DEFENCE

Defence Science Journal
Vol. 2, No. 1, 2025, pp. 1-8
ISSN 0011-748X
https://www.defence-science-journal-issn0011-748x-india.com

ASCEE

Biofeedback Intervention in Rehabilitation of Adolescence with Posterior Sagittal Anorectoplasty

Mostafa Soliman Mostafa Ali[1,*], Noha Ahmed Fouad Abd-Elrahman[2], Reham Alaa ElKalla[3], Shimaa Hussien Ahmed Roshdy[4], Ayman Abdullah Alhammad[5], Rayan Jastania[6], Mohammad Alobaidy[7], Rasha m Hegazy[8], Radwa S. Abdulrahman[9]

[1] Department of Physical Therapy, faculty of applied medical science, Al-Zaytoonah University of Jordon, Amman, Jordon.
[2] Departments of physical therapy for women's health, Faculty of Physical Therapy, Badr University in Cairo, Egypt..
[3] Departments of Physical Therapy for Surgery, Faculty of Physical Therapy, Badr University in Cairo, Cairo, Egypt.

[4] Department of Physical Therapy for Cardio-pulmonary and Geriatric, Faculty of Physical Therapy, Misr University for Science and Technology, Giza, Egypt.

[5] Department of physiotherapy, College of Medical Rehabilitation Sciences, Taibah University, Almadinah Almunawarah

[6] Department of Physical Therapy, Faculty of Medical Rehabilitation Sciences, King Abdulaziz University, Jeddah 21589, Saudi Arabia

[7] Department of Anatomy, Faculty of Medicine, Umm Al-Qura University, Makkah P.O. Box 7607, Saudi Arabia.

[8] Department of physical therapy, Faculty of Medical Rehabilitation Sciences, King Abdulaziz University, Jeddah 21588, Saudi Arabia

[9] Department of Physical Therapy for Pediatrics and Pediatrics Surgery, Faculty of Physical Therapy, Badr University in Cairo, Egypt.

* Corresponding Author : drmostafamalak@cu.edu.eg

ARTICLE INFO

Article history
Received Jan 02, 2025
Revised Jan 07, 2025
Accepted Feb 09, 2025

ABSTRACT

Background: Most children undergo Posterior Sagittal Anorectoplasty complain from fecal incontinence and fecal soiling which negatively impacts the social life of these children prohibiting their participation with their bears.

Defence Science Journal
Vol. 2, No. 1, 2025, pp. 1-8
ISSN 0011-748X

Keywords
Biofeedback;
Fecal incontinence;
Anorectal malformation;
teenager females;
rehabilitation.

Objectives: This study aims to investigate the effect of biofeedback intervention on incontinence in teenager females diagnosed with encopresis following anal reconstruction surgery so be able to continue lifetime without interference with social life and activities.

Methods: Data were gathered from 30 Teenage females (age 10-13 females) were diagnosed with encopresis following anal reconstruction surgery, they were assigned into a single group and underwent biofeedback electrical stimulation training program twice a week for four months, in addition to pelvic floor exercises. They were evaluated before and after the program by using by Electromyography (EMG) biofeedback to measure the anal sphincter pressure and The Abbreviated Baylor Social Continence Scale (BCS) to measure social continence after surgical correction of anorectal malformations (ARMs).

Results: Results showed significant improvements in all measured variables with a substantial increase ($P < 0.05$). Biofeedback training workouts resulted is a 76.03% improvement with a mean difference of 600.83 µV. Baylor Social Continence Scale scores decreased producing a rising percentage of 65.870% and a mean difference of 13.80.

Conclusion: Biofeedback is a beneficial treatment for teenage girls experiencing encopresis following posterior sagittal anorectoplasty, however, extending the therapy duration may further enhance its effectiveness.

1. Introduction

A broad variety of congenital anomalies are included in anorectal malformations (ARM). From milder, simpler variants that typically have satisfactory functional outcomes to more complicated and severe abnormalities, these anomalies can take many different forms. These latter are linked to poor prognoses for both bowel and urine functions and frequently involve the genitourinary system. Typically, in most ARM cases, the anal canal is absent or fails to properly open onto the perineum, making normal bowel function unlikely. Although many individuals with ARM can achieve satisfactory bowel and urinary control, a significant number continue to face challenges with fecal incontinence or other functional complications. Despite advancements in surgical approaches, managing anorectal malformations remains a complex and demanding area for pediatric surgeons (Springford et al.,2016).

DeVries and Peña invented the posterior sagittal anorectoplasty (PSARP) in 1982, and it is currently considered the standard surgical procedure for treating anorectal abnormalities worldwide (DeVries and Peña, 1982). Despite its widespread use, challenges remain with the prognosis and long-term outcomes of the procedure. Surgical complications such as bowel incontinence, soiling, and constipation—often resulting from anal stenosis, enteric neuronal dysplasia, remaining nerve-free sections, or improper rectal positioning—can greatly affect patients' quality of life and everyday functioning (Davies et al, 2004 and Bjørsum-Meyer, 2021). One of the most dangerous functional side effects after this treatment is fecal incontinence, which can range from 22% to 65%, depending on the continence scoring system (Harjai, 2003, Ghorbanpoor, 2018 and Kyrklund, 2015). Fecal incontinence (FI) are prevalent conditions that greatly reduce the quality of life for numerous individuals. These conditions also burden healthcare systems considerably, contributing to both direct and indirect costs, including increased healthcare use and lost productivity. Conservative therapies often prove inadequate, resulting in persistent symptoms for many patients. Instrumented anorectal biofeedback (BF) has become an essential component of treatment, providing symptom relief and enhancing quality of life for individuals suffering from both fecal incontinence and constipation caused by defecation disorders, with a response rate of 80% for constipation and 70% for fecal incontinence. Alternative treatments for fecal incontinence, including surgical intervention or sacral nerve stimulation, tend to be more costly, invasive, and associated with higher risks (Mazor et al, 2019). Biofeedback therapy is a visual and sensory feedback technique recognized as effective in treating fecal incontinence by helping restore normal bowel function. This method enhances strength, coordination, and targeted activation of the levator ani muscle. It also improves the rectum’s ability to detect smaller distensions and increases tolerance for higher rectal distensions without triggering an uncontrollable sense of urgency (Sakr et al.,2022). Despite the analgesic effects of opioids, these drugs have many adverse effects, such as constipation, loss of appetite, vomiting, urinary alterations, and may cause an alteration in cognitive ability (Mohammad Minwer Alnaeem and Muayyad Ahmad, 2022).

For infants with "high" imperforate anus, a colostomy at birth is generally advised, except for those with perineal fistulas, with PSARP typically scheduled during the first year of life. Besides PSARP, various surgical techniques for imperforate anus correction have been introduced, including Rhodes, Pipes, and Randall’s combined abdominoperineal methods, as well as Aluwihare’s sacroperineal approach. Many of these procedures are carried out as the primary surgery immediately after birth, without the need for a colostomy, but they can be risky and lack precision. Moore demonstrated back in 1990 that sagittal anorectoplasty can be performed safely and effectively in newborns with an extremely imperforated anus without the need for a colostomy. Recently, Liu and Hill, as well as Albanese et al., successfully performed primary PSARP on 12 infants without the need for a colostomy. This article presents our experience with primary PSARP for high imperforate anus (rectum ends above the puborectalis sling) and offers long-term follow-up data on bowel continence, which sets it apart from other researches (Mirshemirani et al., 2007).

Biofeedback is a safe, effective, and minimally invasive technique for treating defecation issues. This method employs a "learning through reinforcement" strategy to assist individuals in gaining greater control over specific body systems. Biofeedback allows patients to control their physiological processes by giving real-time input from monitoring equipment. Patients can learn to manage involuntary activities with constant practice and reinforcement, which leads to better outcomes in the treatment of illnesses such as defecation problems. Biofeedback, in conjunction with electrical stimulation and pelvic floor muscle exercises, can strengthen the anal sphincter mechanism, resulting in improved stool continence in children with ARM (Moore,1990 and Leung et al., 2006).

Defence Science Journal
Vol. 2, No. 1, 2025, pp. 1-8
ISSN 0011-748X

The clinical effectiveness of biofeedback in pediatric patients is still unclear. There is a need to have more evaluation regarding the techniques used and the outcomes of biofeedback in treating defecation disorders in adolescents. This research provided insights into the potential benefits of integrating biofeedback training exercises and electrical stimulation of pelvic floor muscles as a treatment approach for managing fecal incontinence in adolescence after posterior sagittal anorectoplasty (Mirshemirani et al., 2007).

Therefore, this research aimed to assess how biofeedback intervention affects teenager females with incontinence in diagnosed with encopresis following anal reconstruction surgery.

2. Method

This research was designed to determine the effect of fecal stimulating electrode on encopresis following anal reconstruction surgery through measuring anal sphincter pressure with the EMG biofeedback equipment.

Ethical considerations:

The Ethics Committee of the Faculty of Physical Therapy at Badr University in Cairo, Egypt accepted this study (Approval No: BUC-IACUC-230507-20), which was published through the ClinicalTrials.gov database under the ID NCT06053879. Prior to data collection, the parents of the female participants were thoroughly informed about the objectives, procedures, and potential benefits of the study. Prior to participating in the trial, each participant's parent provided informed consent.

Participants:

The research sample included 30 Teenage females (10-13 years old) who were diagnosed with encopresis following anal reconstruction surgery. All participants had undergone PSARP, were medically stable, reliable, had normal vision and hearing, and could understand and obey spoken orders.

Participants were assigned into a single group underwent biofeedback electrical stimulation twice a week for four months, in addition to pelvic floor exercises. The trial lasted four months, from May 2023 to September 2023.

Outcome measures:

Every assessment technique was carried out both at baseline (pre-treatment) and again following four months of therapy in a row (post-treatment).

EMG biofeedback:

Before measuring anal sphincter pressure with the EMG biofeedback equipment, each female participant was taught how to appropriately compress and relax the anal sphincter. They were positioned on their sides, facing the instrument, to observe the pressure recordings. The Gymna Feedback electrotherapy machine MYO 200 was used to record and show anal sphincter pressures or activity, allowing for feedback on performance and improvement (fig 1). This was performed by putting a rectal electrode into the anus and lubricating it (each rectal electrode was unique). Participants were asked to squeeze the electrode as hard as possible (as of holding bowel) for 15 seconds while evaluating the pressure fluctuations, with a special emphasis on the anal sphincter's reaction during the squeeze. The greatest pressure measured during the 15 seconds was considered the target in microvolts (µV) for training sessions. Once this target was saved in the device, the female could begin her

Fig 1. Gymna Feedback electrotherapy unit MYO 200

Defence Science Journal
Vol. 2, No. 1, 2025, pp. 1-8
ISSN 0011-748X

Abbreviated Baylor Social Continence Scale (BCS)

The Abbreviated Baylor Social Continence Scale (BCS) was used to measure social continence after surgical correction of ARMs before starting intervention and at the end of intervention. It was created using six questions that respondents rated on a Likert scale to indicate their level of agreement with each statement. The scale spans from 0 (showing good continence) to 24 (representing severe incontinence) (Caruso et al., 2015 and Brandt et al., 2007).

3. Intervention

3.1. Biofeedback electrical stimulation:

Before beginning biofeedback training, the highest pressure measured over 15 seconds was saved. The therapist then progressively raised the stimulation level till the female feels light sensation. Training began with the gadget set to a certain strength, above which it would stimulate the muscles to produce contractions during therapy sessions. Biofeedback electrical stimulation sessions were structured as follows: stimulation (300 µs/35 Hz) for 4 seconds, rest for 8 seconds, feedback for 4 seconds, and another rest period for 8 seconds. Each session lasted 10 minutes and was done twice a week for four months.

3.2. Pelvic floor exercise:

Kegel exercises, sometimes referred to as pelvic floor muscle training, were recommended as a means of strengthening the pelvic floor muscles. Participants were instructed to do maximal anal sphincter contractions as vigorously as possible, holding each contraction for 10 seconds and then resting for 20 seconds, all while breathing normally and not activating the abdominal or gluteus muscles. Each contraction was performed 10 to 20 times, resulting in one set, and participants were instructed to do three to five sets each day. The activities progressed from a supine posture with knees slightly apart to sitting, then standing (Bischoff et al.,2016 and ABD,2017).

4. Statistical analysis

The data underwent review to confirm normality and homogeneity. The Shapiro-Wilk test was applied to assess normality, showing that the data followed a normal distribution ($P > 0.05$) after outliers, identified using box-and-whisker plots, were removed. Additionally, Levene's test for variance homogeneity indicated no significant differences ($P > 0.05$), validating the use of both parametric and non-parametric analyses. Given the normal distribution, parametric analysis was conducted. Statistical analysis was performed using SPSS software version 25 for Windows (SPSS, Inc., Chicago, IL). Quantitative data, including Baylor Social Continence Scale scores, EMG biofeedback anal sphincter pressure of contraction measurements, and ages of the participants, are presented as means and standard deviations. A paired t-test was used to compare pelvic floor function data before and after the intervention.

3. Results and Discussion

The research comprised thirty teenage females between the ages of 10 and 13 who were diagnosed with encopresis after reconstruction surgery. Data was compared by analyzing the pressure measured by EMG biofeedback during 15 seconds in the first session and pressure measured in last session (after 4 months) and the Abbreviated Baylor Social Continence Scale (BCS).

Table (1) and Figure (2) show that participants' ages varied from 10 to 13 years, with an average age of 11.03 ± 0.92 years.

Table 1. Mean, minimum, and maximum of children age

Items	Mean ±SD	Minimum	Maximum
Age (year)	11.03 ± 0.92	10.00	13.00

Data are presented as mean ± standard deviation (SD).

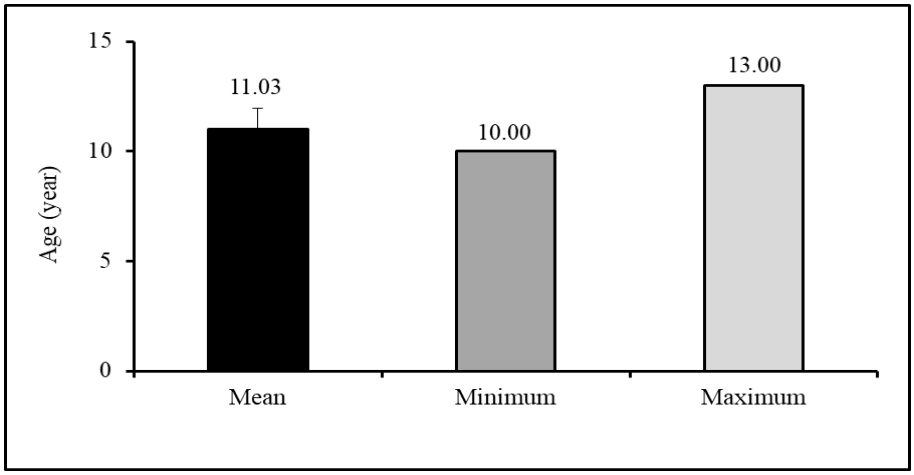

Figure 2. Mean, minimum, and maximum of children age

The Baylor Social Continence Scale and EMG biofeedback anal sphincter pressure outcomes in the study population before and after the intervention were compared statistically, as shown in Table (2) and Figure (3). Pre-intervention EMG biofeedback anal sphincter pressure mean values were 790.23 ± 13.68 µV, while post-intervention mean values were 1391.06 ± 20.64 µV. The study found a substantial increase ($P < 0.05$) in anal sphincter pressure ($P = 0.0001$) in teenage girls with encopresis after anal reconstructive surgery, compared to pre-intervention data. Biofeedback training workouts resulted in a 76.03% improvement with a mean difference of 600.83 µV.

Table (2) and Figure (4) illustrate the statistical comparison of the study population's prior to and afterwards the Baylor Social Continence Scale outcomes. Pre-intervention mean scores on the Baylor Social Continence Scale were 20.95 ± 2.34, while post-intervention mean scores were 7.15 ± 1.21. The study found a substantial decrease ($P < 0.05$) in Baylor Social Continence Scale scores ($P = 0.0001$) for teenage females with encopresis post-anal reconstructive surgery compared to pre-intervention levels. Attributable to the biofeedback training, this decrease produced a rising percentage of 65.87% and a mean difference of 13.80.

Table 2. Comparison between pre- and post-intervention of EMG biofeedback anal sphincter pressure and Baylor social continence scale

Defence Science Journal
Vol. 2, No. 1, 2025, pp. 1-8
ISSN 0011-748X

Items	Pelvic floor muscle	Baylor social continence scale
Pre-intervention (n=30)	790.23 ±13.68	20.95 ±2.34
Post-intervention (n=30)	1391.06 ± 20.64	7.15 ±1.21
MD (Change)	600.83	13.80
95% CI	322.60 – 903.12	10.91 – 16.69
Improvement %	76.03%	65.87%
t-value	30.589	15.98
P-value	0.0001*	0.0001*

The mean ± standard deviation is used to express the data.

MD: Average variation, Confidence interval (CI), The probability value, or P-value: * Significant ($P<0.05$).

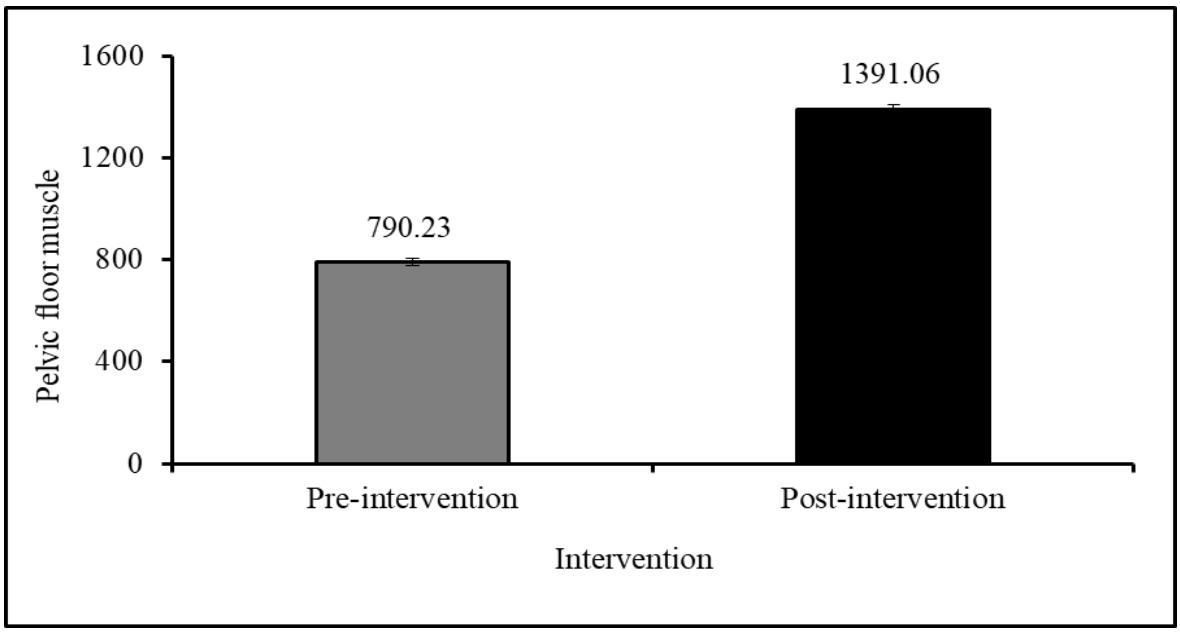

Figure 3. Shows the mean values of EMG biofeedback pressure for the study group before and after the intervention.

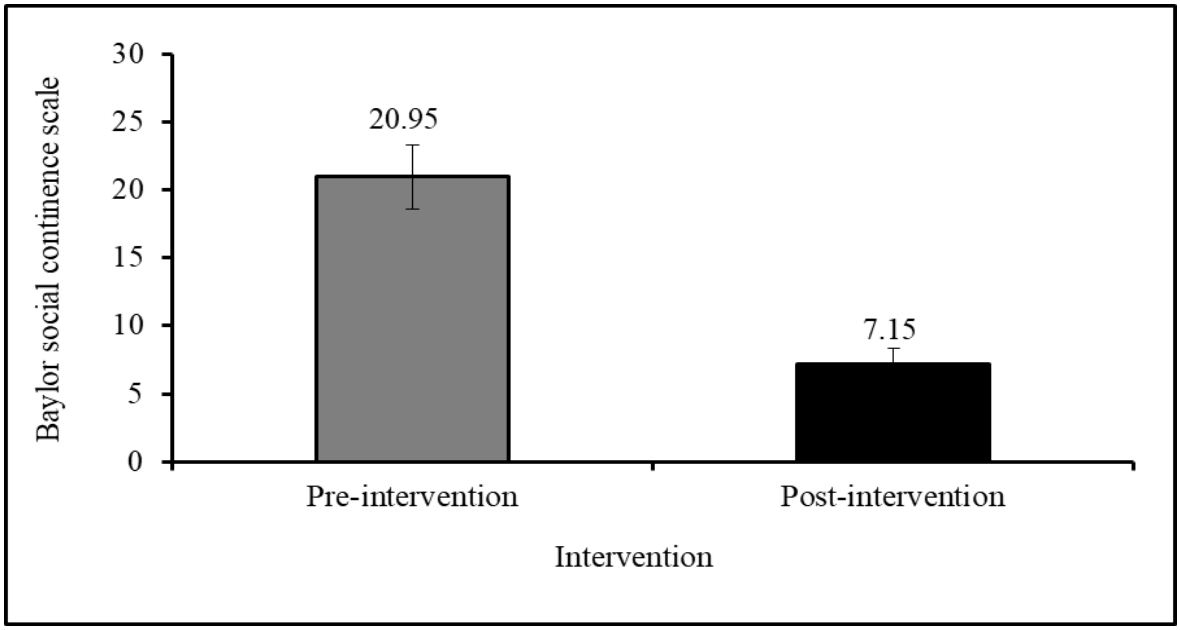

Figure 4. Mean values pre- and post-intervention of Baylor social continence scale in the study group.

4. Discussion

The purpose of this study was to approve the efficacy of biofeedback using fecal electrode in addition to (PFE), taking into account nonspecific effects like education, standard medical interventions, and placebo responses; ascertain whether instrument-assisted biofeedback (Fecal electrode) more effective component of training rather than (surface electrode); also biofeedback training in addition to (PFE) is more effective training instead of using (PFE) alone. This supports a prior study that found pelvic physical activity is a successful treatment for pediatric fecal continence (PFC), with 90% of kids reporting a subjective improvement in their overall condition. Patients also indicated that their frequency of bowel movements, fecal consistency, and fecal diameter had significantly improved. Children who are constipated are typically encouraged to improve their physical activity in outpatient clinics (Fatemeh et al.,2015).

For the treatment of ARM, de Vries and Pena (1982) initially described posterior sagittal anorectoplasty (PSARP), which has a steep learning curve like any other novel surgical surgery (Hopper et al.,2007). Since then, numerous perioperative diagnostic studies as well as research addressing the management of ARM—particularly the timing and single-stage or multistage approach—have been appearing. However, a prior EPSA survey found that the majority of surgeons still employ the invertogram as the primary preoperative diagnostic exam when treating congenital rectovaginal fistulas in females, even though many surgeons prefer to use the anterior sagittal anorectoplasty technique. In males with high ARM, PSARP is the preferred definitive surgical procedure (Kulshrestha et al., 2007, Wang et al., 2015 and Upadhyaya et al., 2007).

Muscle training has also been shown to be equally beneficial as conservative therapy, according to a meta-analysis (Norton, 2008). Biofeedback has been known as an effective therapy for fecal incontinence (FI) for over 35 years, with success rates ranging from 40% to 100% (Okawa, 2024). Nevertheless, despite these positive results over the past three decades, there is still a notable dearth of well-controlled research in this field (Heymen et al., 2001). The literature on biofeedback treatment (BFT) yields inconsistent findings, owing to the range of modalities used. There were no appreciable changes between conservative therapies and BFT exercises in a randomized controlled

Defence Science Journal
Vol. 2, No. 1, 2025, pp. 1-8
ISSN 0011-748X

study that looked at BFT in individuals with fecal incontinence (FI). This disparity emphasizes how urgently further clinical studies on biofeedback training and its impact on incontinence are needed.

Comparing this study's pelvic floor muscle function to pre-treatment data, we found a significant improvement of 76.03%. This conclusion supports studies that have determined the variables affecting the effectiveness of biofeedback treatment for FI in female patients, improving our capacity to choose appropriate management approaches. Biofeedback was observed to relieve FI symptoms in around 50% of patients, which is similar to findings from several studies in the literature (Lee et al.,2013).

The findings were consistent with (Whitehead et al. 2015) The internal and external validity of this intervention are further improved by the centralized training, certification of interventionists using standardized patients, auditing of the anorectal manometry evaluation, and biofeedback training. This is also in line with a previous controlled trial that found 76% of patients who were referred to BFT after receiving an ineffective conservative treatment for FI responded well. According to other research, 70% to 80% of respondents gave positive answers (Markland et al., 2017).

For certain forms of persistent fecal incontinence (FI), biofeedback is commonly recommended as a first line of treatment due to its ease of use, absence of adverse effects, and patient reports of improved FI scores (Young et al., 2018). Less research has been done on sensory training that aims to increase the sensation of rectal fullness and the capacity to withstand urgent sensations than on the strength training component of biofeedback. Consistency, repeatability, and overall efficacy may be enhanced by the capacity to independently modify the biofeedback intervention's components and use an algorithm to tailor the treatment plan to the unique requirements of each patient (Heymen et al., 2009). The motor perception associated with anal electrodes was the main focus of this investigation, which produced noteworthy effects that were digitally measured using innovative technology. Previous randomized controlled trials evaluating biofeedback for FI have produced contradictory results, which are usually ascribed to differences in the intervention providers' training (Bols et al., 2012).

While more RCTs are obviously needed, these initial findings seem to indicate that pelvic floor therapy plays a significant role in the treatment of FI. According to most studies, biofeedback pelvic floor training appears to be beneficial for most patients. However, it is unclear whether the benefits are attributable to increased rectal sensitivity or to better strength and endurance of the anal sphincter and pelvic floor muscles. Further research is also needed in the field of electrical stimulation; however, it may be able to provide an additional benefit when combined with biofeedback training alone (Kelly and Scott,2014). However, the distinction between our research and other studies was to investigate whether instrument-assisted biofeedback with fecal electrodes is a more effective training component than surface as well as to assess whether biofeedback training combined with PFE is more effective than using PFE alone.

Study limitations

1. Each rectal electrode was unique

2. Extremely expensive rectal electrodes

3. Continuity of females during treatment due to school time

5. Discussion

In conclusion, this research highlights the critical role of biofeedback as an effective treatment for teenage girls experiencing encopresis post-posterior sagittal anorectoplasty. The findings indicate that the duration of symptoms and the condition of the anal sphincter significantly influence therapy outcomes. By extending the duration of treatment, we may improve the management and

resolution of postoperative defecation issues, underscoring the importance of personalized approaches in enhancing patient recovery and quality of life

6. References

[1] Springford LR, Connor MJ, Jones K, Kapetanakis VV, Giuliani S. Prevalence of active long-term problems in patients with anorectal malformations: a systematic review. Diseases of the Colon & Rectum. 2016 Jun 1;59(6):570-80.

[2] DeVries PA, Peña A. Posterior sagittal anorectoplasty. Journal of pediatric surgery. 1982 Oct 1;17(5):638-43.

[3] Davies MC, Creighton SM, Wilcox DT. Long-term outcomes of anorectal malformations. Pediatric Surgery International. 2004 Aug; 20:567-72.

[4] Bjørsum-Meyer T, Christensen P, Baatrup G, Jakobsen MS, Asmussen J, Qvist N. Magnetic resonance imaging of the anal sphincter and spine in patients with anorectal malformations after posterior sagittal anorectoplasty: a late follow-up cross-sectional study. Pediatric Surgery International. 2021 Jan; 37:85-91.

[5] Harjai MM, Puri B, Vincent PJ, Nagpal BM. Fecal Incontinence after Posterior Sagittal Anorectoplasty–Follow up of 2 years. Medical Journal Armed Forces India. 2003 Jul 1;59(3):194-6.

[6] Ghorbanpoor M, Dehvan B, Rahimi S, Pirdehghan A. Fecal Incontinence after Posterior Sagittal Anorectoplasty for Anorectal Malformation: A Single-Center Study. Scientifica. 2018;2018(1):8297617.

[7] Kyrklund K, Pakarinen MP, Taskinen S, Rintala RJ. Bowel function and lower urinary tract symptoms in males with low anorectal malformations: an update of controlled, long-term outcomes. International journal of colorectal disease. 2015 Feb; 30:221-8.

[8] Mazor Y, Kellow JE, Prott GM, Jones MP, Malcolm A. Anorectal biofeedback: an effective therapy, but can we shorten the course to improve access to treatment? Therapeutic Advances in Gastroenterology. 2019 Mar; 12:1756284819836072.

[9] Sakr HR, Abd-Elfattah HM, Abdelkhalek MM, Ibrahim M, Aly E, Mousa MK. Anorectal biofeedback influence on encopresis resulting from sexual assault in school aged girls: A randomized controlled trial. Current Pediatric Research 2022; 26 (1): 1215-1220.

[10] Mohammad M. A. and Muayyad A. Constipation Severity and Quality of Life among Patients with Cancer Who Received Prophylactic Laxatives: Quasi-Experimental Study. Asian Pac J Cancer Prev,2022, 23 (10), 3473-3480.

[11] Mirshemirani AR, Kouranlou J, Rouzrokh M, Sadeghian M, Khaleghnezhad A. Primary posterior sagittal anorectoplasty without colostomy in neonates with high imperforate anus. Journal of Acta medica Iranica.2007;May ;45(2):121-125.

[12] Moore TC. Advantages of performing the sagittal anoplasty operation for imperforate anus at birth. Journal of pediatric surgery. 1990 Feb 1;25(2):276-7.

[13] Leung MW, Wong BP, Leung AK, Cho JS, Leung ET, Chao NS, Chung KW, Kwok WK, Liu KK. Electrical stimulation and biofeedback exercise of pelvic floor muscle for children with faecal incontinence after surgery for anorectal malformation. Pediatric surgery international. 2006 Dec; 22:975-8.

[14] Caruso AM, Catalano P, Voti GL, Salerno S, Casuccio A, Di Pace MR, Cimador M. Prognostic evaluation of biofeedback response in patients treated for anorectal malformation. Journal of Pediatric Surgery. 2015 Oct 1;50(10):1648-52.

[15] Brandt ML, Daigneau C, Graviss EA, Naik-Mathuria B, Fitch ME, Washburn KK. Validation of the Baylor Continence Scale in children with anorectal malformations. Journal of pediatric surgery. 2007 Jun 1;42(6):1015-21.

[16] Bischoff A, Bealer J, Peña A. Critical analysis of fecal incontinence scores. Pediatric surgery international. 2016 Aug; 32:737-41.

[17] ABD E. Assessment and conservative management of faecal incontinence and quality of life in adults. Incontinence. 6th ed. Tokyo: International Consultation on Incontinence. 2017:1993-2086.

[18] Fatemeh F., aidin abedi, M., Smaeili-dooKi, Rozita J., Sanaz T. Pelvic Floor Muscle Exercise for Pediatric Functional Constipation J Clin Diagn Res. 2015 Jun;9(6):SC16-7. (2016).

[19] DeVries P, Pena ˜ A. Posterior sagittal anorectoplasty. J Pediatr Surg 1982; 17:638–643.

[20] Pena ˜ A, DeVries P. Posterior sagittal anorectoplasty: important technical considerations and new applications. J Pediatr Surg 1982; 17:796–811.

[21] Hopper AN, Jamison MH, Lewis WG. Learning curves in surgical practice. Postgrad Med J 2007; 83:777–779.

[22] Kulshrestha S, Kulshrestha M, Sing B, Sarkar B, Chandra M, Gangapadhyay AN. Anterior sagittal anorectoplasty for anovestibular fistula. Pediatr Surg Int 2007; 23:1191–1197.

[23] Wang C, Li L, Liu S, Chen Z, Diao M, Li X, et al. The management of anorectal malformation with congenital vestibular fistula: a single-stage modified anterior sagittal anorectoplasty. Pediatr Surg Int 2015; 31:809–814.

[24] Upadhyaya VD, Gopal SC, Gupta DK, Gangopadhyaya AN, Sharma SP, Kumar V. Single stage repair of anovestibular fistula in neonate. Pediatr Surg Int 2007; 23:737–740.

[25] Norton C. Fecal incontinence and biofeedback therapy. Gastroenterology Clinics of North America. 2008 Sep 1;37(3):587-604.

[26] Okawa Y. Effectiveness of Pelvic Floor Muscle Training for Treating Faecal Incontinence. Gastrointestinal Disorders. 2024 Aug 27;6(3):774-83.

[27] Heymen S, Jones KR, Ringel Y, Scarlett Y, Whitehead WE. Biofeedback treatment of fecal incontinence: a critical review. Diseases of the colon & rectum. 2001 May;44(5):728-36.

[28] Lee HJ, Jung KW, Myung SJ. Technique of functional and motility test: how to perform biofeedback for constipation and fecal incontinence. Journal of neurogastroenterology and motility. 2013 Oct;19(4):532.

[29] Whitehead WE, Rao SS, Lowry A, Nagle D, Varma M, Bitar KN, Bharucha AE, Hamilton FA. Treatment of fecal incontinence: state of the science summary for the National Institute of Diabetes and Digestive and Kidney Diseases workshop. Official journal of the American College of Gastroenterology| ACG. 2015 Jan 1;110(1):138-46.

[30] Markland AD, Jelovsek JE, Whitehead WE, Newman DK, Andy UU, Dyer K, Harm-Ernandes I, Cichowski S, McCormick J, Rardin C, Sutkin G. Improving biofeedback for the treatment of fecal incontinence in women: implementation of a standardized multi-site manometric biofeedback protocol. Neurogastroenterology & Motility. 2017 Jan;29(1):12906.

[31] Young CJ, Zahid A, Koh CE, Young JM, Byrne CM, Solomon MJ, Rex J, Candido J. A randomized controlled trial of four different regimes of biofeedback programme in the treatment of faecal incontinence. Colorectal Disease. 2018 Apr;20(4):312-20.

[32] Heymen S, Scarlett Y, Jones K, Ringel Y, Drossman D, Whitehead WE. Randomized controlled trial shows biofeedback to be superior to pelvic floor exercises for fecal incontinence. Diseases of the Colon & Rectum. 2009 Oct 1;52(10):1730-7.

[33] Bols E, Berghmans B, de Bie R, Govaert B, van Wunnik B, Heymans M, Hendriks E, Baeten C. Rectal balloon training as add-on therapy to pelvic floor muscle training in adults with fecal incontinence: A randomized controlled trial. Neurourology and urodynamics. 2012 Jan;31(1):132-8.

[34] Kelly M. and Scott, MD. Pelvic Floor Rehabilitation in the Treatment of Fecal Incontinence, Clin Colon Rectal Surg. 2014 Sep;27(3):99–105.