Defecation disorders and chronic abdominal pain in children. Pathophysiology and treatment
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Chapter 4

Lack of benefit of laxatives as adjunctive therapy for functional non-retentive fecal soiling in children
1. Abstract

1.1 Objectives

To determine whether the combination of laxative treatment and biofeedback therapy is more effective for management of functional non-retentive fecal soiling than biofeedback therapy alone.

1.2 Study design

In a prospective non-blinded study, 48 children were randomized in 2 groups: treatment with oral laxatives and five sessions of biofeedback training or five sessions of biofeedback training alone during a treatment intervention period of 7 weeks. Biofeedback was performed with perfused manometry catheters and rectal balloon distension. Training focused on awareness of balloon distension and instruction in correct defecation dynamics. Successful treatment was defined as <1 encopresis episode per 2 weeks.

1.3 Results

At the end of the intervention period, the number of encopresis episodes was significantly decreased in both groups: from 7 (range, 2 - 24) to 2 (range, 0 - 17) in the ‘biofeedback training’-group and from 7 (range, 3 - 25) to 2 (range, 0 - 14) in the ‘treatment with oral laxatives and five sessions of biofeedback training or five sessions’-group. However, children given biofeedback training alone had significantly higher success rates than children treated with biofeedback training and additional oral laxatives (44% vs. 11%).

1.4 Conclusions

There is no additional effect of laxative treatment in functional non-retentive fecal soiling. Children treated with biofeedback training in combination with laxatives showed a significantly lower success percentage compared with those treated with biofeedback training alone. These results suggest that children with functional non-retentive fecal soiling should be treated differently from children with constipation and encopresis.
2. Introduction

The prevalence of encopresis is 1% to 2% in otherwise healthy school children (1-5). The shame and fear of discovery of their incontinence may lead to social withdrawal, low self-esteem, depression, and behavioral problems (1,3,8). In the majority of affected children no organic cause can be identified. In most patients encopresis is the result of constipation. Consequently, treatment protocols generally use a combination of laxative and behavioral therapy. We previously described a subset of patients with ‘solitary encopresis’ who do not have constipation but have the voluntary or involuntary passage of a quantitatively normal bowel movement in the underwear after the age of 4 years, occurring on a regular basis (9,10). This patient group has recently been classified with a diagnosis of functional non-retentive fecal soiling by the new pediatric Rome criteria (11). Studies in patients with functional non-retentive fecal soiling (9,10) showed normal defecation frequencies, normal anorectal function on manometry, and normal colonic transit times, indicating a different pathophysiologic mechanism compared with that of patients with encopresis as a result of constipation.

A multimodal treatment protocol in patients with functional non-retentive fecal soiling (30) comparing laxative treatment with and without BF showed poor clinical outcome in the 2 treatment groups at the end of the intervention period (39% and 19%, respectively), questioning the possible negative effect of oral laxative treatment on BF in these children. In addition, the clinical history as told by patients with functional non-retentive fecal soiling suggests, in contrast to children with encopresis as a result of constipation, that they use their underpants as a toilet, which also questions the role of oral laxative treatment in this group of children.

Therefore the purpose of the current, nonblinded, randomized, controlled study was to investigate whether laxative treatment has an additional effect to BF on clinical outcome in children with functional non-retentive fecal soiling.

3. Patients and methods

3.1 Subjects

Children were referred by general practitioners, school doctors, pediatricians, and psychiatrists to the Academic Medical Center of Amsterdam. Subjects eligible for the study had encopresis at a frequency of 2 times per week or more, without fulfilling any other criterion of constipation. Encopresis was defined as the voluntary or involuntary passage of a normal bowel movement in the underwear after the age of 4 years (7). Those children who never achieved bowel control were defined as having primary encopresis, whereas children who were completely toilet-trained but regressed to incontinence were defined as having secondary encopresis. Children with constipation were excluded. These children were defined as fulfilling at least 2 of the 4 following criteria for constipation: 2 or more episodes of encopresis per week, <3 bowel movements per week, periodic passage of very large amounts of stool, and a palpable abdominal or rectal mass.
Children with organic causes of fecal incontinence such as muscle disorders, anal repair, spina bifida, anal atresia and Hirschsprung's disease and those with mental retardation were excluded.

3.2 Design

Eligible children were randomly assigned in a nonblinded fashion to receive oral laxatives and biofeedback training or biofeedback training alone. The group receiving oral laxatives used 5 g lactulose per 10 kg body weight/d, divided into 2 doses during the 7-week intervention period and a variable period during follow-up. The laxatives were stopped when patients had <2 encopresis episodes per month or when they showed an increase in encopresis episodes (after an initial decrease during the beginning of the intervention period) while using the laxatives. The patients in the BF group did not receive a placebo.

Each child underwent a complete investigation at the start of the 7-week intervention period including a detailed medical history, abdominal and rectal examination, anorectal manometry, and colonic transit time measurement. During this first visit the child and the parents were educated about the different aspects of encopresis, with an explicit effort to alleviate guilt and to be nonaccusatory. After the first visit all children received advice about a high-fiber diet and were instructed to try to defecate on the toilet for 5 minutes after each meal. Two weeks before intake and during the first 26 weeks after inclusion, the patients, with assistance from their parents, kept a daily diary to record the encopresis episodes and defecation frequency.

The BF consisted of 5 outpatient visits of 45 minutes spread over the 7-week treatment period and was performed as described previously \(^{10,12}\).

Follow-up was carried out at 6, 12, and 26 weeks and at 12 months after the last visit of the intervention period. Follow-up was performed either during a clinical visit or by telephone with a standard questionnaire.

The study protocol was approved by the medical ethical committee of the hospital. Children and parents gave written informed consent.

3.3 Methods

3.3.1 Colonic transit time

Total and segmental analysis of colonic transit time was appraised as reported previously by Metcalf et al \(^{13}\). When instituted, treatment with laxatives was discontinued at least 4 days before the test. All patients ingested an identical capsule with 24 radio-opaque markers on 3 consecutive days at 9:00 AM. An abdominal x-ray evaluation was performed at 9:00 AM on day 4. An additional abdominal x-ray evaluation was taken on day 7 if >20% of markers were still present at day 4. Calculation of colonic transit times was performed according to a previously described formula \(^{14}\). These calculated values were compared with those of a healthy control group as measured by Arhan et al \(^{14}\). When the total colonic transit time exceeded 62 hours, it was considered to be delayed, indicating constipation; subsequently the patient was excluded from the study \(^{14}\).
3.3.2 Anorectal manometry

Anorectal manometry was performed without bowel preparation. All patients had either an empty rectum on rectal examination or were able to adequately clean their bowels just before they underwent manometry. An open catheter (4.8 mm outside and 0.8 mm inside diameter with 2 side holes 3 cm apart) \(^{(10,15)}\) was perfused with distilled, degassed water at a rate of 0.8 mL/min by a pneumohydraulic perfusion pump. When inserted into the anus, the proximal side hole was placed in the rectum and the distal side hole in the mid-anel canal. Pressures were measured by transducers in the perfusion line and connected to PC Polygraph HR preamplifiers (Synectics Medical, The Netherlands). Signals from the preamplifier were converted to digital values and transmitted to a computer. Rectal distension was produced with a highly compliant 7-cm long distending rectal balloon tied at the end of the catheter. The proximal end of the balloon was located 13.5 cm from the distal side hole.

Anal resting tone, maximal squeeze pressure, sensory threshold, critical volume, anorectal inhibitory reflex, and the defecation dynamics were measured before the first and at the end of the last biofeedback session. A defecation attempt was considered to be normal when the anal sphincter pressure minus the abdominal expulsion pressure did not exceed 10 mm Hg. When this occurrence was observed in at least 2 of 3 defecation attempts, defecation dynamics were considered to be normal. The results were compared with values of healthy volunteers from a previous study \(^{(10)}\).

3.3.3 Biofeedback training

Before BF was started, normal manometric tracings were shown to the child. Rectal and anal responses were explained. The sensory threshold was determined, and subsequent training of sensation was performed by inflating the balloon at different times and different volumes and requesting the child to give a response whenever sensation was perceived.

Subsequently, while the child was lying in a left lateral position, the balloon was filled with the volume at which sensation was noticed, and the child was asked to increase abdominal pressure and not to contract the external anal sphincter. After this procedure was performed, the child was asked to bear down and expel the balloon without visual and verbal feedback. The patient was encouraged to use the learned techniques at home during toilet training.

3.4 Analysis

3.4.1 Definition of success

Treatment was considered to be successful if the child had <1 episode of encopresis per 2 weeks \(^{(10,16)}\).
3.4.2 Statistics

Median values to assess the clinical symptoms were used because of the skewed distributions of the continuous variables. Manometric values before and after therapy were compared with the use of the Wilcoxon signed rank test. Manometric values between the 2 groups were compared with the use of the Mann-Whitney U test. Defecation dynamics before and after therapy were compared with the use of the McNemar's test. The $\chi^2$ test was used to analyze the differences in defecation dynamics and in success rates.

3.5 Results

3.5.1 Patient characteristics

Between February 1994 and May 1998, 49 children with functional non-retentive fecal soiling without other symptoms of constipation were enrolled in the study. One patient refused further treatment after the first visit because of anxiety about the manometric procedure.

Baseline characteristics (Table 1) were comparable for both groups.

<table>
<thead>
<tr>
<th>Table 1. Patient characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patients</td>
</tr>
<tr>
<td>Number</td>
</tr>
<tr>
<td>Sex M</td>
</tr>
<tr>
<td>Sex F</td>
</tr>
<tr>
<td>Age (y)</td>
</tr>
<tr>
<td>Defecation frequency per week</td>
</tr>
<tr>
<td>Encopresis per week</td>
</tr>
<tr>
<td>Colonic transit time (h)</td>
</tr>
<tr>
<td>Enuresis diurnal (%)</td>
</tr>
<tr>
<td>Enuresis nocturna (%)</td>
</tr>
</tbody>
</table>

Values are given as median with range

More than 85% of the patients were boys. The median age was 8 years (range, 5 - 17) years. Encopresis episodes occurred frequently, with ranges from 2 to 25 per week. Nighttime encopresis occurred in 3 patients. No statistical difference was found in the number of children with primary encopresis between the BF group and the BF + LAX group, 11 (44%) and 7 (30%) patients, respectively.

Daytime and nighttime enuresis occurred in 46% and 40% of the patients, respectively.
### 3.5.2 Anorectal manometry

No differences in anorectal manometry were found before and after the intervention period between the 2 groups (Table 2).

<table>
<thead>
<tr>
<th>Manometric parameters</th>
<th>Biofeedback training</th>
<th>Controls</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No laxatives (N = 25)</td>
<td>Laxatives (N = 23)</td>
</tr>
<tr>
<td></td>
<td>Before BF session</td>
<td>Last BF session</td>
</tr>
<tr>
<td>Anal rest pressure (mmHg)</td>
<td>47 (36-110)</td>
<td>49 (9-102)</td>
</tr>
<tr>
<td>Max. squeeze pressure (mmHg)</td>
<td>143 (76-353)</td>
<td>169 (65-475) a</td>
</tr>
<tr>
<td>Sensory threshold (mL)</td>
<td>40 (5-110)</td>
<td>15 (5-60) b</td>
</tr>
<tr>
<td>Critical volume (mL)</td>
<td>120 (40-300)</td>
<td>120 (60-300)</td>
</tr>
<tr>
<td>Normal defecation dynamics (%)</td>
<td>39</td>
<td>52</td>
</tr>
</tbody>
</table>

There are no significant differences between the 2 groups before the intervention period (Mann-Whitney U; χ² for normal defecation dynamics)

* a p<0.01, before and after intervention in BF group; Wilcoxon signed ranks test

b p<0.01, before and after intervention in BF group; Wilcoxon signed ranks test
c p<0.01, before and after intervention in BF + LAX group; Wilcoxon signed ranks test
d p<0.05, before and after intervention in BF + LAX group; Wilcoxon signed ranks test

Both groups showed a significant increase in maximal squeeze pressure and a significant decrease in sensory threshold after the intervention period. Defecation dynamics were normal in only 39% and 30% of the patients in the BF group and the BF + LAX group, respectively. At the end of the intervention period, normal defecation dynamics increased to 52% in the group without laxatives and to 45% in the laxative group (not significant).

### 3.5.3 Colonic transit time

No differences in segmental and total colonic transit time were found between the BF group and the BF + LAX group, 37 (range, 4 – 60) and 34 (range, 5 – 60) hours, respectively.
3.5.4 Total number of encopresis episodes

The number of encopresis episodes at intake was comparable for the BF group and the BF + LAX group: 7 (range, 2-24) and 7 (range, 3-25), respectively. At the end of the intervention period, the number of encopresis episodes was significantly reduced in both groups ($P < 0.05$): BF and BF + LAX group 2 (range, 0-17) and 2 (range, 0-14), respectively. The significant decrease in the number of encopresis episodes had occurred already between the visit at intake, during which only an anorectal manometry was performed for basic manometric values, and the first BF session (BF and BF + LAX group 3 (range, 0-19) and 3 (range, 0-15) encopresis episodes, respectively). At every visit and at every stage of follow-up, except for the follow-up at 26 weeks in the BF + LAX group, a 53% to 86% reduction in the total number of encopresis episodes was found compared with the number of encopresis episodes at intake in both groups (from 7.0 to 1.0 – 3.3 (median values)). One child discontinued laxatives after 3 weeks of use because of an immediate increase in the number of encopresis episodes compared with the number at intake. Because of a slight increase or no further decrease in encopresis episodes at a follow-up of 6 and 12 weeks, respectively, 8 and 14 patients were not motivated to continue laxative therapy.

3.6 Success rates

In the BF + LAX group 52% and 35% of the children were still on laxatives at 6- and 12-weeks follow-up, respectively. The success percentage at follow-up of 12 weeks, 26 weeks, and 12 months were 44%, 32%, and 36%, respectively, in the BF group, whereas in the BF + LAX group the percentages were 9%, 4%, and 9%, respectively. Thus, treatment with BF alone led to a significant greater success rate at every stage of follow-up than treatment with additional oral laxative treatment (Figure 1).
Figure 1

![Bar graph showing significantly higher number of patients from BF group compared with BF + LAX group fulfilling criteria of successful treatment at different stages of follow-up.]

* $p < 0.05$, success BF group vs. BF + LAX group; $\chi^2$

**Figure** shows significantly higher number of patients from BF group compared with BF + LAX group fulfilling criteria of successful treatment at different stages of follow-up.

Relapse occurred in 36% and 100% of the BF and the BF + LAX group, respectively, between follow-up at 12 and 26 weeks.

### 3.7 Enuresis

In the total group the frequency of daytime enuresis decreased from 46% to 29% to 19%, respectively, at intake, at the end of the intervention period, and at 1-year follow-up.

### 3.8 Discussion

This study showed for the first time that there is no additional effect of laxative treatment to BF on the decrease of encopresis episodes in children with functional non-retentive fecal soiling. Moreover, a significant negative effect on successful outcome was found in children treated additionally with oral laxatives.

In accordance with others (15), anorectal manometry at intake showed no significant impairment of anorectal sensorimotor function in these encopretic patients compared with healthy volunteers except for abnormal defection dynamics (10,17-19) Similarly to others, we observed in children with functional non-retentive fecal soiling after BF a significant increase in maximal squeeze pressure (10) and a significant decrease in sensory threshold (15). These differences might be the result of a better and more conscious understanding and use of sensorimotor functions. Despite this improvement of anorectal function, no relation to successful treatment was found. The abnormal defection dynamics (paradoxical contraction of
the sphincter complex) in children with functional non-retentive fecal soiling may be explained, as postulated earlier, by an acquired control mechanism in which after the loss of the first stool in the underwear, the child contracts the external anal sphincter to retain the rest of the stool in the rectum [19]. Children with pretreatment abnormal defecation dynamics had no different clinical outcome compared with children with normal defecation dynamics. In addition, no relationship was found between the achievement of normal defecation dynamics and successful treatment [19,23]. Surprisingly, and in contrast with other studies, a relatively low percentage of children, 50% vs. 86%, was able to achieve normal defecation dynamics after 5 BF sessions [9,12,15]. Taken together, although standard manometry in these children shows no obvious abnormalities, the handling of stools clearly is inappropriate, suggesting a wrongful interpretation of rectal sensation or a disturbed rectoanal coordination [17,19].

It is interesting that the significant decrease in frequency of encopresis episodes in both groups occurred between the initial anorectal manometry at intake, which was planned to obtain basic manometric values, and the first biofeedback session at the second visit approximately 1 week later. This striking effect might be due to “demystification” of an anorectal problem or the nonaccusatory approach toward the children, thereby increasing motivation [21]. During this process of manometric measurement, the investigator is able to discuss and explain in detail the findings visualized on the computer screen with the patient and parents. Other factors such as traveling to a referral center and high expectations of adequate treatment might also play a role. However, during this initial period only 3 patients in the BF group and 1 in the BF + LAX group showed such a decrease in encopresis episodes that they fulfilled the criteria of successful treatment.

The majority of the children in the BF group, in contrast to those in the BF + LAX group, achieved success between 6 and 12 weeks follow-up. In this period we placed the full responsibility for success on the children's shoulders and stressed their own capability to respond to the urge to defecate. The significantly lower success percentage in the BF + LAX group might have been due to the unnecessary softening of stools by the laxative treatment resulting in soiling. It is noteworthy that during the BF training itself no major decline in encopresis periods or in achieving success according to the strict criteria was observed. It raises the question of whether BF training itself plays no or only a minor role in the treatment of these children, whereas factors such as attention and demystification or stressing own responsibilities are far more important. We observed a substantial portion of the children who were not successfully treated to be strongly motivated, suggesting that factors other than, for example, psychologic factors may result in functional non-retentive fecal soiling. Therefore further studies should be initiated to establish whether these patients have inadequate rectoanal coordination.

Besides a decrease in the number of encopresis episodes during the intervention period, daytime enuresis also decreased in frequency. This result suggests once more that a regimen of demystification, toilet training, increasing motivation, and a rewarding system is able to improve both enuresis and encopresis. In children with functional non-retentive fecal soiling, the frequency of daytime (45%) and nighttime (40%) enuresis was higher compared with that of constipated children (25-29%) [12,19,29], suggesting an overall delay in the achievement of toilet training in this patient group. A study by Loening-Baucke [21] showed that most constipated
children with urinary incontinence became clean and dry after successful treatment, suggesting their urinary incontinence was caused by constipation.

In conclusion, in children with functional non-retentive fecal soiling with no other symptoms of constipation and a normal colonic transit time, the success rate of BF alone is significantly higher compared with that of the combination of BF and additional oral laxatives. Therefore laxatives seem to have no use in the treatment of children with functional non-retentive fecal soiling in contrast to children with encopresis caused by constipation. The therapeutic regimen containing toilet training with a rewarding system, a nonaccusatory approach, and 'demystification' by anorectal manometry of these children is important in the treatment of these children. Biofeedback training seems to play no or only a minor role in the treatment of these children. Further studies are required to unravel possible pathophysiologic mechanisms in this often difficult-to-treat clinical entity.
Reference List


