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Effect of Electro-Stimulation in Management of Fecal Incontinence Post Colorectal Surgery

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ABSTRACT

Background: Fecal incontinence (FI) is a serious health, financial, as well as social problem. FI can be treated with several different approaches. FI is characterized by the uncontrollable passing of feces and includes (1) solid feces; (2) liquid feces; (3) soiling without any sort of sensation, warning, or trouble wiping it off is a passive FI;as well as (4) coital FI. Furthermore, fecal urgency is the sudden, compelling, and difficult-to-defer need to defecate, while flatal incontinence is the spontaneous loss of flatus. **Objective:** to detect the effect of electro-stimulation in the managing of fecal incontinence in post colorectal surgery patients.

Patients and Methods: A total of 30 male patients experiencing fecal incontinence following colorectal surgery were split up into two groups of 15, completely at random from the physical therapy out-patient clinic at Tahta General Hospital in Egypt. The patients' ages ranged from 45 to 60. Group (A) (Control group): Composed of 15 patients with fecal incontinence post colorectal surgery who received pelvic floor exercise and medical treatment for 3 months. Group (B) (Experimental group): Composed of 15 patients with fecal incontinence post colorectal surgery who received pelvic floor exercise and medical treatment in addition to electrical stimulation for 3 months.

Results: Group B had much substantial improvements in spontaneous as well as maximum contraction amplitude compared to group A, and a significantly lower Vaizey Incontinence Score ($p < 0.01$). **Conclusion:** It could be concluded that electrical stimulation has a significant improvement in management of fecal incontinence.

Keywords: Fecal incontinence, Electro-stimulation, Pelvic floor exercise, EMG, Vaizey Incontinence Score.

INTRODUCTION

Fecal incontinence (FI) is a serious health, financial, and social problem because of the impairment it causes over time. FI can be treated with several different approaches.Definitions and origins: Involuntary feces loss (FI) is characterized by a variety of symptoms, such as (1) solid feces; (2) liquid feces; (3) soiling without any sort of sensation, warning, or trouble wiping it off is a passive FI; as well as (4) coital FI. A person with fecal urgency has an immediate and strong need to defecate and cannot hold it in. Flatus leakage involuntarily occurs in people with flatal incontinence [(1)]. Enteric material, which is sufficiently hard as well as bulky, a passively distensible reservoir capable of being evacuated, as well as an efficient barrier to outflow is the major components required for fecal continence. Therefore, FI can be caused by alterations in the composition or volume of stool delivered to the sphincter, a rectum that is too small to hold stool, damaged function of the ano-sphincter or diminished sensitivity [(2)]. Therefore, diarrhea, reduction in rectal compliance (e.g., ulcerative proctitis as well as radiation proctitis), damage to the anal sphincter (e.g., trauma, obstetrical injury, as well as surgery), a diminished ability to experience rectal sensation (e.g., spinal cord injury, multiple sclerosis, as well as diabetes mellitus) are all common etiologies of FI[(2)].

In addition to overflow incontinence, as a subset of fecal retention, as well as impaction are common causes of FI. Medications (such as laxatives, anticholinergics, antidepressants, as well as caffeine), food intolerances, and psychosis with purposeful soiling may all play a role as well lactose, fructose, and sorbitol. It's also worth noting that patients may be experiencing a combination of symptoms due to the multi-factorial nature of FI[(2)].

Pharmacotherapy, dietary and behavioral changes, and conservative management options for FI include dietary fiber supplements and behavioral changes like scheduled toileting. Few studies have explored prompted voiding as a FI treatment, and they have found little benefit [(3)].

Electrical stimulation, which causes the stimulated muscles to contract passively, is used to treat numerous pelvic floor dysfunctions (Pelvic floor muscles (PFM) or anal sphincters)[(4)]. Pelvic floor muscle training **(**PFMT) outlines a wide range of techniques aimed to improving pelvic floor as well as strength of the anal sphincter, endurance, but also synchronization [(5)].

The aim of current study was to assess the effectiveness of electro-stimulation for treating fecal incontinence following colorectal surgery.

PATIENTS AND METHODS

Thirty male patients havingFI post colorectal surgery;their ages ranged from 45 to 60 years, participated in this study for 3 months.Subjects were recruited from Tahta General Hospital in Egypt. Patients were randomly divided into two equal groups. Patients with FI following colorectal surgery who met the inclusion and exclusion criteria (lack of cardiac or pulmonary disease, diabetes mellitus, other orthopedic constraints, psychological or neurological problems) participated in the study.

Management: Vaizey incontinence score:The higher

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the score, the more severe the FI. Scores range from zero (total continence) up to 24 (complete incontinence).According,to studies, the Vaizey score is one of the most commonly utilized severity scores, the score can be reliably reproduced and has a strong correlation with doctors' clinical impressions [(6)].Recent research has also shown that patients' subjective experience of improvement is reflected in changes to their Vaizey scores, and that greater Vaizey scores are related with greater reported difficulties across a variety of health domains [(7)].

For EMG, the anal sphincter can be tested for activity by having the patient contract then release it. Two channels allow for quick sensory and motor conduction testing, as well as needle EMG; nonetheless, the vast majority of EMGs are performed using only a single channel. Electrodes for measuring motor conduction are typically plugged into the first device channel, whereas electrodes for measuring sensory conduction are typically plugged into the second device channel. Separating channels in this way speeds up the exam's performance. As shortly afterward the motor conduction velocity is determined, the programme will initiate the response acquisition by using second channel then run the sensory conduction velocity test.A USB cable is used to link the device to a computer. This cable can be used to charge the device as well as transfer data. As long as the EMG study room is powered by a notebook's battery and not the mains, it may be set up anywhere. EMG study is now quick and easy with the in-built keyboard.A conventional EMG study can be completed by a trained professional 1.5 times faster using this keyboard than with a regular computer keyboard and mouse. Stimulation settings as well as electrode placement quality can be viewed in vivid colour on the screen. This information is easily accessible with Neuro-MEP-Micro.

- **Group (A) (Control group):**Composed of 15 patients with fecal incontinence post colorectal surgery who received pelvic floor exercise and medical treatment for 3 months.
- **Group (B) (Experimental group):**Composed of 15 patients with fecal incontinence post colorectal surgery who received pelvic floor exercise and medical treatment in addition to electrical stimulation for 3 months.

Physical treatmentfor both Groups; A and B:

Initial evaluation using Vaizey Incontinence Scoreas well as EMG were taken before and after 3months of study treatment protocol.

The subject was positioned prone in a relaxed position.

1. Two surface electrodes, one at 3 o'clock and one at 9 o'clock surrounding the anal sphincter, wereput on sacral nerves.
2. 50 hz was the frequency.
3. Pulse width of 0.1 ms.
4. Duration: 30 minutes.
5. Session frequency: daily for 3 months.

Ethical consent:

The Ethical Committee of Cairo University's Department of Physical Therapy approved the study considering that it was a randomized controlled trial with a single-blind design. The study's quality was ensured by a Research Ethics Committee that reviewed and approved it. Before receiving their written agreement to participate in the current investigation, all participants received a thorough and understandable explanation of the study. The trial coordinator routinely checked the quality of screening, data management, and protocol adherence. All procedures involving human participants in this study were conducted in accordance with the standards indicated in the World Medical Association's Declaration of Helsinki on the conduct of research involving human participants.

Statistical analysis

Data are presented as mean and standard deviation (SD). Mann-Whitney test was used to compare between the 2 groups and Wilcoxon signed-rank test was used to compare before and after treatment in each group.The threshold for statistical significance in all analyses was set at a p value of less than 0.05.All statistical testing was done using SPSS 25 for Windows (IBM SPSS, Chicago, Il, USA).

RESULTS

Subject characteristics:

Table (1) presentedthe subject's characteristics for both Group A as well as Group B. None of the groups differed substantially from one another in terms of age.

Table 1. Comparison of age of both studied groups

	Group A (N=15) Mean ± SD	Group B (N=15) Mean ± SD	MD	t-value	p-value
Age (years)	52.06 ± 4.78	51.33 ± 4.82	0.73	0.41	0.68

SD, standard deviation

Impact of treatment on Vaizey Incontinence Score as well as pelvic floor muscle EMG:

- Within group comparison:

There was a substantial decline in Vaizey Incontinence Score as well as a substantial improvement in spontaneous as well as maximum contraction amplitude after treatment when contrasted with before treatment results in Groups A as well as B(Table 2).

- Between group's comparison*:*

There was no substantial difference among groups before treatment. After treatment, a comparison of the groups revealed a substantial decline in Vaizey Incontinence Score as well as a substantial improvement in spontaneous as well as maximum contraction amplitude with respect to Group B, in comparison to Group A **(Table 2).**

Table 2: Mean Vaizey Incontinence Score as well as pelvic floor muscle EMG before and after treatment of group A and B

	Group A (N=15)	Group B (N=15)			
	Mean ± SD	**Mean ± SD**	**MD**	**U- value**	**p value**
Vaizey Incontinence Score					
Before treatment	14.86 ± 6.09	15.06 ± 5.33	-0.2	112	0.98
After treatment	13.33 ± 5.92	7.66 ± 4.62	5.67	50.5	0.01
MD	1.53	7.4			
% of change	10.3	49.14			
Z- value	-3.10	-3.42			
	p = 0.002	***p = 0.001***			
Spontaneous amplitude (mV)					
Before treatment	33.13 ± 19.84	39.2 ± 23.46	-6.07	98	0.56
After treatment	42.26 ± 16.47	69.8 ± 24.13	-27.54	40.5	0.002
MD	-9.13	-30.6			
% of change	27.56	78.06			
Z- value	-3.41	-3.41			
	p = 0.001	***p = 0.001***			
Maximum contraction amplitude(mV)					
Before treatment	148.33 ± 57.21	141 ± 44.52	7.33	109.5	0.90
After treatment	162.8 ± 51.08	213.53 ± 54.47	-50.73	52.5	0.01
MD	-14.47	-72.53			
% of change	9.76	51.44			
Z- value	-3.40	-3.41			
	p = 0.001	***p = 0.001***			

SD, standard deviation; MD, mean difference.

DISCUSSION

This investigation was essentially planned aiming to investigate the impact of electro-stimulation in the managing of FI post colorectal surgery in terms of decreasing incontinence.

Thirty male patients with fecal incontinence post colorectal surgery; they were all between the ages of 45 and 60 as well as picked from Tahta General Hospital's Physical Therapy Outpatient Clinic in Egypt and were divided at random into two groups, each including 15 patients.

The effectiveness of treatment on fecal incontinence was measured by Vaizey incontinence score and pelvic floor EMG, which were obtained from both groups initially and again after 12 weeks of treatment.

Pelvic floor physical therapy, biofeedback, as well as electrical stimulation successful treatment of FI is achieved with pelvic floor physical therapy; however, most data come from non-randomized cohort studies.There have been over seventy uncontrolled trials on biofeedback as well as pelvic floor physical therapy, and all but one of them have declared positive results for patients. Pelvic floor biofeedback and/or physical therapy has been shown to have a 50-80% success rate in curing and improving symptoms[8].

Physiotherapeutic muscular training in FI aims to improve anal sphincter in addition to pelvic floor muscle strength, tension, endurance, but also coordination [9].The anal sphincter is trained by focusing solely on its contractions and on coordinating its movements with other sphincters[10].

Defecation can be made easier by increasing the tension as well as strength of the anal sphincters, which in turn increases the capacity of the anal canal[11].Additionally, the pressure at the anus's closure while at rest may increase[12].So, muscle training might be complemented with other approaches, according to the patient's present degree of FI development as well as the intended therapeutic effect [13].

Electrical stimulation is effective for many pelvic floor dysfunctions because it causes the stimulated muscles to contract passively (here, PMF or either anal sphincter). Patient awareness of PFM contractions is increased, and tension and muscle strength are both enhanced. Correct spinal arc function is required for reflex activation, which in turn triggers anal sphincter or either pelvic floor contraction[4].Surface perineal

electrodes, vaginal electrodes, in addition rectal electrodes can all be used to perform electro-stimulation of the pelvic floor[14].

Patients with FI benefit from endo-anal electrical stimulation because it persistently stimulates the vulva nerve as well as anal sphincter, resulting in increased strength as well as striated muscle endurance (external anal sphincter) [15].The rectum's sensory function is enhanced by electro-stimulation, as well as the sphincter's fatigue tendency is diminished [16].

It is commonly recommended that patients undergo high-frequency stimulation at 50 Hz for 15-20 minutes twice/day [17,18].

The findings of the present investigation reported that there was a substantial decline in Vaizey Incontinence Score as well as a substantial improvement in spontaneous as well as maximum contraction amplitude after treatment contrasted to that before treatment for group A as well as group B ($p < 0.001$). The % of change in Vaizey Incontinence Score, spontaneous as well as maximum contraction amplitude for group A was 10.3, 27.56 and 9.76% respectively, whereas that for group B was 49.14, 78.06 and 51.44% respectively.

The significant improvements in EMG and Vaizey incontinence may be for the following reasons:

1. The patient feels contraction of external anal sphincter.
2. The psychological effect of treatment may contribute to the better result of ES on FI improvement.

In the same line **Matzel*et al.*** [19]found that stimulating the sacral nerve helped with incontinence after a rectal resection, and also that bilateral stimulation improves the therapeutic effect. Stimulating the bowels unilaterally reduced the rate of incontinence from 37% to 11%, stimulating both sides simultaneously reduced it to 4%, and chronically stimulating both sides simultaneously reduced it to 0%. Significant improvements were seen in both quality of life (ASCRS score) as well as continence (Wexner score), which went from 17 before surgery to 2 after. Ano-rectal manometry showed an improvement in the efficiency of the external sphincter but no change in the internal sphincter.

A previous study by **Leung *et al.*** [20]when combined with the bowel management programme, biofeedback pelvic floor muscle exercise as well as electrical stimulation are helpful for individuals with severe anorectal malformation who have experienced postoperative incontinence.

On the other hand, **Jarrett *et al.*** [21]published outcomes for 3 male patients with postoperative FI after recto-sigmoid excision for malignancy. All of them had a fully functional sphincter despite having failed biofeedback and medicinal treatment. Test PNE stimulation was effective for two of the three patients, thus chronic unilateral stimulation was performed on them. After 12 months, the patient went from having 14 and 5.7 incontinence incidents per week (pre-test) to having 2 and 0 respectively (post-test).Both individuals were able to increase their time to defection from 0 to between 5 and 15 minutes. The SF-36 quality of life score increased in every category except one: bodily pain.Neo-adjuvant radiation was given to the patient who tested negative for PNE stimulation.

Another study by **Ratto *et al.*** [22]tested the impact of SNS in patients who undergone neo-adjuvant chemo-radiotherapy, which preceded by anterior resection of rectum. Unilateral chronic stimulation was performed on four patients who had responded favorably to initial PNE testing. Although one patient did not show any improvement, the average number of incontinent occurrences per week for the other three participants declined substantially from 12 to 2.5 over the process of the investigation ($P< 0.05$).The average Cleveland Clinic score dropped from 16.3 to 4.5 throughout the 2-month follow-up period ($P< 0.05$).

Holzer *et al.* [23] analyzed the findings of SNS in six patients suffering from rectal cancer who had undergone resection following neo-adjuvant chemotherapy and radiation. The patients' ages ranged from 42 to 79 years. Successful test stimulation was also followed by unilateral chronic stimulation in all cases. After a median of 32 (17- 46) months of follow-up, substantial symptom reduction was noted by all six patients; Rectal irrigation was necessary for the treatment of one patient who was unable to maintain adequate continence despite receiving treatment.

Another study by **de Miguel *et al.*** [24]documented the effectiveness of SNS among 15 patients with rectal cancer who had previously had neo-adjuvant chemotherapy and radiation. There were 12 males and the median age ranged from 47 to 82 years old. Seven of the participants who had a positive response to the test PNE stimulation went on to get chronic stimulation. At the most recent follow-up after a median of 12 (1-44) months, the average Cleveland Clinic score has decreased from 19.2 (1.2) at baseline to 6.2 (1.7) (P 0.02). At the most recent follow-up, the average number of days during which a patient experienced incontinence has dropped from 7 (0) at the beginning to 0.2 (0.3) (P 0.01).The Rockwood Quality of Life score increased in all four categories for five people.

A letter from **Moya *et al.*** [25] showed the efficacy of sacral stimulation among 4 patients underwent neo-adjuvant chemoradiotherapy as well as rectal cancer treated with an anterior resection. After at least 2 years of non-invasive treatment, all four patients still experienced severe fecal incontinence after surgery. Each participant reduced their incontinence episodes by at least 50% throughout the course of the 4-week study, with the median Cleveland Clinic score decreasing from 15.5 to 5.5 ($P < 0.005$). Both the average distance of the anastomosis from the anal margin [5 (2-8) cm] and the anatomy of the sphincter were recorded.The external sphincter was intact in all cases.

Another previous study by **Gourcerol e*t al.*** [26] hypothesized that patients with FI have been respond to

SNS via (i) a somato-visceral reflex, (ii) a modification of the perception of afferent information, as well as (iii) an improvement in external anal sphincter activity.Patients with FI likely respond to SNS by modulating spinal and/or supraspinal afferent signals; this is likely the mechanism through which SNS works.

A previous study by **Carrington *et al.*[27]**reported a substantial collection of proofs demonstrates impacts outside the ano-rectum, it is probable that the impact of SNS on ano-rectal function happens at the pelvic afferent or either central level.SNS stimulates the S2–S4 nerves, which comprises somatic fibres from the pudendal nerve, afferent sensory fibres from the anal sphincter/pelvic floor, as well as autonomic fibres largely from the pelvic nerves.EMG investigations reveal that the anal sphincter contraction recorded throughout SNS is the consequence of an afferent-mediated response, suggesting afferent neuronal activation.

In the same line **Jarrett *et al.*[21]**demonstrated a decline in fecally incontinent episodes in individuals with FI after recto-sigmoid resection who received SNS.This finding also demonstrates an enhancement in the patients' ability to control bowel movements. This is also essential to increasing the quality of life for people. More frequently than not, an increase from less than 5 minutes to more than 5 minutes is sufficient for patients to feel more confident that they will be able to locate a toilet in time when they leave their homes.

In a previous study by **Norton *et al.*[28]**,anal electric stimulation was found to enhance bowel control in patients by a little amount after eight weeks.

Finally, based on the preceding discussion of these data and the findings of other researchers in similar studies, it can be concluded that ES has a considerable improvement in fecal incontinence, as demonstrated by the extremely substantial reduction in Vaziey score as well as the improvement in EMG. The findings of the present investigations would introduce a scientifically applicable protocol to assist physical therapists and surgeons in dealing with fecal incontinence after surgery, setting up a treatment strategy to address this problem, slowing down the process of fecal incontinence as well as the growth of associated morbidities, and enhancing the quality of life for these patients.

CONCLUSION

It can be concluded that ES is a beneficial physical rehabilitation approach for reducing FI after colorectal surgery.

DECLARATIONS

- **Consent for publication:** I attest that all authors have agreed to submit the work.
- **Availability of data and material:** Available
- **Competing interests:** None
- **Funding:** No fund
- **Conflicts of interest:** No conflicts of interest.

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