ORIGINAL CONTRIBUTION

Randomized Controlled Trial Shows Biofeedback to be Superior to Pelvic Floor Exercises for Fecal Incontinence

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PURPOSE: This study aimed to compare manometric biofeedback with pelvic floor exercises for the treatment of fecal incontinence in a randomized controlled trial controlling for nonspecific treatment effects.

METHODS: After excluding patients who were adequately treated with medication, education, and behavioral strategies (21%), 108 patients (83 females; average age, 59.6 years) underwent either pelvic floor exercises alone (n = 63) or manometric biofeedback plus pelvic floor exercises (n = 45). Patients in both groups were taught behavioral strategies to avoid incontinence.

RESULTS: At three-month follow-up, biofeedback patients had significantly greater reductions on the Fecal Incontinence Severity Index ($P = 0.01$) and fewer days with fecal incontinence ($P = 0.083$). Biofeedback training increased anal canal squeeze pressure more than pelvic floor exercises did ($P = 0.014$) and with less abdominal tension during squeeze ($P = 0.001$). Three months after training 76% of patients treated with biofeedback *vs.* 41% patients treated with pelvic floor exercises (chi-squared = 12.5, $P < 0.001$) reported adequate relief. Before treatment, the groups did not differ on demographic, physiologic, or psychologic variables, symptom severity, duration of illness, quality-of-life impact, or expectation of benefit. At 12-month follow-up, biofeedback patients continued to show significantly greater reduction in Fecal Incontinence Severity Index scores ($F = 4.83$, $P = 0.03$), and more patients continued to report adequate relief (chi-squared = 3.64, $P = 0.056$).

CONCLUSION: This investigation provides definitive support for the efficacy of biofeedback. Biofeedback training resulted in greater reductions in fecal incontinence severity and days with fecal incontinence. Biofeedback was also more effective than pelvic floor exercises alone in producing adequate relief of fecal incontinence symptoms in patients for whom conservative medical management had failed.

KEY WORDS: Biofeedback; Fecal incontinence; Manometry; Pelvic floor muscle training.

Biofeedback has been reported to be an effective treatment for fecal incontinence (FI) for 35 years[1] with mean success rates ranging from 40 to 100%.[2–5] However, despite more than 30 years of positive results, adequately controlled trials are lacking. It is not known whether instrument-assisted biofeedback training (*i.e.*, visual or auditory displays of electronically amplified physiologic activity) is necessary or whether good patient education alone would be sufficient for the treatment of FI, as suggested in two previous randomized controlled trials.[6,7] The aims of this study were to conduct a randomized controlled trial to determine 1) whether biofeedback is more effective than pelvic floor exercises (PFE) without biofeedback, after controlling for nonspecific effects such as education, standard medical care interventions, and pla-

Supported by National Institute of Diabetes and Digestive and Kidney Disease Grants R01DK57048 and R24 DK067674; General Clinical Research Center, University of North Carolina at Chapel Hill, Grant RR00046; and Sandhill Scientific, Incorporated.

Presented at the Digestive Disease Week meeting, Washington, DC, May 20 to 24, 2007.

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Dis Colon Rectum 2009; 52: 1730–1737
DOI: 10.1007/DCR.0b013e3181b55455

cebo effects; 2) whether instrument-assisted biofeedback is a necessary component of successful training; and 3) whether biofeedback training is more effective than PFE at modifying the physiologic abnormalities believed to be responsible for FI.

METHODS

Patients

Patients were recruited from a consecutive series of chronically incontinent patients referred to University of North Carolina Hospitals between December 2000 and March 2006 for diagnostic assessment of FI. This study was reviewed and approved by the university's Institutional Review Board on May 4, 1999, and reapproved annually thereafter. All patients provided written consent after full disclosure of the experimental procedures.

Inclusion/Exclusion Criteria

Patients were required to be incontinent of at least one teaspoon of fecal material at least weekly. Patients with staining only, or incontinence of flatus only, were not included. Psychotic disorder and severe cognitive impairment were exclusions. Patients with anatomic defects were included in the investigation. A transanal ultrasound (single-element, 10 MHz circumferential transducer (Falcon® 2101 EXL, B-K Medical, Herlev, Denmark) was performed by a radiology technician. An experienced radiologist interpreted these images blindly.

Design

This was a randomized controlled trial involving three phases (Fig. 1): 1) run-in, 2) training with biofeedback or PFE, and 3) follow-up visits at 3 and 12 months. Only patients who did not respond to the run-in intervention advanced to the randomized, pelvic floor muscle retraining phase of the study. Coinvestigator (KJ) produced the randomization table by use of a random number generator (SPSS®, version 7.0; SPSS, Inc., Chicago, IL). Group membership was reported to the therapist (SH) after the patients arrived for their initial visit.

Run-In

During this four-week phase, all patients were provided with education on the anatomy and physiology of the pelvic floor muscles, review of their anorectal manometry results, and medical management instructions regarding the use of fiber supplements and/or antidiarrheal medication (loperamide, 2 mg), as needed. Diaries were used to record FI, Bristol Stool Scale ratings[8] for each bowel movement, and fiber and/or antidiarrheal drug use. All patients were encouraged to contact the therapist at least every four days, and instructions were modified at those times if necessary. Only patients who did not report adequate relief at the end of the run-in progressed to the pelvic floor muscle retraining phase.

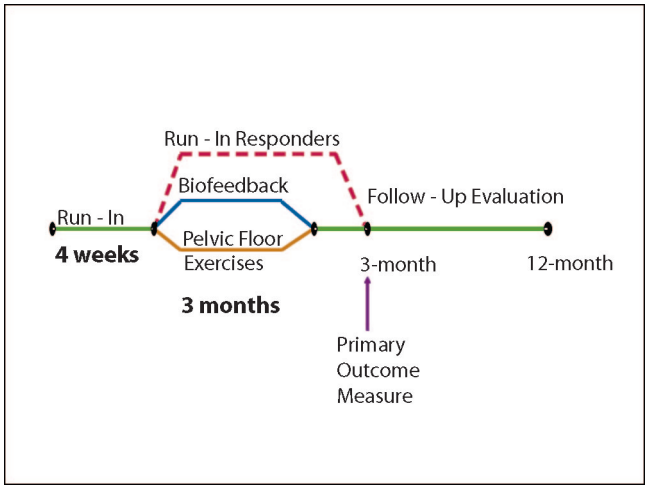

FIGURE 1. Schematic of study flow chart.

Training Phase

Treatments compared in this study were: 1) manometric biofeedback training combined with PFE to teach a coordinated contraction of the pelvic floor muscles in response to diminishing volumes of intrarectal balloon distensions, or 2) PFE training alone. All patients kept symptom diaries in which they recorded practice times for PFE, circumstances associated with FI episodes, and comments on which strategies were effective for the prevention of FI. Diaries were reviewed at each session.

Training Strategies for the PFE Control Group

Patients attended six one-hour training visits, one every two weeks. Patients were shown a video of a normal defecography study (barium paste being retained with squeeze instructions and being evacuated with straining to defecate). The video provided patients with assistance in visualizing pelvic floor muscles when they were relaxed *vs.* when they were tense. All patients were trained to perform PFE by verbal instructions, with emphasis on maintaining relaxed abdominal muscles while squeezing the muscles surrounding the anal canal with maximum effort. Patients were encouraged to duplicate what worked best in the previous training session and to practice five times per day at home. As skill developed, the patients were instructed to practice PFE during usual daily activities (e.g., work, travel, socializing) and while standing. Coaching was provided throughout each session.

Biofeedback Treatment

In addition to the training strategies described, patients received instrument-assisted biofeedback with use of a solid-state manometry catheter with a balloon attachment

(Koenigsburg Instruments, Pasadena, CA). The patients watched a computer monitor displaying intrarectal pressure and anal canal pressure presented as line graphs. A two-channel Sandhill® Insight physiologic recorder running GI motility/biofeedback system software (Sandhill Scientific, Highlands Ranch, CO) was used to record and display these signals. Each biofeedback training session was done while the patient was lying in the left lateral position.

During biofeedback training, patients were trained to recognize smaller distensions by gradually reducing the volume of rectal distensions. They were then told to contract pelvic floor muscles maximally in response to rectal distensions while simultaneously minimizing abdominal wall contraction. This biofeedback protocol is referred to as *coordination training*.[2] The goals were perception of a 10-ml balloon distention and a consistent 10-second pelvic floor contraction of 125 mmHg with no increase in abdominal muscle contraction.

To summarize, the only difference in treatment strategies for patients in the two groups was related to whether they received instrument-assisted biofeedback during the PFE training. Patients in both groups received an intensive educational intervention, behavior strategies to generalize skills learned in treatment sessions to practical, real-life, high-risk situations, PFE, and the use of fiber supplement and antidiarrheal agents as needed to modify stool consistency. Time with the therapist was equivalent for the two groups.

Follow-Up Evaluations

Patients returned for three-month follow-up evaluations regardless of their symptomatic improvement. Patients were instructed to continue to practice PFE throughout follow-up. They kept a symptom diary for the two weeks before their follow-up visit. During the follow-up evaluation, repeat anorectal manometry, posttreatment symptom severity assessment, and psychosocial questionnaires were completed. All patients were then contacted by telephone within one week by investigator (SH) and asked whether they had experienced adequate relief of FI. Those who reported adequate relief were scheduled for 12-month follow-up evaluations. Patients who did not return for follow-up evaluation at three months were labeled as treatment failures. Those who reported inadequate relief at the three-month follow-up visit were provided information on alternative treatment and dismissed from the trial.

Dependent Variables

The primary outcome measure was the decrease in scores on the Fecal Incontinence Severity Instrument (FISI)[9] from the end of the run-in to the three-month follow-up. The FISI is a validated, four-item scale assessing the frequency of four different types of fecal incontinence.

Secondary Outcomes Variables

Diary. The daily diary was used to assess the number of days per week with FI. This conservative measure avoids inappropriately weighting diary data by patients reporting continuous leakage.

The Fecal Incontinence Quality of Life. The fecal incontinence quality of life (FI-QOL) measure[10] assesses the effects that FI has on quality of life.

Adequate Relief. At the end of run-in and at the 3-month and 12-month follow-up visits, patients were asked, "Compared to before you started the study, have you experienced adequate relief of your fecal incontinence symptoms?" Patients could only respond "yes" or "no." This was selected *a priori* as the primary outcome measure based on consensus guidelines,[11] but it has since been criticized as subjective and relatively insensitive. Consequently, we treated the well standardized FISI as the primary outcome measure and made adequate relief a secondary outcome.

Psychosocial Mediator Variables. These variables included the Attitudes Toward Treatment[12] questionnaire, the Spielberger State-Trait Anxiety Inventory (STAI-1 and STAI-2),[13] and the Beck Depression Inventory (BDI).[14]

Physiologic Variables. Baseline and three-month follow-up anorectal manometry and electromyography (EMG) (Sandhill Scientific, Highlands Ranch, CO) were used to investigate the mechanism of treatment effects.

Data Analysis

Sample Size and Power. Before initiating the trial we estimated that 55 subjects per group would be needed to detect between-group differences of at least 25% in the proportion reporting adequate relief at 80% power. The power to detect a change in FISI score of 0.5 standard deviations (a commonly accepted definition for the minimum clinically significant difference) with 55 subjects per group is 74% for a two-sided ANOVA. The CONSORT guidelines (www.consort-statement.org)[15] were followed in reporting the disposition of all patients approached about enrollment in the study (Fig. 2).

Treatment Efficacy. The primary analysis of efficacy was an ANOVA comparing FISI change scores between groups, from the end of the run-in to the three-month follow-up. All patients who were exposed to at least one treatment session were included in these analyses (intent-to-treat analysis). Patients who dropped out during treatment were assigned change scores of zero. Significance was defined by a P value of 0.05.

Secondary analyses of efficacy used independent ANOVAs for change scores in number of days per week with FI, FI-QOL, and psychosocial mediators (BDI, STAI-1, and STAI-2). All secondary measures were evalu-

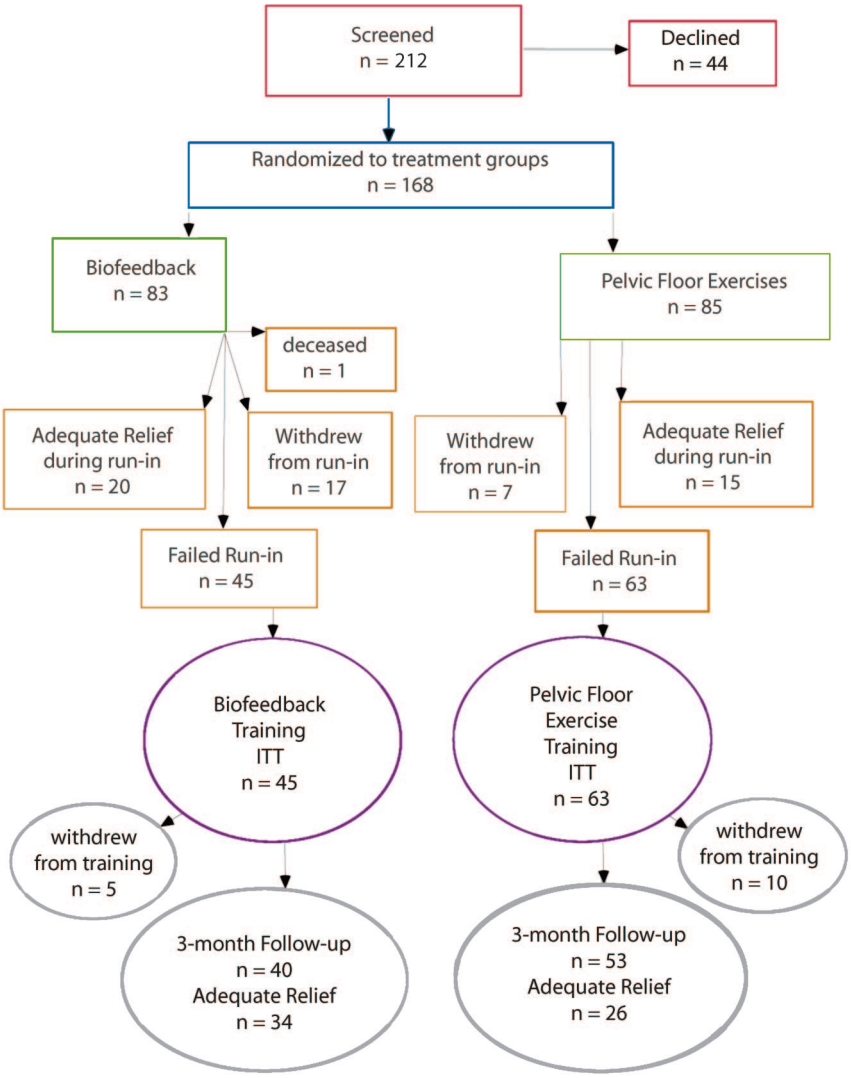

FIGURE 2. Consort guidelines flow chart. ITT = intention to treat.

ated by intent-to-treat analyses and missing values were replaced with zero. Chi-squared test was used to analyze the proportion of patients per group reporting adequate relief of FI compared with before treatment, and reporting continence on diary data.

Mechanism of Treatment Effects. We performed independent ANOVAs of change scores from baseline to three-month follow-up for anal squeeze pressures and abdominal muscle contractions (measured on EMG during squeeze).

RESULTS

Recruitment

The overall participation rate was 79%. The drop-out rate was 23% and was not significantly different between groups (Fig. 2).

Effects of Education and Conservative Medical Management During Run-In

FI for all 168 patients decreased from 3.4 to 2.0 days per week (41% reduction) and 35 patients (21%) reported adequate relief at the end of run-in. FISI scores for all patients decreased from 36.9 at baseline to 31.0 at the end of run-in ($t = -5.23$, $P < 0.001$).

Pretreatment Analyses

The 108 patients who remained incontinent and dissatisfied at the end of run-in progressed to the treatment conditions to which they had been randomly assigned before run-in: 45 received biofeedback and 63 received PFE. The difference in group size is due to differences in response to the run-in procedures and differences in drop-out during run-in (Fig. 2). Before treatment, the groups were well matched on clinical, physiologic, and psychologic characteristics (Table 1), as well as etiologies for FI (Table 2).

TABLE 1. Clinical, physiologic, and psychologic characteristics

Baseline	*Biofeedback*	*PFE*
N	45	63
Age	59	60
Symptoms (years)	6.5	7.9
Physician visits (past six months)	3.1	3.9
First Sensation (ml)	18.4	18.8
Rest (mmHg)	36.0	40.0
Squeeze (mmHg, 10-second average)	62.9	65.9
Abdominal EMG (μV, 10-second average)	11.9	8.4
FI (end of run-in)	1.9	2.3
FISI (end of run-in)	33.3	35.1
FI-QOL (range, 2–119)	71.6	68.6
BDI (range, 0–63)	11.5	11.4
STAI-1 (range, 20–80)	37.8	36.2
STAI-2 (range, 20–80)	39.2	38.4

PFE = pelvic floor exercise group; EMG = electromyography; FI = fecal incontinence; FISI = Fecal Incontinence Severity Instrument; FI-QOL = Fecal Incontinence Quality of Life; BDI = Beck Depression Inventory; STAI-1 and STAI-2 = Spielberger State-Trait Anxiety Inventory.

Transanal ultrasounds were completed in only half of the patients, but these showed no group differences in the distribution of anatomic defects (Table 2). When patients who received ultrasounds were compared with those who did not, there were no differences in baseline FI frequency (3.5 ± 1.8 *vs.* 3.7 ± 2.0 days per week, respectively, mean and standard deviation (SD), $P = 0.7$) or FISI scores (38.9 ± 10.1 *vs.* 35.0 ± 10.0, respectively, mean and SD, $P = 0.052$).

Expectation of Benefit

Both groups had a similar expectation of benefit at the beginning of their second treatment session. Attitudes Toward Treatment scores (range, 0–63) were 57 ± 6.5 for biofeedback, and 55 ± 7.0 for the control group (mean and SD; $P > 0.05$).

TABLE 2. Possible etiology of fecal incontinence

	Biofeedback	*PFE*
Muscle injury		
Obstetrical injury	10	14
Surgery	9	12
Radiation	1	3
Surgery/radiation	4	0
Trauma	2	3
Medical		
Diabetes	2	1
Irritable bowel syndrome	7	10
Diarrhea (unknown cause)	0	2
Crohn's disease	0	6
Spina bifida	0	1
Pelvic floor dyssynergia (constipation)	5	6
Unknown	5	5
N	45	63
TAUS, external damage (n, mean % of defect)	6 (38)	12 (29)
TAUS, internal damage (n, mean % of defect)	10 (13)	19 (14)

PFE = pelvic floor exercise group; TAUS = transanal ultrasound.

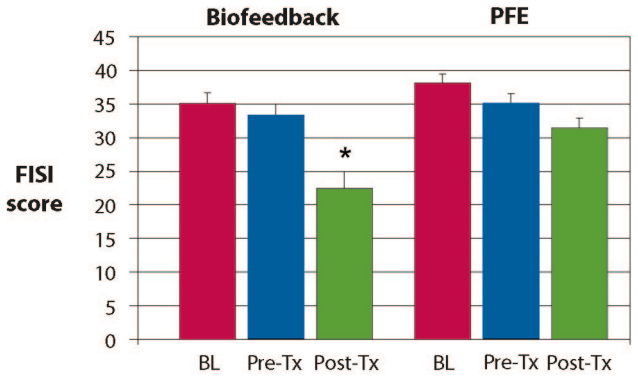

FIGURE 3. Primary outcome measure comparing Fecal Incontinence Severity Index (FISI) change scores from pre-Tx (end of run-in) to post-Tx (3-month follow-up) between groups ($P = 0.01$, ANOVA). BL (baseline) = red; pre-Tx (pre-treatment) = blue; post-Tx (post-treatment) = green; PFE = pelvic floor exercise group.

Effectiveness of Biofeedback

At the three-month follow-up, biofeedback patients had greater reductions in scores on the FISI (Fig. 3) compared with PFE patients ($F = 6.82$, $P = 0.01$, ANOVA). Patients in the biofeedback group also tended to have fewer days per week with FI (Fig. 4) than patients in the PFE group (0.83 ± 1.5 *vs.* 1.6 ± 2.0 days per week of FI, mean and SD, $P = 0.083$). Complete continence (no staining) was achieved by 20 of 45 (44%) of patients in the biofeedback group *vs.* 13 of 63 (21%) in the PFE group (chi-squared = 7.0, $P = 0.008$). There were no significant differences in posttreatment loperamide use (1.5 mg/day for biofeedback *vs.* 1.7 mg/day for PFE) or fiber use (1.4 teaspoons per day for biofeedback *vs.*1.8 teaspoons per day for PFE). A signif-

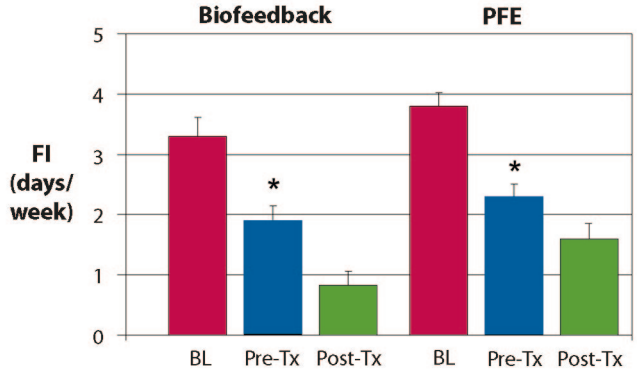

FIGURE 4. Comparison of fecal incontinent episodes between groups at three-month follow-up. Overall, there was a significant reduction from baseline to run-in ($P < 0.001$, ANOVA), but only a trend in favor of biofeedback for further improvement three months after training ($P = 0.083$, ANOVA). FI = fecal incontinence; PFE = pelvic floor exercise group; BL = baseline; Pre-Tx = pretreatment; Post-Tx = posttreatment.

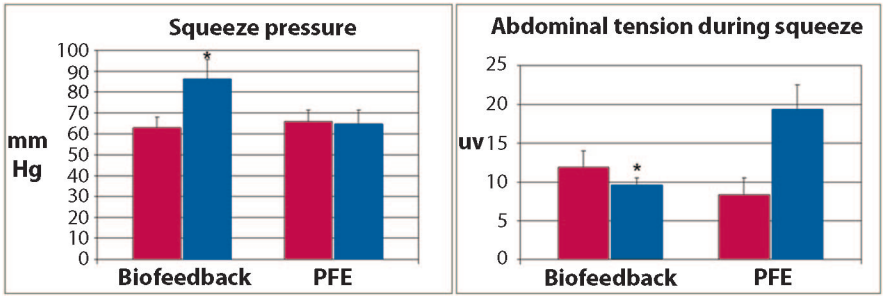

FIGURE 5. Left. Comparison of pelvic floor squeeze values in mmHg ($P = 0.014$, ANOVA). Right. Comparison of abdominal muscle tension (EMG in microvolts) during contraction ($P = 0.001$, ANOVA) between groups. PFE = pelvic floor exercise group; gray bars = pretreatment; black bars = posttreatment.

icantly greater proportion of biofeedback patients (76%) reported adequate relief of FI symptoms at the three-month follow-up compared with 41% of PFE patients (chi-squared = 12.5, $P < 0.001$).

Overall, quality-of-life scores (FI-QOL) increased significantly after treatment ($t = 3.8$, $P < 0.001$), but did not differ between groups ($F = 0.22$, $P = 0.64$, ANOVA). There was no overall improvement in psychologic scales (BDI, STAI-1, STAI-2) from the end of run-in to three months posttreatment and no difference between groups on these measures.

Twelve-Month Follow-Up Data

Only patients reporting adequate relief at the three-month follow-up were invited to return for 12-month follow-up, but all subjects were retained in the analysis by carrying forward their last observation from the three-month follow-up. Biofeedback patients continued to report greater reductions in scores on the FISI from the end of run-in to 12-month follow-up compared with PFE patients ($F = 4.83$, $P = 0.03$, ANOVA). Fifty-three percent (24/45) of biofeedback patients reported adequate relief at 12-month follow-up compared with 35% (22/63) of patients in the PFE group, reflecting a strong trend in favor of biofeedback training (chi-squared = 3.64, $P = 0.056$). Three patients in the biofeedback group could not be reached for 12-month follow-up and were included as treatment failures in this intent-to-treat analysis.

Physiologic Mechanism of Treatment

The biofeedback group demonstrated stronger pelvic floor muscle squeeze pressure (10-second average of 86.2 mmHg *vs.* 64.76 mmHg) at three-month follow-up (Fig. 5) and greater increases from pretreatment in squeeze pressure than the PFE group ($P = 0.014$, ANOVA), and a lower abdominal muscle EMG (10-second average of 9.6 μV *vs.* 19.4 μV; $P = 0.001$, ANOVA; Fig. 5). However, there were no between-group differences in perception threshold following training (16.1 ml for biofeedback *vs.* 17.8 ml for PFE; $P = 0.52$).

DISCUSSION

This investigation provides support for the efficacy of biofeedback treatment of FI. In the intent-to-treat analysis, patients in the biofeedback group reported greater reductions in scores on the FISI and averaged half as many days with incontinence. Nearly twice as many biofeedback patients achieved complete continence compared with PFE patients. In addition, 76% of patients randomly assigned to biofeedback reported adequate relief of FI symptoms compared with 41% of patients treated with PFE. Clearly, biofeedback was more effective than either the conservative treatment during run-in or PFE.

Mechanism of Biofeedback Training Effects

After training, patients in the biofeedback group showed greater anal canal squeeze pressures and were able to maintain significantly more relaxed abdominal muscles, supporting the validity of the trial. Although, on the basis of previous reports,[16,17] we expected a greater decrease in sensory thresholds in the biofeedback group compared with the PFE group, we found no between-group difference. However, most of the patients recruited into this study had sensory thresholds within the normal range before treatment (Table 1), which may have made it difficult to detect a significant reduction.

Nonspecific Effects

In previous studies, biofeedback training was combined with nonspecific treatment components that may have contributed to patient improvement, including increased contact with the health care provider, patient education, and medications. The run-in phase of our study controlled for the effects of improved medical management through patient education and medication to normalize stool consistency, and this produced adequate relief of FI for 21% of patients and an overall decrease of 41% in the number of days per week with FI despite a long history of failed medical management. This shows that the systematic delivery of good clinical management can benefit many patients.

These run-in responders were excluded from the randomized controlled trial.

The treatment phase of the study controlled for contact time with the therapist, education, behavior strategies, medical management, and pelvic floor exercises. Intensive behavioral treatments were provided to all patients, and the only thing that distinguished the biofeedback group from the PFE group was the provision of instrument-assisted biofeedback training. Thus, our findings demonstrate that instrument-assisted biofeedback is an important component of successful treatment.

Conflicting Results in Recent Trials

Norton *et al.*[6] found that manometric biofeedback (53% improved) failed to provide additional benefit compared with the standard care supplemented by advice and education (54% improved). Solomon *et al.*[7] found that biofeedback provided by manometry, trans-anal ultrasound; or "verbal feedback from digital examination" during the practice of PFE (the authors suggest that this represents a type of biofeedback) all resulted in approximately 70% improvement in continence scores. There are several possible explanations as to why our results differ from these two trials.

In the Solomon study,[7] patients were described as having only mild to moderate FI, and differences in exclusion criteria reflect a population with less severe symptoms than those in our investigation. Solomon excluded patients with any anatomic defect, inflammatory bowel disease, acute perianal inflammation, or patients with a "potentially reversible cause of FI (*e.g.*, diarrhea)." We included patients with all of these conditions.

Similarly, our patients had more severe symptoms (mean of 3.4 days per week of FI) than those in the Norton study,[6] who experienced a median of one FI episode per week at enrollment. Norton also included patients who were only experiencing stain-type incontinence, whereas we excluded these patients, requiring at least a teaspoon of fecal loss per week. In addition, Norton excluded patients who had received prior training in PFE, whereas all of our patients had been advised to try PFE in the past.

These differences in inclusion/exclusion criteria reflect very different populations in our investigation compared with the Solomon and Norton studies. We agree that biofeedback may not be necessary for patients with milder symptoms and that education and medical management should be tried first. In fact, we provided the run-in intervention to specifically exclude such patients from the randomized pelvic floor muscle retraining phase of our trial.

Study Limitations

Having the therapist question the patient about adequate relief could have biased patients to report more positive outcomes on this measure. However, experimenter bias can not explain differences on the FISI (which is a printed questionnaire), the symptom diary, or the physiologic outcome measures.

Implications for Clinical Practice

This study confirms that biofeedback is a highly effective treatment for patients with chronic FI. Our data suggest that instrument-assisted biofeedback is an essential element of successful training. However, data from the Solomon *et al.* study showed that verbal feedback during digital examination may be as effective in patients with mild to moderate FI. This remains to be tested in patients who have severe FI.

At present, there is a shortage of practitioners who are trained to provide this form of biofeedback. The shortage of available providers may be due in part to the absence (until now) of randomized controlled trials showing that biofeedback is effective, which has led third-party payers to withhold payment for this treatment. It is hoped that the emerging body of evidence supporting the efficacy of biofeedback for FI will help to address this issue.

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INVITED COMMENTARY

To the Editor—The authors should be congratulated on the publication of this well-constructed randomized controlled trial (RCT) that evaluates the effect of the addition of biofeedback to pelvic floor exercises compared with pelvic floor exercises alone on the outcome of patients with moderately severe fecal incontinence.

Biofeedback is defined as the use of modern instrumentation to give better moment-to-moment information about a physiological process under the control of the nervous system but not clearly or accurately perceived.[1] Biofeedback has been used for over 30 years to treat fecal incontinence. Despite this fact, the most recent Cochrane review in 2006 reports on only 11 randomized trials with a total of 560 patients.[2] The Cochrane collaboration noted that these studies, in general, were of poor methodologic quality and were frequently underpowered; a strong recommendation for biofeedback could not be made.[2] The two largest studies, one from St. Marks[3] and the other from our group,[4] comprised a total of 280 patients. These studies found that no significant difference occurred between the groups treated with biofeedback and the control groups and that all groups improved over the course of the treatments. These results had led some researchers to question whether biofeedback was actually required. It was also suggested that the common interventions of education, dietary manipulation, use of antidiarrheal medication, and support were responsible for the improvements seen in these trials.[3]

The authors of this article are to be commended on a novel trial design. In particular, they have carefully selected a group of patients who have failed to improve adequately after a run-in period with education, dietary/fiber manipulation, and antidiarrheal medications, before randomization. As a consequence they have selected a well-defined group of patients with more severe incontinence than in previous RCTs. More importantly, they have carefully designed a study to evaluate the impact of biofeedback by use of a coordination training strategy in which the moment-to-moment feedback was provided by rectal and anal manometry depicted on a computer screen. This is the only difference between the two treatment groups, and the biofeedback group demonstrates fairly impressive gains in objective measures of continence, such as sphincter strength and the more subjective measures with use of continence scores.

The study could be suspect of a Type 1 error. The study was initially powered to assess the outcome from the patients' viewpoint by use of a dichotomous outcome. The primary endpoint was changed to a more objective measure of incontinence (Fecal Incontinence Severity Instrument score) which may have decreased the power. Nevertheless, the magnitude of the improvements in so many different outcome measures would suggest that this is unlikely to be the case. The precise method of randomization is not clear and the difference in group sizes may indicate some bias. In addition, most assessments appear to not have been performed by a blinded assessor. Both of these factors are known to bias the outcomes of RCTs.

Overall, however, this is a very important study in establishing the efficacy of biofeedback in the management of fecal incontinence. This study adds weight to the body of literature supporting the addition of biofeedback therapy on top of therapies that do not directly use biofeedback.

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