# CONTRIBUTION OF BEHAVIOR THERAPY AND BIOFEEDBACK TO LAXATIVE THERAPY IN THE TREATMENT OF PEDIATRIC ENCOPRESIS[1,2]

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## ABSTRACT

*A model incorporating physiological, behavioral, and psychological parameters are presented to explain the maintenance and consequences of pediatric encopresis. It was hypothesized that the more comprehensive a treatment in addressing these parameters, the more efficacious it would be and the more children it would benefit. Eighty-seven children between the ages of 6 and 15 with the primary complaint of encopresis were randomly assigned to one of three treatments: (a) Intensive Medical Care (IMC), receiving enemas for disimpaction and laxatives to promote frequent bowel movements; (b) Enhanced Toilet Training (ETT), using reinforcement and scheduling to promote response to defecation urges and instruction and modeling to promote appropriate straining, along with laxatives and enemas; or (c) Biofeedback (BF), directed at relaxing the external anal sphincter during attempted defecation, along with toilet training, laxatives, and enemas. Three months following initiation of treatment, ETT and BF produced similar reductions in soiling/child (76% and 65%) that were superior (p's < .04) to IMC (21%). ETT significantly benefited more children than the other two treatments, employing fewer laxatives and fewer treatment sessions at a lower cost. Consistent with the presented model, reduction in soiling was associated with an increase in bowel movements in the toilet, reduction in parental prompting to use the toilet, and defecation pain. These results demonstrate that ETT should be used routinely with laxative therapy in the treatment of chronic encopresis.*

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## INTRODUCTION

Encopresis, or involuntary soiling after the age of four (*Diagnostic and Statistical Manual of Mental Disorders* [DSM-IV] [1]), has traditionally been medically managed with laxative therapy and paired with instructions to sit on the toilet daily to promote regular bowel movements (BM). This treatment is based on the assumption that encopresis is a consequence of chronic constipation, which produces fecal impaction, leading to overflow incontinence (2). Therefore, if constipation can be eliminated, the encopresis will be resolved. Outcome studies involving laxative therapies suggest a 16% to 62% (3–5) success rate at short-term follow-up.

Traditional behavioral strategies, typically referred to as Toilet Training (6–9), employ a reinforcement scheme to encourage frequent trips to the toilet, defecation in the toilet, and clean pants. The regimen is intended to encourage children to respond to rectal distention cues with a visit to the toilet, to encourage frequent self-toileting and bowel movements, and to discourage voluntary fecal retention and soiling in the undergarments. Outcome studies of behavioral interventions suggest a 21% (4) to 60% (5) success rate at short-term follow-up.

Recent literature has indicated that, as a group, children with encopresis paradoxically constrict their external anal sphincter (EAS) when attempting defecation, thus functionally occluding the anal canal and impeding defecation dynamics (3,10–14). Consequently, several studies have reported that teaching children through biofeedback procedures how to relax their EAS, while straining to defecate, has improved constipation and encopresis (3,15). Outcome studies of biofeedback therapies suggest a 55% (16) to 73% (4) success rate at short-term follow-up.

We propose a multifactorial model of encopresis, in which various factors can be of more or less importance in the maintenance of encopresis in any particular child. Consequently, we propose that the more comprehensive a treatment in addressing these factors, the more efficacious this treatment should be.

As illustrated in Figure 1, we propose that chronic encopresis frequently has multiple physiological, behavioral, and psychological factors. Historically (Step 1) there is some constipating event. This event varies for individual children at different developmental stages. Infants may become constipated during the transition from liquid to solid foods. Toddlers may experience constipation as a consequence of over-learning fecal retention during toilet training. Children receiving morphine following surgery may become constipated. Emotional trauma while attempting a BM, as sometimes occurs in a public/school bathroom, or psychological conflicts, such as the birth of a younger sibling, may also trigger fecal retention and subsequent constipation. Once constipated, passage of the subsequent large and hard fecal stool can be both difficult and painful (Step 2). In response to defecation pain, the child may engage in muscular bracing, which can lead to paradoxical constriction of the external anal sphincter. This functional obstruction of the anal canal results in further defecation difficulty and pain (Step 3). In light of this defecation difficulty and pain, some children cope by avoiding the toilet and/or defecation (Step 4). Avoidance may occur in at least three ways: (a) the child may not spontaneously seek out the toilet, (b) when sitting on the toilet the child may not sufficiently strain to increase intra-abdominal pressure to expel a stool, or (c) the child may paradoxically constrict the EAS to prevent a stool from passing. Avoidance of

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BMs leads to accumulation of fecal material in the rectum, where fluid withdrawal culminates in a large, hard fecal impaction (Step 5). If defecation avoidance becomes habitual, then chronic constipation follows (Step 6). When the child habitually retains large fecal matter in the rectum, the rectal capacity stretches, resulting in what sometimes has been termed "acquired megacolon" (Step 7). An enlarged rectum requires a larger stool before the rectum is stretched sufficiently to trigger an urge to defecate. A less sensitive rectum would result in less frequent urges to defecate, and such urges would be associated with larger stools. It is not uncommon to have parents report astonishment over the size of their child's stool and the need to break up the stool before it can be flushed down the toilet. Such infrequent and large stools reinforce the child's expectation of future defecation pain and the avoidance of BMs.

A dysfunctional EAS, avoidance of defecation, an insensitive rectum, and chronic constipation result in fecal soiling or encopresis (Step 8). Fecal accidents can occur either through overflow incontinence, where liquid stool above the impaction leaks around and out, or because the child waits too long to seek out a toilet and the EAS is unable to retain the fecal matter.

This fecal soiling can trigger interpersonal conflicts with parents and peers (Step 9). Adults may get angry and punish the child for "being lazy and not going to the bathroom," assuming that fecal soiling is voluntary. Additionally, parents may find themselves in a struggle with the child over when to use the toilet, in response to the child's avoidance. Public fecal soiling can trigger significant peer rejection and teacher alienation. These situations can culminate in intrapersonal issues (Step 10), such as humiliation/poor self-esteem, parental alienation, social withdrawal, behavioral problems, and even dissociation from the presence and smell of a fecal accident. These psychological factors can then drive behavioral "acting out."

We have generally been able to verify this model. When comparing encopretic children to non-symptomatic siblings, we have reported that patients experience more pain with defecation (Step 2) (17,18), demonstrate paradoxical constriction during attempted defecation (Step 3) (13,14), voluntarily use the toilet less often (Step 4) (18), have fewer BMs/day (Step 5) (18), require more rectal dilation before experiencing the urge to defecate (Step 6) (14), experience more fecal incontinence (Step 7) (17,18), and experience more social and behavioral problems and social withdrawal (Step 8) (19).

As illustrated in Figure 1, enemas and laxative therapy should directly address Steps 2 and 5 of our model, where enemas disimpact the child and laxatives promote daily soft, painless bowel movements. Toilet Training should address Steps 4, 7, and 9 of our model by encouraging frequent trips to the toilet, promoting attention to rectal cues, and neutralizing child-parent conflict with the use of positive reinforcement and greater child autonomy. EAS biofeedback (20–23) should address Step 3 of this model by directly training children how to inhibit paradoxical constriction during straining. However, it is possible that toilet training could achieve the same effects as EAS biofeedback by directly training the child how to strain through modeling, observation, and direct instruction.

Instead of directly comparing the individual treatments alone, we chose to employ an additive strategy that would parallel clinical reality. Most patients present using some type of laxative. Taking a child off laxatives before initiating toilet training may create difficulties between the study team and the referring physician, as well as credibility problems with parents. Consequently, children in the toilet training group also received laxative therapy. For the

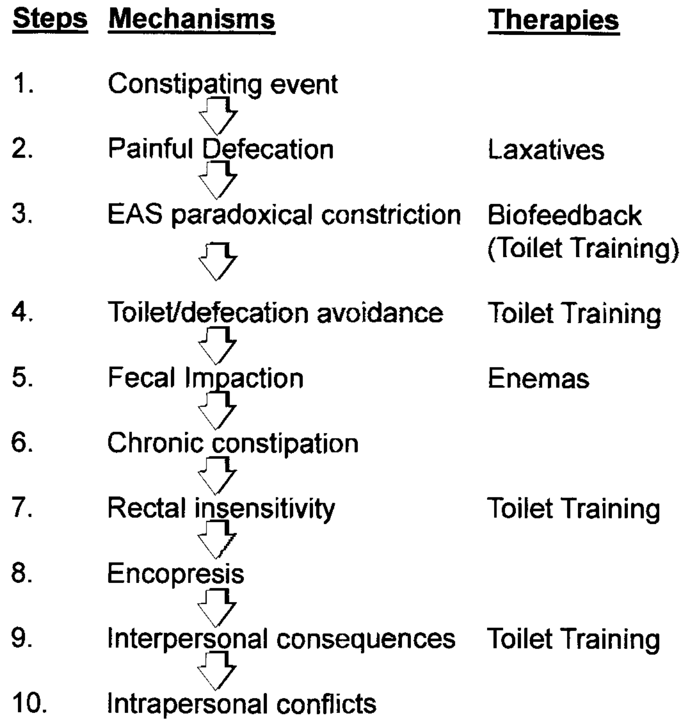


**FIGURE 1: Number of soiling accidents per day, at pre- and three months postinitiation of treatment, for IMC, ETT, and BF.**

EAS Biofeedback group, it was assumed that clinicians providing EAS Biofeedback would also employ laxatives and behavioral techniques to encourage frequent BMs; therefore, subjects assigned to EAS Biofeedback also received laxatives and toilet training. In summary, this study compared three treatment groups: Intensive Medical Care (IMC), Enhanced Toilet Training (ETT) plus IMC, and EAS Biofeedback (BF) plus ETT and IMC.

It was hypothesized that: (a) the more comprehensive treatments (BF > ETT > IMC) would be significantly more effective and benefit more children; (b) ETT would be the most cost-effective (i.e. require fewer sessions to produce maximum effects) because ETT could be the most comprehensive without the burden of electrode hookup and other technological issues; (c) regardless of the treatment, symptom reduction would be associated with improvement of bowel habits referred to in Figure 1 (i.e. increased self-toileting, reduced parental prompting, increased frequency of BMs and reduced pain); and (d) response during the first two weeks of treatment would predict eventual treatment outcome, since the best predictor of future behavior is typically past behavior and because a variety of behavioral interventions have demonstrated that early treatment responsiveness predicts eventual treatment responsiveness (17,24).

## METHOD

### Participants

Participants were recruited by physician referral, following direct mailing to primary care physicians in the University of Virginia catchment area. Inclusion criteria were a child between the ages of 6-15 years and encopresis for at least one year. Exclusion criteria were no documented mental retardation and no neuromuscular or gastrointestinal disease as evidenced by history and physical examination. All participants had previously failed various types of therapy. Of the 105 patients who were referred, six

TABLE 1
**Baseline Characteristics of Subjects in the IMC, ETT, and BF Groups, Presenting Means ± Standard Deviations and 1 × 3 ANOVA p Levels**

| Variables | IMC | ETT | BF | *p* Level |
|---|---|---|---|---|
| *N* | 29 | 27 | 31 | |
| Age | 8.5 ± 1.9 | 8.7 ± 2.0 | 8.4 ± 2.2 | .88 |
| Males/Females | 22 ± 7 | 25 ± 2 | 25 ± 6 | .24 |
| Duration/month | 49 ± 33 | 59 ± 47 | 65 ± 34 | .30 |
| # Soils/day | 1.1 ± .8 | 1.1 ± .8 | 1.2 ± 1.0 | .78 |
| # BMs/day | .97 ± .56 | .87 ± .7 | .96 ± .97 | .78 |
| # Self-toilet | 1.2 ± .87 | 1.4 ± 1.1 | 1.3 ± 1.1 | .83 |
| # Parent toilet | .9 ± 1.1 | 1.0 ± 1.0 | 1.1 ± 1.2 | .68 |
| Tsp. LAX/day | 1.8 ± 2.6 | 1.9 ± 4.8 | 2.9 ± 5.1 | .54 |

reported not wanting random assignment to an experimental condition, five reported wanting no further treatment, three wanted immediate treatment and did not want to participate in baseline evaluation, and four dropped out during baseline assessment. Table 1 displays means/standard deviations of demographics for the 87 participants in the three treatment groups. There were no differences between these groups on demographics or defecation-related behaviors. In general, participants were typically boys, around age eight, with a five-year history of encopresis, who were soiling once a day and having bowel movements once a day in the toilet, and taking about two teaspoons of laxatives a day.

## Procedure

Baseline assessment involved 14 days of recording toilet behavior by a computerized telephone voice mail system. When this computer system called the child's home each evening, a parent identified him/herself by entering their social security number and then answered questions by pressing their telephone's number pad. Parents reported the number of their child's self-initiated and parent-initiated trips to the toilet, number of voluntary bowel movements in the toilet, pain with defecation, number of soilings, number of teaspoons of laxatives, and number of enemas/suppositories used during the previous 24 hours (see Table 1). In the current sample, no children used suppositories. Parents rated defecation pain based on either observation or inquiry, depending on the child's age and availability. Pain was rated on a five-point Likert scale, 0 = No pain to 4 = Extreme pain. Parents were instructed to call in on an 800 number if they missed the computer call or were allowed to enter two days worth of data if they were unable to interact with the computer the previous day. If no data were entered by the third day, then the research assistant would contact the parents or extended family member to solicit the data verbally over the telephone.

The major advantages to this voice mail data collection system were that only 24 hours elapsed between relevant events and data recording, data were directly added to an ASCII file, and data were immediately analyzed for tabulation and graphing. This voice mail system yielded robust split-half reliability when comparing the first and second week of baseline data entries, with correlations ranging from .86 to .97 ($p$'s $< .001$) for the different items.

Participants then came to the Behavioral Medicine Center where they signed an informed consent, completed a series of psychological tests, and underwent physical and manometric exams (14). The psychometric and manometric evaluations were primarily used to compare encopretic to non-symptomatic controls. These data are presented elsewhere (13,14). The children drew from a hat for block randomization for group assignment, where two of every six successive children were randomized to one of the three treatments. On the same day of and immediately following the physical exam, the children had their first treatment session. To assess cost-effectiveness, number of treatment sessions was open-ended, and sessions were scheduled every one to two weeks on an "as needed" basis. Treatment termination was a clinical decision based on the child's performance and parent/therapist decision as to whether the patient was on an effective dose of laxative (IMC), whether the behavioral strategies were being optimally implemented (ETT), and whether the child had learned to consistently inhibit paradoxical constriction (BF).

During the initial two weeks of treatment and three months after the initiation of treatment, parents repeated the 14-day voice mail symptom diary.

*Intensive Medical Care:* IMC involved an initial series of Fleet's phosphate enemas. Parents were instructed to administer enemas at home at twelve-hour intervals for three to four days to remove impacted stool. This occurred immediately before the physical exam. Following disimpaction, children were treated with Milk of Magnesia and/or Senna syrup at a frequency and volume sufficient to produce at least one soft bowel movement per day. If the stools were liquid, the laxative dose was reduced. If the child went for more than two days without a bowel movement, an enema was administered and the laxative dosage was increased. This therapy was generally continued for five months. During month six, parents were instructed to taper off laxative use and introduce more fluids and foods containing fiber. No specific dietary instructions were given beyond increasing fiber and fluid intake. Since it has been reported that the major reason for laxative treatment failure by primary care physicians has been insufficient laxative dosages (25), this treatment represented intensive medical care because the two pediatric gastroenterologists used sufficient laxatives and enemas to promote daily regular bowel movements.

*Enhanced Toilet Training:* ETT employed similar enema and laxative therapy with a clinical psychologist adjusting the laxative dose. The only difference to IMC was that laxatives were reduced gradually once the child demonstrated a stable bowel movement frequency with no soiling episodes. Parents and child were instructed on the psychophysiology of constipation/encopresis and how responding to early rectal distention cues and regular toileting was critical to avoid reimpaction and establish regular bowel habits. Various incentive programs were established, depending on the developmental age and the motivation of the child. Target behaviors were spontaneous trips to the toilet and clean pants.

Our toilet training was enhanced because instructions were given on the role of paradoxical constriction of the EAS and because appropriate defecation straining was modeled. The therapist sat on a portable toilet demonstrating how to relax legs and feet, how to take in a deep breath and hold it while sitting up straight, and how to push down with the held breath and pull in from their lower abdomen (rectus abdominous muscle) in order to propel a stool out. The child then replicated this while sitting on a portable toilet. The child received "hand feedback" by placing one hand on the abdomen just below the naval to feel it move out when the breath was pushed down and placed the second hand just below the first to feel it go in with contraction of the rectus abdominous.

Parents were instructed to prompt this behavior at home. Additionally, eight to twelve minutes of toilet time was scheduled daily, beginning 15-30 minutes after the same two meals. During these times, children were instructed to practice tensing and relaxing their EAS for the first four minutes with the objective being to localize control of and fatigue the EAS, as well as to mechanically stimulate the rectum. In order to desensitize the children to toilet sitting, the second four minutes were spent having fun while being read to or playing games. During the final four minutes, the child was to strain and attempt to have a bowel movement, while relaxing legs and feet. This routine toilet sitting was discontinued two weeks following the last scheduled treatment session.

*Biofeedback:* BF used the same IMC and ETT instructions and simultaneously received electromyographic biofeedback training. Like ETT, BF was delivered by the clinical psychologists. Surface electromyographic biofeedback was employed because it is generally more available, less invasive, and more effective than manometric biofeedback (15,16). After receiving the general educational overview, children exposed their buttocks while laying laterally on an examination table. One silver/silver chloride electrode (Tender-Trace Neonatal #01-7130D, NDM, Dayton, Ohio) was attached over the coccyx and two bilaterally to the anal opening. Under and outer garments were then replaced and the child sat on a portable toilet.

The J&J I-330 system was used and its standard "Egg Drop" game was initially employed. This required the child to learn to tighten and relax his/her EAS in order to control a "basket" that moved horizontally across the bottom of the screen, depending on muscle contraction, to catch the "falling egg." Typically, initial control was spastic and paradoxical (tightening when intending to relax). After 15-20 minutes, children typically learned to control their EAS. The criteria for successful control was "catching" 25 eggs in ten minutes, which was achieved by all biofeedback participants by the end of the first session. The video display was then changed to a circle that constricted when the EAS tightened and opened when the EAS relaxed. While viewing this biofeedback display, children were asked to strain while keeping their anal canal (circle) open. Typically, children were able to achieve this within five to ten minutes. Consequently, BF differed from ETT in its direct exercising of the EAS and viewing its action on a computer screen during these exercises.

*All Treatments:* Child and parents were given specific written instructions concerning the mechanisms of bowel movements and homework assignments, such as when and how much laxative to consume and when to sit on the toilet. The voice mail computer printout from the first two weeks of treatment was made available to the clinicians for the next patient contact.

## RESULTS

### Relative Treatment Efficacy

The primary dependent variable was number of soilings per day for the 14 days before and 14 days three months following initiation of therapy, as defined by the voice mail data. Random assignment resulted in similar frequency of all dependent variables at baseline (all $p$'s $> .5$, see Table 1). Mean soiling rate for the 14 days pre-post treatment were compared across the three treatment groups using a 2 X 3 repeated measures analyses of variance (ANOVA). There was a significant pre-post effect (F = 58.07, $p < .001$, df = 1,84), no group effect (F = 0.59, $p < .35$, df = 2, 84), and a significant interaction effect (F = 3.15, $p = .04$, df = 2,84). While all groups demonstrated a significant ($p$'s $< .01$) pre-post reduction in soiling, contrasts indicated that pre-post percent reduction in soiling for ETT (t = 2.4, $p = .016$, df = 84) and BF (t = 2.0, $p = .04$, df = 84) were superior to IMC and

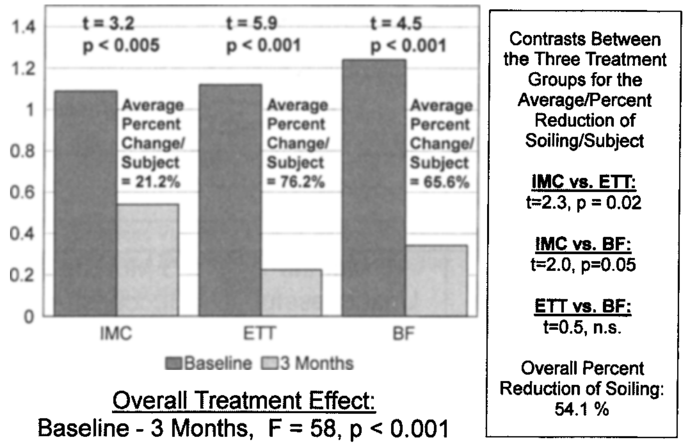


**FIGURE 2: Percentage of children who were classified as responders or non-responders to IMC, ETT, and BF.**

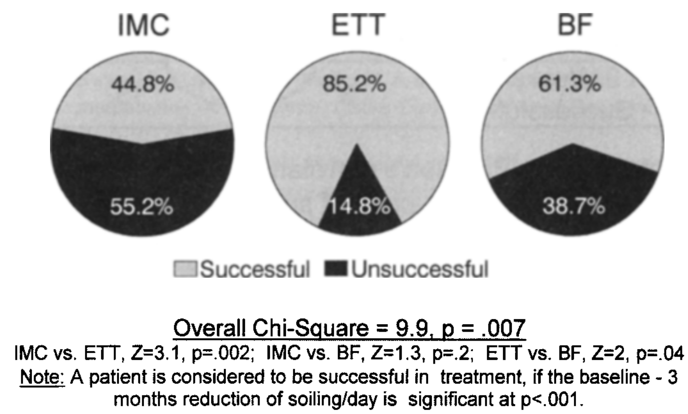


**FIGURE 3: Contingency table for children who were responsive or non-responsive after two weeks and three months of treatment with IMC, ETT, or BF.**

equivalent to one another (t = 0.67, ns, df = 84) (see Figure 2). The mean percent reduction in soiling/child in IMC, ETT, and BF groups were 21%, 76%, and 65%, respectively.

### Impact on Individual Children

Individual t-tests were performed on each child's data, comparing their daily soiling for the 14 days of baseline and three-month follow-up. These individual t-tests identified individual children who significantly benefitted from the various treatments ("Successful"). Because there were multiple t-tests, a Bonferroni correction was applied that required a significance level of $p <. 001$. This indicated that 45%, 85%, and 61% of IMC, ETT, and BF children significantly ($p < .001$) reduced their soiling (see Figure 3). The Kruskal-Wallis test indicated these percentages were significantly different in the three groups ($\chi = 9.76$, $p = .008$, df = 2). Mann-Whitney analysis indicated ETT was superior to IMC (Z = 5.12, $p < .002$) and BF (Z = 2.0, $p = .05$). For those children who experienced significant improvement, this improvement represented a mean reduction of soiling from 1.4 to 0.2 soiling accidents per day, with percent reduction ranging from 50% to 100%.

### Cost-Effectiveness

For the IMC, ETT, and BF groups, the respective mean ± standard deviation and ranges of number of treatment sessions

| IMC | 3 Months Unsuccessful | 3 Months Successful |
|---|---|---|
| 2 Weeks Unsuccessful | 13 | 4 |
| 2 Weeks Successful | 3 | 9 |

r=0.73 p<.001

| ETT | 3 Months Unsuccessful | 3 Months Successful |
|---|---|---|
| 2 Weeks Unsuccessful | 4 | 10 |
| 2 Weeks Successful | 0 | 13 |

r=0.94 p<.001

| BF | 3 Months Unsuccessful | 3 Months Successful |
|---|---|---|
| 2 Weeks Unsuccessful | 7 | 4 |
| 2 Weeks Successful | 3 | 15 |

r=0.95 p<.001

Note: **r** is the Pearson's correlation between the average/subject reduction of soils at 2 wks, and the reduction at 3 months. The **overall R=0.89, p<.001**.

**FIGURE 4: Relationship between 2-week and 3-month successful and unsuccessful children in the three treatment groups.**

were 3.92 ± 1.4, 2-6; 2.96 ± 2.0, 1-10; and 3.42 ± 1.7, 1-9 (Kruskal Wallis $\chi = 8.81$, $p = .01$). ETT required significantly fewer treatment sessions than IMC (Mann–Whitney U = 217, $p < .004$). There was no relationship between number of sessions and whether the patient was successfully treated (Kendall's Tau B = .05, $p = .27$). Based on the fact that Blue Cross–Blue Shield reimbursed $75/half-hour visit with a pediatric gastroenterologist and $72/hour visit with a psychologist, the average cost of therapy for IMC, ETT, and BF would be $295, $213, and $246 (F = 3.0, $p < .05$). ETT was significantly less expensive than IMC (Multiple Range test $p < .05$).

### Predicting Treatment Outcome

When collapsing across groups, reduction in soiling from baseline through the first two weeks of treatment correlated with improvement from baseline to three months r = .89 ($p < .001$). When categorizing children as successful/unsuccessful after two weeks of treatment and at three months, a similar pattern is evident (see Figure 4). For IMC, ETT, and BF, 75% (9/12), 100% (13/13), and 83% (15/18) of the children successfully treated after two weeks continued to be successful at three months. Alternatively, for IMC, ETT, and BF, of those children who were classified unsuccessful at two weeks, 76%, 29%, and 64% continued to be unsuccessful at three months. This generally confirms that early response to treatment predicted eventual response to treatment. The exception was that many initially unsuccessful children receiving ETT were eventfully classified as successful 71% (10/14).

Post hoc analysis explored demographic variables that might differentiate successful and unsuccessful children. None of the following variables were related to treatment outcome: duration of symptoms, previous diagnosis of Attention Deficit/Hyperactivity Disorder, use of Ritalin, bed wetting status, gender, age, baseline bowel habits (number of accidents, stools in toilet, etc.), or family income. Furthermore, there were no differences in number of treatment sessions; unsuccessful children received on average 3.6 ± 1.8 sessions compared to 3.4 ± 1.8 sessions for successful children (t = 0.6, $p = .6$). There was also no therapist effect (F = 0.23, $p = .6$), illustrating similar treatment outcome for IMC regardless of which gastroenterologist delivered the care and for ETT or BF regardless of which clinical psychologist delivered the care. This suggests that the therapeutic interventions were quite robust.

### Mechanisms of Therapeutic Improvement

All treatments significantly reduced defecation pain (F = 4.3, $p < .001$, df = 65, Step 2), increased self-toileting (t = 1.8, $p < .05$, df = 85, Step 4) and frequency of BMs in toilet (t = 4.54, $p < .001$, df = 85, Step 6), while reducing parental prompting (t = 3.1, $p < .005$, df = 85, Step 9). Given that our model hypothesizes these factors contribute to the maintenance of encopresis, their modification should be related to improvement in encopresis, regardless of therapy. When collapsing across groups, a mixed linear-quadratic regression analysis was used with the above variables to predict percent reduction of soiling. This analysis accounted for 40% of treatment outcome variance. Improvement in soiling was significantly related to the quadratic variables reduction in parental-prompted toileting ($p < .001$, partial correlation = .35), increase in bowel movements ($p < .0001$, partial correlation = .24), and to the linear variable reduction in defecation pain ($p = .02$, partial correlation = .20).

## DISCUSSION

This study demonstrates that even aggressive laxative therapy with instructions to use the toilet regularly can be significantly enhanced by the addition of the psychological intervention of enhanced toilet training. The addition of this intervention not only enhanced general treatment outcome and significantly extended the benefits to more children, but also employed significantly fewer patient contacts and at less cost. Additionally, post hoc analysis indicates that ETT children were using significantly less laxatives at three months than IMC children (1.7 vs. 4.0 teaspoons/day, $p < .01$), also representing a cost savings. Another advantage of ETT was that all of the subjects who were classified as successful at two weeks continued to be successful at three months versus a 25% (3/12, see Figure 4) relapse rate in the IMC group. Conversely, typically only 24% (4/17) of the children who were classified as unsuccessful at two weeks were eventually classified as successful at three months for IMC versus 71% (10/14) who were initially unsuccessful at two weeks and eventually become successful with continued involvement in ETT. Consequently, because ETT was more effective, requiring fewer sessions and fewer laxatives, and more capable in turning initially unsuccessful children into successful children, these findings strongly suggest that laxative therapy should routinely be paired with enhanced toilet training in the treatment of children with chronic encopresis.

While group comparisons found that BF was equivalent to ETT, analysis of number of children benefiting from treatment revealed that ETT was significantly better than BF. Why would a treatment (BF) containing everything another treatment (ETT) involves, plus an additional component, be less effective? Our data do not allow a specific answer to this question. On average, BF required 0.5 more sessions of patient contact, suggesting more was done in BF. However, connection of electrodes and comprehending and playing a video game may have taken time and attention away from the behavioral intervention, as well as diminished the significance of toilet training in both the eyes of the child and parents. Thus, greater emphasis may have been placed on Step 3 of the model, to the exclusion of other contributing factors. If this speculation has merit, then it would suggest that biofeedback may be a significant adjunction to toilet training, only after the principles and procedures of toilet training are firmly established. Consequently, biofeedback may be better introduced in the second or third treatment session, instead of the first session.

While all treatments similarly reduced defecation pain, increased bowel movement frequency and self-toileting, and reduced parental toilet prompting, only reduction in soiling differentiated the treatments. This result illustrates the specificity of the ETT treatment effect. The underlying mechanism of this treatment specificity may in part be explained by the finding that the presence of paradoxical constriction during the manometric exam was associated with poorer treatment outcome only for the IMC group (13). Consequently, attention to paradoxical constriction, either through modeling and instruction in ETT or direct monitoring and feedback through BF, may be a necessary element for those children who demonstrated the problem. The regression analysis also indicated that increasing bowel movement frequency, reducing defecation pain, and reducing parental involvement are also important treatment issues, regardless of the specific therapy used. The possible role of non-specific effects must always be considered. While ETT and BF visits typically involved 60 minutes compared to 30 minutes with the pediatric gastroenterologist, the specificity of the treatment effect and the relative superiority of ETT to BF would not suggest that additional time with a supportive therapist made a major contribution. This is further supported by the fact that ETT was the most effective but saw the children for fewer sessions.

The present findings demonstrate that encopresis is not simply being maintained by fecal impaction/constipation, since all treatments lead to a similar increase in BM frequency. Instead, it appears to be a consequence of an interplay between physiology and behavior. The present study provides confirmatory data for Steps 2 and 3 of the model. Attention needs to be paid to how many times the child goes to the bathroom to have a bowel movement on his/her own, how the child strains to pass a stool, how much pain is experienced during defecation, and how successful the straining process is. Additionally, clinical experience suggests that for younger children there may be the additional component of fear: fear that something threatening may come out of the toilet or fear that the child may get drawn into the toilet (26).

While this data clearly points out the benefits of psychology's involvement in the treatment of encopresis in the local setting, it will be imperative to test the external validity of these findings. To this end, a multicenter study involving multiple clinicians, numerous clinical settings, and hundreds of patients will be important to significantly alter routine medical management of encopresis.

## References


(1) American Psychiatric Association: *Diagnostic and Statistical Manual of Mental Disorders* (4th Ed.). Washington, DC: American Psychiatric Association, 1994.

(2) Bellman M: Studies on encopresis. *Acta Paediatrica Scandinavia.* 1996, *56*(Suppl. 170):1–151.

(3) Loening-Baucke V: Modulation of abnormal defecation dynamics by biofeedback treatment in chronically constipated children with encopresis. *Journal of Pediatrics.* 1990, *116*:214–222.

(4) Nolan T, Debelle G, Oberklaid F, Coffey C: Randomized trial of laxatives in treatment of childhood encopresis. *Lancet.* 1991, *338*:523–527.

(5) Berg I, Forsythe I, Holt P, Watts J: A controlled trial of 'Senokot' in fecal soiling treated by behavioral methods. *Journal of Child Psychology and Psychiatry.* 1982, *24*:543–549.

(6) Davis H, Mitchell WS, Marks F: A behavioral programme for the modification of encopresis. *Child: Care, Health and Development.* 1976, *2*:273–282.

(7) Wright L: Outcome of a standardized program for treating psychogenic encopresis. *Professional Psychology.* 1975, *6*:453–456.

(8) Bornstein P, Balleweg B, McLellarn R, et al: The bathroom game: A systematic program for the elimination of encopretic behavior. *Journal of Behavior Therapy and Experimental Psychiatry.* 1983, *14*:67–71.

(9) Lowery SP, Srour JW, Whitehead WE, Schuster MM: Habit training as treatment of encopresis secondary to chronic constipation. *Journal of Pediatric Gastroenterology and Nutrition.* 1985, *4*:397–401.

(10) Borowitz SM, Sutphen JL, Ling WD, Cox DJ: Correlation of anorectal manometry with symptoms of chronic childhood constipation and encopresis. *Diseases of the Colon and Rectum.* 1996, *39*:400–406.

(11) Keren S, Wagner Y, Heldenburg D, Golan M: Studies of manometric abnormalities of the recto-anal region during defecation in constipated and soiling children: Modification through biofeedback therapy. *American Journal of Gastroenterology.* 1988, *83*:827–831.

(12) Meunier P, Merechal JM, Jaubert de Beaujeu M: Rectoanal pressures and rectal sensitivity studies in chronic childhood constipation. *Gastroenterology.* 1979, *77*:330–336.

(13) Sutphen JL, Borowitz SM, Ling WD, Cox DJ, Kovatchev B: Anorectal manometric examination does not predict response to therapy for retentive or non-retentive encopretic-constipated children. *Gastroenterology.* 1998, *114*:909.

(14) Sutphen JL, Borowitz SM, Ling WD, Cox DJ, Kovatchev B: Anorectal manometric examination in encopretic-constipated children. *Diseases of the Colon and Rectum.* 1997, *40*:1051–1055.

(15) Bleijenberg G, Kuipers HC: Biofeedback treatment of constipation: A comparison of two methods. *American Journal of Gastroenterology.* 1994, *89*:1021–1026.

(16) Cox DJ, Sutphen J, Dickerson M, Singles J, Whitehead WE: Simple electromyographic biofeedback treatment for chronic pediatric constipation/encopresis: Preliminary report. *Biofeedback and Self-Regulation.* 1994, *19*(1):41–50.

(17) Cox DJ, Sutphen JL, Ling WD, Quillian W, Borowitz SM: Relative efficacy of laxative toilet-training and biofeedback therapies in the treatment of pediatric encopresis. *Journal of Pediatric Psychology.* 1996, *21*(5):659–670.

(18) Ling W, Cox DJ, Sutphen Jl, Borowitz SM: Psychological factors do

not differentiate children with encopresis. *Clinical Pediatrics*. 1996, *35*:427–428.

(19) Cox DJ, Ling WD, Sutphen JI, Borowitz SM: Differential treatment efficacy for pediatric encopresis. International Society of Behavior Medicine. Washington, DC: 1996.

(20) Olness K, McParland F, Piper J: Biofeedback: A new modality in the management of children with fecal soiling. *Journal of Pediatrics*. 1980, *96*:505–509.

(21) Singles JM, Mikulka PJ, Cox DJ, Mittal R: An alternative biofeedback-based behavior modification treatment for a case of chronic constipation. *Behavior Therapy and Experimental Psychiatry*. 1992, *23*(3):231–235.

(22) Wald A, Chandra R, Gabel S, Chiponis D: Evaluation of biofeedback in childhood encopresis. *Journal of Pediatric Gastroenterology and Nutrition*. 1987, *6*:554–558.

(23) Weber J, Ducrotte PH, Touchais JY, Roussignol C, Denis PH: Biofeedback training for constipation in adults and children. *Diseases of the Colon and Rectum*. 1987, *30*:844–846.

(24) Cox DJ, Ballenger JC, Laraia M, et al: Different rates of improvement of different symptoms in combined pharmacological and behavioral treatment of agoraphobia. *Journal of Behavior Therapy and Experimental Psychiatry*. 1988, *19*(2):119–128.

(25) Loening-Baucke V: Chronic constipation in children. *Gastroenterology*. 1993, *34*:1557–1564.

(26) Pilapil VR: A horrifying television commercial that led to constipation. *Pediatrics*. 1990, *85*(4):592–593.