

# Biofeedback Pelvic Floor Muscle Training for Voiding Dysfunction and Overactive Bladder

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## ABSTRACT

**Objective:** Biofeedback pelvic floor muscle training (PFMT) has been widely used in treatment of stress urinary incontinence, idiopathic detrusor overactivity, learned dysfunctional voiding and chronic pelvic pain. Only limited data have been reported on this treatment of overactive bladder (OAB) and voiding dysfunction in adults. This study used PFMT to treat a group of patients with symptoms of OAB or voiding dysfunction due to poor relaxation of the urethral sphincter or pelvic floor muscles. **Materials and Methods:** All patients were treated with a standard 12-week step by step program which included instruction in voiding physiology, identification of the pelvic floor muscles, correct contraction of the pelvic floor muscles, increase in endurance of the pelvic floor muscles, and a continuing program at home. The symptomatic improvement and uroflowmetry parameters were compared between baseline and post-PFMT. **Results:** A total of 124 patients entered this study, but only 68 (55%) completed the program. Among these patients, 52 (76.3%) had symptomatic improvement. After PFMT, the maximum flow rate and voided volume all increased in both genders and in patients with OAB as well as those with voiding dysfunction. **Conclusions:** The results of this study demonstrated that with a proper training program, 76.5% of patients with OAB and voiding dysfunction can achieve improvement in symptoms using biofeedback PFMT. The severity of frequency urgency symptoms can be reduced and voided volume and Qmax can be increased.

*Key words:* biofeedback, lower urinary tract symptoms, voiding dysfunction, overactive bladder

## INTRODUCTION

Lower urinary tract dysfunction (LUTD) includes urinary incontinence, frequency urgency syndrome, spastic urethral sphincter syndrome, chronic eliminative syndrome and pelvic pain syndrome. LUTD is usually treated with behavioral and medical therapies, however, patients might not tolerate long-term medication or newly-developed adverse side effects. When LUTD cannot be further improved, physiotherapy using electrical stimulation or biofeedback pelvic floor muscle training (PFMT) might be helpful [1]. Using detectable or measurable responses, patients can obtain a perceptible sensation and therefore try to change physiological function through active involvement.

Biofeedback PFMT has been widely used in treatment of stress urinary incontinence (SUI), idiopathic detrusor over-activity, learned dysfunctional voiding in children, and chronic pelvic pain due to hypertonicity of the pelvic floor muscles [2-4]. However, only limited data have been reported using biofeedback PFMT for overactive bladder and voiding dysfunction in adults [5,6]. Theoretically, bladder dysfunction can be caused by pelvic floor dysfunction, but bladder dysfunction can also over-train the pelvic floor muscles through repeated sensory input from noxious stimuli from the bladder, such as in inflammation, infection or irritation. Correction of pelvic floor muscle hypertonicity can also modulate bladder sensation as well as overactivity. About 51% to 83% of patients with dysfunctional voiding improve their voiding on long-term follow-up. Patients can achieve a normal flow curve and good pelvic floor relaxation with no significant postvoid residual urine after successful PFMT. Improvement in constipation and decreased

urinary tract infection can also be achieved [7]. Previous studies also reported that 43% to 100% of patients with levator syndrome and 83% of patients with vulvovaginal pain experienced pain relief after PFMT [8].

This prospective study investigated a group of adult and pediatric patients with symptoms of overactive bladder (OAB) or voiding dysfunction due to poor relaxation of the urethral sphincter or pelvic floor muscles during voiding. The patients were treated with a standard protocol of biofeedback PFMT using patch electromyography or verbal instruction. The results of this study can provide data on the effectiveness of this conservative therapy for patients with overactive bladder and voiding dysfunction.

## MATERIALS AND METHODS

A total of 147 patients were referred to the voiding dysfunction therapeutic center for biofeedback PFMT for LUTD. Twenty-three patients with genuine stress urinary incontinence were excluded from the study. The remaining 124 study patients had overactive bladder symptoms of frequency, urgency, nocturia, urge incontinence or symptoms of difficult urination, small caliber urine or residual urine sensation. All patients had been treated with antimuscarinic agents for OAB symptoms and alpha-blockers plus baclofen for voiding dysfunction but the treatment had failed or the adverse effects of medication were intolerable.

All patients were treated with a standard step by step program which included instruction in voiding physiology, identification of the pelvic floor muscles, correct contraction of the pelvic floor muscles, increase in endurance of the pelvic floor muscles, and a continuing home program. The whole PFMT program was conducted over 12 weeks. Patients advanced to the next step only when they had been adequately trained and were able to follow the instructions for per-

Received: January 1, 2007 Accepted: February 15, 2007

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forming PFMT. In addition, they were advised to avoid any known bladder stimulants, and increase high fiber and daily water intake. Behavioral modification such as changing wrong voiding behavior, taking adequate time for micturition, proper toilet posture, sitting for voiding, even for men, and time voiding without abdominal straining [9].

During the first 2 weeks, patients were trained to relax. The intervals between each pelvic floor contraction were at least twice as long as that of pelvic floor muscle contraction. From the second to the fourth week, patients were trained in the hospital until they could sustain a 5 second maximum contraction. During the second month, they began a home program which included 5 second contractions with 10 seconds of relaxation, ten contractions each time, performed three times a day. In the third month, patients progressed to 10 second contractions with 10 seconds of relaxation.

Uroflowmetry, voided volume and postvoid residual were measured before biofeedback PFMT and 3 months after PFMT began. The flow pattern was also recorded as a normal pattern, obstructive pattern or intermittent pattern. The therapeutic results were classified as excellent, improved or stationary according to the patient's subjective global satisfaction assessment. Patients with excellent and improved results were considered to have a successful outcome.

The therapeutic results of biofeedback PFMT were evaluated in

patients presenting with OAB symptoms and voiding dysfunction. Uroflowmetry and voided volume were compared between baseline and at 3 months. Statistical analysis was performed using the paired t-test and a p value of less than 0.05 was considered significant.

## RESULTS

At 3 months after the initial biofeedback PFMT, only 68 of the 124 patients with OAB or voiding dysfunction completed the training (55%). Thirty-one patients were males and 37 were females. Twenty six patients had OAB symptoms and 42 had voiding dysfunction. The ages of these 68 patients ranged from 9 to 83 years with a mean of  $55 \pm 15$  years old.

The symptomatology of the patients is listed in Table 1. Patients with mainly OAB symptoms also had some degree of voiding dysfunction whereas patients with voiding dysfunction also may have had urgency frequency symptoms. After completion of biofeedback PFMT, 52 (76.5%) patients had successful results while 16 patients had failed treatment.

The uroflowmetry data and postvoid residual of the patients at baseline and post-PFMT are listed in Table 2. Both males and females had significant improvements in Qmax and voided volume after PFMT.

**Table 1.** The Symptomatology of Lower Urinary Tract Symptoms in Patients Undergoing Biofeedback PFMT

	Men (n=31)	Women (n=37)	Total (n=68)
Frequency	21	32	53 (78.0%)
Urgency	7	19	26 (38.2%)
Urge incontinence	2	7	9 (13.2%)
Nocturia	17	12	29 (42.6%)
Small caliber urine	18	8	26 (38.2%)
Residual urine	15	18	33 (48.5%)
Straining to void	4	7	11 (16.2%)

**Table 2.** The Uroflowmetry Data at Baseline and 3 Months after Biofeedback PFMT in Patients with OAB and Voiding Dysfunction

		Qmax (mL/s)	Voided volume (mL)	PVR (mL)
Total (n=68)	baseline	14 ± 7.5	256 ± 135	61 ± 70
	Post-PFMT	19.5 ± 9.7	374 ± 144	41.3 ± 49.2
	P value	0.000	0.000	0.037
Men (n= 31)	baseline	10.5 ± 4.3	243 ± 148	70 ± 79.6
	Post-PFMT	14.1 ± 4.7	375 ± 153	44.7 ± 42.1
	P value	0.000	0.000	0.467
Women (n=37)	baseline	17 ± 8.3	268 ± 124	53.3 ± 60.7
	Post-PFMT	24 ± 10.5	373 ± 54.9	38.5 ± 54.9
	P value	0.000	0.000	0.072

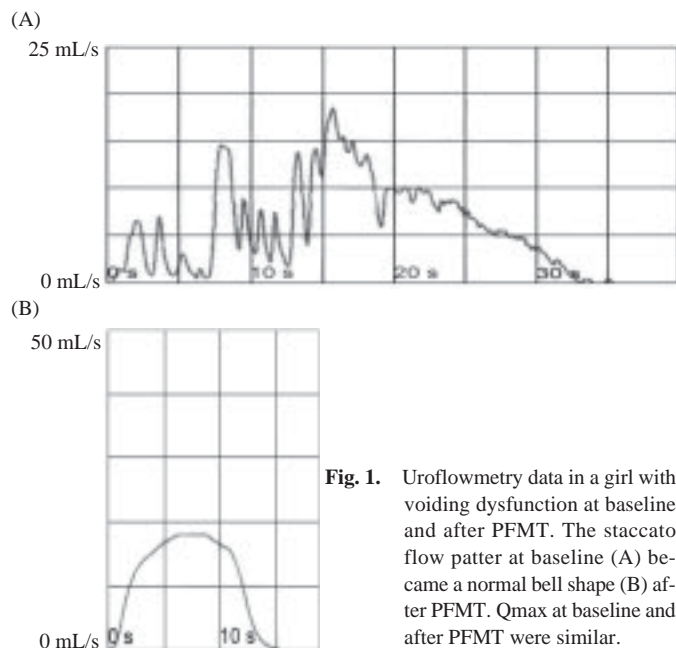
**Table 3.** The Uroflowmetry Data at Baseline and 3 Months after Biofeedback PFMT in Patients with OAB and Voiding Dysfunction

		Qmax (mL/s)	Voided volume (mL)	PVR (mL)
OAB (n=26)	baseline	14.4 ± 7.4	229 ± 125	58.1 ± 75.5
	Post-PFMT	18.4 ± 9.7	332 ± 132	39.4 ± 45.7
	P value	0.013	0.002	0.220
V.D. (n= 42)	baseline	13.8 ± 7.6	273 ± 139	62.6 ± 67.1
	Post-PFMT	20.2 ± 9.7	400 ± 146	42.4 ± 51.7
	P value	0.000	0.000	0.266

V.D.: voiding dysfunction

**Table 4.** Changes of Uroflowmetry Data between Baseline and 3 Months in Patients with Successful and Failed Results after Biofeedback PFMT

	Successful PFMT (n=52)	Failed PFMT (n=16)	P value
Qmax (mL/s)	7.5 ± 7.6	-1.1 ± 4.7	0.000
Voided volume (mL)	150 ± 122	12.9 ± 141	0.000
PVR (mL)	-16.8 ± 75.1	-28.8 ± 80.7	0.585

**Fig. 1.** Uroflowmetry data in a girl with voiding dysfunction at baseline and after PFMT. The staccato flow patten at baseline (A) became a normal bell shape (B) after PFMT. Qmax at baseline and after PFMT were similar.

Improvements in Qmax and voided volume were also significant in patients with OAB and those with voiding dysfunction after PFMT (Table 3).

Uroflowmetry data showed that changes in Qmax and voided volume were significantly greater in patients with a successful result than those with failed treatment (Table 4). The uroflow pattern in patients with voiding dysfunction became a normal bell shape in patients with successful results, but not in patients with failed treatment (Fig. 1).

## DISCUSSION

Biofeedback PFMT is a physiotherapy that can change the contractile and relaxation properties of the skeletal muscles through repeated exercise. Regular PFMT can strengthen the pelvic floor muscles and treat stress urinary incontinence (SUI) in women [10]. This therapeutic modality has been recommended and widely used as a first line treatment for female SUI. However, for patients with overactive bladder and voiding dysfunction, biofeedback PFMT has not been accepted as a treatment choice [11]. The results of this study demonstrated that with a proper training program, 76.5% of patients with OAB or voiding dysfunction can achieve improvement in symptoms. The severity of frequency urgency symptoms can be reduced, and the voided volume and Qmax can be increased.

However, only 55% of patients who were referred for biofeedback PFMT completed the training program. The motivation and cooperation of patients are the most important factors in achieving successful therapeutic results. Therefore, appropriate selection of patients for biofeedback PFMT is very important [1,4,9].

Non-neurogenic voiding dysfunction can be caused by a poorly relaxed urethral sphincter or pelvic floor muscles during voiding, or a hyperactive urethral sphincter or pelvic floor muscles during voiding. Although these pelvic floor disorders result in bladder emptying dysfunction, patients might have storage symptoms as well. Similarly, patients with OAB might experience urgency when their bladders are not yet full, and therefore, they might also experience difficult urination or a residual urine sensation. Clinically, it is not easy to differentiate patients with OAB and voiding dysfunction by symptomatology alone.

Nevertheless, we can use biofeedback PFMT to treat symptoms in these patients. The high success rate of biofeedback PFMT in this study has provided an encouraging therapeutic modality as a first line treatment for patients with symptoms of OAB and voiding dysfunction.

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