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ORIGINAL ARTICLE

Biofeedback training in persistent encopresis in children with dyssynergic defecation

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ABSTRACT

Background: Encopresis with dyssynergic constipation is very common in the pediatric population. Biofeedback therapy could be more effective than laxatives, and it has no known adverse effects. In this study, we aimed to evaluate the role of biofeedback training in persistent encopresis in children with dyssynergia. **Methods:** A randomized clinical trial was carried out on 38 children with dyssynergic- defecation who visited the GIT motility unit—a multimodal treatment of 6 weeks. Children were randomized into two groups. Each group received dietary, toilet advice, enemas, and oral laxatives. One group also received 6 biofeedback training sessions. Outcome measures were 1-Patient-reported outcome measures (Patient Assessment of Constipation Quality of Life (PAC QOL) score; Wexner/Cleveland Clinic Fecal Incontinence Score (CCFIS) and Bristol stool form score (BSFS) were done baseline and 6 weeks after. 2- High-resolution manometry assessment was done before and 3 months after treatment. **Results:** Both groups showed improvement in constipation-related symptoms and quality of life during treatment (within the biofeedback group, there was a significant decrease in scores from 85.74 to 0, while within the conventional treatment group, the decrease was from 87.63 to 28), there was a statistically significant decrease in incontinence score among the studied groups; with higher scores reported among conventional treatment patients, both groups differed significantly as regard remission at 6th week and 6th months (p=0.022, 0.012 respectively). Full remission occurred in 42.1% versus 78.9% within the conventional group versus biofeedback groups, respectively, in the 6th week. In the 6th month, full remission occurred in 52.63% versus 89.47% within the conventional group versus biofeedback groups, respectively, at the 6th week. **Conclusions:** Biofeedback combined with conventional treatment could be superior to the conventional treatment alone in managing encopretic patients with dyssynergic defecation; it improved the quality of life, maintaining the continence response and correcting the physiological manometric parameters.

Keywords: Biofeedback training, persistent encopresis, children, dyssynergic defecation.

INTRODUCTION

Dyssynergic defecation (DD) (etymology: “dys” = abnormal and “synergia” = coordination) refers to any disturbance of the neuromuscular coordination between abdominal, rectoanal, and pelvic floor muscles, leading to inadequate rectal propulsive forces and increased resistance to defecation [1].

In most children, it is a result of poor toileting habits, painful defecation, or brain-gut dysfunction. Stool withholding behavior, "retentive posture," is a major cause of constipation and, consequently, fecal retention, which results in encopresis (the involuntary passing of stool into inappropriate places in children older than four years of age, which is the age of control) due to leakage of liquid stool around the impacted stool. Encopresis causes physical and emotional distress and concerns for children and their families, ultimately impairing health-related quality of life. [2].

Diagnosis of DD requires 3 components: first, the occurrence of constipation symptoms according to The Rome IV criteria requires ≥ 2 of the following, occurring at least once a week for a minimum of one month: ≤ 2 defecations per week; ≥ 1 episode of fecal incontinence a week; retentive posturing; painful or hard bowel movements; large fecal mass in the rectum [3]. Second, manometric evidence of dyssynergic pattern during attempted defecation; and third, another abnormal colorectal test such as the balloon expulsion test, defecography, or markers retention with colonic transit study [4].

One effective method for dyssynergic defecation treatment is biofeedback therapy. According to many randomized controlled trials, manometry-based biofeedback therapy, administered throughout four to six sessions, has an efficacy rate of 70 to 80 % when compared to standard treatment for DD and demonstrated that the biofeedback therapy effects, which includes rectoanal coordination, sensory training, and simulated feces, last for a long time [5].

We hypothesized that visual assisted biofeedback training could have an additive effect on laxatives in the treatment of encopresis with dyssynergia, so this research aimed to evaluate the role of biofeedback training in persistent encopresis in children with dyssynergia.

SUBJECTS AND METHODS

This randomized clinical trial was done in the Tropical Medicine Department at Zagazig University Hospitals from March 2023 to December 2023.

The study included 38 patients with encopresis secondary to dyssynergic defecation.

Inclusion Criteria: Patients aged 6 to 18 years old who had functional dyssynergic constipation with encopresis according to Rome IV, which required 2 or more of the following, happening every week for at least a month: The following symptoms should be present: at least two defecations per week, at least one episode of fecal incontinence per week, retentive posture, painful or hard bowel motions, a huge fecal mass in the rectum, and stools with a diameter that can obstruct the toilet [7].

Exclusion criteria: we excluded secondary constipation causes such as (Hypothyroidism, Hypercalcemia, Celiac disease, Sacral nerve damage, Rectocele, rectal prolapse, Rectal intussusceptum, colonic stricture, irritable bowel disease, Hirschsprung disease, or who were taking following Medication: opioids, calcium and iron supplements, anticholinergic, clonidine.

This study followed the guidelines [the World Medical Association's Code of Ethics (Declaration of Helsinki) for human studies]. All participants provided informed and written consent. The Institutional Review Board has approved this research (#10513/5-3-2023).

All the included children were subjected to the entire history. Questions related to constipation and encopresis were asked with a focus on (The onset of constipation, how often the bowels empty, the consistency of the stool, and any other visible symptoms, dietary habits, previous anorectal or bowel surgery, medications, number of episodes and timing of fecal incontinence, withholding behavior and painful bowel movement. To assess constipation and monitor the effects of therapy, we used validated scales and questionnaires such as (the Bristol stool chart, fecal incontinence score, and patient assessment constipation- quality of life questionnaire).

All patients were examined using a general and digital rectal examination to exclude secondary causes of constipation. Laboratory data was requested to exclude organic causes of constipation, such as (CBC, serum calcium, thyroid profile, anti-TTG IgA, fecal calprotectin, and pelvi-abdominal X-ray).

Anorectal manometry (anorectal functional tests): to diagnose dyssynergic defecation and consistent symptoms according to ROME criteria. The Bristol stool form scale was used on a scale from very hard (type 1) to very soft (type 2) (type 7). [9].

Assessment of Constipation-Quality of Life (PAC-QoL) questionnaires: This 28-item self-reporting questionnaire measures the quality of life of patients undergoing constipation evaluations. Physical discomfort (items 1-4), psychosocial discomfort (items 5-12), fears and concerns (items 12-23), and satisfaction (items 24-28) are the four subscales that make up the overall measure [10]. On a five-point Likert scale, from 0 to 4, the questionnaire asked participants to rate the severity of their symptoms [11,12].

The severity of encopresis was assessed by the Cleveland Clinic Florida (Wexner) fecal incontinence score: Minimum score of 0 (perfect continence), maximum score of 20 (complete incontinence) [13,14].

Manometry procedure:

All cases used the solar GI HRAM device (High-Resolution Anorectal Manometry). Before inserting the catheter, a digital rectal examination was performed using a finger that was lubricated and gloved. Anal squeezing pressure and anal tone were measured. The subjects may keep taking their regular meds and were not required to change their diet. If digital rectal examination revealed the presence of stools, an enema was administered, with a 30-minute interval between the enema's insertion and the placement of the probe. No sedative was administered. Data collecting and processing were carried out using a manometric system (Medical Measurement System), which is available for purchase. The intensity of color on the computer screen represented pressure, and pressure activity was shown as a plot of colors. A familiarisation run-in period of three minutes was granted to ensure the patient's comfort and a return to basal levels of sphincter tone. A 60-second recovery gap was used between each maneuver during the test. We repeated each maneuver three times [15].

The 38 patients were randomly computerized and categorized into two groups. **Group 1 (conventional group):** Included 19 patients who received conventional treatment in three steps: disimpaction, maintenance treatment, and weaning. Disimpaction was achieved with rectally administered enema or temporary high-dose oral polyethylene glycol PEG (PEG; 1–1.5 g/kg/day) (with a maximum of 6 days). Maintenance therapy with Lactulose (70% solution): 1 mL/kg three times per day. Maintenance therapy was initiated to prevent the re-accumulation of feces and continued over 6 weeks. Because relapses might occur after abruptly stopping maintenance medication, it was tapered off gradually. For weaning, use lactulose in a 70% solution. Once symptoms have been stable for one month while on maintenance medication, which means the child defecates at least three times a week and does not meet any other Rome criteria, weaning can be explored. Over three months, weaning dosages were progressively reduced to 75%, 50%, and 25% until they were finally stopped.

Group 2 (The Biofeedback group): 19 patients who received the same conventional treatment and computer-assisted visual biofeedback training sessions were included.

The patient was placed in the left lateral position for the biofeedback training procedure. The same nurse conducted six weekly 30–45-minute biofeedback training sessions using computer software. The computer screen showed changes in the pressure activity, which provided visual input, while the nurse gained oral feedback. When rectal sensitivity was lost, a balloon was inserted distally into the anorectal manometry catheter to help with training. Usually, an anorectal manometry catheter and the right software program were used [16].

Criteria for therapy outcomes: At six months follow-up, the main outcome was the elimination of fecal incontinence. **Full remission** was defined as on medication and no soiling for at least four weeks; **Partial remission** was defined as soiling no more than once a week, regardless of medication used [17].

STATISTICAL ANALYSIS

Software version 26 of SPSS (Statistical Package for the Social Sciences) was used for data analysis. We used the absolute frequencies to characterize the categorical variables and compared them using chi-square tests and Fisher tests as needed. Parametric tests' assumptions were checked with the Shapiro-Wilk test; normally distributed data was tested with the independent sample t-test and the Mann-Whitney test; non-normally distributed and categorical data were tested using the Wilcoxon signed rank test.

RESULTS

No significant differences were found between the two groups regarding gender, age, duration of

symptoms, laboratory data, or baseline manometric findings (Table 1).

Significant differences were found in the pre-and post-treatment after 3 months between the groups in the manometric parameters regarding defecation index ($p<0.001$), duration of squeeze pressure ($p<0.001$), push relaxation (%) ($p<0.001$) and push rectal pressure rise ($p=0.04$) and max squeeze pressure after treatment ($p=00.039$); all were higher among biofeedback group (Table 2).

Improvement in physiological parameters was noted following BF (mean resting pressure 54.58 mmHg versus 69.58mmHg; mean maximum squeeze pressure 161.741mmHg versus 118mmHg; median duration of squeeze pressure17.9 seconds versus 7.7seconds; median push relaxation % (32.5% versus 11.9%); median push rectal pressure rise 46 mmHg versus 32 mmHg; defecation index 2.02versus 0.86) (Table 3, Figure 1).

Both groups improved constipation-related symptoms and quality of life starting from the third, fourth, fifth, and sixth weeks. In the biofeedback patient group, the average PAC-QOL score dropped from 85.74 to 0; in the conventional treatment group, it decreased from 87.63 to 28. Also, significant differences were found in the pre-and post-treatment scores on the PAC-QOL score between the two treatment groups; lower scores were in the biofeedback group, and there were statistically significant decreases in Wexner/Cleveland Clinic Fecal Incontinence Score between the groups studied groups with higher scores reported among conventional treatment patients (Table 4).

Statistically significant differences were revealed between both groups regarding PAC-QoL and CCFIS ($p<0.001$ and $p=0.033$, respectively) after treatment. Still, no significant differences were found between the studied groups regarding BSFS (Table 5).

Statistically significant differences were found between the studied groups regarding remission at the 6th week and 6th month ($p=0.022$ and 0.002, respectively). Full remission occurred in 42.1% versus 78.9% within the conventional group versus biofeedback groups, respectively, in the 6th week. In the 6th month, full remission occurred in 52.63% versus 89.47% within the conventional and biofeedback groups in the 6th week (Table 6).

Table (1) : Demographic data, laboratory data, radiological data, baseline physiological parameters among the studied groups:

	Conventional treatment group	**Biofeedback group**	**χ^2**	**p**
	N=19 (%)	**N=19 (%)**		
Gender: Female Male	9 (47.4%) 10 (52.6%)	8 (42.1%) 11 (57.9%)	0.106	0.744
	Mean ± SD	**Mean ± SD**	**t**	**p**
Age (year)	10.58 ± 3.01	10.32 ± 3.32	0.256	0.799
	Median (IQR)	**Median (IQR)**	**Z**	**p**
Duration of symptoms (month)	24(12 – 36)	18(18 – 36)	-0.015	0.988

	Conventional treatment group	**Biofeedback group**	**t**	**p**
	Mean ± SD	**Mean ± SD**		
Hemoglobin(g/dl)	12.56 ± 0.6	12.14 ± 0.94	1.649	0.108
Serum calcium	9.75 ± 0.73	9.93 ± 0.78	-0.708	0.484
TTG (IU/ml)	4.76 ± 2.74	4.6 ± 3.11	0.172	0.865
TSH (mIU/L)	2.4 ± 0.98	2.63 ± 0.64	-0.841	0.406
Fecal calprotectin (ug/g)	33.42 ± 10.1	31.63 ± 9.78	0.555	0.582
X ray	**N=19 (%)**	**N=19 (%)**	**χ^2**	**p**
Impacted stool	19 (100%)	19 (100%)	0	>0.999

	Conventional treatment group Biofeedback group		t	p
	Mean ± SD	**Mean ± SD**		
Resting pressure (mmHg)	73.89 ± 25.35	69.58 ± 24.11	-0.78	0.435
Max squeeze pressure(mmHg)	136.53 ± 34.45	118.0 ± 31.88	1.721	0.094
Defecation index	0.84 ± 0.28	0.86 ± 0.24	-0.273	0.786
	Median (IQR)	**Median (IQR)**	**Z**	**p**
Duration of squeeze pressure (second)	7.1(5 – 9)	7.7(4.6 – 9.8)	-0.234	0.815
Push relaxation (%)	11.9(-44.56, 13.51%)	11.9(-46.66, 16.1%)	-0.044	0.965
Push rectal pressure rise (mmHg)	22(17 – 47)	37(17 – 45)	-0.423	0.672
Rectal volume for first sensation	87 ±17	90 ± 19	-0.513	0.611
Rectal Volume for defecation desire	106 ±15	110 ±18	-0.744	0.462
Balloon expulsion test (seconds)	155±30	160±35	-0.473	0.639
Dyssynergic defecation	19 (100%)	19 (100%)	0	>0.999

χ^2Chi square test t independent sample t test Z Mann Whitney test IQR interquartile range

Table (2) :physiological parameters three months after treatment among the studied groups:

	Mean ± SD	**Mean ± SD**		
Resting pressure (mmHg)	69.58 ± 23.34	54.58 ± 9.21	2.606	0.013*
Max squeeze pressure(mmHg)	141.21 ± 33.8	161.74 ± 24.72	-2.137	0.039*
Defecation index	1.01 ± 0.23	2.02 ± 0.58	-7.147	<0.001**
	Median (IQR)	**Median (IQR)**	**Z**	**p**
Duration of squeeze pressure (second)	9(8 – 9.5)	17.9(16.8 – 20)	-4.46	<0.001**
Push relaxation (%)	9.09(-32.05,17.64%)	32.5(29.09, 48.61%)	-4.92	<0.001**
Push rectal pressure rise (mmHg)	31(18 – 50)	46(42 – 56)	2.06	0.04*
Rectal volu md for first sensation (cc)	74 ±10	63±9	3.564	<0.001**
Rectal volume for defecation desire (cc)	92 ± 8	75±7	6.499	<0.001**
Ballon expulsion test (seconds)	125±16	58±9	15.909	<0.001**
Dyssynegic Defecation	17 (89.5%) 1/19 inadequate propulsive force	2 (10.5%)	Fisher	<0.001**

t independent sample t test Z Mann Whitney test χ^2 Chi square test

Table (3) :physiological parameters before and three months after conventional and biofeedback treatment:

Conventional group	**t**	**p**	
Resting pressure			
Baseline (Mean ± SD)	73.89 ± 25.35	4	<0.001**
After (Mean ± SD)	69.58 ± 23.34		
Max squeeze pressure(mmHg)			
Baseline (Mean ± SD)	136.53 ± 34.45	-4.827	<0.001**
After (Mean ± SD)	141.21 ± 33.8		
Rectal volume of first sensation (cc)			
Baseline (Mean ± SD)	87 ± 17	-5.171§	<0.001**
After (Mean ± SD)	74 ± 10		
Rectal volume for defecation desire (cc)			
Baseline (Mean ± S)	١٠٦ ± 15	-2.746	0.013*
After (Mean ± SD)	92 ± 8		
Ballon expulsion test (seconds)			
Baseline (Mean ± SD)	١٥٥± 30	10.786	<0.001**
After (Mean ± SD)	125 ± 16		
Dyssynetgic defecation			
Baseline	19/19	-1.414	0157
After	17/19		
Duration of squeeze pressure (second)			
Baseline [Median (IQR)]	7.1(5 – 9)	-3.517§	<0.001**
After [Median (IQR)]	9(8 – 9.5)		
Push relaxation (%)			
Baseline [Median (IQR)]	11.9(-44.56, 13.51%)	-2.415§	0.016*
After [Median (IQR)]	9.09(-32.05, 17.64%)		
Push rectal pressure rise (mmHg)			
Baseline [Median (IQR)]	22(17 – 47)		
After [Median (IQR)]	31(18 – 50)	-3.227§	0.001**
Defecation index			
Baseline (Mean ± SD)	0.84 ± 0.28	-4.751	<0.001**
After (Mean ± SD)	1.01 ± 0.23		
Biofeedback group		**Z**	**p**
Resting pressure			
Baseline (Mean ± SD)	69.58 ± 24.11	3.774	0.001**
After (Mean ± SD)	54.58 ± 9.21		
Max squeeze pressure(mmHg)			
Baseline (Mean ± SD)	118.0 ± 31.88	-6.227	<0.001**
After (Mean ± SD)	161.74 ± 24.72		
Rectal volume for first sensation (cc)			
Baseline (Mean ± SD)	90 ± 19	-3.585	<0.001**
After (Mean ± SD)	63 ± 9		
Rectal volume for defecation desire (cc)			
Baseline (Mean ± SD)	110 ± 18	-4.019	0.001**
After (Mean ± SD)	75 ± 7		
Balloon expulsion test (seconds)			
Baseline (Mean ± SD)	١٦٠± 35	20.943	<0.001**
After (Mean ± SD)	58± 9		
Dyssynergic defecation			

Conventional group t	p	Conventional group t	p
Baseline	19/19	-4.123	<0.001**
After	2/19		
Duration of squeeze pressure (second)			
Baseline [Median (IQR)]	7.7(4.6 – 9.8)	-3.517	<0.001**
After [Median (IQR)]	17.9(16.8 – 20)		
Push relaxation (%)			
Baseline [Median (IQR)]	11.9(-46.66, 16.1%)	-2.415	0.016*
After [Median (IQR)]	32.5(29.09, 48.61%)		
Push rectal pressure rise (mmHg)			
Baseline [Median (IQR)]	37(17 – 45)		
After [Median (IQR)]	46(42 – 56)	-3.543	0.001**
Defecation index			
Baseline (Mean ± SD)	0.86 ± 0.24	-7.943	<0.001**
After (Mean ± SD)	2.02 ± 0.58		

§ t Paired sample t test Wilcoxon signed rank test *p<0.05 is statistically significant **p≤0.001 is statistically highly significant

Table (4): Patient Assessment of Constipation Quality of Life (PAC-QoL), and The Wexner/Cleveland Clinic Fecal Incontinence Score (CCFIS) data before and six weeks after treatment:

Patient Assessment of Constipation Quality of Life (PAC-QoL) before and six weeks after treatment				
	Conventional treatment group	**Biofeedback group**	**t**	**p**
	Mean ± SD	**Mean ± SD**		
Baseline	87.63 ± 14.32	85.74 ± 14.26	0.40	0.685
First week	77.11 ± 13.55	74.16 ± 16.12	0.61	0.546
p (pt)	<0.001**	<0.001**		
Second week	59.47 ± 17.2	50.79 ± 17.72	1.533	0.134
p (pt)	<0.001**	<0.001**		
	Median (IQR)	**Median (IQR)**	**Z**	**p**
Third week	46(32 – 75)	28(24 – 44)	-2.045	0.041*
p (Wx)	0.001**	<0.001**		
Fourth week	35(18 – 75)	9(0 – 22)	-2.795	0.005*
p (Wx)	0.002*	<0.001**		
Fifth week	32(15 – 59)	0(0 – 11)	-3.729	<0.001**
p (Wx)	0.012*	0.001**		
Sixth week	28(14 – 59)	0(0 – 0)	-4.36	<0.001**
p (Wx)	0.011*	0.041*		
p§	<0.001**	<0.001**		
The Wexner/Cleveland Clinic Fecal Incontinence Score (CCFIS) before and six weeks after treatment				
	Conventional treatment group	**Biofeedback group**	**Z**	**p**
	Median (IQR)	**Median (IQR)**		
Baseline	12 (9 – 16)	12(8 – 16)	-0.78	0.435
First week	12 (8 – 12)	12(8 – 12)	-1.702	0.089
p (Wx)	>0.999	0.01*		
Second week	9(9 – 12)	6(4 – 9)	-3.105	0.002*
p (pt)	0.004*	<0.001**		

Third week	6(0 – 12)	0(0 – 0)	-2.456	0.014*
p (Wx)	0.001**	0.001**		
Fourth week	6(0 – 9)	0(0 – 0)	-2.207	0.027*
p (Wx)	0.02*	>0.999		
Fifth week	4(0 – 9)	0(0 – 0)	-2.303	0.021*
p (Wx)	0.102	0.18		
Sixth week	4 (0 – 9)	0(0 – 0)	-2.304	0.021*
p (Wx)	0.655	>0.999		
Sixth month	0 (0 – 6)	0(0 – 0)	-2.246	0.025*
p (Wx)	0.001**	0.176		

t independent sample t test Z Mann Whitney test pt paired sample t test Wx Wilcoxon signed rank test $p^{\S}$ difference between baseline value and that after six weeks

0 (Perfect continence); 1–8 (mild incontinence); 8–14 (Moderate incontinence); 15–20 (Severe incontinence);
Z Mann Witney test Wx Wilcoxon signed rank test $p^{\S}$ difference between baseline value and that after six weeks **p≤0.001 is statistically highly significant *p<0.05 is statistically significant

Table (5) : Comparison between both groups regarding improvement in different outcome measures (PAC-QoL, CCFIS and BSFS) after 6 weeks :

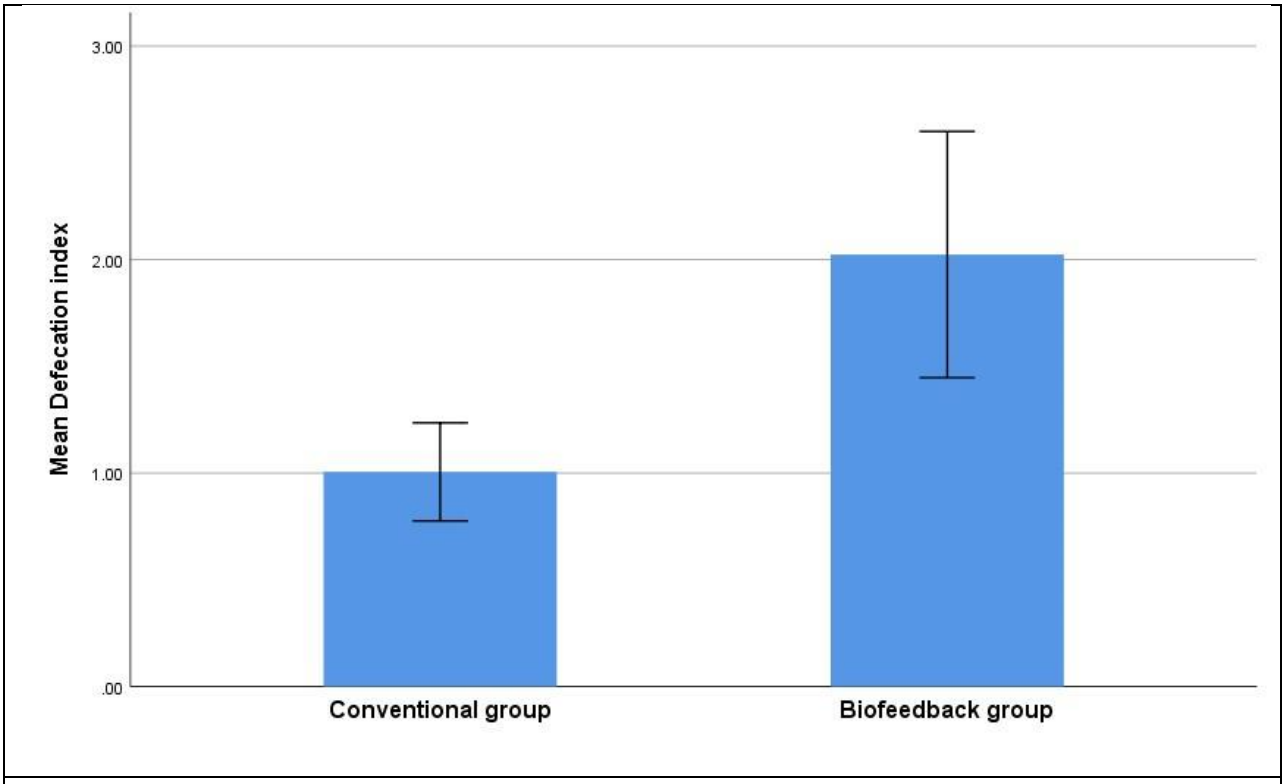
	Conventional treatment group	**Biofeedback group**	**Z**	**p**
	Median (IQR)	**Median (IQR)**		
PAC-QoL	67.82 (26.16 – 86.67%)	100(100 – 100%)	-4.421	<0.001**
CCFIS	55.56 (33.3 – 100%)	100(100 – 100%)	-2.138	0.033*
BSFS	100 (33.3 – 100%)	100(33.3 – 200%)	-0.211	0.833

Z Mann Whitney test *p<0.05 is statistically significant **p≤0.001 is statistically highly significant

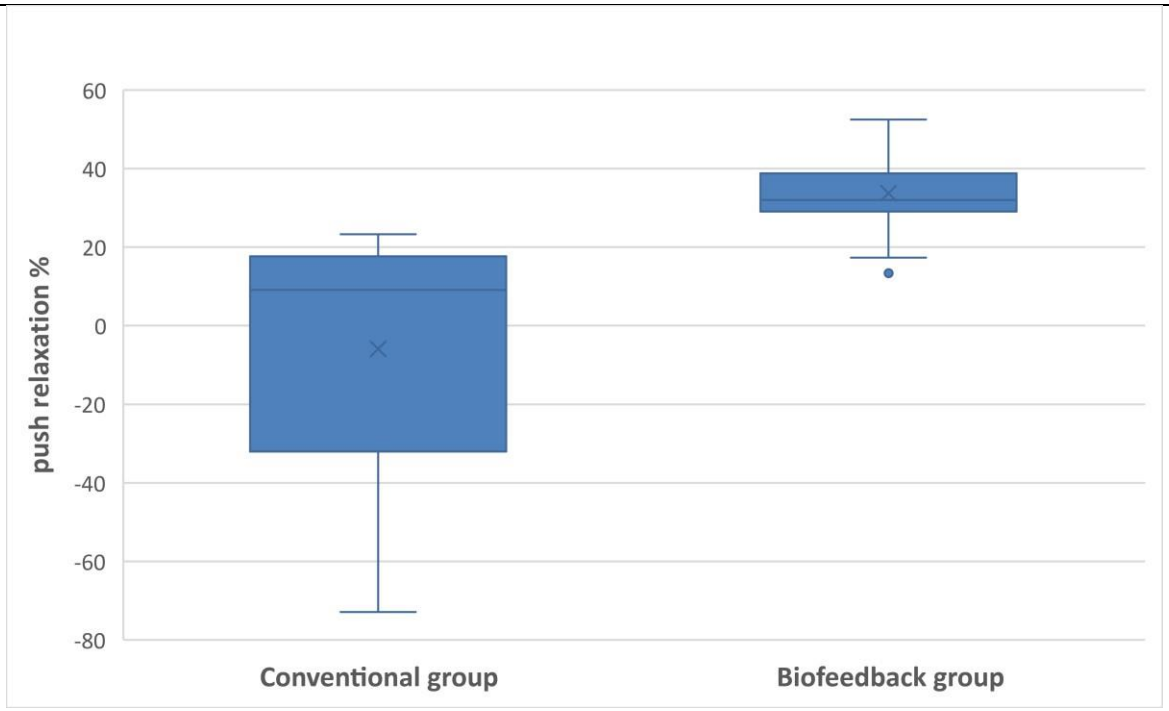
Table (7) : Incidence of soiling remission at 6th week and 6th month:

			χ^2	**p**
	Conventional treatment group	**Biofeedback group**		
	N=19 (%)	**N=19 (%)**		
Remission 6th week **No** **Partial** **Full**	 7 (36.8%) 4 (21.1%) 8 (42.1%)	 2 (10.5%) 2 (10.5%) 15 (78.9%)	5.224	0.022*
6th month No **Partial** **Full**	 2 (10.52%) 7 (36.84%) 10 (52.63%)	 0 (0 %) 2 (10.52%) 17 (89.47%)	6.283	0.012*

χ^2 Chi square for trend test



(A)



(B)

Figure (1) (A): Simple bar chart showing comparison between groups regarding defecation index three months after treatment, (B): Boxplot showing comparison between groups regarding % push relaxation three months after treatment.

DISCUSSION

Constipation in children is a common health problem affecting 0.7% to 29.6 % of children worldwide. There are three recognized heterogeneous and overlapping subtypes: slow-transit constipation (STC), irritable bowel syndrome, -constipation-predominant (IBS-C), and dyssynergic defecation (DD). In tertiary care settings, the prevalence of DD among patients with chronic constipation is 40–50%. DD is characterized by the inability of the abdominal, rectal, pelvic floor, and anal sphincter muscles to properly coordinate the process of defecation, resulting in a functional anorectal obstruction and difficulty with evacuation.

According to manometric classification, Dyssynergic defecation has four types; Type one is characterized by paradoxical anal sphincter contraction instead of relaxation during defecation, Type two is characterized by inadequate rectal propulsive force with paradoxical anal sphincter contraction during defecation, type three is characterized by decreased or absence of anal sphincter relaxation during defecation, and finally type 4 is characterized by inadequate rectal propulsive force with decreased or lack of anal sphincter contraction during defecation.

Treatment modalities for dyssynergic constipation complicated with persistent encopresis include standard or conventional therapy (consisting of conventional laxatives, diet modification, and education) and biofeedback therapy.

During manometric-biofeedback therapy, patients can observe the pressure changes in their pelvic floor muscles and rectum as they defecate on screen, thanks to the helpful audiovisual aid offered by anal canal pressure monitoring. The patient learns to relax the pelvic floor and external anal sphincter through repeated training. This allows them to increase intra-abdominal pressure and modify the coordination between their belly and anorectal muscles, resulting in the cure of constipation [18].

In this study, we found that biofeedback therapy reduced the severity of constipation and was effective when used in conjunction with conventional treatment for dyssynergic defecation disorder, which improved patients' quality of life, improved the stool form, decreased the soiling episodes and corrected the physiologic High resolution -anorectal manometry parameters.

Significant differences were found in the pre-and post-treatment between the groups in the manometric parameters regarding defecation index, duration of squeeze pressure, push relaxation (%), and push rectal pressure rise and max squeeze pressure after treatment; all were higher among the biofeedback group. The biofeedback therapy (BF) group had significantly improved resting pressure after treatment. Roa et al. [19] showed that all of the manometric parameters mentioned had improved dramatically in the BF group compared to those who received standard therapy, which agreed with this present study.

Improvement in physiological parameters was noted following BF (mean resting pressure 54.58mmHg versus 69.58mmHg; mean maximum squeeze pressure 161.741mmHg versus 118mmHg; median duration of squeeze pressure17.9 seconds versus 7.7seconds; median push relaxation % (32.5% versus 11.9%); median push rectal pressure rise46 mmHg versus 32 mmHg; defecation index 2.02versus 0.86). Also, Verma et al. [20] studied the effect of BF among patients with fecal evacuation disorders. They showed that biofeedback therapy improves the anorectal physiological parameters in patients with fecal evacuation disorders regarding the maximum intrarectal pressure and defecation index, which agreed with this study.

The present study showed that 17 patients (89.47%) had corrected their dyssynergia in the biofeedback group versus only one patient (5.2%) in the conventional treatment group who had corrected his dyssynergia on high-resolution anorectal manometry. That means that biofeedback training greatly affects the restoration of the normal coordination of the rectoanal complex.

This was in accordance with Rao et al. [19], who studied the long-term efficacy of biofeedback therapy for dyssynergia and revealed that Biofeedback was superior to baseline and standard conventional treatment for correction of dyssynergia, and that was in agreement with our study results.

This study demonstrated that biofeedback therapy improved rectal sensitivity in encopretic children with dyssynergic constipation by decreasing the rectal volume for the first sensation and the rectal volume for defecation desire. Before treatment, all patients had reduced rectal sensitivity, including rectal volume for first sensation and rectal volume for defecation desire, with a statistically

nonsignificant difference. After treatment, rectal volume for first sensation decreased from (90 ±19)to (63± 9) in the biofeedback group versus from (87± 17) to (74 ± 10) in the conventional treatment group. Rectal volume for defecation desire decreased from (110± 18) to (75±7) in the biofeedback group versus from (106±15) to (92±8) in the conventional group, with significant differences in both groups (were lower in the biofeedback group). So, Biofeedback was superior to the baseline and the conventional treatment in improving and regaining normal rectal sensitivity. Although there was an improvement in rectal sensitivity, the rectal volumes didn't reach the normal values of rectal volume for the first sensation threshold or rectal volume for defecation desire, which may be due to the longstanding nature of chronic constipation and obstructive defecation leading to the rectal hyposensitivity and may need a more prolonged course of treatment for totally correcting the rectal hyposensitivity.

This was in agreement with Ahn et al. [21], who studied the Effect of Biofeedback Therapy on Constipation regarding Rectal Sensation and demonstrated that BFT showed restoration of rectal sensation that was in agreement with our present study. Also, Rao et al. [22] studied a controlled trial of biofeedback, sham feedback, and standard therapy for dyssynergic defecation. They showed improvement in the first sensory perception after biofeedback therapy compared to baseline and other treatments, such as sham feedback and standard conventional treatment, which agrees with our study.

Normal balloon expulsion test time ranged from 1 to 3 minutes. Considering the normal test time as 3 minutes is associated with decreasing sensitivity in diagnosis of dyssynergitic defecation [23].

Normal balloon expulsion test time ranged from 1 to 3 minutes.

Normal balloon expulsion test time ranged from 1 to 3 minutes. In our study, we considered the normal test time to be less than 1 minute and the abnormal test time to be more than one minute. In a comparative study among 232 patients, Lee et al. reported that considering the normal test time as 3 minutes is associated with decreasing sensitivity in diagnosing dyssynergic defecation [23].

The present study demonstrated that biofeedback therapy had a positive effect on the normalization of the balloon expulsion test. Before treatment, all patients had delayed balloon expulsion tests with a statistically nonsignificant difference. After treatment, balloon expulsion test time decreased significantly in both groups, with normalization of the balloon expulsion test time in the biofeedback group and not in the conventional group.

. Roa et al. [24] studied the long-term outcome of biofeedback therapy on dyssynergic defecation. They showed that the Balloon expulsion test improved in the BT group but not in the standard group, which aligned with this study.

This study revealed a notable change in the scores of patient assessment constipation quality of life before and after treatment in both groups. In the biofeedback patient group, the average PAC-QOL score dropped from 85.74 to 0; in the conventional treatment group, it decreased from 87.63 to 28. This aligns with the findings of Magalhães et al. [25], which also found a marked enhancement in quality of life following both traditional and biofeedback treatments for constipation. There was a notable disparity in the PAC-QOL ratings before and after treatment between the two groups; the biofeedback group had lower scores.

Sahin et al. [26] examined the impact of biofeedback as a treatment for constipation in patients with dyssynergic defecation disorder and found that it significantly improved their quality of life. Similarly, Ba-Bai-Ke-Re et al. [27] demonstrated the effectiveness of biofeedback-guided pelvic exercise training in enhancing the quality of life for individuals with pelvic floor dysfunction, which aligns with the current study findings.

On the other hand, research by Damon et al. [28] into the effects of fecal incontinence and chronic constipation on quality of life revealed a weak association between the severity of incontinence and QoL. The impact of fecal incontinence or chronic constipation on patients' quality of life cannot be adequately assessed using symptom scores, as they reported.

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therapy for constipation significantly improved quality of life**.** Also, there was a significant difference in the pre-and post-treatment scores on the PAC-QOL score between the two treatment groups; lower scores were in the biofeedback group.

Improvements in stool consistency on the BSFS were observed in both groups of patients during treatment, with a statistically significant difference in the sixth week compared to baseline. According to Özkütük et al. [16], who found that biofeedback therapy had a significant positive effect on the biofeedback group on stool consistency, this finding is consistent with the current study.

The present study revealed a statistically significant decrease in incontinence scores among the studied groups, with higher scores reported among conventional treatment patients. Anaraki et al. [29] documented similar results as the CCF Score of patients improved significantly after biofeedback therapy.

Full remission of soiling was higher in the biofeedback group than in the conventional treatment group (78.9% versus 42.1% at the 6th week and 89.7%versus 52.63% in the 6th month) with a statistically significant difference. Murad-Regadas et al. [30] studied biofeedback for fecal incontinence in female patients. They showed that biofeedback therapy shows effective treatment with 50% reductions in FI score in half of the patients at six-month follow-up, which agrees with our study.

Contrary to our findings, Van et al. [31] discovered that conventional therapy alone had no greater success rate than anorectal manometry in reducing the number of soiling episodes in chronically constipated children. This could be because the study only used two biofeedback sessions, significantly less than our 6-sessions intervention.

Limitations

The patient follow-up period was too short, which was the study's biggest flaw. Long after the treatment ended, several studies have continued to track the beneficial effects of biofeedback (up to 5 years after treatment). However, thorough evaluation using objective outcomes (physiological parameters) and patient-reported outcomes has demonstrated that biofeedback is superior to conventional treatment alone in patients with DD.

CONCLUSION

Biofeedback combined with conventional treatment could be superior to conventional treatment alone in the management of encopretic patients with dyssynergic defecation; it not only improves the quality of life score but also improves the stool form, decreases the soiling episodes, maintains the continence response, corrects the physiological manometric parameters and corrects the abnormal dyysnergic defecation dynamics.

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