

## Effect of Visceral Mobilization on Abdomino-Phrenic Dyssynergia in Irritable Bowel Syndrome Patients

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### ABSTRACT

**Background:** Irritable Bowel Syndrome (IBS) is among the highest debilitating, commonly diagnosed gastrointestinal disorder. Considering its chronic nature, it would be more beneficial to resort to a treatment option that doesn't have a long-term drug effect.

**Objective:** This research assessed the impact of visceral mobilization on abdomino-phrenic dyssynergia in IBS patients.

**Patient and Methods:** 60 female IBS patients (constipation subtype), equally split into two groups, were recruited from Boulak Al Dakror General Hospital outpatient clinics. Subjective distention feeling and girth measurement were assessed for all participants, as well as psychiatric assessment was done by two scales; Beck Depression Inventory and Spielberger State-Trait Anxiety Inventory. Both groups followed a low fermentable oligosaccharides, disaccharides, monosaccharides and polyols (FODMAP) diet with their prescribed medications. Group A received visceral mobilization, while group B received medical care only.

**Results:** Post 6 weeks of intervention, the study group had a significant lowering in median subjective distension feeling score by (1.50 (1.00-2.00)) contrasted to the control group (3.00 (2.00-4.00)) (P<0.001). The mean girth measurement was significantly decreased by 8.00±3.22 cm in the study group contrasted to 2.60±0.93 in the control group (P< 0.001). The study group had a significant reduction in depression score by 14.80±8.11 points compared to the control group by 2.97±3.66 points (p<0.001). Furthermore, the study group showed a significantly lower mean trait anxiety score by 22.57±10.67 points than the control group by 3.83±2.44 points (P<0.05).

**Conclusion:** Visceral mobilization effectively normalizes mechanical, vascular, and neurological bowels dysfunctions in IBS patients.

**Keywords:** Visceral mobilization; Irritable bowel syndrome; Abdomino-phrenic dyssynergia.

### INTRODUCTION

Irritable bowel syndrome (IBS) is a chronic, frequently debilitating, and widespread illness of gut-brain interaction (formerly known as functional gastrointestinal [GI] disorders) [1].

IBS is a widespread and potentially severe gastrointestinal illness characterized by abdominal pain, distention, and alterations in bowel routines, excluding organic pathology [2]. IBS is linked to a significant drop in health-related quality of life, higher rates of somatization, increased risk of psychological comorbidity, including depression and suicidal thoughts, and work impairment, as well as higher annual medical and prescription medicine [3].

The onset is triggered in a genetically predisposed person. Changes in the gut, those brought on by diet or gastrointestinal tract (GIT) dysfunction, reflect on the brain and negatively affect psychological health. Greater dysbiosis response from the gut microbiota may have a role in mediating these effects. Similarly, the CNS may impact GIT physiology by changing motility or GIT sensitivity. Shifts in intestinal transit with the experience of pain can result in alteration in bowel habits [4].

IBS mostly targets women and people under the age of 50. IBS has a significant negative influence on the quality of life of patients. Moreover, patients might sacrifice 10-15 years of life span for quick treatment. In contrast, patients with IBS might tolerate a 1% risk of

sudden and unexpected death if a potential medicine might eliminate their IBS symptoms [1].

Abdomino-phrenic dyssynergia occurs when some patients with abdominal distension have a paradoxical abdomino-phrenic response to elevated intraluminal gas. The diaphragm contracts (descends) while the anterior abdominal wall muscles relax during this action. This is in contrast to the normal physiologic reaction to rising intraluminal gas, in which the diaphragm relaxes and the anterior abdominal muscles contract to enhance the craniocaudal capacity of the abdominal cavity while avoiding abdominal protrusion [5]. Findings of previous studies showed that visceral mobilization was useful for improving intestinal symptoms significantly (bowel movement frequency, stomach pain or distress, difficulty eliminating stools and gas, feeling of distention and incomplete bowel movement, and anal pain) [6].

Accordingly, we sought to investigate the impact of intestinal motility on abdomino-phrenic dyssynergia in irritable bowel syndrome female patients.

### SUBJECTS AND METHODS

This research involved 60 female patients with moderate IBS (constipation subtype) from October 2021 to September 2022. They were recruited from outpatient clinics of Boulak Al Dakror General Hospital. Equally split into two groups, Subjective

distention feeling and girth measurement were assessed for all participants, as well as psychiatric assessment was done by two scales; Beck Depression Inventory and Spielberger State-Trait Anxiety Inventory. Both groups followed a low fermentable oligosaccharides, disaccharides, monosaccharides and polyols (FODMAP) diet with their prescribed medications. Group A received visceral mobilization, while group B received medical care only.

**Ethical approval:**

**Research Ethical Committee of Faculty of Physical Therapy Cairo University approved this investigation P.T.REC/012/003417. All subjects signed a consent form to participate in this research. This work has been carried out in accordance with The Code of Ethics of the World Medical Association (Declaration of Helsinki) for studies involving humans.**

**Inclusion criteria:** age ranges between 35-45 years old, body mass index (BMI) between (25-29.9 Kg/m<sup>2</sup>), diagnosed with IBS based on Rome IV diagnostic criteria, constipation subtype, with a baseline severity score of (175-300) [moderate].

**Exclusion criteria:** functional, intestinal organic disorders or systemic disorders affecting GIT movement (hypothyroidism, diabetes or chronic renal impairment), recent abdominal or gynecological surgery, inflammatory bowel disease (Crohn's disease – ulcerative colitis), pregnant and lactating women, obese (BMI greater than 30 kg/m<sup>2</sup>) and if the patients have blood in their stools.

**Methods:**

In this study, each patient has been thoroughly assessed pre- and post-intervention protocol application utilizing the following materials: girth measurement using the metric tape to assess changes in abdominal

circumference with the distance around the abdomen near the belly was calculated [7] and psychiatric assessment using two scales. The Beck Depression Inventory (BDI) includes 21 questions on a 4-point scale ranging from 0 (no symptom) to 3 (severe symptoms), with scores indicating depression level as follow: 0–13 (minimal), 14–19 (mild), 20–28 (moderate), and 29–63 (severe) [8]. Scores of 20–39, 40–59, and 60–80 on the Spielberger State-Trait Anxiety Inventory's 40 items on a 4-point Likert-type scale (0-3) for each item indicate low, moderate, and high anxiety, respectively [9].

**Statistical Analysis:**

Statistical Package for the Social Sciences (SPSS) vs. 25 (IBM, Chicago, Illinois, USA) was employed to examine the data. Initially, the Shapiro–Wilk test was utilized to explore if the data were normally distributed. Continuous data were presented as mean ± standard deviation (SD) for normally distributed data or median (interquartile range; 25<sup>th</sup> percentile–75<sup>th</sup> percentile) for non-normally distributed data and range. Continuous data were contrasted utilizing the independent sample t-test (for normally distributed data), while the Mann-Whitney U-test was for non-normally distributed data. Additionally, the outcomes were contrasted in the same group before and after the intervention for normally-distributed data utilizing the paired Student's t-test; otherwise, the Wilcoxon signed-rank test was utilized. P<0.05 was considered significant.

**RESULTS**

In total, 60 female patients were randomly recruited and split into two equal groups. Table 1 shows a non-significant variation between the two groups regarding their age or BMI.

**Table (1):** Demographic data of the studied participants

Variables	Total (N=60)	Study group (N=30)	Control group (N=30)	Z/t	P-value
Age (years)	38.00(36.00-40.00)	38.00(35.75-40.25)	38.00(36.00-40.00)	-0.030 <sup>a</sup>	0.976 (NS)
Median (IQR) (Range)	(35.00-45.00)	(35.00-45.00)	(35.00-45.00)		
Weight (kg)	70.13±9.01	69.90±9.12	70.37±9.05	-0.199 <sup>b</sup>	0.843 (NS)
Mean ±SD (Range)	(52.00-90.00)	52.00-90.00	52.00-86.00		
Height (cm)	163.25±5.44	163.80±6.27	162.70±4.51	0.780 <sup>b</sup>	0.438 (NS)
Mean ±SD (Range)	150.00-177.00	(152.00-177.00)	(150.00-170.00)		
BMI (kg/m <sup>2</sup> )	26.40(24.40-29.23)	26.27(24.22-27.73)	27.01(24.55-29.63)	-0.961 <sup>a</sup>	0.336 (NS)
Median (IQR) (Range)	20.06-30.00	(20.06-29.76)	(20.31-30.00)		

Data are reported as Mean ±SD or Median (IQR) and range. - Z/t: a test of significance. - a: Mann-Whitney U-test. b: Independent t-test.- NS: Not significant.

Regarding subjective distension feeling, significant reductions in the median were detected between pre-and post-intervention in the two groups. Additionally, 50.0% of the study group patients exhibited minimal subjective distension feeling, whereas only 3.3% of the control group patients exhibited the same post-intervention (Table 2).

**Table (2):** Comparison of subjective distension feeling pre- and post-six weeks of therapy in both groups

Subjective Distension feeling	Study group (N=30)	Control group (N=30)	Z/ $\chi^2$	P-value <sup>b,c</sup>
Pre-intervention Score	4.00(3.75-6.00) (2.00-6.00)	4.00(3.00-5.00) (2.00-6.00)	-1.159 <sup>b</sup>	0.246(NS)
Median (IQR) (Range)				
Scales, N (%)	0(0.00%)	0(0.00%)		
Not at all	0(0.00%)	0(0.00%)		
Minimal	2 (6.7%)	4 (13.3%)	3.383 <sup>c</sup>	0.496(NS)
Mild	5 (16.7%)	5 (16.7%)		
Moderate	11 (36.7%)	12 (40.0%)		
Almost sever	4 (13.3%)	6 (20.0%)		
Severe	8 (26.7%)	3 (10.0%)		
Extreme				
Post-intervention Score	1.50(1.00-2.00) (1.00-3.00)	3.00 (2.00-4.00) (1.00-5.00)	-5.166 <sup>b</sup>	<0.001 (S)
Mean $\pm$ SD (Range)				
Scales, N(%)	0(0.00%)	0(0.00%)		
Not at all	15(50.0%)	1(3.3%)		
Minimal	12(40.0%)	8(26.7%)	37.300 <sup>c</sup>	<0.001 (S)
Mild	3(10.0%)	13(43.3%)		
Moderate	0(0.00%)	5(16.7%)		
Almost sever	0(0.00%)	3(10.0%)		
Severe	0(0.00%)	0(0.00%)		
Extreme				
Z-test	-4.778 <sup>a</sup>	-5.112 <sup>a</sup>		
p-value <sup>a</sup>	<0.001(S)	<0.001(S)		

Data presented as Median (IQR) and range for continuous data and N(%) for categorical data. a: Wilcoxon’s sign rank test. b: Mann-Whitney U-test. c: Chi square test. NS: Not significant. S: Significant

Regarding girth measurement, significant variations were observed between before and after therapy in the two groups. Additionally, significant inter-group variations (between the two groups) were detected, with the changes were 8.59% ↓ in the study group contrasted with 2.80% ↓ in the control group (Table 3).

**Table (3):** Comparison of girth measurement pre- and post-six weeks of intervention in the two groups

Girth Measurement (cm)	Study group (N=30)	Control group (N=30)	$\Delta$	t-value	95% CI (Lower, Upper)	p-value <sup>b</sup>
Pre-intervention	93.13 $\pm$ 8.21 (80.00–109.00)	92.70 $\pm$ 8.50 (75.00-110.00)	0.43	0.201 <sup>b</sup>	-3.89,4.75	0.842(NS)
Post-intervention	85.13 $\pm$ 8.016 (70.00-99.00)	90.10 $\pm$ 8.45 (71.00-107.00)	-4.97	-2.335 <sup>b</sup>	-9.22, -0.71	0.023(S)
$\Delta$	8.00 $\pm$ 3.22	2.60 $\pm$ 0.93	-5.40	-8.805 <sup>b</sup>	-6.63, -4.17	<0.001(S)
% of change	8.59% ↓	2.80% ↓				
t-value <sup>a</sup>	13.578	15.28				
95% CI (Lower, Upper)	6.80, 9.21	2.25, 2.95				
P-value <sup>a</sup>	<0.001(S)	<0.001(S)				

Data presented as Mean  $\pm$ SD and range.  $\Delta$ : Mean difference of post-pre value (MD). a: Paired t-test. b: Independent t-test. NS: Not significant. S: Significant.

Regarding the Beck Depression Inventory score, significant variations were observed between before and following therapy in the two groups. Additionally, significant inter-group variations (between the two groups) were observed. Also, a significantly greater percentage of patients in the study group had mild depression symptoms (36.7%) contrasted with the control group (23.3%) post-treatment (Table 4).

**Table (4):** Comparison of beck depression inventory score pre- and post-six weeks of therapy in the two groups

Beck Depression Inventory Score	Study group (N=30)	Control group (N=30)	Δ	t/χ <sup>2</sup>	95% CI (Lower, Upper)	p-value <sup>b, c</sup>
Pre-intervention						
Score	31.37±12.95	29.27±12.17	2.10	0.647 <sup>b</sup>	-4.40, 8.60	0.520 (NS)
Mean ±SD	(9.00-58.00)	(11.00-60.00)				
(Range)						
Scales, N (%)	2(6.7%)	2(6.7%)				
Minimal	4(13.3%)	4(13.3%)		1.5000 <sup>c</sup>		0.682 (NS)
Mild	6(20.0%)	10(33.3%)				
Moderate	18(60.0%)	14(46.7%)				
Severe						
Post-intervention						
Score	16.57±5.69	26.30±12.46	-9.73	-3.893 <sup>b</sup>	-14.74, -4.73	<0.001 (S)
Mean ±SD	(5.00-30.00)	(9.00-61.00)				
(Range)						
Scales, N (%)	8(26.7%)	3(10.0%)				
Minimal	11(36.7%)	7(23.3%)		13.977 <sup>c</sup>		0.003(S)
Mild	10(33.3%)	7(23.3%)				
Moderate	1(3.3%)	13(43.3%)				
Severe						
Δ	14.80±8.11	2.97±3.66	-11.83	-7.285 <sup>b</sup>	-15.09, -8.58	<0.001 (S)
% of change	47.18↓	10.15↓				
t-test <sup>a</sup>	9.99	4.437				
95% CI (Lower, Upper)	11.77, 17.83	1.60, 4.33				
P-value <sup>a</sup>	<0.001(S)	<0.001(S)				

Data are expressed as Mean ±SD and range for continuous data and N (%) for categorical data. Δ: Mean difference of post-pre value (MD). a: Paired t-test. b: Independent t-test. c: Chi square test. NS: Not significant. S: Significant.

Regarding the trait anxiety inventory score, significant variations were observed between before and after therapy in the two groups. Additionally, significant inter-group differences (between the two groups) were detected. Also, a significantly greater percentage of patients in the study group had a low trait anxiety inventory contrasted with the control group (Table 5).

**Table (5):** Comparison of trait anxiety inventory score pre- and post-six weeks of therapy in the two groups

Trait Anxiety Inventory Score	Study group (N=30)	Control group (N=30)	Δ	t/χ <sup>2</sup> -test	95% CI (Lower, Upper)	p-value <sup>b, c</sup>
Pre-intervention						
Score	53.83±9.47	52.20±9.67	1.633	0.661 <sup>b</sup>	-3.31, 6.58	0.511(NS)
Mean ±SD	(32.00-75.00)	(32.00-70.00)				
(Range)						
Scales, N (%)	2 (6.7%)	3 (10.0%)				
Low	22 (73.3%)	21 (70.0%)		0.223 <sup>c</sup>		0.894 (NS)
Moderate	6 (20.0%)	6 (20.0%)				
High						
Post-intervention						
Score	31.27±8.71	48.37±9.67	-17.10	-7.196 <sup>b</sup>	-21.86, -12.34	<0.001(S)
Mean ±SD	(20.00-49.00)	(30.00-68.00)				
(Range)						
Scales, N (%)	21(70.0%)	5 (16.7%)				
Low	9(30.0%)	21 (70.0%)		18.646 <sup>c</sup>		<0.001(S)
Moderate	0 (00.0%)	4 (13.3%)				
High						
Δ	22.57±10.67	3.83±2.44	-18.73	-9.378 <sup>b</sup>	-22.73, -14.73	<0.001(S)
% of change	41.91↓	7.34↓				
t-test <sup>a</sup>	11.588	8.617				
95% CI (Lower, Upper)	18.58, 26.55	2.92, 4.74				
P-value <sup>a</sup>	<0.001(S)	<0.001(S)				

Data are expressed as Mean ±SD and range for continuous data and N (%) for categorical data. Δ: Mean difference of post-pre value (MD). a: Paired t-test. b: Independent t-test. c: Chi square test. NS: Not significant. S: Significant.

## DISCUSSION

This research explored the impact of visceral mobilization on abdomino-phrenic dyssynergia in female patients with irritable bowel syndrome. Our findings revealed that six weeks of 15-30 minutes of visceral mobilization (twice a week) [10], resulted in an improvement in bloating and distention (with the resultant decrease in subjective distension feeling and a girth measurement of the patients as follows: 50% of the patients reported minimal distension feeling and there was 8.59% ↓ in girth, respectively). These improvements may be attributed to the effectiveness of visceral mobilization in normalizing mechanical, vascular, and neurological malfunctions of the bowels and, thus, the ability to regain abdominal organ motility as well as the functional features of the tissues engaged [6].

Our results agree with **Neto *et al.*** [6] who applied five sessions of visceral mobilization on thirty stroke survivors with functional constipation for one week and found significant improvements in intestinal symptoms (bowel movement frequency, stomach pain or distress, difficulty eliminating stools and gas, feeling of distention and incomplete bowel movement, and anal pain). A recent study reported by **Tamburella *et al.*** [11] found a significant improvement in initiating remarkably sustained intestinal transit and reduced colon movement that led to recurrent symptoms of abdominal distension and constipation accompanied by distension, pain and abdominal constipation after the application of visceral mobilization as one technique of osteopathic manipulative technique (OMT) on 13 spinal cord injury patients with bowel dysfunctions once a week for four weeks. In agreement with our results also, **Namirianian *et al.*** [12] supported the usefulness of visceral mobilization application on gastrointestinal disorders like irritable bowel syndrome and stated that it could significantly improve visceral organs movements and fascial restrictions; which causes bloating.

Also, there was a significant improvement in the psychiatric comorbidities in the form of depression and anxiety by 47.18% ↓ and 41.91% ↓, respectively. These improvements may be attributed to the steady static touch utilized in visceral mobilization, which could stimulate depolarization of the C fibers, transmitting information to the spinal cord, reaching the interoceptive pathway to increase its accuracy and, thereby, balancing the emotions [13].

These findings came in agreement with **Dixon *et al.*** who applied osteopathic manipulative therapy (OMT) including visceral mobilization on adult outpatient participants aged 18 to 65 years which primarily diagnosed with moderate-severe generalized anxiety disorder (GAD), which linked to abnormal neurochemistry and digestion as detected in the gut-brain axis, for 8-9 weeks and reported that 62% (n=16) of the sample revealed a 50% drop in their symptoms.

He stated that OMT, which includes visceral mobilization, focuses on facilitating a free pathway from the neurovascular supply to the intestine, such as fascial connections, to aid digestion, enhance immune function, and facilitate mobility of abdominal fascia by influencing the mechanoreceptors and the afferent vagal pathway. Accordingly, visceral mobilization may ameliorate the symptoms of GAD and depression and also the frequent physical comorbidities of GAD, including IBS [14]. In agreement with these findings, **Wang *et al.*** showed the same results. He stated that applying abdominal massage as one technique of visceral mobilization to relieve abdominal complaints (commonly in anxiety and depression patients) could alleviate palpable adhesions and reduce visceral hypersensitivity and reduce levels of anxiety and depression [15].

Considering the incidence of irritable bowel syndrome affecting 10-15% of the population, a condition caused by visceral organ motility dysfunction [16], we found that visceral mobilization is a safe, non-invasive potential treatment and can be implemented in the treatment program of IBS patients.

In light of the previous findings that visceral organs have motility because of their fascial attachments and ligamental attachments required for respiration, with the findings of visceral mobilization ability to relieve any ligamentous or fascial area of tension, improve blood flow, lymphatic drainage, and nerve conduction, it could be concluded that it regains the organs motility [16]. These findings emphasized that visceral mobilization could improve the severity of constipation, the bloating symptoms of constipation [11], and the psychiatric comorbidities.

## CONCLUSION

Visceral mobilization effectively normalizes mechanical, vascular, and neurological bowels dysfunctions in IBS patients.

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