Efficacy of biofeedback in school age anal incontinence. Analysis of 150 patient with functional non retentive fecal incontinence (FNRFI)

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Abstract

Background: Functional non retentive fecal incontinence (FNRFI) is an entity of fecal incontinence that is defined according Rome III classification as fecal incontinence in a child with mental age more than 4 years with no evidence of metabolic, inflammatory or anatomical cause. It is psychologically frustrating shameful problem with bad impact on children.

Aim of this study is to evaluate early and late impact of Biofeedback therapy as a treatment of FNRFI.

Methodology: The current study included 150 patients with mean age of 10±3 years with FNRFI who are eligible for biofeedback therapy that was designed for 3 months. Anorectal manometric findings were recorded before and after treatment. Vaizey incontinence score was recorded and compared with baseline patient’s score.

Results: According to our schedule of biofeedback therapy there was significant improvement in the mean squeeze pressure from 97±15 mmHg to 169±26 mmHg with significant improvement of incontinence score (Vaizey score) from 6-20 to 0-6 before and after biofeedback therapy respectively. There was also a significant improvement of rectal sensation and compliance after biofeedback therapy.

Conclusion: Biofeedback is a reliable, easy, noninvasive, fast and effective method for treatment of FNRFI with satisfactory early outcome.

Keywords: fecal incontinence, Biofeedback, Anorectal manometry

Declaration of conflicting interests

The authors declare no potential conflicts of interest with respect to the research, authorship and publication of this article

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**Introduction**

Fecal incontinence is defecation in places inappropriate to social context once per month for two successive months. It is psychologically frustrating shameful problem with bad impact on children.  

(1)

Normal fecal continence is maintained by the intact functions of: the colon, rectum, anal sphincters, pelvic floor muscles and local motor and sensory nerves, in addition to spinal and higher cortical connections. Damage to any of these structures may lead to fecal incontinence, though it is a more complex and multifactorial disorder.  

(2)

Therefore, fecal incontinence can have several causes: constipation; damage to anal sphincters (during childbirth or after anal surgery); damage to nerve supply; loss of rectal storage capacity; diarrhea and pelvic floor dysfunction.  

(3)

In approximately 95% of the children, no organic cause can be identified and these children are considered to have a functional defecation disorder. Of this latter group, in approximately 80% of these children FI is the result of constipation and is treated with laxatives, the remaining 20% without signs of fecal retention are classified as FNRFI.  

(4)

FNRFI is a separate entity of fecal incontinence that is defined according Rome III classification as fecal incontinence in a child with mental age more than 4 years with no evidence of metabolic, inflammatory or anatomical cause.  

(5)

The underlying mechanism of FNRFI is largely unknown. The pathophysiology seems to be complex and it is considered to be a multifactorial disorder. Historically, FI was seen as a manifestation of emotional disturbance. The association between FI and stress, however, has not been well documented. It is thought that children with FNRFI deny or neglect their normal physiological stimuli to defecate in the toilet and contract the external anal sphincter to retain stool in the rectum.  

(6)

Education, toilet training, and positive motivation are the cornerstones of treating children with FNRFI. Children and parents should be prepared for a long lasting treatment process with many ups and downs. The
goal is to prevent stool accidents and have regular bowel movements by teaching the child the importance of immediate toilet use with urge on a regular basis. (7)

Biofeedback therapy is a non-invasive and easily feasible option which has been used for fecal incontinence over several decades. Numerous published studies support it as the first choice of treatment for FNRAI. These studies have reported a success rate of about 70% (between 40 to 100%). (8)

Aim of this study is to evaluate early and late impact of Biofeedback therapy as a treatment of FNRFI.

Patients and methods

The current study was conducted at the colorectal surgery unit, surgery department, Benha university hospital throughout the period from March 2017 till June 2018. Approval to conduct the research was obtained from the institute of ethical and research committee, Benha University.

The study included 150 children (age ranged from 8 to 14 years) with functional non-retentive fecal incontinence with normal bowel habits, normal defecation frequency and normal stool consistency with incontinence score ranging from 6-20 according to St’ Mark’s (Vaizey) score.

Exclusion criteria included Children with traumatic sphincter injury, Children with fecal impaction or spinal diseases causing incontinence, Children with anorectal malformation, children younger than 4 years and children who were not cooperative.

A written informed consent was obtained from parents or guardians of all included children.

Detailed history was taken including bowel habits, duration and severity of incontinence and history of trauma. Complete physical examination to exclude patients requiring surgical correction. Transanal ultrasonography using (BK Medical Flex Focus 400 with 2052 colorectal transducer) was done to patients with history of trauma to exclude sphincteric defect.

All patients were given a score according to St’ Mark’s (Vaizey) score ranging from 0 (perfect continence) with maximum score 24 indicating total incontinence.

Baseline anorectal manometry was done using high resolution anorectal manometry by (Solar GI HRAM MMS) using 24 channel water-perfused catheter with latex
balloon. Anorectal manometry was done to 10 normal volunteers to standardize the normal variables for same age and sex groups.

An enema was done before procedure if stool was detected. With the patients in the left lateral position both knees and hips were bent at a 90 degree angle, a lubricated probe is gently introduced into the rectum with its dorsal aspect corresponding to that of the patient.

After probe placement, a run-in period of approximately 5 minutes should be allowed to give the patient time to relax such that anal sphincter tone returns to basal levels. Anal resting pressure is generally measured over 20 seconds.

The patient is asked to squeeze the anus for as long as possible, for a maximum of 30 seconds, followed by a 1-minute rest.

The patient is asked to bear down as if to defecate. This test is conducted without and with distention of a 50-mL rectal balloon, separated by an interval of 30 seconds.

Cough reflex test was applied to assess the integrity of spinal reflex pathways in patients with incontinence. The patient is asked to cough, normally, the increased abdominal pressure triggers external sphincter contraction.

To assess rectal sensation, the rectal balloon is initially distended with air in increments of 10 mL, until the patient reports a first sensation. Thereafter, the balloon is increased in 20-mL steps up to a maximum volume of 400 mL. The distensions should be terminated earlier if the maximum tolerable volume is reached. Each distension is maintained for at least 30 seconds. Patients are asked to report sensations (first sensation, desire to defecate and urgency to defecate).

Recto anal inhibitory reflex was elicited by a volume of 15 mL, it is efficient to inflate the balloon to 50 mL of air to assess this reflex.

This manometry was repeated after 1 month (4 biofeedback sessions) and by the end of biofeedback sessions.

Biofeedback was planned after full guardians' education. Modification of the patient diet was planned to include high fibers with limitation of fast foods, spicy drinks and caffeine. Local hygiene for perianal skin for soiling episodes and using zinc oxide cream to prevent excoriation.

Biofeedback was done using two types of catheters; a 24-channel water-
perfused catheter with latex balloon for sensory training and double lumen rectal PVC balloon clothed catheter (MMS U-72210) for Strength training.

Biofeedback was done for all patients in the left lateral position with knees and hips bent at a 90 degree angle. The protocol for biofeedback therapy included sensory and strength training.

Strength training by asking the patient to concentrate on contracting the external anal sphincter without a balloon, while watching his/her own tracings, the patient tries to modify the external sphincter response. The patients were also given a program of sphincter exercises to practice at home.

The sensory training by repeated inflations and deflations of a balloon in stepwise increments of 5 mL of air or saline by 24-channel water-perfused catheter with latex balloon. The patients were required to retrain the rectal sensory threshold, usually with the aim of enabling the patient to discriminate and respond to smaller rectal volumes.

Biofeedback sessions were planned once a week for 1 month then once every two weeks for 2 months.

After completions of sessions the parents asked to continue on diet and sphincter exercise for 1 year.

All patients will have clinical evaluation every month for 6 months by Vaizey score.

Data management and statistical analysis were done using SPSS vs.25. (IBM, Armonk, New York, United states). Numerical data was summarized as means and standard deviations or medians and ranges. Categorical data was summarized as numbers and percentages.

Comparisons between cases and controls were done using Mann Whitney U test for numerical data. Categorical data was compared using Chi-square test.

Different manometry findings were compared at different points using repeated measures ANOVA. Squeezing pressure was compared between males and females at different points using two way repeated measures ANOVA.

All pairwise comparisons were adjusted for multiple comparisons. All P values were two sided. P values less than 0.05 were considered significant.
Results

The current study included 150 children with functional non retentive fecal incontinence and 10 normal children. There were no significant differences between both groups as regard age and gender as shown in table 1.

Table (1) Demographic characteristics in cases and controls

<table>
<thead>
<tr>
<th></th>
<th>Cases (n = 150)</th>
<th>Controls (n = 10)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age (years)</strong></td>
<td>Mean ±SD</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Males</td>
<td>10 ±3</td>
<td>11 ±3</td>
<td>0.129</td>
</tr>
<tr>
<td>Females</td>
<td>77 (51.3)</td>
<td>5 (50.0)</td>
<td></td>
</tr>
</tbody>
</table>

Mann Whitney U test was used for age. Chi-square test was used for gender

Manometry findings in cases and control before starting biofeedback therapy

Mean resting pressure was significantly higher in controls (52) compared to cases (34). P value <0.001.

As regard mean squeeze pressure was significantly higher in controls (158) compared to cases (97.0). P value was <0.001.

Median 1st sensation volume was significantly higher in cases (80.0) compared to controls (20.0). P value was <0.001.

As regard 1st urge and intense urge volumes, they were higher in cases (141 & 204) compared to controls (109 & 186) respectively. The difference was borderline significant. P values were 0.054 and 0.085. (Table 2)

Table (2) : Manometry findings in cases and control before starting biofeedback therapy

<table>
<thead>
<tr>
<th></th>
<th>Cases (n = 150)</th>
<th>Controls (n = 10)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Resting pressure</strong></td>
<td>Mean ±SD</td>
<td>34 ±9</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td><strong>Squeeze pressure</strong></td>
<td>Mean ±SD</td>
<td>97 ±15</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td><strong>1st sensation</strong></td>
<td>Median (range)</td>
<td>80 (20 - 250)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td><strong>1st urge</strong></td>
<td>Mean ±SD</td>
<td>141 ±50</td>
<td>0.054</td>
</tr>
<tr>
<td><strong>Intense urge</strong></td>
<td>Mean ±SD</td>
<td>204 ±48</td>
<td>0.085</td>
</tr>
</tbody>
</table>
Squeezing pressure in males and females in cases

There was a significant interaction between squeezing pressure at different time points and gender. P value on interaction is <0.001.

After 4 sessions, median percent change in squeezing pressure from baseline was significantly higher in males (44%) compared to females (33%). P value = 0.003

After 8 sessions, median percent change in squeezing pressure from baseline was significantly higher in males (81%) compared to females (68%). P value = 0.003

table 3

Table (3) Squeezing pressure in males and females at baseline, after 4 and 6 months

<table>
<thead>
<tr>
<th>Squeeze pressure</th>
<th>Baseline</th>
<th>Mean ±SD</th>
<th>Males (n = 73)</th>
<th>Females (n = 77)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>100 ±17</td>
<td>94 ±13</td>
<td>0.014</td>
</tr>
<tr>
<td>After 4 sessions</td>
<td>Mean ±SD</td>
<td></td>
<td>145 ±22</td>
<td>126 ±12</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>% Change</td>
<td>Median (range)</td>
<td>44 (0 - 15)</td>
<td>33 (9 - 100)</td>
<td>0.003</td>
<td></td>
</tr>
<tr>
<td>After 8 sessions</td>
<td>Mean ±SD</td>
<td></td>
<td>184 ±27</td>
<td>155 ±16</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>% Change</td>
<td>Median (range)</td>
<td>81 (26 - 250)</td>
<td>68 (27 - 157)</td>
<td>0.001</td>
<td></td>
</tr>
</tbody>
</table>

Two way repeated measures ANOVA was used.

P value of interaction was <0.001

The current study shows significant improvement in resting anal pressure with the progression of the biofeedback sessions, this is reflected by significant increase in the mean resting pressure that was 39 ±6 mmHg after 4 sessions and 41 ±5 mmHg after 8 sessions compared to baseline that was 34 ±9 mmHg. (fig.1, fig.2)
Figure 1: high resolution anorectal manometry, resting pressure before biofeedback

Figure 2: high resolution anorectal manometry, resting pressure after completion biofeedback.

Also there was significant improvement in the squeeze pressure over time with mean of 97 ±15 mmHg, 135 ±20 mmHg and 169 ±26 mmHg before biofeedback sessions, after 4 sessions and after 8 sessions respectively. (Fig.3, fig.4)
Figure 3: High resolution anorectal manometry, squeeze pressure before biofeedback.

Figure 4: High resolution anorectal manometry, squeeze pressure after completion biofeedback.

As shown in table 4 there was overall significant improvement of the sensation that was reflected by decrease the volume for the 1st sensation, 1st urge and intense urge with p value of <0.001
Table 4 Manometric measurements at baseline, after 4 and 8 sessions

<table>
<thead>
<tr>
<th>P value</th>
<th>Resting pressure</th>
<th>Baseline</th>
<th>34 ±9&lt;sup&gt;a&lt;/sup&gt;</th>
<th>&lt;0.001</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>After 4 sessions</td>
<td>39 ±6&lt;sup&gt;b&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>After 8 sessions</td>
<td>41 ±5&lt;sup&gt;c&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Squeeze pressure</td>
<td>Baseline</td>
<td>97 ±15&lt;sup&gt;a&lt;/sup&gt;</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td></td>
<td></td>
<td>After 4 sessions</td>
<td>135 ±20&lt;sup&gt;b&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>After 8 sessions</td>
<td>169 ±26&lt;sup&gt;c&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td>1st sensation volume</td>
<td>Baseline</td>
<td>80 (20 - 250)&lt;sup&gt;a&lt;/sup&gt;</td>
<td></td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>(cc)</td>
<td></td>
<td>After 4 sessions</td>
<td>40 (20 - 120)&lt;sup&gt;b&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>After 8 sessions</td>
<td>30 (10 - 50)&lt;sup&gt;c&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td>1st urge volume (cc)</td>
<td>Baseline</td>
<td>141 ±50&lt;sup&gt;a&lt;/sup&gt;</td>
<td></td>
<td>&lt;0.001</td>
</tr>
<tr>
<td></td>
<td></td>
<td>After 4 sessions</td>
<td>120 ±33&lt;sup&gt;b&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>After 8 sessions</td>
<td>108 ±24&lt;sup&gt;c&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td>Intense urge</td>
<td>Baseline</td>
<td>204 ±48&lt;sup&gt;a&lt;/sup&gt;</td>
<td></td>
<td>&lt;0.001</td>
</tr>
<tr>
<td></td>
<td></td>
<td>After 4 sessions</td>
<td>185 ±34&lt;sup&gt;b&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>After 8 sessions</td>
<td>211 ±34&lt;sup&gt;a,c&lt;/sup&gt;</td>
<td></td>
</tr>
</tbody>
</table>

Data presented as mean and standard deviation
Repeated measures ANOVA was used
Different letters indicate statistical significant pair

Incontinence score showed overall significant improvement between different measures. Pairwise analysis revealed that mean incontinence score was significantly lower after 4 sessions (2), after 8 sessions (1) and after 3 months (0). Also it was significantly lower after biofeedback compared to baseline (12) table 5.
Table (5) Incontinence score at baseline, after 4 and 6 sessions

| Incontinence score | Baseline 12 (6 - 20) a | <0.001 | After 4 sessions 2 (0 - 10) b | After 6 sessions 0 (0 - 4) c | After 3 months 0 (0 - 6) c,d |

Data presented as median and range

Repeated measures ANOVA was used

Different letters indicate statistical significant pair

Manometry findings in cases after completion of biofeedback therapy compared to controls

There were no significant differences between cases after completion of biofeedback therapy and controls as regard squeezing pressure and 1st urge. P values were 0.228 and 0.428 respectively.

Mean resting pressure was significantly higher in controls (52 mmHg) compared to cases (41 mmHg). P value = 0.003

Mean 1st sensation volume was significantly lower in controls (20 cc) compared to cases (27 cc). P value = 0.009

Intense urge volume was significantly lower in controls (186 cc) compared to cases (211 cc). P value = 0.007

Table (6) Manometry findings in cases after completion of therapy and controls

<table>
<thead>
<tr>
<th>Cases (n = 150)</th>
<th>Controls (n = 10)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean ±SD</td>
<td>Mean ±SD</td>
</tr>
<tr>
<td>Resting pressure</td>
<td>41 ± 5</td>
</tr>
<tr>
<td>Squeeze pressure</td>
<td>169 ± 26</td>
</tr>
<tr>
<td>1st sensation</td>
<td>27 ± 8</td>
</tr>
<tr>
<td>1st urge</td>
<td>108 ± 24</td>
</tr>
<tr>
<td>Intense urge</td>
<td>211 ± 34</td>
</tr>
</tbody>
</table>

Mann Whitney U test was used
Discussion

Although fecal incontinence is a socially devastating disorder, many physicians are still unaware that it is often amenable to treatment. Recently, well-designed, randomized trials have shown that standard medical care implemented with simple pelvic floor exercises is effective in a large percentage of patients with fecal incontinence. Attention to diet, scheduled defecations and judicious use of anti-diarrheal medications seem to preserve a relevant role in this “untreatable” disease. (9)

Biofeedback therapy is an accepted option for treatment of fecal incontinence. It is relatively easy, non-invasive, reliable, however there is continuous controversies regarding its efficacy due to methodological studies limitations. Biofeedback could be considered as the first line therapy in patients with fecal incontinence. (10)

The current study included 150 children with FNRFI with mean age of 10±3 years who were applied for biofeedback therapy

In the beginning of the treatment program, the children were afraid from the biofeedback technique and demonstrated mild pain, but the children got used to the techniques quickly and went on in the treatment protocols.

Anorectal manometry of patients included in the study show several abnormalities: a decrease in resting pressure, a decrease in maximum squeeze pressure, a low intense urge volume and increase in the rectal volume necessary to induce first rectal sensation.

In an attempt to identify any parameters that can reliably predict treatment outcome, variables such age; gender; the underlying etiology for fecal incontinence and the initial anorectal manometry parameters were studied.
Age was not predictive of a successful outcome. This was in agreement with the studies that found age not to be important in predicting the outcome of biofeedback therapy; (11) Although Ferna´ndez et.al (12) found that young age negatively affected the responsiveness of anal incontinence to treatment.

The current study revealed a significant interaction between squeezing pressure at different time points and gender with value on interaction is <0.001. This is in the same line with Jason et. al (13) who describe the effect of gender in anorectal manometry in fecal incontinence suggesting differences in the pathophysiology of fecal incontinence in female versus male patients.

We noticed that successful results of biofeedback were associated with significant improvement in rectal sensations more than improvement in maximum squeeze pressure and this match with Chiarioni et. al (14) who suggested that sensory discrimination training may be the most important ingredients of successful training.

The current study showed significant improvement of strength of anal sphincter after biofeedback therapy and this was reflected by significant increase of squeeze and resting pressure. This matches with Sun et.al (15) who concluded in their study that biofeedback therapy improves resting and squeeze pressure in children.

In our study there was significant improvement of rectal sensation after biofeedback therapy. The improvement begin after the 1st session of biofeedback therapy and significant improvement were observed after four sessions , the mean 1st sensation volume was significantly lower after 4 sessions (40 cc) and after 6
sessions (30 cc) compared to baseline (80 cc).

As regards the intense urge early after 4 sessions the volume that induce intense urge decreased but after completions of biofeedback sessions this volume increased. This may be due to we try to train patient to early recognize the 1st sensation in early sessions then in later sessions we train them to increase rectal compliance by increasing the volume of intense urge.

These findings are matching with those of Terra et al. They found significant improvement of rectal sensation after biofeedback therapy and they attributed this improvement to improved pattern of recognition of both sensory pathway and cerebellar cortex. They also match with findings of Bols et al. who found training to enhance rectal discrimination of sensation may be helpful in reducing fecal incontinence.

Regarding incontinence score our study showed overall significance between different measures. Pairwise analysis revealed that median incontinence score was significantly lower after 4 sessions (2), after 8 sessions (0) and after 3 months (0) compared to baseline.

The results of the Norton trial suggest that biofeedback provides no specific benefit and that the cost associated with it may be unjustified. However, subsequent studies have used a step-wise protocol, trying the simpler interventions first and then only recruiting those who fail to respond to simpler measures such as diet and education.

These later studies have found a difference between exercise alone and exercise with the addition of rectal balloon or EMG biofeedback in favor of adding biofeedback.

In our study, the benefits of biofeedback therapy for function
anal incontinence in children lasted for a long time. We checked the patients after 3 months we found 12 patients (8%) complaint from minor degree of FI with score range from 2 to 6 on Vaizy score these patient treated with diet and regular bowel training and the patients didn’t need biofeedback therapy again and all become continent.

Then we checked the patients after six months of completing biofeedback sessions and none of the children required retraining. This match with findings of Byoung et. al (20) who found all patients who responded to biofeedback therapy have maintained the improvement on the most recent follow-up by telephone interview.

References


incontinence: where are we, and where are we going? World J Gastroenterol; 11:4771-4775.


