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The Effects of Interferential Current and Kaltenborn-Evjenth Orthopedic Manual Therapy on Functional Constipation

2 week study was conducted to investigate the effects of Interferential Current(IC) and Kaltenborn-Evjenth Orthopedic Manual Therapy(KEOMT) on functional constipation. Interventions were applied to spinal segments between T_9-L_2 which provides innervations to the gastrointestinal tract. Subjects(n=24) were randomly allocated to two treatment groups: the IC group or the KEOMT group. Results for the IC therapy demonstrated significant decrease with the colonic transit time(CTT) as well as scores on the constipation assessment scale(CAS). The frequency of defecations per week had increased significantly($p<0.05$). The KEOMT displayed decreased CTT in the left colon region. The scores on the CAS were reduced and frequency of defecations per week had increased significantly ($p<0.05$). This study not only showed that both modes of therapy improved symptoms of constipation, but also optimized gastrointestinal content movement, eventuating in a more normalized CTT. In conclusion, both the IC therapy and the Kaltenborn-Evjenth Orthopedic Manual Therapy have shown to be effective interventions for improving functional constipation.

Key words : *constipation assessment scale(CAS); colonic transit time(CTT); functional constipation; interferential current(IC); Kaltenborn-Evjenth orthopedic manual therapy(KEOMT)*

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INTRODUCTION

It is evident that there is increased prevalence of constipation and other gastrointestinal disorders. Hypothesised factors to explain the cause of this increase include gradual westernization of Korean eating habits and the increasing stress levels that follow the rapid urbanization and industrialization processes. Constipation is a common symptom described by patients; approximately 5 to 20 percent of the world population. However, the word constipation is not well defined due to the vast ranges of symptoms and experiences that it encompasses(1). The colon is a functional unit that works interactively with the nervous and the endocrine system to administer absorption, secretion, conservation and excretion. Optimal excretion or defecation requires anti-peristalsis, haustral contraction and mass movement inside the colon(2, 3). Any disruptions to this optimal excretion process leads to functional constipation. It is important to note that constipation is not a disease, but a term that describes symptoms or experiences among people. As a result, various explanations regarding the etiology of constipation have risen and have led to controversies(4).

Current increases in attention have led to more studies conducted that examine the pathophysiology of constipation. Constipation is differentiated from functional constipation through the presence of disturbance of colon motility and/or symptoms that may arise from various drugs or diseases. Especially, functional constipation is that does not have a physical malformations of the colon or anus, and endocrinal or metabolic disorders. Three pathophysiological causes of functional constipation have been described. The first explanation suggests that there

is insufficient input of food to cause progression of fecal movement in the colon. Another possible cause is due to pelvic floor dyssynergia subsequent to anorectal defecation. Lastly, slow transit constipation may be due to suboptimal mobility of the entire colon structures(5).

Most common form of constipation is the functional constipation which is due to the impairment of functional movements of the colon. Evaluation of functional movements of the colon is performed through tests such as anorectal manometry, CTT, electromyogram and defecography(6). CTT is most commonly used and it utilizes radio-opaque markers to identify functional constipations(7). CTT was developed by Metcalf in 1987 and has proven itself to be simple and easily utilized in a clinical setting. It is because of these reasons that CTT is used as a standard at The International Symposium of Neurogastroenterology and the United Kingdom Surgical Society(8). In addition, another advantage of CTT is that transitional time of the colon and each section of the colon can be estimated.

This study was carried out to find the effectiveness of IC and Kaltenborn-Evjenth Orthopedic Manual Therapy on functional constipation using CTT to identify activation of autonomic nervous system followed by functional mobility of colon.

BACKGROUND

Functional constipation

Functional constipation is a functional disorder. Functional constipation consists of several symptoms including continuous difficulty of defecation and decreased frequency of defecation with imperfect feces. 20% of America population was found to have functional constipation. It is more common with women and elderly(9). To be diagnosed with functional constipation, a comprehensive history taking is required consisting of investigative questions directed at anatomical structural problems, internal medical problems and aggravating factors. The Rome II criterion table 1 is a standard tool for diagnosing functional constipation which is based on patients responses(10).

Table 1. Rome Ⅱ criteria for functional constipation(Thompson et al., 1999).

Doctors diagnose functional constipation by looking at the pattern of symptoms and making sure there is no other explanation for constipation. To be diagnosed with functional constipation, a person should have two or more of the following for at least 3 months :

1. Straining while having a bowel movement at least one fourth of the time.
2. Lumpy and/or hard stools at least one fourth of the time.
3. A sensation of incomplete emptying after having a bowel movement at least one fourth of the time.
4. A sensation of blockage at least one fourth of the time.
5. Using a hand or finger to help pass stool more than one fourth of the time and/or
6. Two or fewer bowel movements per week.

Autonomic Nervous System(ANS)

Gastrointestinal movements are controlled by the ANS(11). The distal third of the large intestine is stimulated by the parasympathetic nerves at the lumbar level, and the small intestine and the proximal two thirds of the large intestine are governed by local nerves and hormonal stimulations from individual segments of gastrointestinal structures (11).

Study findings from Ebner(12) suggested that the status of internal organs could be evaluated by the level of tension of the body surface. This was explained to be the result of the body reflex system which refers pain from the internal organs to the area of skin that is governed by the same spinal cord segments.

Other researches have shown that IC therapy may improve the mobility of the large intestine. Surface electric stimulation was performed on sacral dermatome distributions in the constipation group of patients who also had spinal cord lesion(13). Post treatment, pressure spikes and mobility of the large intestine were significantly improved. Another research showed that CTT was decreased gradually when IC therapy was applied to a group of patients who had constipation as a result of spinal cord lesion (14). Another study also showed that specific points of the spine, which have increased sensitivity and

tension, may be used for local treatment (15).

METERIALS AND METHODS

Objectives and study period

This study arranged functional constipation patients(n=24) from S hospital at Mapyong-Dong in Yongin City in South Korea between December 2007 and April 2008. The patient was randomly allocated to two intervention groups: IC group or Kaltenborn-Evjenth Orthopedic Manual Therapy group. Rome II criteria, CAS and CTT were used for subject inclusion. Exclusion criteria included patients with the following conditions: malignant tumor, peptic ulcer, drug hypersensitivity, inflammatory bowel disease, patients who had gastric operation, women over 30kg/m^2 of Body Mass Index(BMI) and pregnant.

Methods of study

Informed consent was gained from patients. History taking was conducted before starting the research. Patients were asked to stop taking all medications for 7 days prior to relevant clinical tests. All candidates fasted from 10 o'clock the night before the clinical tests. Clinical tests involved collection of blood samples from the candidates. They also took a capsule containing 24 radio-opaque markers on a regular basis for 3 days. On the fourth day abdominal X-ray tests were conducted simultaneously while taking the capsule. After the initial set of clinical tests, both IC and the Kaltenborn-Evjenth Orthopedic Manual Therapy group had received treatments at spinal segment of T_9-L_2 for 20 minutes, 5 times a week for 2 weeks. Blood samples and abdominal X-ray tests were retaken after 2 week treatment to be compared with previous data.

Interferential Current(IC) Method

The interference current therapy machine SEDANTE 520 (Nihon medix, Japan) Quadripolar suction cup electrode was attached to the equipment. After the patient prone position, IC were applied to spinal segments between T_9-L_2 which provides innervations to the gastrointestinal tract. Quadripolar electrode around the paravertebral placement was conducted. Frequency used 100Hz, and the current intensity applied the submaximal intensity that the patient did not feel painfulness.

Kaltenborn-Evjenth Orthopedic Manual Therapy(KEOMT) Method

The Kaltenborn-Evjenth Orthopedic Manual Therapy enforced the physiotherapy private residence which studied OMT Kaltenborn-Evjenth Concept spine course.

After the patient prone position, KEOMT were applied to spinal segments between T_9-L_2 which provides innervations to the gastrointestinal tract. Facet joint grade Ⅱ glide to use in KEOMT was carried out. The lower thoracic does in order for the motion to happen at the ventral-cranial direction, and in order for the motion to happen with ventral direction, from the lumbar vertebra.

Fig. 1. Kaltenborn-Evjenth Orthopedic Manual Therapy Method

MEASUREMENT

Colonic Transit Time(CTT)

Involves a Sitzmarks capsule, which contains 24 radio-opaque markers (1×4.5mm archetype), used by Metcalf in their method. Medication for improving the function of large intestines and enemas were stopped 7 days prior to clinical tests. During the clinical test, individual took meals similar to a regular meal on a daily basis. The Sitzmarks capsule was taken at 9 o'clock in the morning for 3 days. On the fourth day, abdominal X-ray tests were conducted in standing position. If archetype of ring was shown from X-ray film the X-ray test was retaken on the seventh day. Number of archetype of ring on the X-ray film is multiply by 1.2 to give a value to CTT.

The large intestine is divided into three parts including right colon, left colon and rectosigmoid(7).

Arhan et al.(16) concluded that a part of the right colon (ascending colon) is between L_5 and a linkage of superior of right pelvic outlet and same level of spinous process of the spine. Part of the left colon (descending colon) is between the spinous process of the spine and a linkage of left anterior-superior iliac crest and L_5. It is a lower part of imaginary line between sigmoid colon and rectum. The imaginary line is connected right pelvic and left anterior-superior iliac crest(16).

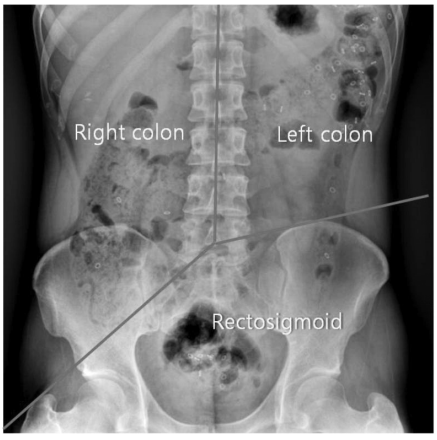

Fig. 2. Colonic transit time(CTT)

Observations of symptomatic changes

Number of defecation per week

Number of defecation was recorded before and after treatment for 1 week.

Constipation Assessment Scale(CAS)

This study used translated CAS questionnaire as observational method which had been developed by McMillan and Williams in 1989(17).

The content consists of 8 items including amount of gas, number of defecation, type of feces, feeling when defecating, feces weight and comfort while defecating. The items are scaled so that 'Not at all' is 0 point, ' A little bit' is 1 point and 'Most likely' is 2 points. Range of total score is from 0 to 16 points. Higher score indicates severe constipation. The CAS questionnaire's reliability(α) was 0.98(18).

Data analysis

A statistical process program(SPSS 13.0/PC) was used to analyze collected data. Specifically descriptive statistics was used to identify characteristic distribution among subjects. Cronbach's Alpha was conducted to evaluate CAS's reliability. Effect of treatments in functional constipation was evaluated by Wilcoxon matched pairs test.

RESULTS

General characteristics of the patient

Characteristics of demography

This study was conducted with 24 patients who had functional constipation. Interventions included IC and KEOMT. Patients were randomly allocated into two groups(each group n=12). There were gender differences in each group.

Table 2. Gender distribution at study groups

Classification		M		F		Total	
		N	(%)	N	(%)	N	(%)
Functional Constipation Group	IC	4	(40.0)	8	(57.1)	12	(50.0)
	Kaltenborn	6	(60.0)	6	(42.9)	12	(50.0)
	Total	10	(100.0)	14	(100.0)	24	(100.0)

M; male, F; female, IC; interferential current, KEOMT; Kaltenborn-Evjenth Orthopedic Manual Therapy

Reliability of CAS

Reliability of CAS was 0.786(before intervention) and 0.746(after intervention). Total CAS scale was 0.882 therefore the reliability was reasonable and acceptable.

Table 3. Constipation assessment scale reliability

Variable	Number of the question	Reliability(α)	Total Reliability(α)
CAS before study	8	0.7869	0.8824
CAS later study	8	0.7463	

CAS : constipation assessment scale

Analysis of effectiveness in the intervention

The effect of intervention was analysed by CAS, CTT and number of defecation per week. Wilcoxon matched pairs test was applied to IC group and KEOMT group.

Analysis of effectiveness of IC

IC was applied to spinal areas of T_9-L_2. Table 4 shows effects of IC before and after treatment. CTT at ascending colon was reduced from 8.40±3.69 hours(before treatment) to 4.40±3.87 hours(after treatment), CTT was reduced from 9.20±6.66 hours to 6.80±6.81 hours at descending colon and CTT was reduced from 18.40±4.84 hours to 7.20±7.38 hours at recto-sigmoid. Total CTT was reduced from 36.00 ±1.02 hours to 18.40±11.27 hours. The number of defecation per week was increased from 1.67±0.49 times to 4.33±0.98 times. CAS was reduced from 11.00±0.85 points to 7.00±0.85 points. In conclusion, after IC intervention, CTT from all part of the large intestine and CAS were significantly reduced, however the number of defecation per week was increased ($p<0.05$).

Table 4. Effect of IC

Method	Classification		Before study (n=12)	Later study (n=12)	t	z	p	
IC	Colon transit time	Right colon	8.40±3.69	4.40±3.87	0	3.059	0.002	**
		Left colon	9.20±6.66	6.80±6.81	0	3.059	0.002	**
		Rectosigmoid	18.40±4.84	7.20±7.38	10	2.275	0.023	*
		Total colon	36.00±1.02	18.40±11.27	0	3.059	0.002	**
	Weekly frequency of defecation		1.67±0.49	4.33±0.98	0	3.059	0.002	**
	CAS		11.00±0.85	7.00±0.85	0	3.059	0.002	**

IC : Interferential current CAS : constipation assessment scale * $p<0.05$, ** $p<0.01$

Analysis of effectiveness of Kaltenborn-Evjenth Orthopedic Manual Therapy

Kaltenborn-Evjenth Orthopedic Manual Therapy(KEOMT) was applied to the group of patient at spinal segment of T_9-L_2. Table 5 shows that effectiveness of KEOMT before and after treatment. CTT at ascending colon not showed significant difference before treatment(6.90±8.28 hour) and after treatment(5.10±4.55 hour). CTT was significantly reduced from 18.30±16.42 hours to 6.90±10.43 hours at descending colon. CTT was reduced from 30.90±19.75 hours to 18.90±10.43 hours at recto-sigmoid. Total CTT was reduced from 56.10±9.88 hours to 30.90±15.61 hours. Number of defecation per week was significantly increased from 1.50±0.52 times to 4.00±1.28 times. CAS was reduced from 11.25±0.45 points to 6.25±1.36 points. In conclusion, after KEOMT intervention, CTT was significantly reduced from left colon, total CTT and CAS on the colon transit time. However, the number of defecation per week was significantly increased ($p<0.05$).

DISCUSSION

Song reported that CTT(recto-sigmoid and total CTT) was reduced after non-invasive electrical stimulation at sacral dermatome in idiopathic slow transit constipation(19). Lim stated that electrical stimulation can improve CTT in stress bowel syndrome after spinal cord injury(14).

Table 5. Effect of Kaltenborn-Evjenth Orthopedic Manual Therapy

Method	Classification		Before study (n=12)	Later study (n=12)	t	z	p	
KEOMT	Colon transit time	Right colon	6.90±8.28	5.10±4.55	39	0.000	1.000	
		Left colon	18.30±16.42	6.90±10.43	0	3.059	0.002	**
		Rectosigmoid	30.90±19.75	18.90±10.08	6	1.955	0.051	**
		Total colon	56.10±9.88	30.90±15.61	0	3.059	0.002	**
	Weekly frequency of defecation		1.50±0.52	4.00±1.28	0	3.059	0.002	**
	CAS		11.25±0.45	6.25±1.36	0	3.059	0.002	

KEOMT; Kaltenborn-Evjenth Orthopedic Manual Therapy CAS; constipation assessment scale * p<0.05, **p<0.01

After IC treatment, CTT was reduced from the entire large intestine. After Kaltenborn-Evjenth manual therapy CTT was reduced from descending colon and the entire large intestine($p<0.05$). The result of this study is similar to previous researches' results. Therefore, this study has high quality of reliability. IC treatment and Kaltenborn-Evjenth manual therapy could be used to reduce CTT of the entire large intestine in functional constipation. These interventions are the only non-invasive treatments without invasive treatment such as medication and surgery in patients experiencing constipation.

Mechanical stimulations such as massage stimulate sympathetic terminal reticulum. Sensory input signals are activated from the stimulation. These signals then pass through the spinal nerve and the autonomic nervous system until it arrives at the dorsal root. The signals pass through the ventral root and the white ramus communicans. Finally it travels through the sympathetic nervous ganglions to change neurons before it exits through the spinal nerve into visceral organs. CAS was reduced from 20.27±2.40 points to 15.20±1.37 points after 4 weeks in chronic constipation. And number of defecation per week was improved from 1.73±0.46 times to 2.73±0.46 times(4). A recent study stated number of defecation was increased to 2.31 times a week and CAS was reduced from 8.86 to 1.45(20).

After IC treatment, the number of defecation per week was increased and CAS was reduced. The result of KEOMT was similar to that of IC treatment ($p<0.01$). From the result, IC treatment and KEOMT could be used to manage ANS, hypersensitivity of the SNS, circulation problems at problematic areas, and to improve digestive system. This could lead to improvements with defecation and secondary complications of constipation. Consequently, IC treatment and KEOMT can alleviate symptoms and also improve movements of gastrointestinal tract. The intervention could be helpful for internal diseases such as functional indigestible problem and functional constipation. Physiotherapy approaches for the internal diseases lack research and evidence in South Korea. Therefore further investigations are needed to be conducted in the future.

CONCLUSION

This study was conducted to identify the effects of IC treatment and KEOMT in 24 functional constipation patients. The patients were randomly divided into two groups: IC group(n=12) and KEOMT group (n=12). The collected data was evaluated by CTT (before and after treatment), number of defeca-tion per week and CAS.

1. After IC treatment, CTT at the entire large intestine ($p<0.05$) and CAS were reduced, and number of defecation per week was increased ($p<0.01$).

2. After Kaltenborn-Evjenth Orthopedic Manual Therapy, in CTT, total CTT and CAS were reduced. The number of defecation per week was significantly increased ($p<0.01$).

IC treatment and KEOMT may improve symptoms of functional constipation and facilitate movements of the gastrointestinal tract. CTT can be improved to normal by improving movements of gastrointestinal tract. For this reason, the physiotherapy interventions are reasonable and effective treatments for the internal diseases such as functional constipation. However, further investigations regarding physiotherapy approaches for the internal diseases are

required due to lack of research and evidence. Spinal segments(which are linked to visceral organs) should be researched in particular. Clinical tests and multidisciplinary approaches should be conducted to identify characteristics of gastrointestinal tract disorder and compare collected data. This could lead to physiotherapy treatments that will be a part of intervention included in the internal medicine in the future.

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