International Journal of Medical, Medicine and Health Sciences
ISSN: 2517-9969
Vol:10, No:5, 2016

Efficacy of Biofeedback-Assisted Pelvic Floor Muscle Training on Postoperative Stress Urinary Incontinence

Asmaa M. El-Bandrawy, Afaf M. Botla, Ghada E. El-Refaye, Hassan O. Ghareeb

***Abstract*—**Background: Urinary incontinence is a common problem among adults. Its incidence increases with age and it is more frequent in women. Pelvic floor muscle training (PFMT) is the first-line therapy in the treatment of pelvic floor dysfunction (PFD) either alone or combined with biofeedback-assisted PFMT. The aim of the work: The purpose of this study is to evaluate the efficacy of biofeedback-assisted PFMT in postoperative stress urinary incontinence. Settings and Design: A single blind controlled trial design was. Methods and Material: This study was carried out in 30 volunteer patients diagnosed as severe degree of stress urinary incontinence and they were admitted to surgical treatment. They were divided randomly into two equal groups: (Group A) consisted of 15 patients who had been treated with post-operative biofeedback-assisted PFMT and home exercise program (Group B) consisted of 15 patients who had been treated with home exercise program only. Assessment of all patients in both groups (A) and (B) was carried out before and after the treatment program by measuring intra-vaginal pressure in addition to the visual analog scale. Results: At the end of the treatment program, there was a highly statistically significant difference between group (A) and group (B) in the intra-vaginal pressure and the visual analog scale favoring the group (A). Conclusion: biofeedback-assisted PFMT is an effective method for the symptomatic relief of post-operative female stress urinary incontinence.

***Keywords*—**Stress urinary incontinence, pelvic floor muscles, pelvic floor exercises, biofeedback.

I. Introduction

PFD is a universal condition that describes an interrelated group of weather such as urinary incontinence, pelvic organ support, and sexual dysfunctions which often coexist together by sharing common risk factors adversely influencing the efficacy of pelvic floor functions which fail to function decently in a coordinated manner [1].

Urinary incontinence is defined as "the complaint of any involuntary leakage of urine" and is a common problem in the female population with the prevalence rates varying between 10% and 55% in 15- to 64-year-old women. The most frequent kind of urinary incontinence in women is stress urinary incontinence, defined as "involuntary leakage on effort or exertion, or on sneezing or coughing" [2].

Asmaa M. El-Bandrawy, Afaf M. Botla are with the Department of Physical Therapy for Obstetrics and Gynecology, Cairo University, Giza, Egypt (e-mail: asma_elbandrawy@yahoo.com).

Ghada E. El-Refaye is with the Department of Physical Therapy for Obstetrics and Gynecology, Cairo University, Giza, Egypt.

Hassan O. Ghareeb is with the Faculty of Medicine, Department of Obstetrics and Gynecology, Cairo University, Giza, Egypt.

The most common type of urinary incontinence among women is the effort urinary incontinence, which is responsible for nearly half of the shells. Effort urinary incontinence occurs most often in young adult females aged between 25 and 49 years [3]. Middle-aged women, who are close to menopause, are more committed by the mixed urinary incontinence and older women by the urge-incontinence [4].

The incidence of incontinence is significantly higher in females. Such fact is due to anatomical reasons, hormonal changes and consequences of deliveries and pregnancies which may dislocate as well as weaken the perineum muscles [5]. The effect caused by incontinence in women, is not limited to their physical aspects. It negatively affects the sexual, social, domestic, and occupancy levels of the woman's life. Women with urinary incontinence fell ashamed, embarrassed for social and sporting activities and less attracted to sexual relationships. Incontinence is also associated with the feelings of loneliness and sadness. Some studies have shown that around 80% of women with severe symptoms of incontinence present depressive symptoms, followed by decrease of self-esteem and increase of anxiety [6].

PFMT is considered as first-line therapy in the treatment of PFD either PFMT alone or combined with adjunctive biofeedback-assisted PFMT (BF-assisted PFMT). Performance of a correct maximum pelvic floor muscle (PFM) contraction is important to achieve the best training effect [7].

PFMT includes the repetitive contraction of the pelvic floor muscle, which establishes the intensity level and the personal support, and increases the muscle feeling. The movement is a voluntary inward and upward contraction or squeeze of the pelvic floor muscle. The number of contractions recommended across studies ranges from 8 to 12 contractions three times a day, to 20 contractions four times a day or to as many as 200 contractions per day. The continuance of 'squeeze and hold', or contraction, variables in published studies from 4 s to 30–40 s [8].

The recommended posture to be assumed during the prescribed exercise regimen also varies and includes sitting, kneeling, standing, lying low and standing with legs astride. The recommended duration of the prescribed regimen alters widely, from one week to six months, with three months being most frequently recommended [9].

Even though in that respect are other methods of treatment, the PFME should still be the first conservative treatment option for adult females with incontinence and prolapse, since

it is a safe, efficient, and low-cost method. PFME should be provided with specialized supervision and last at least for three months [10].

The biofeedback uses a device to read the biological signals during the voluntary contraction of PFM, and presents this information back to the women in audio and/or optical form, thus enhances the consciousness and the proper contraction of PFM [11].

Biofeedback is a common treatment for PFD and it is done with the help of a physical therapist This non-irritating, non-surgical technique provides improvement in more than 75% of people with PFD. Physical therapists may take several approaches for biofeedback. These include the use of special sensors and video to monitor the pelvic floor muscles when the patient attempts to loosen up or burn them. The therapist then provides feedback and works with the patient on increasing their muscle coordination [12].

Biofeedback can enhance the awareness of correct PFMs contraction and motivation to do repetitively this correct response through audio and/or visual or haptic means to enable the patient to ascertain how to check and improve their PFM function [13].

A. Hypothesis

There will be a difference between the effect of pelvic floor exercises and the biofeedback in treating postoperative stress of urinary incontinence.

II. Materials and Methods

This study was approved by the ethical committee of faculty of Physical Therapy, Cairo University (reference number: P.T.REC/012/001141- 29/11/2015).

A. Design

A single-blind controlled trial involving 30 volunteer patients, diagnosed as severe degree of stress urinary incontinence and were admitted to surgical treatment. Their ages ranged from 45-55 years and BMI are <30 kg/m^2.They were allocated randomly into two equal groups (A&B) using permuted randomization: (Group A) consisted of 15 patients who had been treated with post-operative BF-assisted PFMT and the home exercise program, and (Group B) consisted of 15 patients who had been treated with the home exercise program only.

Patients were excluded if they had a history of urinary tract infection, neurological disorders, pelvic tumor, diabetes, uncontrollable postoperative hemorrhage, fever and psychotic illness.

The outcome measures utilized to compare the treatment effectiveness among the two groups (A) and (B) included:

1- Measuring the intra-vaginal pressure.
2- The visual analog scale.

All patients of both groups (A&B) were granted a broad explanation of the treatment protocol, and all authors declare that the written informed consent was received from the patients before embarking on the work.

B. Postoperative Pelvic Floor Exercises for Group (A)

Before beginning the discussion session, the patient was taken to empty her bladder.

1. First Step for Pubovaginalis Muscle

Each patient of group (A) was asked to relax in a comfortable crock lying position with slightly abducted legs to prevent substitution by hip adductors, and there is one stretched layer of clothes on the lower abdomen to allow observation of the right action of pubovaginalis muscle. The researcher stood at the level of the patient waist line and notices the lower abdomen of the patient to see the correct action of pubovaginalis muscle. Then, the patient was asked to contract the urethral orifice, hold for 10 counts, then relax for another 10 count, and repeat this for 15 repetitions.

2. Second Step for Puborectalis Muscle

Each patient of group (A) was advised to relax in the crock lying position. The researcher stood at the level of the patient waistline, and his two hands stayed under the gluteal region with the tip of the fingers around the anus to feel with the contraction of puborectalis muscle and to avoid any substitution of the gluteal muscles. Every patient was asked to control the bowel action, hold it for 10 counts, then relax for another 10 count, and repeat this for 15 repetitions.

3. Third Step for the Whole puococcygeus Muscle

Each patient of group (A) was asked to relax in the crock lying position with slightly abducted legs to avoid substitution by hip adductors, and there is one stretched layer of clothes on the lower abdomen to allow the observation of the correct action of the pubovaginalis muscle. The researcher stood at the level of the patient waist line to see the correct contraction of the pubovaginalis muscle, while two hands were under the gluteal region till the tip of the fingers around the anus to feel with the contraction of puborectalis muscle and to prevent the substitution of the gluteal muscles. The patient was asked to control the bowel action and the urethral orifice, draw the vagina up, hold it for 10 counts, then relax for another 10 count. Each patient in this group performed the pelvic floor exercises at the second post-operative day for about 20 minutes three sessions/ week for three months in addition to a daily home routine program.

C. Postoperative Biofeedback for Group (A)

The patient was asked to lie in the crock lying position with slightly abducted legs to prevent any substitution by the hip adductors. The battery of the biofeedback was checked out. Wires of the vaginal electrode were properly linked to the main unit. Then, the vulva was cleaned with antiseptic solution, and the vaginal electrode was covered with a condom and a layer of the sterile lubricant and inserted until 1 cm of the lower margin of the press area of the probe remains outside (sensory feedback). Then, each patient was covered with another sheet. Afterwards that, each patient required to contract her pelvic floor muscles aiming to increase the reading of the manometer. She required to contract the anterior and posterior fibers of pubococcygeus muscle 15

repetitions which consisted of contraction and holding for 10 counts followed by relaxation for 10 counts.

D. Home Exercise Program for Both Groups (A&B)

All the patients of both groups (A&B) were required to do the pelvic floor exercises as a home routine from the crock lying position through contracting their pubococcygeus muscle in the same succession.

- Early morning before getting from the bed from crock lying position.
- Afternoon during the activities of everyday living from standing and seating posture.
- At night after getting into the bed from crock lying position

Evaluation of all patients in both groups (A&B) was done before and after the treatment program by VAS that was scored on a simple ordinal scale after the treatment (1-worse, 2-same, 3- slightly improved, 4-greatly improved and 5-cured) in addition to evaluation of the intravaginal pressure by using the vaginal probe of the biofeedback apparatus. Each patient was trained in localization and isolation of pelvic floor muscle contraction to achieve full awareness of the needed muscular contraction. After that, each patient was asked to contract her pelvic floor muscles when she was asked to relax (five times). The mean vaginal pressure of five muscular contractions was recorded and recorded the evaluated value

III. Results and Discussion

The data were analyzed by using SPSS statistical package version17 and presented by using the descriptive statistics such as the mean value and the standard deviation. In addition, sample-dependent t-test was used for the comparison between the variables. A p-value of less than 0.05 ($p<0.05$) was regarded as statistically significant.

A. Physical Characteristic of All Patients in Both Groups

TABLE I
THE PHYSICAL CHARACTERISTICS OF ALL PATIENTS FOR BOTH STUDY AND CONTROL GROUPS (A&B)

Item	Group A		Group B		P-value	S
	Mean	±SD	Mean	±SD		
Age (yrs)	42.3	±3.59	41.95	±4.17	>0.05	NS
BMI (kg/cm^2)	29.1	±1.52	28.98	±1.15	>0.05	NS

B. Statistical Analysis

1. Regarding to the Intra-Vaginal Pressure (IVP) and Visual Analogue Scale before and after the Treatment for Group (A)

The mean value for IVP before treatment was 49.55±6.5, while the mean value was (58.66±3.73) after the treatment program.

The statistical difference between the results before and after the treatment program was $P<0.001$, which indicates a statistically significant reduction in the pain perception as shown in Table II. The mean value for VAS was 3.65±0.91 before treatment, while the mean value was 1.76±0.82 after the treatment program.

TABLE II
IVP AND VISUAL ANALOGUE SCALE BEFORE AND AFTER THE TREATMENT FOR GROUP (A)

Variables	Before ttt	After ttt	Significance	
			T- value	P-value
IVP	49.55±6.5	58.66±3.73	4.52	0.001
VAS	3.65±0.91	1.76±0.82	9.0	0.001

2. Regarding to IVP and Visual Analogue Scale before and after the Treatment for Group (B)

The mean value for IVP before treatment was 49.46±6.44, while the mean value was 52.27±4.82 after the treatment program. The statistical difference between the results before and after the treatment program was $P<0.01$ as it is shown in Table III. The mean value for VAS before treatment was 3.40±0.94 and the mean value was 2.20±0.77 after the treatment program. The statistical difference between the results before and after the treatment program was $P<0.05$, indicating a statistically significant decrease in pain perception as shown in Table III.

TABLE III
IVP AND VISUAL ANALOGUE SCALE BEFORE AND AFTER THE TREATMENT FOR GROUP (B)

Variables	Before ttt	After ttt	Significance	
			T- value	P-value
IVP	49.46±6.44	52.27±4.82	2.79	0.01
VAS	3.40± 0.94	2.20±0.77	1.07	0.05

3. Regarding to Comparative Analysis of Mean Differences of IVP after Treatment for Both Groups (A&B)

There was no statistically significant difference between the groups A&B before the treatment, while the post-treatment mean values of IVP were higher than the mean values of group B. This reveals a more significant improvement in group A than in group B as shown in Table IV.

4. Comparative Analysis of Mean Differences of Visual Analogue Scale after Treatment for Both Groups

There was no statistically significant difference between both groups A&B before the treatment, while post-treatment mean values of VAS were lower than mean values of group B. This reveals a more significant reduction in group A than in group B as shown in Table V.

TABLE IV
COMPARATIVE ANALYSIS OF MEAN DIFFERENCES OF IVP AFTER TREATMENT FOR BOTH GROUPS (A&B)

Variables	Mean	S. D	Significance	
			T- value	P-value
Group (A)	58.66	3.73	2.79	0.001
Group (B)	52.27	4.82		

TABLE V
COMPARATIVE ANALYSIS OF MEAN DIFFERENCES OF VISUAL ANALOGUE SCALE AFTER TREATMENT FOR BOTH GROUPS

Variables	Mean	S. D	Significance	
			T- value	P-value
Group (A)	1.76	0.82	3.35	0.001
Group (B)	2.20	0.77		

C. Discussion

Urinary incontinence (UI) is being particularly common among aged women in residential care. Appraisals of the prevalence for the urinary incontinence in women vary from 10% up to 40% [14].

Comparing the results of IVP in both groups (A&B), there was a more significant (P<0.001) increase in group (A) that was treated with post-operative biofeedback, which was assisted by PFMT and home exercise program than in group (B) that was treated by home exercise program only. This outcome is in agreement with Bo [2] who stated that strength training of the pelvic floor muscles has been efficient in treating stress urinary incontinence in parous females in the worldwide population. PFMT has no serious adverse effects and has been recommended as a first-line treatment in the general population.

Pelvic floor exercises offer a possible reprieve from urinary incontinence. This conservative therapy appears to have no significant side effects and enables improvement in symptoms; it can therefore be considered as a first line of the treatment for urinary incontinence in the women guideline, which states that the pelvic floor exercises were found to be very effective in the treatment of incontinence in female patients in more than 50% of subjects [9].

Capelini et al. [15] provided that treatment of SUI with pelvic floor exercises associated to biofeedback caused significant alterations in the analyzed parameters with the maintenance of good results three months after exercise

Dumoulin et al. [16] added that multimodal pelvic floor rehabilitation with abdominal muscle training is an effective method of treatment for the persistent postpartum stress urinary incontinence.

Effective pelvic floor muscle contraction (lifting the pelvic floor muscle in a cranial and forward direction), anterior to and during the effort or exertion, clamps the urethra and enhances the urethral pressure, thereby stops the urine leakage [17].

A study conducted by Cammu et al. [18] comprising a 10-year follow-up of women after pelvic floor muscle exercise for the stress incontinence, reported that when PFMT is initially successful and there is a 66% chance that the favorable outcomes will persist for at least 10 years. Moreover, Dumoulin et al. [19] proved that, daily PFMT is a good treatment for stress or mixed urinary incontinence, compared with no treatment, over the short term.

The trials suggest that the treatment effect (especially self-reported cure/improvement) might be greater in the ladies with stress urinary incontinence performing a supervised PFMT program for at least three months [20]. Also, Goode et al. [21] studied the effect of biofeedback-assisted PFM exercise training and self-monitoring with bladder diaries, in the treatment of SUI and reported that the ladies with predominant SUI symptoms, who were given comprehensive written instructions in the form of an 8-week self-help behavioral program, showed a mean 68.6% decrease in the frequency of incontinence episodes when compared with the mean 52.5% reduction in incontinence episodes for the controls.

Bo et al. [22] stated that the biofeedback therapy provides awareness of the physiological action of the pelvic floor muscles by the audio/visual, and tactile means. Also, Pages et al. [23] added that four weeks of both intensive groups physical therapy or individual biofeedback training followed by an unsupervised daily home exercise program for two months are effective treatment for female urinary stress incontinence and results a significantly decreased nocturnal urinary frequency and improved subjective outcome.

BF-assisted PFMT is an effective therapy compared to PFMT alone for well-motivated females with mild to moderate PFD [1].

IV. Conclusion

BF-assisted PFMT is an effective therapy, non-invasive and safe method for the symptomatic relief of post-operative female stress urinary incontinence compared to PFMT alone.

V. Consent

All authors declare that 'written informed consent was obtained from the patient before starting the study for publication of this case report.

VI. Ethical Approval

This study was approved by the ethical committee of faculty of Physical Therapy, Cairo University.

VII. Competing Interests

Authors have declared that no competing interests exist.

VIII. Authors' Contributions

This work was carried out in collaboration between all authors. Author AME designed the study, wrote the protocol, and wrote the first draft of the manuscript. Author AMB & GEE managed the literature searches and performed the statistical analysis. Authors HOG managed the analyses of the study. All authors read and approved the final manuscript.

Acknowledgements

Many thanks, to all patients who participated in this study for their co-operation.

References

[1] Ibrahim K, Abdel Hameed M, Taher M, Shaheen M. , Elsawy S. Efficacy of biofeedback-assisted pelvic floor muscle training in females with pelvic floor dysfunction. Alexandria Journal of Medicine. 2015; 51: 137-42.

[2] Bø K. Urinary incontinence, pelvic floor dysfunction, exercise and sport. Sports Med. 2004; 34(7):451-64.

[3] Hannestad YS, Rortveit G, Daltveit AK, Hunskaar S. Are smoking and other lifestyle factors associated with female urinary incontinence? The Norwegian EPINCONT study. Int J Obstet Gynaecol. 2003; 110:247-54.

[4] Minassian VA, Drutz HP, Al-Badr A. Urinary incontinence as a worldwide problem. Int J Gynaecol Obstet.2003; 82:327-38.

[5] Simeonova Z, Milson I, Kullendorf AM, Molander U,Bengetss, C. The prevalence of urinary incontinence and its influence on the quality of life in women from urban Swedish population. Acta Obstet Gynecol Scand. 1999; 78:546-51.

[6] Hannestad YS, Rortveit G, Sandvik H, Hunskaar S. Norwegian EPINCONT study. Epidemiology of Incontinence in the County of Nord-Trondelag. A community-based epidemiological survey of female urinary incontinence: The Norwegian EPINCONT study. Epidemiology of incontinence in the county of Nord-trondelag. J Clin Epidemiol. 2000;53(11):1150–7.
[7] Neumann P., Gill V. Pelvic floor and abdominal muscle interaction: EMG activity and intra-abdominal pressure. Int Urogynecol J Pelvic Floor Dysfunct. 2002; 13: 125–32.
[8] Peschers U, Vodusek D, Fanger G, Schaer G, Delancey J, Schussler B. Pelvic muscle activity in nulliparous volunteers. Neurourol Urodyn 2001; 20:269–75.
[9] National Institute for Health Clinical Excellence. Urinary incontinence: the management of urinary incontinence in women. Clinical guideline 40. London: NICE; 2006.
[10] Filho A, Fonseca A, Camillato E., Cangussu R. Analysis of the resources for rehabilitation of pelvic floor muscles in women with prolapse and urinary incontinence. Fisioter. Pesqui. 2013; 20: 90-96.
[11] Herderschee R, Hay-Smith J, Herbison P, Roovers P. and Heineman J. Feedback or biofeedback to augment pelvic floor muscle training for urinary incontinence in women. Cochrane Database Syst Rev. 2011; 6:52-55. CD009252.
[12] Norton C. Cody D. Biofeedback and/or sphincter exercises for the treatment of faecal incontinence in adults. Cochrane Database of Systematic Reviews, 2012; 7: 6-7. Article ID CD002111.
[13] Rosenbaum T.: Pelvic floor physiotherapy for women with urogenital dysfunction: indications and methods. Minerva Urol Nefrol. 62011; 3: 101–7.
[14] Temml C, Haidinger G, Schmidbauer J. Urinary incontinence in both sexes: prevalence rates and impact on quality of life and sexual life. Neurourol Urodyn. 2001; 19:259–71.
[15] Capelini M, Riccetto C, Dambros M, Tamanini J, Herrmann V. Muller V. Pelvic Floor Exercises with Biofeedback for Stress Urinary Incontinence. International Braz J Urol. 2006; 32: 462-9.
[16] Dumoulin C, Lemieux MC, Bourbonnais D, Gravel D, Bravo G, Morin M. Physiotherapy for persistent postnatal stress urinary incontinence: a randomized controlled trial. Obstet Gynecol. 2004; 104:504-10.
[17] Miller JM, Perucchini D, Cardichi LT, Delancey JOL, Ashton-Miller J. Pelvic floor muscle contraction during a cough and decreased vesical neck mobility. Obstet Gynecol. 2001; 97:255–60.
[18] Cammu H, Van Nylen M, Amy JJ. A 10 year follow up after Kegel's pelvic floor muscle exercises for genuine stress incontinence. Br J Urol Int 2001; 85:655–8.
[19] Dumoulin C, Hay Smith J. Pelvic floor muscle treatment versus no treatment, or inactive control treatments, for urinary incontinence in women. Cochrane Database Syst Rev. 2010; 1: 7-9. Art. No. CD005654.
[20] Slack A, Hill A, Jackson S. Is there a role for a specialist physiotherapist in the multi-disciplinary management of women with stress incontinence referred from primary care to a specialist continence clinic? J Obstet Gynaecol. 2008; 28:410–2.
[21] Goode P, Burgio K. Locher J.: Effect of behavioral training with or without pelvic floor electrical stimulation on stress incontinence in women. a randomized controlled trial. Journal of the American Medical Association (JAMA). 2003; 290:345–52.
[22] Bo K, Talseth T, Holme I. Single blind, randomized controlled trial of pelvic floor exercises, electrical stimulation, vaginal cones and no treatment in man- agement of genuine stress incontinence in women. BMJ. 1999; 318:487–93.
[23] Pages IH, Jahr S, Schaufele MK. Conradi E. Comparative analysis of biofeedback and physical therapy for treatment of urinary stress incontinence in women. Am J Phys Med Rehabil.2001; 80: 494-502.