

Biofeedback Therapy for Fecal Incontinence After Surgery for Anorectal Malformations: Preliminary Results

By Naomi Iwai, Masako Nagashima, Takashi Shimotake, and George Iwata
Kyoto, Japan

● Eight patients with fecal incontinence after surgery for anorectal malformations received one to four sessions of biofeedback therapy. The physiologic status of the anorectum before and after biofeedback therapy was investigated by anorectal manometry and electromyography of the external sphincter. The effectiveness of biofeedback treatment and the indications for its use in patients with fecal incontinence were investigated. Three of the four patients responded well to biofeedback therapy following three or four training sessions. However, in the other five patients who had only one or two sessions, a good response to the therapy was not obtained. Anorectal manometry and electromyography recordings of the external sphincter showed that biofeedback therapy improved voluntary sphincter function. The three good responders had an adequate anal resting pressure both before and after biofeedback therapy and had good electrical activity of the external sphincter after therapy. In the presence of adequate resting anal pressure, biofeedback therapy should be attempted for the treatment of fecal incontinence after correction of anorectal malformations before resorting to further surgical intervention. However, biofeedback therapy may not be suitable if the sphincters are markedly hypoplastic, or do not surround the anal canal after an inappropriate pull-through operation.

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INDEX WORDS: Anorectal malformations; fecal incontinence, biofeedback.

IT HAS BEEN reported^{1,2} that many patients treated for anorectal malformations have postoperative difficulty in defecation, constipation, and fecal incontinence, the later being the most difficult management problems. A corrective operative procedure³⁻⁶ has been the treatment of last resort for releasing patients from the restriction of their social activities, but these secondary procedures are not always successful. Alternatively, it has been reported⁷⁻¹⁰ that biofeedback therapy is a simple and safe method for treating these children with fecal incontinence. However, objective investigations of the anorectum before and after biofeedback therapy have not been reported, and the specific indications for this therapy have not been formulated.

The purpose of this study was to determine the effectiveness of biofeedback therapy as an alternative to operative intervention in the treatment of fecal incontinence after surgery for anorectal malformations. Objective assessment of the continence appara-

tus, using anorectal manometry and electromyography (EMG) of the external sphincter was obtained.

MATERIALS AND METHODS

From 1960 to 1991, 171 patients with anorectal malformations were treated in the Division of Surgery, Children's Research Hospital, Kyoto Prefectural University of Medicine. Eight of these patients, six with high-type anomalies and two with intermediate-type anomalies, continued to have fecal incontinence or soiling in spite of medical treatments (dietary manipulations, toilet training, suppositories, or enemas), and received biofeedback therapy. The six patients with high-type anomalies were 6 to 12 years old, and the two with intermediate-type anomalies were 8 and 12 years old.

Seven patients underwent abdominoperineal rectoplasty and the remaining patient had abdominosacroperineal rectoplasty as the primary operation.

Manometric Assessments

Manometric studies and biofeedback therapy were performed with a probe which was perfused at a constant speed of 10 mL/h.¹¹ This apparatus was connected to a transducer (P231D; Gould Inc, Oxnard, CA), and the pressure was recorded with a Nippon-Sanei thermal pen recorder.

Anorectal reflex, resting pressure, and anorectal pressure difference (ARPD) were examined. Voluntary contraction pressure was measured twice, at 2 cm and at 1 cm from the anal verge. The mean pressure was expressed as the voluntary contraction pressure. For determining the rectal reservoir threshold for sensation, maximum tolerated volume and rectal compliance were measured.

Electromyographic Assessment

EMG was recorded from the external anal sphincter by two surface electrodes placed just outside the anal orifice, as we previously reported.¹²

The external sphincter electrogram at rest was recorded and classified into 3 grades: +, ±, and -. The presence or absence of the inflation reflex and the electrical activity during further rectal filling were noted, as was the presence or absence of phasic activity during voluntary anal contraction.

From the Division of Surgery, Children's Research Hospital, Kyoto Prefectural University of Medicine, Kyoto, Japan.

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Address reprint requests to Naomi Iwai, MD, Division of Surgery, Children's Research Hospital, Kyoto Prefectural University of Medicine, Kamigyo-ku, Kyoto 602, Japan.

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Table 1. Kelly Scores Before and After Biofeedback Therapy

Case No.	Type of Anomaly	Age Before and After Biofeedback Therapy	No. of Biofeedback Sessions	Kelly Score	
				Before	After
1	High	8 yr → 9 yr	4	1 → 1	
2	Intermediate	8 yr → 10 yr	4	0 → 3	
3	Intermediate	12 yr → 14 yr	4	2 → 3	
4	High	10 yr → 11 yr	3	1 → 4	
5	High	10 yr → 11 yr	2	4 → 4	
6	High	12 yr	1	3 → 3	
7	High	6 yr	1	1 → 1	
8	High	7 yr	1	3 → 3	

Biofeedback Therapy

Sphincter squeeze training was given with a recording probe in the anal canal. The patient was aware of the pressure curve on the recording paper, visualizing the pressure response to sphincter squeezing. Synchronization of the sphincter contraction with a rectal stimulus was established by asking the patient to contract the sphincter when rectal distension was sensed. When appropriate synchrony was obtained, the balloon distension was gradually diminished to the threshold volume.

The patients were hospitalized for biofeedback therapy. A training session was 1 week long, with therapy performed twice a day, morning and evening. The patients underwent one to four sessions.

Clinical Assessment

In the clinical assessment of the functional results, we followed the Kelly scoring system,¹³ which is based on three criteria: (1) control of feces and bowel habits, (2) fecal staining, and (3) sling action of the puborectalis muscle.

Clinical assessments were performed before and after the biofeedback sessions, and during follow-up periods ranging from 3 months to 3 years.

RESULTS

Clinical Assessment (Kelly Score)

The eight patients had Kelly scores of 0 to 4 before biofeedback therapy. Three of the patients showed improvement in the scores after three or four sessions

(Table 1). The scores of the other five patients who had only one or two sessions did not improve.

Anorectal Manometry

As shown in Table 2, an anorectal reflex was not present before or after biofeedback therapy in any of the eight patients. Anal resting pressure and ARPD were not significantly affected by biofeedback treatment. However, voluntary contraction pressure, which was 19.6 ± 3.1 cm H₂O before therapy, increased to 51.9 ± 9.0 cm H₂O after therapy, a significant increase ($P < .02$) (Fig 1). In addition, it is noteworthy that the three patients whose Kelly scores improved after biofeedback therapy had an adequate anal resting pressure before and after the therapy.

Electromyographic Recordings

Tonic activity at rest was present (+) in two of the eight patients, (\pm) in four, and absent (-) in two (Table 3). These results did not change following biofeedback therapy.

Before biofeedback therapy, two of the eight patients had an inflation reflex. One additional patient developed an inflation reflex after therapy.

Electrical activity during further rectal filling was increased in only one patient before therapy, and after therapy it was increased in the three patients whose Kelly scores improved.

Phasic activity was present in six patients before biofeedback therapy, and in all eight after therapy, as they practiced the sphincter squeeze during the training sessions.

Rectal Sensation and Compliance

The threshold sensation volumes before and after biofeedback therapy were 44.3 ± 6.3 cm H₂O and 25.7 ± 6.4 cm H₂O, respectively (Table 4). The value

Table 2. Results of Anorectal Manometry Before and After Biofeedback Therapy

Case No.	Kelly Score Before and After Biofeedback	Anorectal Reflex	Anal Pressure (cm H ₂ O)	ARPD (cm H ₂ O)	Voluntary Contraction Pressure (cm H ₂ O)
1	1 → 1	Absent → absent	9 → 10	5 → 4	14 → 20
2	0 → 3	Absent → absent	24 → 30	10 → 10	12 → 47
3	2 → 3	Absent → absent	10 → 30	1 → 16	9 → 42
4	1 → 4	Absent → absent	22 → 30	14 → 20	10 → 28
5	4 → 4	Absent → absent	31 → 31	18 → 19	22 → 48
6	3 → 3	Absent → absent	16 → 16	6 → 6	30 → 110
7	1 → 1	Absent → absent	12 → 19	2 → 9	32 → 60
8	3 → 3	Absent → absent	22 → 28	2 → 13	28 → 60
Mean			$18.3 \pm 2.6 \rightarrow 24.3 \pm 2.7$	$7.3 \pm 2.1 \rightarrow 12.1 \pm 1.9$	$19.6 \pm 3.1^* \rightarrow 51.9 \pm 9.0^*$

Abbreviation: ARPD, anorectal pressure difference.

* $P < .02$.

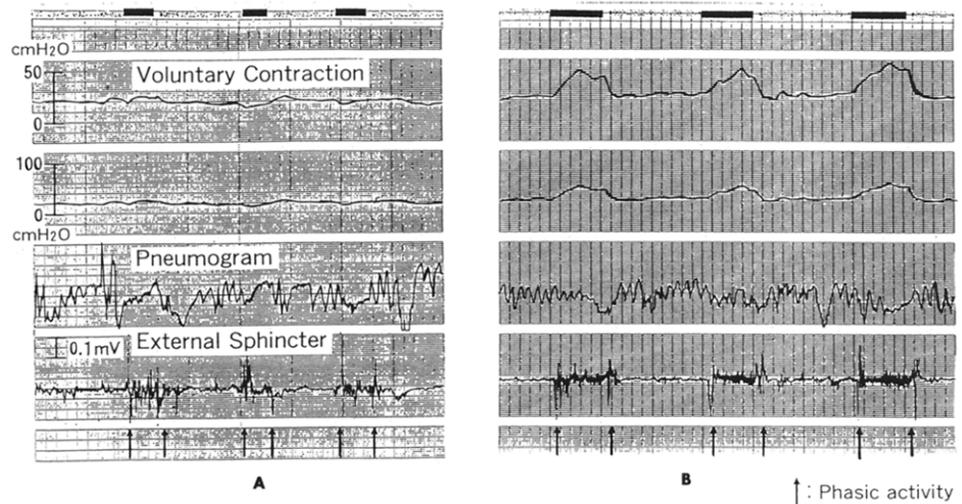


Fig 1. Voluntary contraction pressures and phasic activities of the external sphincter (A) before and (B) after biofeedback therapy. Voluntary contraction pressures and electrical activities of the phasic activities are increased after therapy.

tended to be lower after therapy ($.5 < P < .1$). However, maximum tolerated volume and rectal compliance were not affected by biofeedback therapy.

DISCUSSION

Fecal incontinence after surgery for anorectal malformations is inevitable in some patients, especially those with high-type anomalies. Therefore, we pediatric surgeons must accept the challenge of managing these patients with fecal incontinence which restricts their social activities.

Engel et al⁷ first reported on the usefulness of biofeedback therapy in the treatment of this problem. However, it has been difficult to predict which patients will respond to this treatment. In the present study, four of eight patients with postcorrection fecal incontinence were treated with three or four sessions of biofeedback therapy, and bowel control was objectively improved in three of four. The five who received shorter courses of therapy did not improve. More sessions and longer follow-up periods may be necessary to evaluate the results of therapy in these nonresponders.

In these patients, the physiological status of the anorectum before and after biofeedback therapy was carefully investigated by anorectal manometry and EMG of the sphincter musculature. Anorectal manometry showed that voluntary contraction pressure in the anal canal was significantly increased after therapy. Similar results have been reported by Rintala et al.¹⁴ Thus, biofeedback therapy appears to improve voluntary sphincter function in bowel control. The EMG recordings showed definite phasic activity during voluntary contraction in all eight patients after therapy, and in three of them, electrical activity during further rectal filling was also increased. These results support the concept that biofeedback therapy strengthens the contractile power of the sphincter complex.

Improved conditioning of rectal sensation is also an important aspect of biofeedback therapy. In the present study, threshold sensation volume decreased after treatment. Cerulli et al⁹ reported that the threshold diminished in good responders, but not in poor responders. However, we found that the threshold diminished even in the poor responders.

In which patients can we expect success with biofeedback therapy? Our three good responders had adequate anal resting pressure before therapy, and showed good electrical activity of the external sphincter after therapy. Therefore, this treatment may not be suitable if the sphincters are markedly hypoplastic or do not surround the anal canal after an inappropriate pull-through operation. when anal resting pressure is significantly diminished. Biofeedback therapy should be attempted prior to any further surgical intervention in the treatment of fecal incontinence following correction of anorectal malformations if an adequate anal resting pressure is present.

Table 3. Electromyography Recordings Before and After Biofeedback Therapy

Case No.	Tonic Activity	Inflation Reflex	Activity During Further Rectal Filling	Phasic Activity During Voluntary Contraction
1	→ -	→ -	Stationary → Stationary	- → +
2	± → ±	→ → +	Stationary → Increased	+ → +
3	+ → +	+ → +	Stationary → Increased	+ → +
4	± → ±	→ → -	Increased → Increased	+ → +
5	± → ±	→ → -	Stationary → Stationary	+ → +
6	± → ±	→ → -	Stationary → Stationary	+ → +
7	- → -	→ → -	Stationary → Stationary	- → +
8	+ → +	+ → -	Stationary → Stationary	+ → +

Table 4. Rectal Sensation and Compliance Before and After Biofeedback Therapy

Case No.	Threshold for Sensation (mL)	Maximum Tolerated Volume (mL)	Rectal Compliance (mL/cm H ₂ O)
1	50 → 55	120 → 90	3.0 → 2.8
2	40 → 10	100 → 170	1.7 → 1.8
3	50 → 10	80 → 80	2.4 → 1.3
4	40 → 30	180 → 80	1.9 → 3.2
5	50 → 40	140 → 110	2.3 → 2.4
6	70 → 30	170 → 120	2.3 → 4.5
8	10 → 5	30 → 45	0.5 → 0.4
	44.3 ± 6.3* → 25.7 ± 6.4*	117.1 ± 18.4 → 99.3 ± 13.8	2.0 ± 0.3 → 2.3 ± 0.5

NOTE. Data given as mean ± SE.

*.05 < P < .1.

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