Efficacy of Abdominal Muscles Contraction for Enhancing Pelvic Floor Exercises in Persistent Postnatal Stress Urinary Incontinence

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ABSTRACT

This study was conducted to determine the effectiveness of abdominal muscle exercises on the function of pelvic floor muscles and reducing the persistent postnatal stress urinary incontinence. Fifty volunteers' premenopausal women, their age ranged from 30 to 39years (mean 36.60±1.07), participated in this study. They were divided randomly into two groups (A and B) equal in number; each group contained 25 premenopausal women suffering from persistent postnatal stress urinary incontinence. Group (A) had been treated with abdominal and pelvic floor exercises, while, group (B) had been treated with pelvic floor exercises only. The outcomes measures included: visual analogue scale (VAS) and vaginal pressure, they were done before the first session, after the 12th session and at the end of the 24th session of the treatment for both groups. While, the urodynamics study (the leak point pressure) were done before the first session and at the end of the 24th session of the treatment. The results of both groups (A and B), in (VAS) scores showed a highly significant (P<0.01) decreased in urine loss after the 12th session and at the end of the 24th session of the treatment while, comparing the results in both groups, showed a highly significant (P<0.01) decreased in group (A) compared to group (B) after the end 24th session of the treatment. Group (A) showed a highly significant (P<0.01) increased in leak point pressure results While, group (B) showed significant (P< 0.05) increased in the leak point pressure results, Also, it was a highly significant (P<0.01) increased in vaginal pressure after treatment in both groups. Comparing the results of both groups (A and B) after the end of the treatment there were a highly significantly (p<0.01) increased in the leak point pressure results and vaginal pressure in group (A). Accordingly it could be concluded that there was an influence of the abdominal muscles exercises in improving the efficiency of the pelvic floor muscles therefore, combined abdominal and pelvic floor muscles exercises considered as an effective method in treating cases with postnatal stress urinary incontinence.

Key words: *Abdominal muscles exercises - Pelvic floor muscles exercises - Postnatal stress urinary incontinence.*

INTRODUCTION

Stress urinary incontinence (SUI) is urodynamically proved as involuntary loss of urine occurs following a sudden rise in the intra-abdominal pressure caused by coughing, sneezing, straining, laughing or other physical activities, when the intravesical pressure exceeds the maximum urethral pressure in the absence of detrusor contraction[28].

Postnatal stress urinary incontinence is an important social and hygienic health problem affecting between 3% and 24% of adult women[1,2]. Those in whom stress urinary incontinence develops during pregnancy or puerperium without remission 3 months after delivery have a very high risk of symptom persistence 5 years later.[3] Postpartum

incontinence is typically attributed to path physiological changes that occur as a result of delivery, such as bladder trauma, nerve or muscle injury, or damage to the urethra and its suspension[5,14,17].

Previous research on the development of postpartum incontinence suggests a multifactor etiology. Clinical and epidemiological studies generally agree that women who undergo vaginal delivery are at greater risk of incontinence than are women who are delivered by cesarean, presumably as a result of the detrimental impact on the pelvic floor[4,5,6,8,12,13,19,20]. Further, it appears that the first vaginal delivery is when most women are likely to sustain this damage[18]. Supporting these findings are several studies that have shown relationships between vaginal delivery and damage to pelvic floor innervations, as manifested by decreased pelvic floor muscle strength, changes in bladder neck position and mobility, and anal sphincter disruption[9,17,21–29]. Other factors that have been implicated in the etiology of incontinence are fetal factors, operative vaginal deliveries, prolonged second stage labor, and anesthesia[4,5,6,9,13,18,30].

Pelvic floor muscle physiotherapy is generally recommended to reduce postnatal urinary incontinence. This therapy involves graded muscle training, either alone or in combination with biofeedback, electrical stimulation, and vaginal cones and is designed to rehabilitate and strengthen the pelvic floor muscle.4 Although pelvic floor muscle physiotherapy after childbirth has proven effective in the prevention of urinary incontinence, 5–8 few trials have addressed the treatment of persistent postnatal stress urinary incontinence[9,10]. In addition, although these trials produced good results, the dropout rates were high (52% and 25%, respectively)[9,10].

Certain researches indicated that deep abdominal muscles activity is a normal response to pelvic floor muscle contraction and when specific isometric deep abdominal contraction were performed in lying position, pelvic contraction and EMG activity increased. Also, urethral pressure increases with voluntary pelvic floor muscle contraction and isometric deep abdominal muscles holds, which seems to be enough evidence of pelvic floor muscles and deep abdominal muscles interaction[25].

Purpose of the study

Because of the higher incidence of stress urinary incontinence that reach 30% of women during childbearing period, 50% in elderly women, and its social embarrassing condition causing socio-psychological problems, disability and dependency with higher economic impact.

The primary objective was to assess the effectiveness of the abdominal muscles exercises on the function of the pelvic floor muscles. The secondary objective was to compare pelvic floor rehabilitation programs with and without deep abdominal muscle training in the treatment of persistent postnatal stress urinary incontinence.

MATERIALS AND METHODS

This study was carried out on fifty volunteer's premenopausal women still presenting symptoms of stress urinary incontinence at least once per week 3 months or more after their last delivery, and willing to participate in the study. were diagnosed with mild stress urinary incontinence, They were selected from the Gynaecological Outpatient Clinic of Maternity Hospital-Faculty of Medicine, Ain Shams University, their ages ranged from 32 to 39 years, their parity ranged

from 2 to 4 times and their body mass index not exceed 30 Kg/m^2.

All subjects were referred from gynecologists, after medical examinations and confirmation of their diagnosis. Women who had experienced urinary incontinence before pregnancy, who had had previous surgery for stress incontinence, a neurological or psychiatric disease, or a major medical condition, or there is occurrence of pregnancy or those who were taking medication that could interfere with their evaluation or treatment were excluded.

All patients were given a full explanation of the treatment protocol and informed consent form had been signed from each patient before participating in this study. Women were randomly divided into two group equal in number (A, B):

- Group A (Abdominal and pelvic floor muscles exercises): Consisted of 25 patients who trained on deep abdominal and pelvic floor muscles exercises for 8 consecutive weeks.
- Group B (pelvic floor muscles exercises): Consisted of 25 patients who trained on pelvic floor muscles exercises for 8 consecutive weeks.

Table (1): General characteristics for all women participating in this study.

	Groups	Range		Mean	SD	t-value	P- value	Significance
		Min.	Max.					
Age (Yrs)	Group (A)	32	39	36.19	1.05	0.143	0.987	NS
	Group (B)	34	39	37.02	1.09			
Weight (Kg)	Group (A)	69	86	76.15	3.96	0.152	0.957	NS
	Group (B)	66	88	75.95	3.51			
Height (Cm)	Group (A)	158	170	164.85	3.44	0.142	0.896	NS
	Group (B)	158	171	165.32	3.74			
BMI (Kg/m^2)	Group (A)	24.20	29.83	26.17	1.04	0.115	0.985	NS
	Group (B)	22.17	28.62	24.15	1.14			
Parity (number)	Group (A)	2.00	4.00	2.00	0.00	0.177	0.995	NS
	Group (B)	2.00	4.00	2.00	0.00			
Duration of symptoms (month)	Group (A)	35.00	87.50	61.00	2.87	0.189	0.668	NS
	Group (B)	33.2	90.85	66.50	1.45			

Group A: combined abdominal & pelvic floor muscles exercise Group B: pelvic floor muscles exercise
SD: Standard Deviation t-value: Unpaired t-value Min: Minimum
Max: Maximum BMI: Body Mass Index NS: Non Significant

Materials and Methods

a- Assessment tools:

- Meticulous history taking and Gynaecological examination: A detailed medical, obstetrical and gynecological history were taken from each women including a characterization of the voiding patterns, stresses that evoke loss of urine, medication that used, history of urinary tract infection and history of neurological or spinal cord disorders also, Gynaecological examination was carried by the staff of Gynaecological Department of Maternity Hospital-Faculty of Medicine, Ain Shams University, to exclude any genito-urinary anomaly or infection that may cause urinary incontinence. Routine laboratory investigations, mainly fasting and post prandial blood glucose and complete urine analysis were carried out as to exclude diabetes mellitus, urinary infection as well as renal affection.

- Weight height scale was used for measuring the patient's body weight and height to calculate the body mass index.
- Preniometer (Peritron 9300): The Peritron 9300 designed by Cardio Design Pty Itd Australia. It is supplied with vaginal sensor. Technical specification: Numerical readout 0-300 cm H2o, Resolution 1cm H2o, Accuracy ±1cm H2o for 95% of readings, Display liquid crystal 3.5 digits, 12.7mm high with indicator for battery low charge, Output option 0-3.5 DC into 3.5 K ohms min. proportional to sensor pressure and Vaginal sensor 28 mm diameter, 30 mm. It was used before starting the treatment, after the 12thand 24th sessions of treatment for objective assessment of the strength and endurance of pelvic floor muscles contractions as well as teaching muscle re-education and training of pelvic floor muscles.
- DANTIC UD5000/5500 Urodynamic Investigation System: it was used to confirm the diagnosis of stress urinary incontinence and also, was done for subtract cystometry and leak point pressure before starting the first session and after the twelfth session of the treatment, for all patients in both groups (A&B), women with involuntary detrusor contraction on cystometry were excluded from the study.
- Visual analogue scale (VAS): is a graphic rating scale, which was used to measure the severity of symptoms of urine incontinence as reported by the patient. The patient was asked to place a cross on VAS with numerical values placed equidistantly along a 10cm line. The descriptors and numbers help the subject to place her estimate on the line It was done for all subjects in both groups (A and B), before starting the first session, after the sixth session and at the end of the twelfth session of the treatment.

b- Treatment procedure

Subjects were divided randomly into two groups (A & B) and each group was included 25 patients. Before starting the treatment sessions patients were asked to evacuate their bladders and this followed by 5 min. warming up in the form of circulatory connected with breathing exercises. Also each treatment session was ended by 5 min. cooling down in form of relaxation exercises.

Group A (Trained on abdominal and pelvic floor muscles exercises): All subjects in group (A) were trained on pelvic floor muscles exercises and deep abdominal muscle training consisting of isolation, reeducation, and functional retraining of the transversus abdominis[19]. In the first four weeks of the study isometric abdominal muscles exercises were performed in combination with pelvic floor muscles exercises. In the last four weeks of the study the previous exercises (isometric abdominal and pelvic floor muscles exercises) were performed and deep abdominal muscle training consisting of isolation, reeducation, and functional retraining of the lateral trunk flexion exercises[19] was added, each session lasting 45 min. divided into 5 min. warming up, 35 min. actual treatment and 5 min. cooling down, three times a week for eight consecutive weeks.

Group B (Trained on pelvic floor exercises): In this group all patients were instructed to contract their pelvic floor muscles without contracting adjacent muscles, such as the abdomen, glutei and hip adductors muscles twenty repletion consisted of contraction and squeezing of the muscle ten seconds followed by relaxation for twenty second then rested for two minutes, according to Romanzi[21] protocol. The exercises program lasted for lasting 45 min. divided into 5 min. warming up, 35 min.

actual treatment and 5 min. cooling down, three times a week for eight consecutive weeks. The patient was taught to contract their pelvic floor muscles before coughing or sneezing thus to prevent leakage. Home exercises through continuing practicing these contractions as frequent as possible according to her ability, at early morning before getting from bed from crock lying position, at afternoon from sitting and standing positions, at evening from sitting and standing positions and finally at night at bed time from crock lying position.

Statistical Analysis:

In that study, we observed a difference in the pretreatment and post treatment mean results with the Student "t" test: for the significance of difference between studied parameters (for quantitative variables) and Chi-square test: was used for qualitative variables, the statistical significance at a confidence of 95% (α-level of 0.05).

RESULTS

The pretreatment evaluation indicated no significant difference in all measured parameters between both groups (P>0.05) as indicated in table (1).

The severity of urine loss measured by the visual analogue scale as reported by the women revealed a highly significant decrease (P<0.01) after the end of 24th session of treatment in each group. While comparing both groups (A and B) the post treatment scores showed that group (A) was highly significantly (P<0.01) decrease than group (B) at the end of 24th session of treatment. (Table 2, 3 and 4).

Table (2): shows the visual analogue scores before the 1st session, after the 12th session and at the end of the 24th session of the ttt in group A.

	Before 1st S		After 12th S		After 24th S	
VAS	No.	%	No.	%	No.	%
1= Not wet	0	0%	8	32%	19	76%
2= Mild wet	0	0%	11	44%	6	24%
3= Moderate wet	3	12%	6	24%	0	0%
4= Severe wet	7	28%	0	0%	0	0%
5= Complete wet	15	60%	0	0%	0	0%
Total	25	100%	25	100%	25	100%

S = session ttt = treatment No. = number %= percentage

Table (3): Shows the visual analogue scores before the 1st session, after the 12th session and at the end of the 24th session of the ttt in group B.

	Before 1st S		After 12th S		After 24th S	
VAS	No.	%	No.	%	No.	%
1= Not wet	0	0%	1	4%	15	60%
2= Mild wet	0	0%	8	32%	9	36%
3= Moderate wet	2	8%	15	60%	1	4%
4= Severe wet	9	36%	1	4%	0	0%
5= Complete wet	14	56%	0	0%	0	0%
Total	25	100%	25	100%	25	100%

S = session ttt = treatment No. = number % = percentage

Table (4): shows analytical statistics of the visual analogue scores in both groups (A and B) before and after treatment.

Visual analogue scores	X^2	P. value	significance
Before the first session of the ttt in group A Vs Before the first session of the ttt in group B	0.95	>0.05	NS
After the 12th session of the ttt in group A Vs After the 12th session of the ttt in group B	4.50	<0.05	S
At the end of the 24th session of the ttt in group A Vs At the end of the 24th session of the ttt in group B	8.42	<0.01	HS

X^2 = Chi-square test P. Value = Probability of error HS = highly significant
S = significant NS= Non significant Vs = Versus ttt = Treatment

The mean values of vaginal pressure were presented in table (5) and figure (1) post treatment results highly significant increase (P<0.01) shown after two consecutive months of treatment in both groups however, comparing post treatment results in both groups (A and B) showed significant increase (P<0.05) in group (A) compare to group (B) after the end of the 12th session of treatment and also highly significant increase (P<0.01) in group (A) as compared with group (B) at the end of treatment after two consecutive months.

Table (5): The mean values of vaginal pressure pre and post treatment in group (A) and group (B).

		Group (A)	Group (B)	t- value	P- value	Significance
Pre-ttt	Mean	50.65	53.86	0.227	0.822	NS
	SD	10.21	11.23			
Post 12th session	Mean	90.55	70.23	0.176	<0.05	S
	SD	11.32	14.32			
Post 24th session	Mean	138.56	90.54	0.162	<0.01	HS
	SD	13.56	17.56			

Group A: combined abdominal & pelvic floor muscles exercise Group B: pelvic floor muscles exercise
SD: Standard Deviation t- value: Unpaired t value P- value: Probability value
NS: Non Significant S: Significant HS: Highly Significant

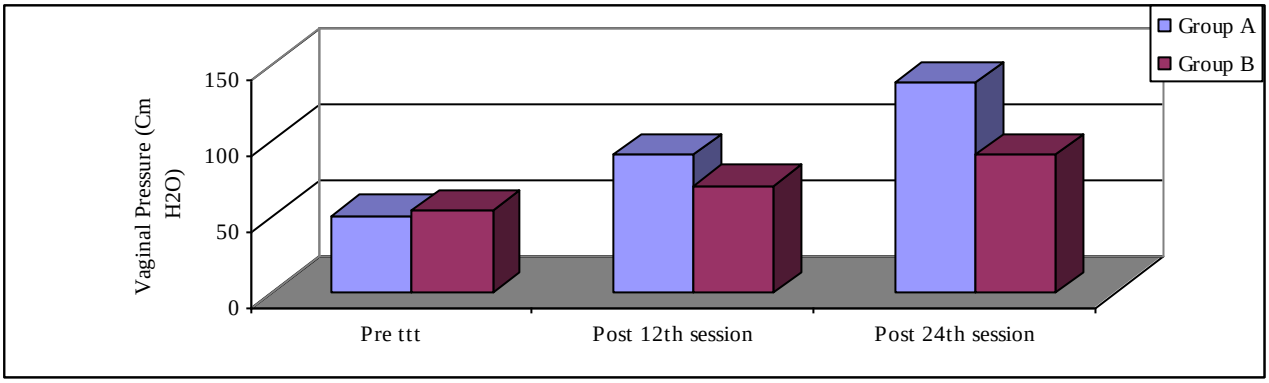

Fig. (1): The mean values of vaginal pressure pre & post 12th, 24thsession in both group (A) and (B).

The leak point pressure post treatment results in group (A) showed highly significant (P<0.01) and the same post treatment results obtained in group (B) while, comparing post treatment results for both groups (A and B) showed that the leak point pressure results in group (A) was highly significant increase (P<0.01) at the end of treatment as compared with group (B). {Table (6) and figure (2)}

Table (6): The mean values of the leak point pressure pre & post treatment in both groups (A and B).

		Group (A)	Group (B)	t- value	P- value	Significance
Pre-ttt	Mean	86.42	79.36	0.127	0.899	NS
	SD	15.65	15.23			
Post-ttt	Mean	107.54	98.25	2.185	<0.01	HS
	SD	21.35	17.36			

Group A: combined abdominal & pelvic floor muscles exercise Group B: pelvic floor muscles exercise
SD: Standard Deviation t- value: Unpaired t value P- value: Probability value
NS: Non Significant HS: Highly Significant

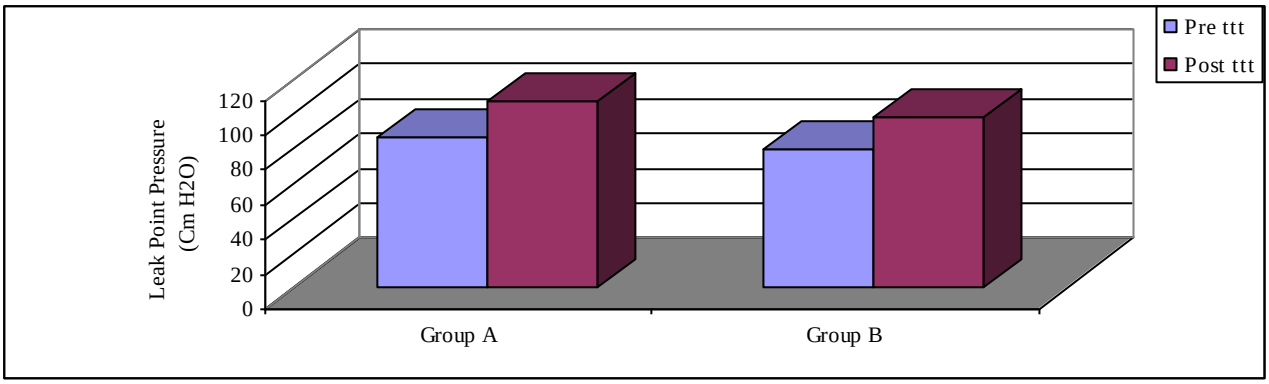

Fig. (2): The mean values of the leak point pressure pre & post treatment in both groups (A&B).

DISCUSSION

Pelvic floor muscles exercises prescribed for treatment of stress urinary incontinence commonly emphasize concurrent relaxation of the abdominal muscles. The purpose of this study was to investigate the interaction between deep abdominal wall muscles contraction and the pelvic floor muscles and the effect of their contraction in treating persistent stress urinary incontinence.

Our results corroborate those from the randomized controlled trials of Wilson and Herbison[9] and Glazener et al.,[10] who reported that 7 and 9 months of pelvic floor rehabilitation significantly reduced persistent stress Urinary incontinence. In-depth comparison between the results of the present study and those of the previous studies is difficult, because the training protocol and its duration differed among studies. It is important to point out that marked objective and subjective improvement in continence status was observed after only 8 weeks of pelvic floor rehabilitation with high adherence to treatment. Our dropout rate was none compared with 52% in Wilson and Herbison's study and 25% in Glazener et al's study. It is possible that the much shorter intervention time and close supervision of the intervention by a skilful physiotherapist in this study contributed to the patients' strong adherence to the treatment.

Many factors may have contributed to the marked objective and subjective improvement in continence status observed in a shorter period. First, pelvic floor muscle exercises conducted under the close supervision of a trained professional have proven more effective than pelvic floor exercises performed at home may have contributed to rapid continence improvement. However, the relative contribution of each factor cannot be determined in our study. Whether these results will translate into long-term cure or improvement of persistent post urinary stress incontinence is unknown at this point.

The results of the current study agreed with those reported by Bo, K. (2004)[3] who studied the effective treatment of female stress urinary incontinence, she found that there are three proposed theories to explain the effectiveness of pelvic floor muscles training for stress urinary incontinence, women learn to consciously pre-contract the pelvic floor muscles before and during increases in abdominal pressure to prevent leakage; strength training builds up long-lasting muscle volume and thus provides structural support; and abdominal muscle training indirectly strengthens the pelvic floor muscles.

Secondary, the pelvic floor muscles are apart of the trunk stability mechanism, their function is interdependent with other muscles of the system. The innovative rehabilitation program for stress urinary incontinence utilizes abdominal muscles action to initiate tonic pelvic floor activity. Abdominal muscles activity is then used in pelvic floor muscles strengthening[23].

Although the objective and subjective continence outcomes improved significantly after implementation of both pelvic floor rehabilitation programs, it appears that these effects are not related directly to changes in the pelvic floor muscle function. Factors other than strength and rapidity of contraction may have contributed to continence.

Motor learning phenomena not related to change in maximal strength, such as better timing of the pelvic floor contraction and increased perception of pelvic muscle contraction encouraged by the present rehabilitation protocol, may have contributed to the rapid change in continence status.

The results of current study agreed with those of Sapsford et al. (2001), they studied the co-activation of the abdominal and pelvic floor muscles during voluntary exercises, they found that the response of the abdominal muscles to voluntary contraction of the pelvic floor muscles was investigated in women with no history of symptoms of stress urinary incontinence to determine whether there is co-activation of the muscles surrounding the abdominal cavity during exercises for the PF muscles. Electromyographic (EMG) activity of each of the abdominal muscles was recorded with fine-wire electrodes in seven parous females. The results of these experiments indicate that abdominal muscle activity is a normal response to pelvic floor exercise in subjects with no symptoms of pelvic floor muscle dysfunction and provide preliminary evidence that specific abdominal exercises activate the pelvic floor muscles.

Also, the results of this study agreed with that of Sapsford and Hodges (2001), they studied contraction of the pelvic floor muscles during abdominal maneuvers, they concluded that exercise of the abdominal muscles may be beneficial in maintaining pelvic floor muscles coordination, support, endurance and strength, contraction of the abdominal muscles may provide an efficient mechanism with which the contraction of the pelvic floor muscles is initiated, particularly for patients who have difficulty in learning to contract those muscles,

so the use of abdominal muscles training to rehabilitate pelvic floor muscles may be useful in treating stress urinary incontinence.

The results of this study supported by relevant research work conducted abroad in this area confirm and add that the use of both of combined abdominal & pelvic floor muscles exercises and pelvic floor exercises alone appears to be effective in improving the pelvic floor muscle function and in the management of parous women with persistent stress urinary incontinence still, Co-activation of the deep abdominal and pelvic floor muscles exercises was found to be more effective when compared with pelvic floor exercises alone.

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الملخص العربي

كفاءة انقباض عضلات البطن لتحسين وظيفة عضلات الحوض الرافعة في حالات السلس البولي الإجهادى الدائم بعد الولادة

أجريت هذة الدراسة لتحديد تأثير تمرينات عضلات البطن على وظيفة عضلات الحوض الرافعة وعلاج حالات السلس البولي الإجهادى الدائم بعد الولادة . ولقد أجريت هذه الدراسة علي خمسين سيده متطوعة في مرحلة ما قبل انقطاع الطمث تعانين من حالات السلس البولي الإجهادى الدائم بعد الولادة وكانت أعمارهن تتراوح ما بين 30-39 عاما . وقد تم تقسيمهن عشوائيا إلي مجموعتين (ا،ب) : المجموعة (ا) والتى عولجت بتمرينات لعضلات البطن وعضلات الحوض الرافعة معا والمجموعة (ب) والتى عولجت بتمرينات لعضلات الحوض الرافعة فقط . وضمت كل مجموعة خمس وعشرون سيدة . وتضمنت القياسات المسجلة : استخدام المقياس المدرج المرئي في تقيم شدة البول المتسرب واستخدام جهاز قياس الضغط المهبلى لقياس قوة عضلات الحوض الرافعة وقد تم التسجيل في كلتا المجموعتين قبل بدء أول جلسة علاجية و بعد الانتهاء من الجلسة العلاجية الثانية عشر وكذلك بعد الانتهاء من الجلسة العلاجية الرابعة والعشرون . بينما تم استخدام اختبارات ديناميكية الجهاز البولي (لقياس الضغط داخل تجويف البطن المؤدى إلى التسرب البولى) وقد تم عمل تلك الاختبارات في كلتا المجموعتين قبل بدء أول جلسة علاجية وبعد الانتهاء من الجلسة العلاجية الرابعة والعشرون . أوضحت النتائج أن هناك نقص ذو دلالة إحصائية عالية في كمية البول المتسرب من المثانة بإستخدام كل من المقياس المدرج المرئي بعد الانتهاء من الجلسة العلاجية الثانية عشر وكذلك بعد الانتهاء من الجلسة العلاجية الرابعة والعشرون في المجموعتين (ا، ب) و لكن بمقارنه نتائج المجموعتين معا ظهر أن هناك انخفاض ذو دلالة إحصائية عالية في كمية البول المتسرب من المثانة بعد الانتهاء من الجلسة العلاجية الرابعة والعشرون في المجموعة (ا) عن المجموعة (ب) . أظهرت النتائج في المجموعة (ا) زيادة ذات دلالة إحصائية عالية في فى الضغط داخل تجويف البطن المؤدى الى التسرب البولى . بعد الانتهاء من الجلسات العلاجية بالمقارنة قبل بدء العلاج . بينما في المجموعة (ب) أظهرت النتائج زيادة ذات دلالة إحصائية في الضغط داخل تجويف البطن المؤدى الى التسرب البولى بعد الانتهاء من الجلسات العلاجية بالمقارنة قبل بدء العلاج . وكذلك وجد أن هناك زيادة في قوة الضغط المهبلى ذو دلالة إحصائية عالية بعد العلاج في المجموعتين (ا، ب) في المجموعة (ا) وبمقارنة نتائج المجموعتين معا بعد الانتهاء من الجلسة العلاجية الرابعة والعشرون تبين حدوث زيادة ذات دلالة إحصائية عالية في المجموعة (ا) في الضغط داخل تجويف البطن المؤدى الى التسرب البولى وقوة الضغط المهبلى بالمقارنة بالمجموعة (ب) وهكذا يمكن أن نستخلص ان تمرينات عضلات البطن لها تاثير فعال على وظيفة وكفاءة عضلات الحوض الرافعة وكذلك فأن التمرينات لعضلات البطن وعضلات الحوض الرافعة معا لها تأثير فعال فى علاج حالات السلس البولي الإجهادى الدائم بعد الولادة .