**Effect of laser acupuncture on fecal incontinence after anorectal surgery**

Nesma M. Allam, Hussein G. Mogahed

Department of Physical Therapy for Surgery, Faculty of Physical Therapy, Cairo University, Giza, Egypt

Correspondence to Nesma M Allam, PhD, Department of Physical Therapy for Surgery, Faculty of Physical Therapy, Cairo University, 7 Ahmed Alzayate Street, Been Ulsarayat, Giza, 12111, Egypt. Tel: +20 100 403 7190; fax: 0020237617692; e-mail: dr.nesma2011@yahoo.com

Received 20 October 2017
Accepted 26 September 2018

Bulletin of Faculty of Physical Therapy 2018, 23:60–68

**Background**

Fecal incontinence (FI) is considered a common complication after anorectal surgeries because of sphincter injury. Application of laser acupuncture (LA) on acupoints is a noninvasive modality that may assist in the treatment of FI and in decreasing the frequency of incontinence.

**Aim**

This study investigated the effect of laser stimulation to acupoints on anal pressure during rest and squeeze, and the frequency and consistency of defecation in FI after anorectal surgery.

**Settings and design**

This study was carried out as a randomized-controlled trial of 40 patients (17 men and 23 women) diagnosed with moderate FI after anorectal surgery.

**Patients and methods**

The ages of the patients ranged from 40 to 70 years. They were assigned randomly to two equal groups: the experimental (LA) group, which received 60 s laser stimulation for acupuncture points plus pelvic floor exercises three sessions per week for 4 weeks, and the control (placebo) group, who received sham LA plus pelvic floor exercises three sessions per week for 4 weeks. Anorectal manometry was used to measure resting anal pressure and squeeze anal pressure. The frequency of FI was measured using the FI severity index. Assessment was carried out before and after 1 month of treatment.

**Results**

The results showed that there was a significant increase in resting anal pressure and squeeze anal pressure of the study group compared with that of the control group after treatment ($P > 0.001$). Also, there was a significant decrease in the fecal incontinence severity index of the study group after treatment compared with that of the control group ($P > 0.001$).

**Conclusion**

It was concluded that stimulation of laser to acupuncture points for 4 weeks is an effective approach for FI after anorectal surgery.

**Keywords:**
anorectal manometry, anorectal surgery, fecal incontinence, laser acupuncture

**Introduction**

Fecal incontinence (FI) is defined as the involuntary passage of fecal material through the anal canal [1]. It has a profound impact on quality of life and can result in severe restriction of usual activities such as dining out, engaging in sexual activity, or even going to work or school [2]. Also, patients with FI are more subject to health complications, such as skin injuries, urinary infection, and nutritional alterations [3].

Fecal incontinence might be caused by trauma to the sphincter after anal surgery, idiopathic degeneration of the sphincter muscle, spinal injury, or other neurological causes [4].

The mechanism of anal continence is complex and includes the integrated activity of anal sphincter muscles and pelvic floor muscles, the rectoanal inhibitory reflex, the rectal capacity, sensitivity, and complacency, and also stool consistency [5]. Changes in the sensitivity of the anal canal and postoperative complications, such as stenosis and FI, are because of injury to muscle fibers, which may occur during anorectal surgery [6].

Anal incontinence is a common complication after anorectal surgeries because of sphincter injury, and early physiotherapy rehabilitation can help improve the recovery of patients subjected to such surgeries, promoting sustainable outcomes and successfully
avoiding or treating postoperative complications, and improve the quality of life [7].

Surgery of anal fistula is the most common cause of FI because of surgical injury as transection of some parts of the sphincter muscles is usually part of the surgery. This leads to high rates of incontinence after fistulectomy [8].

Surgery for anal fissure adjustment is the second most common operation that causes incontinence. Lateral sphincterotomy, in most cases, promotes healing of chronic fissure and decreases the recurrence rate, but it may lead to long-term anal incontinence [9].

Traditional hemorrhoidectomy, which requires extraction of anal cushions, is a safe procedure for patients with typical fecal continence. From the viewpoints of cost viability, the traditional hemorrhoidectomy is recommended, particularly in the developing countries. Therefore, surgeons should keep in mind that this sort of surgery may increase the risk of complicated anal incontinence in patients with anal function defects or subclinical incontinence [10]. The highest incidence rate of FI has been reported in patients with a positive surgical history of hemorrhoidectomy [11,12].

In the case of mild incontinence, most patients can be treated with behavioral therapy, whereas severe incontinence should be treated with surgical repair if there is a physical interruption of the sphincter, which may result in variable outcomes because of the multifactorial premise of this issue. The internal anal sphincter has an excellent role in the resting anal pressure yet the vascular tissue of the mucosa and submucosa (called the anal cushions) might additionally encourage closure of the anal canal [13].

The standard surgical treatment for FI is sphincter repair with a covering sphincteroplasty. Different modalities include biofeedback, the Procon incontinence device, injection of manufactured materials, radiofrequency (Secca strategy), antegrade colonic enema, sphincteroplasty, graciloplasty, and stimulation of the sacral nerve [14].

The physiotherapy rehabilitation of pelvic floor muscle re-education is considered a conservative therapy that includes training for increased contractile ability and voluntary control of the external anal sphincter (EAS) and the pelvic floor muscle [15].

Acupuncture therapy affects biologic mediators for example, cytokinin, neurotransmitters, and T-cells. A noninvasive treatment technique is utilized because of the invasive impact of needle and probability of infection in this strategy. One of these strategies is laser acupuncture (LA) therapy. In this technique, a low-level laser is utilized as acupuncture therapy. The mechanism of action of LA is the same as acupuncture therapy [16].

Low-level LA therapy includes the utilization of light energy to acupuncture points for the stimulation of normal healing or for pain relief. The standard wavelengths of lasers that are most commonly utilized as a part of acupuncture therapy are those that enter most deeply because of its low absorption in soft tissues and water [17].

In clinical utilization of LA therapy, the points are chosen on a similar basis as for acupuncture therapy; for 10–60 s at each point per treatment session. Two to three sessions of LA therapy are regulated every week [18].

Acupuncture therapy has been found to be effective for the treatment of both urinary and FI, in addition to its effects on different neurological and cardiovascular conditions, despite the fact that there are few reports on these options [19].

Pelvic floor electrophysiological examinations are essential for the assessment and treatment of anorectal disorders such as FI. They enable the determination of the lesion, mechanism of damage, and severity, particularly when the neurological examination is completely normal [20].

Anorectal manometry is an easy, noninvasive strategy that measures different aspects of contractile movement in the anorectal region. It includes tests that include examination of internal and EASs, anorectal coordination, and rectal sensation. It has a high diagnostic potential [21]. It is used in the following conditions: FI, constipation, pain in the anal canal, Hirschsprung disease, dyssynergic defecation, and preoperative and postoperative assessment of anorectal disorders and anatomic defects [22].

Thus, this study was carried out to investigate the effect of laser stimulation to acupuncture points on FI after anorectal surgery, to improve maximum resting anal pressure, maximum squeeze pressure and to decrease the frequency of incontinence.
Patients and methods

Study design
This study has a randomized, placebo-controlled, pretest, and post-test design study. The patients were assigned randomly to the study group (n=20) or the control group (n=20) by an independent therapist who picked a sealed opaque envelope from a box following a numerical sequence; the envelope contained a letter indicating whether the patient would be allocated to the study group or the control group. This study was approved by the Laser Institute Research Ethical Committee.

Participants
Forty patients (17 men and 23 women) with moderate FI after anorectal surgeries (fistulectomy, fissurectomy, and hemorrhoidectomy) were diagnosed by a physician; the sample size was measured using a general power analysis program (G Power 3.0.10; Heinrich-Heine, University of Dusseldorf, Kiel, Germany) with α errors of 0.05, effect size of 0.60, and power (1−β) of 0.80. The estimated total sample size was 40 patients. A sample size of 20 patients per group was required. All patients received behavioral therapy and their ages ranged from 40 to 70 years. The study was carried out in The Institute of Laser Enhanced Sciences (NILES), Cairo University, Egypt.

The study excluded patients with severe FI, damage to the rectovaginal fascia, FI from spinal cord injury, neurological disorders, pregnancy, inflammatory bowel disease, idiopathic FI, patients with a history of incontinence before surgery, intake of photosensitive drugs, injury or active infection in the treatment area, and patients with unstable medical conditions. All patients were provided full information on the protocol and a written informed consent form for participation in this study.

Intervention
Patients who fulfilled the selection criteria were divided randomly into two equal groups: the experimental (LA) group, in which patients received LA plus pelvic floor exercises, and the control (placebo) group, which received sham LA plus pelvic floor exercises.

Evaluation procedures
The assessment strategies were utilized for every patient in the two groups before and after the treatment period (4 weeks). Assessment techniques included the following.

Anorectal manometry
High-resolution anorectal manometry (Solar GI HRM; MMS, Enschede, the Netherlands) was utilized for all patients. High-resolution pressure graphs were plotted. These were utilized to measure anal pressure during rest and squeeze using a catheter that had 10 circumferential sensors along the anal canal.

Patients were placed in the side lying position with the hips flexed to 90°. Evacuation enema was performed on all patients before the technique. The catheter was presented through the anal verge so that the balloon was located at the rectum and the anal canal. Patients were asked to relax and then squeeze the anal sphincter [23].

Resting anal pressure is linked to internal anal sphincter movement and is characterized as the contrast between intrarectal pressure and the most recorded anal sphincter pressure at rest, whereas squeeze anal pressure is related to EAS movement and is characterized as the contrast between the intrarectal pressure and the most recorded anal sphincter pressure during squeeze [24].

<table>
<thead>
<tr>
<th>Table 1 Fecal incontinence severity index [26]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient checklist</td>
</tr>
<tr>
<td>-------------------</td>
</tr>
<tr>
<td>a. Gas</td>
</tr>
<tr>
<td>b. Mucus</td>
</tr>
<tr>
<td>c. Liquid stool</td>
</tr>
<tr>
<td>d. Solid stool</td>
</tr>
<tr>
<td>Weights</td>
</tr>
<tr>
<td>Gas</td>
</tr>
<tr>
<td>Mucus</td>
</tr>
<tr>
<td>Liquid</td>
</tr>
<tr>
<td>Solid</td>
</tr>
<tr>
<td>A, patient rating of severity; B, surgeon rating of severity.</td>
</tr>
</tbody>
</table>
Fecal incontinence severity index
Self-report questions identified with loss of stool are usually used to determine stool consistency (gas, mucus, liquid, solid). Similarly, they typically intended to determine the frequency of stool-loss by using (never, always) or behavioral recurrence scales (day by day, week after week) [25] (Table 1).

Treatment procedures
The treatment procedures for the experimental group included LA and exercise. The treatment was administered 1 month after surgery three times per week for 4 weeks.

LASER acupuncture
Infrared laser (Giotto, MED SPA, Lissone, Italy) with a wavelength of 905 nm, an average power of 15 W, and an energy of 225 mJ, 60 s for each point, was used. In the lower abdomen, Zhong ji (RN3) and Qi Hai (RN6) (Fig. 1) were stimulated, in the back and sacrum, Shen Shu (BL 23), Ciliao (BL 32), and Huiyang (BL 35) were stimulated bilaterally (Fig. 2), and in the lower limb, Zu San Li (ST 36) and Tai Xi (KI 3) were stimulated bilaterally (Fig. 3). These acupoints were stimulated as they are the points of stimulation of the rectum and anus [30].

Pelvic floor exercises
Patients in the two groups were instructed to contract in different ways – as maximal voluntary sustained sphincter contractions, submaximal managed contractions, and quick-twitch contractions [31].

Statistical analysis
Descriptive statistics and t-test were carried out for comparison of patient characteristics between both groups. Mixed-design multivariate analysis of variance (MANOVA) was used to compare the mean values of resting anal pressure, squeeze anal pressure, and the fecal incontinence severity index (FISI) between the study and control groups as a between-group comparison and between pretreatment and post-treatment in each group as a within-group comparison. Post-hoc tests using the Bonferroni correction were carried out for subsequent multiple comparisons. The level of significance for all statistical tests was set at $P$ less than 0.05. All statistical analyses were carried out using the...
statistical package for social studies version 19 for windows (SPSS; IBM SPSS, Chicago, Illinois, USA).

**Results**

**Patient characteristics**

Table 2 shows the mean±SD age of the patients in groups A and B. There was no significant difference between both groups in the mean age ($P=0.49$). Also, there was no significant difference in the sex distribution between the two groups ($P=0.74$).

**Effect of treatment on resting anal pressure and squeeze anal pressure**

Mixed MANOVA showed that there was a significant interaction of treatment and time (Wilks’ $\lambda=0.22$; $F=41.16$; $P>0.001$). There was a significant main effect of time (Wilks’ $\lambda=0.02$; $F=454.83$; $P>0.001$). There was a significant main effect of treatment (Wilks’ $\lambda=0.5$; $F=11.6$ $P>0.001$)(Table 3).

**Within-group comparison**

There was a significant increase in resting anal pressure and squeeze anal pressure after treatment in group A compared

| Table 2 Comparison of patient characteristics between groups A and B |
|-----------------------|-----------------------|-----------------------|------------------------|
|                       | Mean±SD               | MD                    | $P$ value              |
| Group A               | Group B               |
| Age (years)           | 58.4±9.13             | 60.15±6.66            | −1.75                  | 0.49                    |
| Males/females         | 9/11                  | 8/12                  |                        | 0.74                    |

MD, mean difference.

with that before treatment ($P>0.001$). The percentages of increase in resting anal pressure and squeeze anal pressure were 18.55 and 11.87%, respectively. There was a significant decrease in FISI after treatment compared with that before treatment ($P>0.001$), with the percent of decrease being 26.44% (Table 3).

There was a significant increase in resting anal pressure and squeeze anal pressure after treatment in group B compared with that before treatment ($P>0.001$). The percentages of increase in resting anal pressure and squeeze anal pressure were 10.49 and 6.62%, respectively. There was a significant decrease in FISI after treatment compared with that before treatment ($P>0.001$), with the percent of decrease being 13.9% (Table 3).

Location of acupoints in the lower limb [29].
Between-group comparison
As shown in Table 3 and Figs 4 and 5, there was no significant difference between both groups in resting anal pressure, squeeze anal pressure, and FISI before treatment ($P>0.05$). Comparison between groups A and B after treatment showed a significant increase in resting anal pressure and squeeze anal pressure in group A compared with that in group B ($P>0.001$). Also, there was a significant decrease in FISI of group A after treatment compared with that of group B ($P>0.001$).

Discussion
The findings of this study showed that there was a significant increase in resting anal pressure and squeeze anal pressure in the study group compared with that of the control group ($P>0.001$). Also, there was a significant decrease in FISI of the study group after treatment compared with that of the control group ($P>0.001$).

Incontinence after anal surgery is associated with internal sphincter damage, which is distal in the high-pressure zone, causing changes in the ordinary resting pressure inclination in the anal canal. It was found that anal surgery causes FI [32].

Conventional treatment of FI is centered on changing stool consistency and volume, intestinal travel time, and patterns of clearing. It is usually an essential approach for patients who are not indicated for surgery; also, it is useful when combined with surgery or biofeedback treatment. However, it cannot be considered the only treatment for FI. To date, surgery is still considered the best approach for treating most patients with severe FI [33].

Non-surgical treatments of FI appear to be extremely effective, especially in symptomatic patients, during the postoperative period of anorectal surgeries as they lead to improved and excellent good results after the surgery and prevent postoperative complications. Physiotherapy can...
be offered during follow-up of patients with anorectal disorders and offers different modalities that can enable improved evacuation control [34].

Stimulation of specific acupuncture points regulates and restores the energy balance along the paths and thus treat the disease. Traditional Chinese classification identifies 361 points along 14 main paths; however, other points have been identified over time to more than double the total number of identified points [35].

Depending on the power and type of laser, the treatment time is \( \sim 15-60 \) s per point. Most specialists have reported excellent outcomes in 10–15 s depending on the type of laser used. Points that require deep stimulation, such as the legs and trunk, may require longer treatment durations. However, the ears, hands, and feet require less treatment durations [36].

LA has numerous positive applications for enuresis, overactive bladder, weight loss, pain relief in musculoskeletal conditions, postoperative nausea and vomiting, chronic tension headache, and carpal tunnel syndrome. This study describes the effect of LA on FI after anorectal surgery.

MacPherson et al. [37] proved that there are practical differences between laser and needle acupuncture. One disadvantage of laser is that treatment protocols often involve multiple-point stimulation. This requirement can be easily met with the use of needles; however, piecemeal treatment is obviously required with a single laser and optic fiber. Both methods are considered safe [37].

Acupuncture therapy plays a major role in preventing FI. The mechanism of action is related to the effect of the ‘neuromodulation’ of the rectoanal function like the effect that gained after sacral nerve stimulation. The concomitant regulation of FI may also contribute toward satisfactory results. This was proved by a study by Scaglia et al. [30], who used acupuncture needles placed either over the sacrum or the perineal area on Zhong ji (RN3), Qi Hai (RN6), Ciliao (BL 32), Shen Shu (BL 23), Zu San Li (ST 36), and Tai Xi (KI 3) acupoints; with a stimulation regimen of 30 min per week for 10 weeks, followed by maintenance therapy after 1–3 months, a 50–85% reduction in incontinence episodes was reported.

The findings of the study are in agreement with those of Tao et al. [38], who used electro acupuncture on Ciliao (BL 32) and Huiyang (BL 35) acupoints, which have the function of regulating and activating the qi of both the urinary bladder and the kidney. Acupuncture stimulation at these acupoints is also effective for treating incontinence of defecation. According to traditional Chinese medicine, the kidney, which is...
interiorly–exteriorly related to the urinary bladder, is responsible for urination and defecation, and controls the functional activities of qi [38].

Several studies have explained the effect of stimulation of the sacral nerve for the treatment of FI. Brill and Margolin [39] reported positive outcomes in both medium-term and long-term follow-up periods. It is more appropriate for patients with incontinence that arises from a functional deficit not from anatomic cause. Usually, excellent outcomes are recorded with a subchronic stimulation trial. The effect of SNSs is likely multifactorial, with the current data indicating both an improvement in striated muscle action and neuromodulation of sacral reflexes that manage rectal sensitivity and contractility.

The results of this study are in agreement with a study by Sun et al. [40], who found that stimulation of acupuncture points is an effective and safe strategy for the treatment of urinary incontinence after stroke. This study provided a systematic review of the present evidence that proved that the stimulation of acupuncture points is an effective and safe modality for the treatment of urinary incontinence [40].

Moreover, the results of this study are in agreement with those of Gamal et al. [41], who found that low-level LA has a significant effect on bladder reservoir function in primary monosymptomatic nocturnal enuresis because of increasing bladder capacity at night following laser stimulation on the (BL 23, 28, and 32), (RN 3, 4, 6, and 12), (UB 13 and 20), and (SP 6, ST 36, and KI 3) acupoints [41].

Also, Jafarpoor et al. [42], found that application of LA on an overactive bladder syndrome was positive and the incidences of urinary urgency and nocturia in the intervention group compared with the control group decreased significantly. In the experimental group, there was a change in patient satisfaction after the treatment. Acupuncture inhibits acetylcholines. Therefore, it controls the parasympathetic system. Afferent fibers of the bladder mainly originate from the parasympathetic nerve system and acupuncture inhibits afferent fibers of the bladder wall [42].

In addition, a study by Alsharnoubi et al. [43] found that a combination of LA and medications in 45 children ranging in age from 5 to 15 years is viable for the treatment of nocturnal enuresis. Laser therapy was applied at the following points: (RN 2, 3, and 4), and (UB 23, 28, and 32 bilaterally) and SP6 bilaterally. Laser stimulation to acupuncture points is considered a noninvasive, safe modality, with no side effects and lower recurrence rates; hence, it is an effective therapy for the treatment of nocturnal enuresis [43].

Another study carried out by Graham and Cook [44] proved that stimulation of acupuncture points of the bladder (BL) acupoints increases the capacity of the bladder and controls bladder muscle contraction by inhibiting the parasympathetic nerve system [44].

**Limitations of the study**

This study was limited by the physical and psychological conditions of the patients at the time of treatment, patient lifestyle, small sample size, short duration of treatment in the study, and differences between patients in the rate of recovery.

Further, studies are recommended to study the effect of LA in patients with FI after anorectal surgery on the quality of life and other manometric measurements, which include rectoanal inhibitory effect, anal canal length, rectal sensation and balloon expulsion test, and measurement of Electromyography (EMG) at rest and during squeeze.

Further studies are required to compare LA and other modalities such as sacral nerve stimulation and posterior tibial nerve stimulation in patients with FI after anorectal surgery. More extensive studies should be carried out to follow-up and evaluate the efficacy of LA 3and 6 months after surgery.

**Conclusion**

From the results of this study, it can be concluded that LA is an effective modality for the treatment of FI after anorectal surgery as there was a significant increase in resting anal pressure and squeeze anal pressure of the study group compared with that of the control group. Also, there was a significant decrease in FISI of the study group after treatment compared with that of the control group.

**Financial support and sponsorship**

Nil.

**Conflicts of interest**

There are no conflicts of interest.

**References**
