patients [5 men and 6 women; mean age 64.8 years; standard error of the mean (SEM) 3.3 years] consented to be studied. The incontinent patients had persistent incontinence of liquid or solid stools. The constipated patients had persistent infrequent stools (less than 2 bowel movements a week or otherwise needing laxatives), excessive straining at defaecation (regular straining for more than 15 min) and/or a frequent sensation of incomplete defaecation.¹ These symptoms had not improved after a mean 33.3 (SEM 6.1) months after LAR. All patients had unsatisfactory responses to at least 6 months of supervised appropriate anti-diarrhoeal agents or laxatives.

LAR was performed for adenocarcinoma of the mid or lower rectum in 10 patients (Dukes staging A=6, B=1, C=2, D=1). The remaining patient had LAR done for severe radiation proctocolitis bleeding following irradiation for previous cervical cancer. The surgical technique involved mobilisation of the left colon to proximal of the splenic flexure. The inferior mesenteric artery

* Consultant Surgeon

Department of Colorectal Surgery

** Nurse Technician

Anorectal Physiology Laboratory

Singapore General Hospital

Address for Reprints: Dr Ho Yik Hong, Department of Colorectal Surgery, Singapore General Hospital, 1 Hospital Drive, Singapore 169608.

was ligated proximal to the left colic artery. The rectum was dissected down to the pelvic floor with total excision of the mesorectum. A RL 30 transverse stapler (Ethicon, Somerville, NJ) was applied just proximal to the anorectal junction and the rectum was removed. The descending colon was anastomosed to the anorectal stump (Ethicon, Somerville, NJ). In one patient, a colonic J pouch with 6 cm limbs was constructed from the descending colon and anastomosed to the anorectal stump (this patient subsequently complained of incontinence). Two of the patients also underwent postoperative adjuvant radiotherapy (4500 to 5000 cGy in 28 fractions over 5 weeks). There was no clinical evidence of anastomotic dehiscence, or local recurrence (on endoscopy and pelvic computed tomographic [CT] scans) in all 11 patients.

Biofeedback

BF was performed using the Biosearch manometric biofeedback equipment (Dubkoff, Somerville, NJ) for either faecal incontinence or constipation, as appropriate.^{9,17} This consisted of a probe with a rectal balloon at its tip and a pressure transducer situated to measure the mid anal canal pressures. The anal pressures were displayed on a portable monitor. With the faecal incontinence BF equipment, increased pressure in the anal canal was indicated to the patient by an appropriate increase in the number of coloured bulbs lighted up on the monitor screen. With the constipation BF equipment, abnormal increased pressure in the anal canal was indicated by a decrease in the number of coloured bulbs lighted up on, the monitor screen. Thus, patients were given feedback on their efforts to contract and relax their anal sphincter muscles.

The aims and rationale were explained to the patients. The patients then underwent four outpatient sessions of BF. Each session was a week apart and lasted one hour. A sitting position was adopted. The patients were first taught relaxation by abdominal breathing exercises. After that, the BF probe was inserted into the anorectum. The rectal balloon was inflated with air until a sensation of fullness was felt. The patients were then taught to squeeze maximally and to sustain the effort, before relaxing their anal sphincter muscles. In the constipated patients, they were taught additionally to strain down whilst effectively relaxing their anal sphincter muscles. Feedback was provided by the changing pattern of coloured lights on the Biosearch meter. Relying on this feedback, the patients were encouraged to improve their results with each repeated effort. It was ensured that the patients clearly understood the requirements. They were encouraged to continue these pelvic floor exercises at home, without the BF equipment. None of the patients were given any formal psychological as-

essment or counselling.

Clinical and Anorectal Physiology Assessment

From the start to the end of the BF treatment, the patients kept a daily bowel function log. This log recorded the number of daily bowel movements, incontinent episodes, need to wear perineal pads, straining at defaecation, sensation of incomplete defaecation and anti-diarrhoeal agent/laxative requirements. The patients' progress were also assessed by an independent investigator who was not associated with the BF treatment. Anorectal manometry was performed before, and repeated one week after BF. A microcapillary perfusion system (Synectics, Stockholm, Sweden) was used, the technique having been previously described.^{17,18}

Statistical significance was calculated using the Wilcoxon's and McNemar nonparametric tests where appropriate.

Results

Clinical

The effects of BF on incontinence after LAR are shown in Table I. The number of weekly incontinent episodes were significantly reduced ($P < 0.05$). All 6 patients had more than 90% reduction in their incontinent episodes. These included nocturnal and day time incontinent episodes. The stool frequency was also reduced but this did not reach statistical significance. The requirements for anti-diarrhoeal agents were also significantly reduced ($P < 0.05$). After BF, all 5 patients who previously needed perineal pads were able to do without.

The results of BF on intractable constipation are also shown in Table I. There was a significant increase in the stool frequency ($P < 0.05$). Of the 5 patients, only 1 needed to continue excessive straining. This patient was also 1 of the 2 who still needed laxatives after BF. Apart from him, 4 of the 5 patients were at least 90% subjectively satisfied with the results. At a mean follow-up of 12 (SEM 1.6) months after BF, there were no

TABLE I: BOWEL FUNCTION BEFORE AND AFTER BIOFEEDBACK

	Incontinence (n = 6)		Constipation (n = 5)	
	Before	After	Before	After
Stool frequency (/week)	37.3 (12.7)	14.4 (2.3)	3 (0.5)	8.9 (1.6)*
Incontinence episodes (/week)	14.8 (4.1)	1.8 (0.8)	—	—
Patients needing pads (n)	5	0	—	—
Patients needing to strain (n)	—	—	5	1
Patients with sensation of incomplete defaecation (n)	—	—	3	0
Patients needing anti-diarrhoeal agents/laxatives (n)	6	0*	5	2

Values in mean (standard error of the mean). * $P < 0.05$, using Wilcoxon's and McNemar tests where appropriate.

TABLE II: ANORECTAL PHYSIOLOGY BEFORE AND AFTER BIOFEEDBACK

	Incontinence (n = 6)		Constipation (n = 5)	
	Before	After	Before	After
Perineal descent				
Rest (cm)	1.6 (0.2)	1.6 (0.1)	0.9 (0.2)	1.4 (0.2)
Strain (cm)	2.5 (0.1)	2.5 (0.1)	2 (0.2)	2.4 (0.2)
Anal canal				
Mean resting pressure (mmHg)	52.3 (9.4)	57.6 (14.2)	50.4 (7.1)	71.3 (4.2)
Maximum squeeze pressure (mmHg)	89.3 (7.8)	108.2 (21.4)	109.8 (23.4)	118.5 (13.6)
Physiological length (cm)	3.3 (0.5)	3.8 (0.6)	2.3 (0.3)	2.5 (0.5)
Rectum				
Volume of initial sensation (ml)	65.3 (13.9)	78.4 (12.3)	50.8 (21.9)	98 (56.8)
Maximum tolerable volume (ml)	130.5 (50.7)	123 (11.7)	89.5 (35)	148.5 (78.4)
Compliance (ml/mmHg)	1.6 (0.7)	4.3 (1.9)	2.9 (2.4)	1.4 (0.7)

Values in mean (standard error of the mean). Differences not significant with Wilcoxon's test.

complications and no regressions from treatment.

Anorectal Physiology

The anorectal physiology findings before and after BF are shown in Table II. The anal pressures following LAR tended to be low before BF, but improved after treatment. However, this increment in the anal pressures did not reach statistical significance. BF did not significantly affect the other measured parameters in either the incontinent or constipated patients after LAR.

Discussion

We report that BF was successful in managing patients who had faecal incontinence or intractable constipation after LAR. All 6 patients with incontinence had at least 90% reduction in their incontinent episodes. Four of the 5 patients with intractable constipation were at least 90% satisfied with improvements in their bowel function. The mean follow-up was 12 (SEM 1.6) months, and to date there have been no regressions or complications. The need for anti-diarrhoeal agents or laxatives was also reduced, although this reached statistical significance only in the incontinent group. It has been well established that BF is 70% to 90% successful in managing mild to moderate faecal incontinence.⁵⁻⁸ BF is 70% to 90.3% successful in managing intractable outlet obstruction constipation.⁹⁻¹⁵ However, our study pertained to a group of patients where previous information was deficient.¹⁹ These were patients distressed by faecal incontinence or intractable constipation after LAR. There have not been many options available when such symptoms did not settle with time or remained poorly controlled despite anti-diarrhoeal or laxative medications. Our early results suggest that BF should be considered as a possible therapeutic option for this debilitating complication.

Poor continence after LAR relates to the eventual

reservoir function of the neorectum, consisting of proximal colon anastomosed to the rectal stump.²⁰ Being less compliant, stools are less efficiently stored.²²⁰⁻²⁴ In addition, there is a postoperative deficiency in anal sphincter pressures which may be caused by denervation or injury to the internal sphincter during transrectal insertion of an intraluminal stapling device for anastomosis.²⁵⁻²⁷ Intractable constipation after LAR is likely the result of resection of the sigmoid colon, which is the main propulsive organ of the large intestine.^{1,28} The results of our anorectal physiology tests done before and after BF, could shed little light on how BF improved these physiological problems. There was improvement in the anal pressures but this was not statistically significant, possibly because of the small number of patients. Nonetheless, this is consistent with findings reported in patients with other forms of incontinence²⁹ and intractable constipation^{9,30,31} treated with BF. However, other reports show no correlation between the improvements in symptoms and the anorectal physiology measurements done before and after BF.^{8,32-34} BF can possibly work by improving anal sphincteric coordination,³⁵ rectal sensation^{6,32,33,36,37} rectal liquid retention³⁸ and/or anal canal sensation.^{6,38} Although improved rectal sensation is likely to be the most important factor, it is difficult to explain the success of BF in managing defaecatory problems in children with spinal cord disorders.³⁹ Further research is required to elicit the precise mechanism of BF.

The role that psychology plays in BF therapy needs to be considered. Reports of functional improvement after BF not associated with any change in anorectal physiology parameters suggest that psychology may be important.⁴⁰ Whilst it is undeniable that the patient-biofeedback therapist relationship may be vital, none of our patients received any formal psychiatric counselling.

Conclusion

We found that BF was successful in alleviating the distressing incontinence or constipation which affected certain patients after LAR. Functional improvements were maintained for a mean of 12 months after treatment. There was neither discomfort to the patients nor any complications from BF. Although the number of patients was small and a simultaneously treated control group was lacking, our results suggest that BF should be explored further as a useful option in such patients.

REFERENCES

- Ho Y H, Low D, Goh H S. Bowel function survey after segmental colorectal resection. *Dis Colon Rectum* 1996; 38:307-10.
- McDonald P J, Heald R J. A survey of postoperative function after rectal anastomosis with circular stapling devices. *Br J Surg* 1983; 70:727-9.
- Williams D S, Durdley P, Johnston D. The outcome following sphincter-saving resection and abdomino-perineal resection for low rectal cancer. *Br J Surg* 1985; 72:595-8.
- Nakahara S, Itoh H, Mibu R, Ikeda S, Oohata Y, Kitano K, et al. Clinical and manometric evaluation of anorectal function following low anterior resection with low anastomotic line using EEA stapler for rectal cancer. *Dis Colon Rectum* 1988; 31:762-6.
- Engel B T, Nikoomeanesh P, Schuster M M. Operant conditioning of rectosphincteric responses in the treatment of fecal incontinence. *N Engl J Med* 1974; 290:646-9.
- Cerulli M A, Nikoomeanesh P, Schuster M M. Progress in biofeedback conditioning for fecal incontinence. *Gastroenterology* 1979; 76:742-6.
- Goldenberg D A, Hersch T, Horacio J. Biofeedback therapy for fecal incontinence. *Am J Gastroenterol* 1980; 74:342-5.
- Enck P. Biofeedback training in disordered defecation: a critical review. *Dig Dis Sci* 1993; 38:1953-60.
- Ho Y H, Tan M, Goh H S. The clinical and physiological effects of biofeedback in outlet obstruction constipation. *Dis Colon Rectum* 1996; 39:520-6.
- Wexner S D, Cheape J D, Jorge J M N, Heymen S, Jagelman D G. Prospective assessment of biofeedback for the treatment of paradoxical puborectalis contraction. *Dis Colon Rectum* 1992; 35:145-50.
- van Baal J G, Lgvit I', Brummelkany W H. Relaxation biofeedback conditioning as treatment of a disturbed defecation reflex. *Dis Colon Rectum* 1984; 27:187-9.
- Bleijenberg G, Kuipers H C. Treatment of spastic pelvic floor syndrome with biofeedback. *Dis Colon Rectum* 1987; 30:108-11.
- Kawimbe B M, Papchrysostomou M, Binnie N R, Clare N, Smith A N. Outlet obstruction constipation (anismus) managed by biofeedback. *Gut* 1991; 32:1175-9.
- Turnbull G K, Ritvo P G. Anal sphincter biofeedback relaxation treatment for women with intractable constipation symptoms. *Dis Colon Rectum* 1992; 35:530-6.
- Fleshman J W, Dreznik Z, Meyer K, Fry R D, Carney R, Kodner I J. Outpatient protocol for biofeedback therapy of pelvic floor outlet obstruction. *Dis Colon Rectum* 1992; 35:1-7.
- MacLeod J H. Biofeedback in the management of partial anal incontinence. *Dis Colon Rectum* 1983; 26:244-6.
- Ho Y H, Goh H S. Current value of anorectal physiology and biofeedback in clinical practice. *Asian J Surg* 1995; 18:244-56.
- Ho Y H, Goh H S. Computerized 3-dimensional vector volume analysis—the role of a new method for assessing anal sphincter competence. *Ann Acad Med Singapore* 1992; 21:263-6.
- Ho Y H, Chiang J M, Tan M, Low J Y. Biofeedback therapy for excessive stool frequency and incontinence following anterior resection or total colectomy. *Dis Colon Rectum* 1996; 39:1289-92.
- Ho Y H, Wong J, Goh H S. Level of anastomosis and anorectal manometry in predicting function following anterior resection for adenocarcinoma. *Int J Colorectal Dis* 1993; 8:170-4.
- Batignani G, Monaci I, Ficari F, Tonelli F. What affects continence after anterior resection of the rectum? *Dis Colon Rectum* 1991; 34:329-35.
- Carmona JA, Ortiz H, Perez-Cabanas I. Alterations in anorectal function after anterior resection for cancer of the rectum. *Int J Colorectal Dis* 1991; 6:108-10.
- Lewis W G, Holdsworth P J, Stephenson B M, Finan P J, Johnston D. Role of the rectum in the physiological and clinical results of coloanal and colorectal anastomosis after anterior resection for rectal carcinoma. *Br J Surg* 1992; 79:1082-6.
- Pederson K, Hint K, Olsen J, Christiansen H N, Jensen P, Mortensen P E. Anorectal function after low anterior resection for carcinoma. *Ann Surg* 1986; 204:133-5.
- Molloy G G, Moran K T, Coulter J, Waldron R, Kirwan W O. Mechanism of sphincter impairment following low anterior resection. *Dis Colon Rectum* 1992; 35:462-4.
- Ho Y H, Goh H S. Unilateral anal electrosensation-modified technique to improve quantification of anal sensory loss. *Dis Colon Rectum* 1995; 38:239-44.
- Horgan F G, O'Connell P R, Shinkwin C A, Kirwan W O. Effect of anterior resection on anal sphincter function. *Br J Surg* 1989; 76:783-6.
- Schoetz D J Jr. Postcolectomy syndromes. *World J Surg* 1991; 15:605-8.
- Keck J O, Staninas R J, Collier J A, Barrett R C, Oster M E, Schoetz D J Jr, et al. Biofeedback training is useful in fecal incontinence but disappointing in constipation. *Dis Colon Rectum* 1994; 37:1271-6.
- Ho Y H, Ho J M S, Parry B R, Goh H S. Solitary rectal ulcer syndrome: the clinical entity and anorectal physiology findings in Singapore. *Aust N Z J Surg* 1995; 65:93-7.
- Ho Y H. Biofeedback therapy in solitary rectal ulcer syndrome. *SGH Proceedings* 1995; 4:5-7.
- Miner P B, Donnelly T C, Read N W. Investigation of mode of action of biofeedback in treatment of fecal incontinence. *Dig Dis Sci* 1990; 35:1291-8.
- Latimer P R, Campbell D, Kasperski J. A component analysis of biofeedback in the management of fecal incontinence. *Biofeedback Self Regul* 1984; 9:311-24.
- Loening-Bauke V. Efficacy of biofeedback training in improving incontinence and anorectal physiologic function. *Gut* 1990; 31:1395-402.
- Whitehead W E, Burgio K L, Engel B T. Biofeedback treatment of fecal incontinence in geriatric patients. *J Am Geriatr Soc* 1985; 33:320-4.
- Schiller L R, Santa Ana C, Davis G R, Fordtran J S. Fecal incontinence in chronic diarrhoea: report of a case with improvement after training with rectally infused saline. *Gastroenterology* 1979; 77:751-3.
- Buser W D, Miner P B. Delayed rectal sensation with fecal incontinence. Successful treatment using anorectal manometry. *Gastroenterology* 1986; 91:1186-91.
- Sun W M, Read N W, Miner P B. Relation between rectal sensation and anal function in normal subjects and patients with faecal incontinence. *Gut* 1990; 31:1056-61.
- Koletzko S, Herdmann J, Bogermann K, Theisen U, Voit T, Enck P. Evoked potentials and manometry are complementary in the evaluation of anorectal functions. *Gastroenterology* 1991; 100:A460.
- Wald A. Biofeedback therapy for fecal incontinence. *Ann Intern Med* 1981; 91:146-9.