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THE EFFICACY OF ELECTROTHERAPY WITH BIAN STONE IN TREATING FUNCTIONAL CONSTIPATION IN THE ELDERLY

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Abstract: Objective: The objective of the study is to assess the effect of a combined therapy of electric heating and Bian stone use with functional constipation in aged patients aiming to come up with a non-drug teaching method and to obtain a subjective reference of applying the intervention of traditional Chinese medicine non-drug to treat chronic diseases. **Methods:** Sixty-six elderly constipated patients were recruited notwithstanding the inclusion criteria. The patients were randomly split into a group of patients undergoing stone therapy and a control group (n=33 each) using Stata 15.1 software. Both conditions were treated to conventional monotherapy, using lactulose and glycerol suppositories, and the control group also had the pseudo clinical nursing care. Moreover, the Bian stone therapy group went through an extensive course of electrotherapy using Bian stones. This system involved the use of Chinese herbal medicine as a vehicle, the application of acupoints, and localized four energy methods, including rubbing, vibration, tapping, and warming. The treatment was done as 20 minutes per day during a 10-day course of the therapy. The scores of constipation symptoms were measured in both groups before the treatment and in day five and day ten. Symptomatic efficacy and quality of life were also observed by the time to the first bowel movement after treatment. **Results:** The overall efficacy rate of the stone treatment group, at the end of the treatment, was 93.94% which was much better than that of the control group, which was 54.84. Median time taken to pass bowel movement was 18hours in the stone therapy group and 34hours in the control group and the differences were statistically significant ($P<0.01$). Day 5 of treatment, both groups proved to have a significant improvement in the constipation symptom score levels with the stone therapy group proving better than the other in terms of the time to first bowel movement score, feeling of incomplete evacuation score, and the abdominal distension score ($P < 0.05$). Compared to the situation prior to the intervention, quality of life symptom scores improved in both groups following the intervention ($P < 0.01$) and stone therapy but not the control group had significantly lower scores across all domains ($P < 0.01$). **Conclusions:** To treat functional constipation of older patients, a combination of conventional clinical and electro-therapeutic stone therapy has better effects. The approach reduces the time to the first bowel movement by a significant margin, decreases the symptoms of constipation, and increases the quality of life of patients. Hence, electric-therapeutic stone method has unique paths to cure functional constipation among elderly people.
Keywords: Electro-heated stone therapy; Elderly; Functional constipation; Non-pharmacological traditional Chinese medicine therapy; Clinical efficacy

1 INTRODUCTION

Constipation is a condition, which is predominantly characterized by the inability to pass stools, longer periods between bowel movements, dry and hard stool, or an unresolved feeling of incomplete evacuation regardless of defecation urgency [1]. One of the gastrointestinal problems that is the most prevalent with the elderly population is functional constipation. As the number of elderly people is rapidly increasing in China because of the ageing population, it has been observed that the instances of constipation in older adults are also increasing by the year end and more than a quarter of them are reporting symptoms [2]. According to several surveys, local and foreign, the prevalence of constipation among older persons, in home care provision or nursing facilities, can even reach 50% [3,4].

Even though constipation per se is not a significant mortal threat, its presence raises the risk of the related diseases considerably, in particular, it can advance the risks of the onset of colorectal polyps and, possibly, lead to the development of colorectal cancer. Secondly, long-term straining when using the restroom may lead to cardiovascular and cerebral accidents, including congestive heart illness and hemorrhage of the brain [5,6]. A significant psychological load on the elderly is also constipation, which seriously impacts their everyday life and the overall quality of health, which should be given universal consideration [7].

It is widely agreed nowadays that the pharmacological therapies of functional constipation in the aging population depend basically on the use of chemical medications. Although quick symptom relief is achieved with these medications the drugs are always accompanied by side effects including high recurrence rate, nonoptimal efficacy at a long term and dependence on the drugs. The Chinese non-pharmacological therapies traditionally are aimed at preventing and curing the disease without medication using the application of traditional methods to regulation of the yin-yang balance of the body. One of the four major non-pharmacological therapies of traditional Chinese medicine (along with acupuncture, moxibustion and Daoyin massage) is called Bian stone therapy because the object in this

therapy is the Bian stones that have specific physical characteristics and which are used to treat acupoints and meridians. Its efficacy in the treatment of functional constipation has been verified in the previous works.

Nonetheless, keeping a constant temperature of the stone is a technical problem with Bian stone therapy. High temperature may lead to certain undesirable side effects like burns and blisters whereas low temperature does not bring the intended therapeutic effect [8]. Electrically heated stone that is employed in the current study is made of natural stone material that is supplemented with semiconductor parts and is governed by a microcomputer program. The innovation helps in overcoming the conventional limitations of the inconveniency in heating and inability to sustain the temperatures over long durations making sure that the stone is kept at the same temperature over exercising and tackling the technical challenges posed by stone therapy. Informed by the traditional Chinese medicine principles in the areas of the viscera and meridians, a complex conventionalized electrothermally heated stone integrated diagnosis and treatment regimen was further refined. In this research, they used the electrothermally heated stone protocol to intervene in elderly patients with constipation that was functional and the results of this intervention were favorable as outlined below.

2 SUBJECTS AND METHODS

2.1 Study Population

Sixty-six elderly patients who came to the tertiary hospital in Shanghai and got diagnosed with functional constipation between February 2023 and February 2024 were randomly assigned to one of the two conditions, i. e. an observation group and a control group (n=33 each). This study received approval from the hospital's ethics committee. During the study, two patients were excluded from the control group: one for poor compliance (self-administering other constipation medications) and the other for premature discharge before completing the required treatment duration. At the study's completion, there were 33 effective cases in the stone therapy group and 31 in the control group. A comparison of general characteristics (age, gender, height, weight) between the groups showed no statistically significant differences ($P > 0.05$), satisfying the study's requirements. Detailed results are presented in Table 1.

2.2 Inclusion Criteria

① Patients meeting the Rome IV diagnostic criteria for functional constipation; ②Aged between 60 and 89 years, regardless of gender; ③ Voluntarily signed informed consent and able to cooperate.

2.3 Exclusion Criteria

① Patients with concurrent cardiovascular disease or organic organ dysfunction (e.g., pulmonary, hepatic, renal); ②Patients with psychiatric disorders or cognitive impairment that impede communication; ③ Constipation due to intestinal strictures caused by colorectal organic lesions; ④Patients with advanced tumors; ⑤ Constipation resulting from medication factors; ⑥ Patients with abdominal skin damage or severe skin diseases that prevent massage and heat application; ⑦ Patients with bleeding or coagulation abnormalities due to severe primary hematopoietic system diseases.

Table 1 Comparison of General Characteristics Between Two Groups (n=64)

Group	Number of Cases	Age (years)	Gender (n, %)		Height (m)	Weight(kg)
		[M(P25, P75)]	Male	Female	(x±s)	(x±s)
Stone therapy group	33	67(63,70)	18(54.5)	15(45.4)	1.67±0.086	63.68±12.218
Control group	31	70(66,75)	11(35.4))	20(64.5)	1.64±0.073	62.31±13.469
Statistic		Z=-1.476	χ^2=2.344		t=-1.576	t=-0.428
P		0.14	0.126		0.12	0.67

2.4 Research Methods

2.4.1 Control group intervention

Patients in the control group received conventional therapeutic medication, specifically lactulose oral solution, taken orally after meals at a dose of 2 vials once daily for 10 consecutive days. Enema suppositories (20ml) were used as needed. Additionally, they were provided with routine clinical care, including personal care, dietary management, exercise guidance, abdominal massage instruction, and psychological support.

2.4.2 Intervention method for the Bian Stone Group

In addition to routine clinical care provided to the control group, patients in the Bian Stone Group underwent the following specific procedures: The practitioner stood to the patient's left side while the patient lay supine with a pillow under the knees. The formula was Tongfu Formula which included Raw rhubarb 2g, Zhi shi 1g, Aloe 2g,1g Areca nut that was used to enhance the spleen, improve digestion, and balance qi and blood. Electrically heated stone was applied on the stone as follows:

1. Abdominal Rubbing: The stone was applied round the belly button, and rubbed in a clockwise rotary motion of 10 minutes until warmth was experienced and a feeling of distension being felt along the lower left abdomen was obtained;
2. Vibration Massage: Viable, One side of the stone was laid against the left lower abdomen of the patient and the vibrations, with a high frequency of more than 200 vibrations per minute were done by flexing up and down in 1 minute;
3. Acupoint Stimulation: The bilateral Tianshu (ST25), Guanyuan (CV4) and Zhongwan (CV12) points were stimulated with the corner of the electrically heated stone with 1 minute pressure per point with the aim of a sore and distending feeling;
4. Warming Technique: A 45degC and warm rock was rolled over the umbilicus and lasted a point of 5 minutes. The entire treatment period was 20 minutes and the patients underwent this whole course of electro-heated stones therapy after one day of treatment of 10 days in a row.

2.5 Evaluation Methods

Four indicators were used to evaluate clinical efficacy in both groups namely: (1) Differences in syndrome efficacy (pre-treatment, day 10 post-treatment); (2) Time to first bowel movement post-treatment; (3) Constipation Symptom Score (pre-treatment, day 5 post-treatment, day 10 post-treatment); (4) Constipation Patient Quality of Life Scale (pre-treatment, day 10 post-treatment).
Details are as follows:
(1) Syndrome-Based Therapeutic Efficacy Assessment: The disease efficacy was assessed according to the guidelines on clinical research of new traditional Chinese medicines [9], when the nimodipine method was used. The syndrome score was calculated as follows: [(Pre-treatment score - Post-treatment score) / Pre-treatment score] × 100%. Complete Recovery: Normal bowel function was restored, and all related symptoms were resolved or substantially alleviated, with a syndrome score ≥ 95%. Marked Improvement: Primary symptoms and signs showed significant amelioration, with a syndrome score ranging from 70% to less than 95%. Effective: Primary symptoms and signs were significantly ameliorated, with a symptom score between 30% and less than 70%. Ineffective: There was no marked improvement or even a worsening of primary symptoms and signs, with a symptom score < 30%. Efficacy rate (%) = [(Cured + Markedly effective + Effective) ÷ Total number of cases] × 100%.
(2) Time to the First Bowel Movement after Treatment Initiation: The time to the first bowel movement measured after administration of treatment or the beginning of medication administration was taken on the two patient groups, starting at the beginning of medication or treatment.
(3) Constipation Symptom Score Sheet: This questionnaire was compiled in 2005 by the Surgery Division of the Chinese Medical Association that evaluated six aspects namely: ① Severity of defecation difficulty; ②_Faecal consistency; Time taken to defecate; ③Sensation of heaviness, ④incomplete evacuation, or distension; ⑤Weekly frequency of bowel movements; ⑥Abdominal bloating. The scoring system used was four points (0-3) in the sense that the higher score, the worse the symptoms of constipation. The symptom score constipation was the tally of scores in every of the six domains [10].(4) Chinese Version of the Patient-Specific Constipation Quality of Life Questionnaire (PAC-QOL): licensed, Mapi Research Trust (France) this special tool assessed the quality of life in patients with chronic constipation. It comprised 28 questions and four domains; physical status, psychological status, concerns, and social relationships/satisfaction with a 5-point Likert scale. The scales of 0-4 points were used to rate the level of discomfort as not at all, somewhat, somewhat not, somewhat, not, and extremely. Some items were reverse-scored. An increase in the scores marked a decrease in the quality of life and the total Cronbach a coefficient of the scale was 0.93 [11].

2.6 Statistical Methods

Statistical analysis was conducted using IBM SPSS 24 software. Quantitative data were expressed as mean ± standard deviation (x±s) and analyzed using t-tests; data not normally distributed were presented as medians and analyzed using the Mann-Whitney U test. Categorical data were presented as frequencies and percentages and analyzed using chi-square tests. Repeated measures analysis of variance was employed to compare pre- and post-treatment constipation symptom scores between patient groups. $P < 0.05$ was considered statistically significant.

3 RESULTS

3.1 Therapeutic Efficacy Evaluation in Both Groups Post-Treatment

After 10 days of treatment, the efficacy evaluation results for patients in the Bian stone group and the control group are presented in Table 2. A comparison indicated that the comprehensive therapy integrating electro-heated Bian stones significantly outperformed conventional clinical nursing paired with basic medication alone. Although the number of effective cases was similar between the two groups, the Bian stone group exhibited significantly more cured and markedly effective cases than the control group. Additionally, the control group had a greater proportion of ineffective cases, suggesting that conventional clinical care combined with basic medication yields less satisfactory results for elderly patients with functional constipation.

Table 2 Therapeutic Efficacy of Syndromes in Both Groups After Treatment (n=64)

Group	Number of Cases	Cured	Markedlyeffective	Effective	Ineffective	Overallresponserate %	Z	*P*
Stone therapy group	33	6	14	11	2	93.94%	-3.528	<0.001
Control group	31	3	4	10	14	54.84%		

3.2 Time to First Bowel Movement After Treatment in Both Groups

A Mann-Whitney U test was conducted to analyze the time to first anal defecation post-treatment in both groups. The results showed a statistically significant difference, with P=0.015 (P<0.05). The electro-thermotherapy group had a significantly shorter time to first bowel movement compared to the control group, indicating that the electro-thermotherapy treatment was notably more effective. See Table 3 for detailed information.

Table 3 Comparison of Time to First Anal Defecation Post-Treatment Between Two Patient Groups [M(P25, P75)]

Group	Time to First Anal DefecationPost-Treatment (h)	Z	*P*
Stone therapy group (n=33)	18(5.75,43)	-2.432	0.015
Control group (n=31)	34(12.5,70.5)		

3.3 Evaluation of Constipation Symptom Scores Before and After Treatment in Both Groups

When comparing the efficacy between the stone therapy group and the control group, it was found that the stone therapy group consistently had significantly lower total constipation symptom scores than the control group at each intervention time point (p<0.05). The control group did see statistically significant score reductions during treatment compared to pre-treatment levels (P＜0.05). However, the differences in scores between the fifth and tenth days of treatment were not statistically significant (P>0.05), see Table 4.

Table 4 Comparison of Constipation Symptom Scores Before and After Treatment Between the Two Groups (x±s, points)

Group	Pre-treatment	Day 5 of Treatment	Day 10 of Treatment	F	*P*
Control group (n=31)	11.42±3.33	6.84±4.46△	6.84±4.10△◆	F_{time}=158.91	P_{time}＜0.001
Stone therapy group (n=33)	11.88±2.90	3.12±2.85△	4.36±2.99△◇	F_{group}=6.91	P_{group}=0.01
t/Z	-5.950*	-2.725**	-3.396**	$F_{Interaction}$=13.46	$P_{Interaction}$＜0.001
P	0.557	0.010	0.001		

Note: *Two-sample t-test, **Mann-Whitney U test: Compared with pre-intervention values in the same group, △P < 0.05, ▲P > 0.05: Compared with values on day 5 of intervention in the same group, ◇P < 0.05, ◆P > 0.05

3.4 Quality of Life Scores Before and After Treatment in Both Groups

Prior to treatment, the stone therapy group had a quality of life score of 49 ± 15.91, and the control group scored 46.39 ± 13.87, with no statistically significant difference between them (P > 0.05). After treatment, the stone therapy group's quality of life score improved to 16.91 ± 11.28, while the control group's was 31.16 ± 13.71. This post-treatment improvement was statistically significant (P < 0.001) (Table 5). These results highlight the added benefits of incorporating electrotherapy stone therapy.

Table 5 Comparison of Quality of Life Scores Before and After Treatment Between Groups (x±s, points)

Group	Pre-treatment	Aftertreatment	Difference	t	*P*
Stone therapy group (n=33)	49±15.91	16.9±11.28	32.09±16.9	10.905	＜0.001
Control group (n=31)	46.39±13.87	31.1±13.71	15.2±11.87	7.145	＜0.001
t/Z	-0.699*	-3.965**	-4.592*		
P	0.487	＜0.001	＜0.005		

Note: *Two-sample t-test, **Mann-Whitney U test

4 DISCUSSION AND CONCLUSION

The findings of this paper indicate the patients of the stone therapy exhibited longer time to first anal defecation and symptomatic efficacy than the controls who underwent the intervention therapy after 10 days of therapy. This shows that the introduction of electrotherapy stone therapy into the mainstream clinical practice has better results that attest its high effectiveness in functional constipation treatment in the elderly. Such findings are in agreement with Tang Ying et al [12], who found that there was a lower rate of improvement in the symptom of constipation amongst patients undergoing dietary counseling and abdominal massage versus the group of patients receiving supplementary electro-thermal stone acupoint massage and acupoint plaster application.

The electrothermally heated group of stones had a much earlier first bowel movement after the treatment as compared to the control group and thus it would appear this treatment accelerates the process by comparison to the usual care. It is believed that this positive effect can be attributed to the resonance in which the energy waves within the human cells when they are touched by the stone are exposed to the internal electrons in the cells leading to the production of pulse frequencies ranging between 20-2000 kHz. With a combination of far-infrared, the application causes an increase of 0.5-2degC in body temperature and allows the formation of infrared thermal images following the meridian paths [13, 14]. As a result, aside from the anticonstipation properties of this practice, the electrically heated stone therapy used as an adjunct to treat functional constipation among the elderly population promotes the peripopular blood and microcirculation of their bowel and stool volumes. This is a general facilitation of visceral performance to aid the propulsion capacity of the large intestine waste.

The older patients who experience constipation frequently experience reduced organ functionality as a result of being old and weak. The impairment of the large intestine propulsion and fluid circulation is caused by kidney yin deficiency and qi deficit. A deficiency in the ability of the spleen-stomach, especially deficiency of the spleen, results in insufficient transformation and transportation which results in abdominal distension and poor appetite. This interferes with qi and blood production causing blood deprivation and consequent intestinal parchedness which materialized as dry and hard stool and constipated bowel movements. Consequently, functional constipation in the elderly is normally chronic and difficult to manage. The hours that are spent on it are often accompanied by depression, anxiety, and psychological discomfort significantly worsening the quality of life of patients [11]. The Expert Consensus on Constipation Grading and Clinical Management also indicates [15] that constipation can cause a number of negative emotional and psychological disorders. These negative effects, in turn, impact the gastrointestinal functioning via the autonomic route, increasing the rectal sensory threshold, decreasing the reflex defecation reflex, and increasing pelvic floor muscle tension, which leads to aggravation of the symptoms of constipation and formation of a vicious circle. This paper will prove that when integrated stone therapy intervention was administered, patients had better quality of life scores than in the control group which points to an improved quality of life. The action of electrically heated Bian stones has more force than the hand massage alone, penetrate to deeper areas and points of the body that are not available to the hand massage. It alters temporarily the abdominal wall by meaning that the lumen on the intestines, this acts to stimulate and enhance gastrointestinal reflexes, increase muscular activity to the digestive tract, and relaxation of the sphincters to hasten faecal expulsion [16]. Another method used in this study was the use of meridian acupoints and the four points that were most applicable (billetal Tianshu, Zhongwan and Qihai) were used. The Tianshu point is one of these, the point selected by adhering to the principle of choosing points near the affected area, and it is the Mu point of the large intestine in its area, mostly curing large intestine diseases. The Mu point of the stomach is Zhongwan on the Ren Meridian on the anterior midline, and the intersection of the viscera in all the Eight Convergence Points. It balances the stomach, strengthens the spleen, promotes qi, produces blood and eases constipation. According to the Universal Relief Formulas: in case of hard bowel movements, treat Zhongwan. One of the most important acupoints in the treatment of constipation is the Qihai point and it is the first point to be considered when restoring original qi. Together, all these four make the viscera feed and cause intestinal peristalsis as well as eliminate stool. This is also augmented with topical deposition of the herbal formula "Tongfu Fang" (Intestinal-Opening Formula) which gets into the skin and is able to internally loosen and control the intestines. The combination of these three complementary methods forms the electro-thermal stone integrated therapy to the treatment of functional constipation in elderly.

The combined results of the research prove that the use of the electro-thermal stone therapy actually enhances the first bowel movement time, symptom efficacy scores, and the quality of life of patients with constipation. This treatment mostly relieves the symptoms of constipation and minimizes the pain of patients by increasing the manual force of the practitioner to reach the depths and section that could not be achieved in the treatment solely using manual methods. Patient satisfaction was improved, compliance was also good, and there were no adverse reactions throughout the treatment process. Further studies can prove this combined therapy as a successful standardized TCM intervention of functional constipation in the elderly that can be applied clinically.

Treatment of constipation involves long-term strategies in treatment; this research project used short-term treatment and therefore a follow-up study should ensure a prolonged intervention period where the effect of the intervention is lasting and individual use of laxatives may have reduced.

COMPETING INTERESTS

The authors have no relevant financial or non-financial interests to disclose.

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