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Effectiveness of pelvic floor muscle training on symptoms and uroflowmetry parameters in female patients with overactive bladder

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Background/aim: To evaluate the effects of pelvic floor muscle training (PFMT) on symptoms of overactive bladder (OAB) as well as uroflowmetry parameters and functional bladder capacity.

Materials and methods: Fifty-nine female patients with OAB symptoms were included. Patients were assessed by SEAPI-QMM, uroflowmetry, and abdominal ultrasound. A specially designed PFMT program using a Pilates ball was generated for patients. The training period was 1-h sessions twice a week for 6 weeks and aerobic home exercises to be performed at home 4 or 5 times every other day. Following training, subjects were reevaluated for body mass index, SEAPI questionnaire, and uroflowmetry.

Results: Initial mean SEAPI score, mean maximum and average flow rates, and mean voided volume were 9.8 ± 7.2, 29.8 ± 16.4 mL/s, 16.3 ± 8.7 mL/s, and 211.6 ± 173.5 mL, respectively. After completion of the training program, SEAPI scores improved significantly to 3.4 ± 6.4 ($P < 0.05$). Maximum and average flow rate results did not show significant changes, whereas voided volume seemed to have improved in conjunction with patients' symptom scores (Pearson correlation coefficient: 0.86).

Conclusion: According to our results, we think that proper PFMT results in increase of functional bladder capacity as well as improvement in OAB symptoms and can be recommended as first-line therapy or in conjunction with medical therapy in severe cases.

Key words: Overactive bladder, pelvic floor muscle training, incontinence, uroflowmetry

1. Introduction

Overactive bladder (OAB) symptoms are devastating and have been reported to affect at least 11.8% of both the male and female populations in the most recent international population-based survey (1). Lifestyle changes have been suggested to help alleviate the OAB symptoms in women. Among the lifestyle changes, dietary modifications to avoid irritants, voiding training, and liquid intake control have previously been proven to improve patients' quality of life (2). Pelvic floor muscle training (PFMT) has been one of the most effective treatment modalities in bladder symptoms (3).

Kegel exercises, the pioneer in PFMT, were popularized by Arnold Kegel to be applied by women in the postpartum period to avoid stress urinary incontinence (SUI) (4). It has been widely accepted and used among both the urological and gynecological communities. Its use as a treatment for SUI has been logically well established since pelvic muscle and supportive tissue strength and elasticity are the key elements for the bladder outlet control in SUI; however, the mechanism for OAB symptomatology has not been clarified (5).

Most patients with OAB symptoms usually have increased urinary flow rates with a voided volume below normal values. This study was planned to evaluate the effects of PFMT on the symptoms of OAB as well as uroflowmetric parameters and functional bladder capacity. We aimed to investigate the initial uroflowmetry parameters of the patients with OAB and the possible differences after the training program, if any.

2. Materials and methods

Fifty-nine female patients presenting with OAB symptoms to the Selçuk University School of Medicine's Department of Urology were included in the study. All participants were naive to any form of treatment for OAB symptoms and did not have a history of delivery and/or medical abortion in the last 12 months. All patients were informed about the treatment options for OAB and recruitment was totally voluntary. All patients provided their written informed

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consent for participation. Those patients who had had a pelvic surgery, lumbosacral disc disease, or known cardiac or pulmonary disabilities that may be affected by exercise; those actively receiving medical therapy for OAB symptoms; and those with known neurological diseases that affect urinary system (such as stroke, Parkinson disease, multiple sclerosis, etc.) were excluded from the study. The study, which followed the principles of the Helsinki Declaration, was approved by the local ethics committee (approval number B.30.2.SEL.0.28.00/130).

The OAB symptoms were assessed by the SEAPI-QMM questionnaire. The SEAPI-QMM Incontinence Classification System was developed in the early 1990s as a system that could quantify urinary incontinence and its impact without special equipment or time-consuming procedures (6). SEAPI-QMM is an acronym for stress-related leak (S), emptying ability (E), anatomy (female) (A), protection (P), inhibition (I), quality of life (Q), mobility (M), and mental status (M). Quality of life (Q) related to incontinence is measured with an index consisting of a 15-item questionnaire that examines a broad variety of aspects of a patient's life (domains). Patients filled in the validated Turkish version of SEAPI-QMM questionnaire (7). All patients had weight and height measurements and body mass indices (BMIs) were calculated. Childbearing histories and medical and pharmaceutical aspects were noted. A uroflowmetry test was initially performed for all patients. Maximum flow rate, mean flow rate, and voided bladder capacity were the end-points for the uroflowmetry test.

A specially designed PFMT program was generated for this patient group using a Pilates ball by the Department of Physical Education and Training. The exercise period was 1-h sessions 3 times a week for 6 weeks in a public gym supervised by a certified Pilates coach and aerobic home exercises to be performed personally at home for 4 or 5 times every other day. For the first 3 weeks, each session consisted of 10 min of warming up, 40 min of a Pilates mat exercise program of 8 × 2 sets, and 10 min to cool down. For the following 3 weeks, there was 45 min of the Pilates mat exercise program of 8 × 3 sets with the warming up and cooling down times remaining the same. The coach showed each exercise and then provided verbal cues and physical assistance for the accuracy of subject movements. The Pilates exercise program is accepted universally and is seen in Table 1 (8,9). Following the exercise program for 6 weeks, the subjects were reevaluated for BMI, SEAPI incontinence questionnaire, and uroflowmetry parameters.

All tests were analyzed using the t-test and $P < 0.05$ was accepted as statistically significant. A regression analysis was performed for the causal relationship.

3. Results

The mean age of the study group was 38.4 ± 9.8 years (range: 22–54 years). Thirty-eight patients had 2 children, 15 patients had 3 children, and 5 patients had 1 child, while 1 patient did not have a childbearing history. The initial mean SEAPI score of the group was 9.8 ± 7.2. Pure urge incontinence was reported in 38 of the total 59 patients. There were no drop outs during the program and all participants completed the training period.

The average maximum flow rate was 29.8 ± 16.4 mL/s, while initial average flow rate and mean voided volume were 16.3 ± 8.7 mL/s and 211.6 ± 173.5 mL, respectively. The BMIs were high in the study group with a mean BMI of 26.6 ± 5.1 kg/m^2.

After the completion of the training program, SEAPI scores improved significantly to 3.4 ± 6.4 ($P < 0.05$). There seemed to be a drop in the flow rate parameters (both maximum and average flow rates), but this did not reach statistical significance. Voided volume was the only parameter that seemed to have improved after the training program in conjunction with the improvement in patients' symptom scores (Pearson correlation coefficient: 0.86). All results are summarized in Table 2.

Table 1. The training program.

	Weeks 1–3	Weeks 4–6
Monday	10 min warm up 40 min Pilates mat exercises (8 × 2) 10 min cool down	10 min warm up 45 min Pilates mat & ball exercises (8 × 3) 10 min cool down
Wednesday	10 min warm up 40 min Pilates mat exercises (8 × 2) 10 min cool down	10 min warm up 45 min Pilates mat & ball exercises (8 × 3) 10 min cool down
Friday	10 min warm up 40 min Pilates mat & ball exercises (8 × 2) 10 min cool down	10 min warm up 45 min Pilates mat & ball exercises (8 × 3) 10 min cool dawn

Table 2. The mean initial and postexercise uroflowmetric parameters, voided urine volumes, and SEAPI scores of the group.

	Initial	After exercise	P-value
Q_{max} (mL/s)	29.8	26.2	>0.05
Q_{ave} (mL/s)	16.3	12.5	>0.05
V_{voided} (mL)	211.6	290.0	<0.05
SEAPI Score	9.8	3.4	<0.05

Q_{max}: Maximum flow rate, Q_{ave}: Average flow rate, V_{voided}: Voided volume.

4. Discussion

Incontinence rates have been proven to be one of the most prevalent and bothersome health issues in both women and men. The urinary symptoms associated with OAB have been reported to be as 11.8% among the general population in a multiinstitutional survey and the prevalence increases as age increases (1). In relation to this high incidence, many therapeutic approaches have been suggested. Medical management offers patients comfort but may require long treatment periods, side effects such as constipation that can be bothersome to most females, and of course a high medical bill. Conservative approaches are recommended in patients with OAB symptoms solely or in conjunction with medical therapies in order to increase effectiveness, decrease side effect profile and costs, and give patients a more permanent therapy that they personally can control and apply (10,11).

The most effective conservative approach has been reported to be PFMT. The pelvic floor muscles (PFMs) comprise the pelvic diaphragm separate from the urogenital diaphragm and urethral sphincter muscles, and they consist of several muscles with different fiber directions (12,13). The PFMs form a U-shaped sling around the urethra, vagina, and anus, and contraction of the muscles has a direct influence on the urethra because they compress the urethra, thereby increasing the urethral pressure (12–14). Disorders of the PFMs may lead to bladder control problems, retention, prolapse, or sexual dysfunction.

Although the effect of PFMT on OAB pathogenesis has not been clearly explained, there are some data from anatomical studies about PFMs and bladder interaction. The PFMs and bladder transmit afferent information to the lumbosacral cord and the periaqueductal gray matter (PAG) (15). The pontine micturition center (PMC) receives excitatory information from the PAG. In the PMC, there are two regions, namely the medial (M) and lateral (L) region, which have reciprocal inhibitory effects on each other. The M-region is the center of synergetic micturition with projections to the bladder and the urethral sphincter. The L-region has direct projections on the nucleus of Onuf and in this way initiates contraction of the PFMs and striated sphincter of the urethra and anus (16).

In a normal situation, the PFMs and bladder are coordinated at the level of the PMC under control of the PAG. The effect of a contraction of the PFMs on the bladder is the inhibition of the detrusor contraction (17). This reflex mechanism may be of sacral origin, but the role of the PMC in this mechanism has been described as inhibition of the L-region on the M-region (18). A similar effect can be observed when PFMT is used in the conservative treatment of OAB. PFMT leads to hypertrophy of local skeletal muscle fibers, enhanced cortical awareness of muscle groups, strengthening of connective tissue in the muscles, and more effective recruitment of active motor neurons (13).

The aim of this study was to establish the efficacy of PFMT on OAB symptomatology and which uroflowmetry parameters correlated with this change in symptom improvement. Our results showed an improvement in the symptom scores of the patients, but no change in the maximum or the mean flow rates. However, the mean voided volume showed an increase that correlated with the SEAPI scores.

In order to predict whether PFMT may be effective in treating OAB symptoms, it is necessary to know the status of the PFMs. On physical examination, three types of pelvic floor dysfunction can be seen: no voluntary control, voluntary control but impaired strength and/or relaxation, and voluntary control with normal strength and/or relaxation. PFMT is the treatment of choice when there is voluntary control but strength and/or relaxation is impaired. The most important feature of PFMT is training the coordination between bladder and PFMs (19).

The effect of PFMT on urgency may be explained by the anatomical structures related to voiding. Detrusor muscles are the main component of compliance and voiding physiology and are under the control of both the somatic and sympathetic nervous system. The main pathology resulting in OAB symptoms is yet to be identified. Since people may experience OAB symptoms without abnormal detrusor contractions and even with normal urodynamic findings, we think that there may be different types of OAB involving the bladder itself or the nervous system innervations. Pudendal nerve stimulation has been proposed as one of the most effective models for alleviating OAB symptoms in electric stimulation therapies for urge incontinence (20,21). It is highly possible that proper PFM stimulation through exercise may have a similar effect on the pudendal nerve and thus result in the improvement of the OAB symptoms (22–24).

Numerous recently done studies have shown the efficacy of PFMT on urinary incontinence and OAB symptoms. Dugan et al. showed that the patients older than 65 years and participating in PFMT classes twice a week for 6 weeks experienced significant improvement in all self-administered questionnaires when compared to the control group having only one educational session and didactic information via a booklet (25). Fan et al. evaluated the effects of PFMT on the urinary symptoms and quality of life. Participants participating in 3 to 9 months of PFMT observed improvement both in their urinary symptom scores and in their quality of life regardless of their diagnosis of SUI, OAB symptoms, or mixed urinary incontinence (26).

Another study evaluated the effects of PFMT on lower urinary tract symptoms (LUTS) and quality of life in women with multiple sclerosis. The authors observed statistically significant improvement in the scores of all questionnaires assessing LUTS and quality of life after performing PFMT for 12 weeks (27). A different study involving 143 male patients receiving alpha-blocker therapy compared the effectiveness of behavioral treatment with that of antimuscarinic therapy. It was observed that behavioral treatment consisting of PFMT, urge suppression techniques, and delayed voiding was at least as effective as antimuscarinic therapy for OAB in men without bladder outlet obstruction (28).

It is obvious that PFMT is effective in OAB symptoms as well as SUI. The actual question is for how long PFMT should be done. There are miscellaneous treatment protocols in the literature and no consensus exists for the ideal duration. In most of the studies, however, it is advised to perform PFMT at least for 6–8 weeks. It makes sense that the longer the duration of PFMT is, the better results the patients get.

Our study is the first reported on the effect of PFMT on correlation of uroflowmetry parameters and OAB symptoms. Uroflowmetry, as an easy, noninvasive, and cheap test, can be done in the first evaluation of patients with OAB symptoms as well as in their follow-up for the effects of the treatment. We think that proper PFMT results in increase of functional bladder capacity as well as improvement in OAB symptoms and can be recommended as a first line of therapy or in conjunction with medical therapy in severe cases.

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