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The Effects of Interferential Current Therapy on Functional Dyspepsia

This study aims to address the effect of interferential current therapy and thereby to provide basic resources to physical therapies for internal medicine by identifying symptoms for functional dyspepsia and serum gastrin level that shows gastric motility. Following results were obtained by performing interferential current therapy to 16 subjects composed of 8 for functional dyspepsia group and 8 for control group for 20 minutes a day, 3 days a week, for 6 weeks. In control group, serum gastrin level was significantly($p<.01$), lowered after the therapy whereas there was no significant difference observed in all questions from questionnaire for symptoms of functional dyspepsia between before and after the therapy. In functional dyspepsia group, serum gastrin level was significantly($p<.01$), lowered after the therapy and there was also significant($p<.01$) reduction in every question from questionnaire for symptoms of functional dyspepsia between before and after the therapy. There was more significant decrease in serum gastrin level and reduction in questionnaire for symptoms of functional dyspepsia in the functional dyspepsia group compared to the control group($p<.01$). This study confirms the interferential current therapy as an effective therapeutic method for internal diseases including functional dyspepsia since it not only improves the symptoms of functional dyspepsia but also allows the gastric motility close to normal.

Key words: *Functional Dyspepsia; Gastrin; Interferential Current Therapy*

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INTRODUCTION

Symptoms in gastro-intestinal tract are very common in general public(1). Majority of patients who visit gastro-intestinal clinic complain diseases related to functional dyspepsia with continuous symptoms such as epigastralgia, nausea, vomiting, and belching without organic abnormalities(2, 3). The significance of functional dyspepsia was found in various aspects including its high prevalence rate of about 30~40% revealed in sample population surveys and new annual occurrence from over approximately 1% of population, and was reported as a big influencing factor on socio-economy(4). Functional dyspepsia, that has 20~30% of global prevalence rate, is a very common symptom(5, 6) and its prevalence rate was revealed as 15.4% from the study on non-ulcerative dyspepsia in Korea(7). A study on the distribution of functional diseases in gastro-intestinal tract based on the patients visiting the primary and tertiary medical centers has reported that functional dyspepsia has the highest incidence rate of 39.4% among other disease(8) and another study on types of the functional dyspepsia in Korea has reported that the frequency of the occurrence of the motility dyspepsia was significantly higher than that of other types of the functional dyspepsia(9).

Functional dyspepsia do not mean histopathological and biochemical organic lesions but mean functional digestive disorders(5, 10), it has been known that various emotional and genetic factors including hypergastric acidity, delays in motility of gastro-intestinal tract, chronic gastritis, infection of Helicobacter pylori, duodenitis, emotions and stress were related to the pathophysiology of the functional dyspepsia(11). Hypofunction caused by abnormal

motility of gastro-intestinal tract was considered as the most critical cause among reported causes and causality between the functional dyspepsia and the gastric emptying function was reported as 30~80%(12).

Emptying of stomach is promoted by strong peristalsic contraction of pyloric antrum and is dependent on the degree of resistance on the passing through of chime at the region of pylorus at the same time(13). While various factors are required for the gastric motility, hormonal action in digestive tract among these factors is known to be the most closely associated in this process(14). According to the findings from the studies suggesting that hormonal abnormality is associated in inhibition of gastric motility, gastrin and cholecystokinin are known as hormones that cause delay in gastric emptying time not only pharmacologically but also physiologically(15,16).

Pyloric antral mucus membrane is triggered to secrete gastrin by the stimulation of food intake, elongation of stomach wall and mild or moderate promotion effect on gastric body occur as effects of gastrin on emptying of stomach. While the most important effect of gastrin is known as activation of pyloric pump, the emptying rate of gastric content gets significantly slower due to increased gastrin secretion caused as food remaining in the stomach continuously stimulate gastric antrum in case of gastric motility malfunction(13).

Although the correlation between motility malfunction of gastro-intestinal tract and various symptoms of functional dyspepsia was reported as fragments, however these are not clearly confirmed yet and study related to the application of physiotherapy on functional dyspepsia has not been reported.

In this study, the effect of interferential current therapy on functional dyspepsia was discovered by identifying symptoms for functional dyspepsia and serum gastrin level that shows gastric motility.

METHODS

Subjects

This study is based on total of 16 subjects composed of 8 normal individuals and 8 patients with functional dyspepsia who satisfy the criteria listed on the modified version of the Glasgow dyspeptic questionnaire(17)(Table 1) among the patients visiting C hospital in Pohang city during the period from March 2012 to September 2012.

General characteristics of subjects are described as below(table 2).

Table 1. Modified version of the Glasgow dyspeptic questionnaire

1.	A patient without organic disease that is explainable by examinations including endoscope.
2.	A patient with one or more following symptoms: pain in epigastrium, displeasure n epigastrium, satiety in epigastrium, early satiety, nausea, vomiting, belching.
3.	In case of symptoms listed in criteria 2 stays at least more than over 12 weeks.

Table 2. General characteristics of the subjects

	[a]FDG(n=8)	[b]CG(n=8)	Total	p
Sex(mal/female)	2/6	2/6	4/12	
Age(yrs)	[c]31.29±5.77	28.17±1.49	28.96±4.48	.182
Hight(M)	1.66±.08	1.68±.09	1.67±.08	.506
Weight(kg)	61.33±10.89	64.63±17.96	62.99±13.60	.709
BMI(kg/m²)	22.14±2.30	22.39±4.18	22.33±3.16	.941

[a]FDG : functional dyspepsia group
[b]CG : control group
[c]M±SD : mean±standard deviation

Experimental Procedure

Overall research process was explained to the participants and informed consents were collected from subjects for participation to this clinical research. Subjects' medical histories were reviewed and administration of medications that can influence the clinical examinations was prohibited from at least 7 days prior to the study initiation.

Pre study examination including blood test and answering questionnaire was performed to all subjects fasting from 10p.m of the day before the examination.

After 4 weeks, Poststudy examination was performed in exactly the same way as the pre study examination and the results obtained from pre and post study examinations were compared.

Method of interferential current therapy

NEW MIF-2100(MED MAX KOREA, Korea) device with suction type quadrupole electrode was used as an interferential current therapy device. Patients were asked to take the most comfortable posture in prone position and interferential current was applied through quadrupole electrode paravertebrally placed to the regions around spinal segment T_7~T_9 which is relevant to gastro-intestinal tract.

The stimulation was applied for 20 minutes per time, 1 time a day, 3 days a week for 6 weeks. Frequency of 100Hz was applied and the maximum intensity of the current in which the patients feel comfortable without pain was applied.

Measurement Scale

Measuring serum gastrin level

All subjects were fasted at least 10 hours prior to the examinations and 5㎖ of venous blood was collected on the day of Pre and Post study examination. Serum was isolated from the collected venous blood by centrifugation, stored at -20℃, and the level of gastrin was measured. Normal range of gastrin level is 0~90pg/㎖. Gastrin RIA kit from DPC was used to measure the gastrin level radioimmunoassay.

Symptoms of functional dyspepsia

Symptom questions were prepared based on definitions of Rome II standard(18) and patients were interviewed with 7 separate questions by scoring them from 0 to 5 scale.

Data Analysis

SPSS 18.0, a statistical program, was used for analysis in this study. The subjects' general characteristics were obtained by analyzing the frequency and calculating means and standard deviations. Wilcoxon matched pairs test was performed to identify the differences between before and after the therapy, and Mann-Whitney U Test was done to identify the differential therapeutic effects on each group. The level of significance was set as α= .05 to test the statistical significance.

RESULTS

Analyzing the Effect of Interferential Current Therapy in Control Group

Serum gastrin level was significantly decreased after the interferential current therapy in control group($p<.01$). There were no significant differences observed in all types of functional dyspepsia symptoms including pain in epigastrium, displeasure in epigastrium, early satiety, satiety in epigastrium, distent in epigastrium, nausea and belching(Table 3).

Analyzing the Effect of Interferential Current Therapy in Functional Dyspepsia Group

Serum gastrin level was significantly decreased after the interferential current therapy in functional dyspepsia group, and there were significant reduction observed in every type of functional dyspepsia symptoms including pain in epigastrium, displeasure in epigastrium, satiety in epigastrium, early satiety, distent in epigastrium, nausea and belching($p<.01$) (Table 4).

Table 3. Analyzing the effect of interferential current therapy in CG

Variable		Pre	post	t	z	p
Gastrin(unit : pg/㎖)		30.67±12.9	21.67±3.94	0	3.059	.002**
Symptoms of functional dyspepsia (unit : score)	Pain in epigastrium	.33±.49	.00±.00	0	1.826	.068
	Displeasure in epigastrium	.67±.49	.33±.49	0	1.826	.068
	Early satiety	1.00±.00	1.00±.00	0		
	Satiety in epigastrium	.67±.49	.67±.49	0	.000	1.000
	Distent in epigastrium	.33±.49	.00±.00	0	1.826	.068
	Nausea	.00±.00	.00±.00	0		
	Belching	.33±.49	.00±.00	0	1.826	.068

**p<.01

Table 4. Analyzing the effect of interferential current therapy in FDG

Variable		Pre	post	t	z	p
Gastrin(unit : pg/㎖)		45.33±16.72	21.67±5.14	0	3.059	.002**
Symptoms of functional dyspepsia (unit : score)	Pain in epigastrium	3.33±.49	1.67±.49	0	3.059	.002**
	Displeasure in epigastrium	3.67±.98	1.67±.49	0	3.059	.002**
	Early satiety	4.00±.00	1.33±.49	0	3.059	.002**
	Satiety in epigastrium	4.00±.00	2.00±.00	0	3.059	.002**
	Distent in epigastrium	3.67±.49	1.67±.49	0	3.059	.002**
	Nausea	2.33±.98	.67±.49	0	3.059	.002**
	Belching	2.67±1.30	1.33±.98	0	3.059	.002**

**p<.01

Analyzing the Differential Effect of Interferential Current Therapy on Control Group and Functional Dyspepsia Group

According to the results obtained above, serum gastrin level and all types of functional dyspepsia symptoms including pain in epigastrium, displeasure in epigastrium, satiety in epigastrium, early satiety, distent in epigastrium, nausea, and belching was significantly decreased or reduced in functional dyspepsia group compared to the control group(p<.05) (Table 5).

Table 5. Analyzing the differential effect of interferential current therapy on control group and functional dyspepsia group

Variable		CG(Rank Sums)	FDG(Rank Sums)	U	z	p
Gastrin(unit : pg/㎖)		206	94	16	3.233	.001**
Symptoms of functional dyspepsia (unit : score)	Pain in epigastrium	214	86	8	3.695	.000***
	Displeasure in epigastrium	214	86	8	3.695	.000***
	Early satiety	222	78	0	4.157	.000***
	Satiety in epigastrium	222	78	0	4.157	.000***
	Distent in epigastrium	222	78	0	4.157	.000***
	Nausea	222	78	0	4.157	.000***
	Belching	206	94	16	3.233	.001**

**p<.01, ***p<.001

DISCUSSION

Although the correlation between the symptoms in gastro-intestinal tract and delay in gastric emptying caused by gastric motility malfunction is not clear, the malfunction of gastro-intestinal tract motility is known to cause the symptoms in gastro-intestinal tract by either directly influencing on contraction or inflation and indirectly influencing on refluxes in esophagus, duodenum, and stomach or on gastric retention(19).

Hormonal malfunction is considered to be associated with delay in gastric emptying, and gastrin is known to be a hormone that has this action(15).

Brandsborg et al. measured emptying time of gastric content and serum gastrin level at the same time after vagotomy, found that serum gastrin level was maintained higher in patients group with delayed emptying time of gastric content and thus reported that gastrin causes delay in gastric emptying time(20). Nyren et al. measured serum gastrin level in normal control group, patients group with non-ulcerative dyspepsia, and patients group with duodenal ulcer, and reported that the serum gastrin level was significantly higher in patients group with non-ulcerative dyspepsia compared to the normal control group and patients group with duodenal ulcer(21). A study performed by Lee reported that the serum gastrin level was significantly decreased after application of stimulation with high voltage electricity to the patients with functional dyspepsia in region around T_6~T_9 of spinal segment that controls stomach($p<.05$)(22).

In this study, serum gastrin level after interferential current therapy was significantly decreased in both control group($p<.01$) and functional dyspepsia group($p<.01$).

Comparison of results obtained from these two groups showed that the serum gastrin level after interferential current therapy was more significantly decreased in functional dyspepsia group compared to the control group($p<.01$).

The consistency between these results and the results from the previous studies confirms the reliability of this study and the correlation between gastrin and functional dyspepsia. Serum gastrin level is considered to be closely associated to the motility malfunction caused by delayed emptying time of gastric content, and also considered to have an important role in pathophysiology of functional dyspepsia. Moreover, according to the significantly decreased serum gastrin level after the therapy, interferential current therapy is thought to shorten the delayed gastric emptying time by activating gastric motility, thus thereby decreasing the secretion of gastrin which was usually over-secreted by the gastric retention.

Kloth warned that sufficient understanding about spinal segment and its controlling regions were highly required for interferential current therapy around spinal cord since antagonism can be occurred in skin, muscle and internal organs due to spontaneous activity caused by over-stimulated sympathetic nerve system as effects of this therapy on internal organs or circulations in the level of spine(23). Lee applied orthopedic manipulative therapy of Kaltenborn and high voltage electric stimulation in T_6~T_9 of spinal segment the region controlling stomach and reported that there were significant decreases in pain in epigastrium, displeasure in epigastrium, satiety in epigastrium, and belching after the application of high voltage electric stimulation($p<.05$)(22).

After the interferential current therapy, none of symptom questions showed significant reduction in control group whereas all of symptom questions showed significant reduction in functional dyspepsia group($p<.01$).

When results from each group were compared, there were significant reduction in all of symptom questions in the functional dyspepsia group after interferential current therapy compared to the control group($p<.01$).

According to the results above, overall related symptoms of functional dyspepsia patients were thought to be improved to normal condition due to activated motility of digestive system in upper gastro-intestinal tract caused by the stimulation of parasympathetic nerve system. These results were consistent with the results from the previous studies and thereby supporting the reliability of this study.

Therefore, the interferential current therapy is considered to be helpful for the treatment of internal diseases without organic causes, for example functional dyspepsia, by not only improving the symptoms but also activating motility function of gastro-intestinal tract as well as allowing the gastric emptying time to be close to normal. Furthermore, future studies on therapeutic methods for internal diseases through physical therapeutic approach should be encouraged since these studies are not sufficiently reported in Korea yet.

CONCLUSION

This study was performed to determine the effect of interferential current therapy applied to the region of T_7~T_9 spinal segment, relevant area to gastro-intestinal tract, on gastro-intestinal tract in normal population and in patients with functional dyspepsia. The results from this study were as below.

The interferential current therapy was confirmed as a possible effective therapeutic method for internal diseases like functional dyspepsia since it improves symptoms of the functional dyspepsia, promotes gastric motility, and thereby shortens gastric emptying time.

Therefore, further studies that include various examinations diagnosing functional diseases in gastro-intestinal tract and provide overall comparison of results obtained from these examinations could be strong supports for setting the interferential current therapy as a practical internal physiotherapeutic treatment in clinic.

REFERENCES

1. Thompson WG, Lonstreth GF, Drossman DA, Heaton KW, Irvine EJ, Muller-Lissner SA. Functional bowel disorders and functional abdominal pain. Guts 1999; 45(2): 1143-1147.
2. Sahay P, Axon AT. Non-ulcer dyspepsia; does Helicobacter pylori matter. Postgrad J Med 1995; 71: 262-264.
3. Witteman EM, Tytgat GN. Functional dyspepsia. Neth J Med 1995; 46: 205-211.
4. Drossman DA, Richter JE, Talley NS. The functional gastrointestinal disorder. 1st Ed. Boston, Little Brown and Company; 1994.
5. Lee SI. Functional dyspepsia. J Korean Med Assoc 2005; 48(1): 48-60.
6. Kim HO, Lee JC, Kim SK, Park JJ, Lee DH, Lee ST, Lee EH et al. Index of dyspepsia symptoms-Korean IDS-K. Korean J Gastroenterol 2003; 41: 562
7. Kim DJ. Irregular, guick meal is associated with non-ulcer dyspepsia . Korean J Fam Med 1999; 22(8): 35-46.
8. Choi H, Choi MG, Kim SW, Moon SB, Kim BK, Kim BW et al. Functional gastrointestinal disorders in patients with gastrointestinal symptoms . Korean J Gastroenterol 1999; 33: 741-748.
9. Lee JC, Yang CS, Seong IK, Kang IK, Hahm JS, Lee MH et al. A case of gastroesophageal intussusception in an achalasia patient. Korean J Gastroenterol 1992; 24(6): 53.
10. Talley NJ, Choung RS. Whither dyspepsia a historical perspective of functional dyspepsia and concepts of pathogenesis and therapy in 2009. Journal of gastroenterology and hepatology 2009; 24(3).
11. McQuid K. Dyspepsia: Pathophysioloy, Diagnosis and Management. Volume 1. 6th Ed. Philadelphia, W.B. saunder Co; 1997: 108-111.
12. Malagelada JR. Gastrointestinal motor disturbance in functional dyspepsia. Scand J Gastroenterol 1991; 26: 29-34.
13. Guyton C, John EH. Text Book of Medical Physiology, 10Ed. Philadelphia, W.B. Saunders; 2002.
14. Mayer EA. New treatment of for functional pain: pharmacologic approaches. In: Syllabus of American: Gastroenterological Association Postgraduate Course. San Diego, 1995; 30: 315-326.
15. MacGregor IL, Zealous DW, Martin PM. Effect of pentagastrin infusion on gastric emptying rate of solid food in man. Am J Dig Dis 1978; 23: 72.
16. Valenzuela JE, Defilippi C. Inhibition of gastric emptying in humans by secretin, the octapeptide of cholecystokinin, and intraduodenal fat. Gastroenterol 1981; 81: 898.
17. Smith D, Gillen KM, Cochran E. Dyspepsia on withdrawal of ranitidine in Previously asymptomatic volunteers. Am J Gastoenterol 1999; 94: 1209-1213.
18. Hongo M, Okuno Y. Diabetic gastropathy in patients with autonomic neuropathy. Diabet Med 1993; 10: 79-81.
19. Minami H, McCallum RW. The physiology and pathophysiology of gastric emptying in humans. Gastroenterol 1984; 86: 1952.
20. Brandsborg O, Brandsborg M, Lovgreen NA, Mikkelsen K, Moller B, Rokkjaer M, Amdrup E. Influence of parietal cell vagotomy and selective gastric vogotomy on gastric emptying rate and serum gastrin concentration. Gastroenterol 1977; 72: 212.
21. Nyren O, Adami HO, Bergstrom R, Gustavsson S, Loof, L, Lundavist G(1986). Basal and food-stimulated levels of gastrin and pancreatic polypeptide in non-ulcer dyspepsia and duodenal ulcer. Scand J. Gastroenterol 1986; 21: 471.
22. Lee HJ. The Effects on the Activation of Internal Organs of Electrical Stimulation and Orthopedic Manipulative Therapy of Kaltenborn-Evjenth Concept to the T6~T9 Thoracic Vertebral Segments. Yong-in University. Master's Thesis; 2001.
23. Kloth LC. Electrotherapeutic Alternatives for Treatment of Pain. Electrotherapy in Rehabilitation, Philadelpia, Pa F.A., Davis Co; 1992: 197-217.