



# Efficacy of Pelvic Floor Muscle Training Using Bio-assisted Surface Electromyography in Women With Pelvic Floor Dysfunction With and Without Pelvic Organ Prolapse

Ting WH, Liu YJ, Wu WY, Hsiao SM

Far Eastern Memorial Hospital, New Taipei City, Taiwan R.O.C

### Hypothesis/ Aim of Study

Pelvic floor dysfunction (PFD) in women comprises a complex presentation of clinical symptoms, such as urinary incontinence (UI), fecal incontinence, overactive bladder (OAB) and pelvic organ prolapse (POP). Treatment options for PFD vary depending on symptom severity, conservative approaches such as pelvic floor muscle (PFM) exercises, biofeedback, and lifestyle advice are usually suggested for UI, OAB, and mild-to-moderate POP. Most of the past literature focused on the effectiveness of pelvic floor muscle training (PFMT) on single disease, but seldom explored its effectiveness on complex disease (i.e. women presenting with more than one type of PFD). The aim of this study is to compare the efficacy of a 12-week PFMT bio-assisted surface electromyographic program in women with complex PFD.

### Study design, materials and methods

This is a prospective observational study performed from December 2015 to November 2018. It included 83 women with PFD: those with OAB and stress urinary incontinence (SUI), with or without POP. These women underwent a 12-week PFMT bio-assisted surface electromyographic program. The main outcome was the electromyographic activity of the pelvic floor muscles (PFMs) and the synergistic abdominal muscles (SAMs) during each session of PFMT. Since the electromyographic activity is affected by muscle tension in the resting posture, the resting value was deducted from the measured value, which is known as the increased sustained voluntary contraction, and is also a reflection of muscle strength. The secondary outcomes included the comparison of the stage of prolapse with the women’s perception of symptom cure or improvement following the program, and lastly, the variables influencing the efficacy of PFMT. The prolapse severity was assessed subjectively and objectively (anatomically, using Pelvic Organ Prolapse Quantification (POP-Q) System) before and after the intervention.

### Results

There was no significant difference in baseline characteristics between the groups except the number of participants with SUI in each group. A notable effect was identified after 12 weeks of training in all women with PFD, with or without POP. Training yielded a significant improvement in PFM strength in both standing and sitting positions in women with PFD without POP, but only in the supine position in women with POP (Table 1). In the POP group, there was a poor inter-observer agreement between the subjective and objective improvement of prolapse severity (Kappa, κ=0.016). The duration of training and the number of effective PFM contractions were significant factors influencing the treatment outcome in women with OAB or USI, with or without POP (Table 2).

Table 1 Pelvic floor muscle strength in different positions over time (after 2, 4, 8, and 12 weeks of training)

		ISVC (W2)	ISVC (W4)	ISVC (W8)	ISVC (W12)		
Variables	Group	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	P value	Post HOC
Supine	1	3.90 ± 4.90	3.43 ± 6.66	3.50 ± 4.18	9.69 ± 18.32	0.21	
	2	3.20 ± 3.15	4.66 ± 5.64	3.33 ± 5.59	10.14 ± 10.20	<0.01	W2, W8<W12
Standing	1	3.02 ± 3.28	4.71 ± 4.16	8.00 ± 7.47	8.39 ± 7.91	<0.01	W2<W8, W12
	2	6.09 ± 7.21	5.02 ± 4.69	5.24 ± 5.04	4.48 ± 0.48	0.87	
Sitting	1	1.75 ± 1.86	3.14 ± 2.22	3.68 ± 3.75	6.66 ± 7.06	<0.05	W2<W4,W2, W4,W8<W12
	2	2.33 ± 3.04	3.69 ± 0.679	2.56 ± 3.62	4.88 ± 0.888	0.16	

Group 1 = PFD without POP; Group 2 = PFD with POP

\*statistically significant

Abbreviations: ISVC, increased sustained voluntary contraction; PFM, pelvic floor muscle; SD, standard deviation; W, week

### Interpretation of results

In this prospective observational study, we demonstrated that a 12-week PFMT bio-assisted surface electromyographic program was effective in improving female PFD symptoms, including those with OAB, SUI, and stage I~II POP. PFMT performed in the standing or sitting position was equally as effective in women with OAB or SUI without POP; however, it was only effective in the supine position in women with OAB or SUI with POP. Participants with POP expressed a strong bearing down sensation in upright (i.e. standing and sitting) position; this echoes the pathophysiology of POP and possibly has a negative impact on the efficacy of PFMT. Our study showed no agreement between the subjective and objective improvement of prolapse severity after completing PFMT. This was anticipated as women with POP experience symptoms that do not necessarily correlate with prolapse severity or compartment specific-defect. The duration of training and the number of effective PFM contractions were significant factors influencing the treatment outcome in women with OAB or USI, with or without POP. This was congruent to the statement by expert scientists that the combination of frequency, intensity, and duration of chronic exercise is effective for producing a training effect.

Table 2 Increased sustained voluntary contraction of pelvic floor muscle in different positions between groups via linear mixed models analysis

		Supine ISVC			Standing ISVC			Sitting ISVC		
Group	Variables	B	SE	p	B	SE	p	B	SE	p
1	Time									
	Week 2 (ref.)									
	Week 4	-0.99	1.53	0.52	1.40	1.89	0.46	1.71	1.40	0.23
	Week 8	-0.81	1.80	0.66	3.20	2.17	0.15	0.74	1.54	0.63
	Week 12	6.81	4.45	0.14	7.05	2.96	0.001*	5.34	1.52	0.001*
	No. of effective PFM contractions	1.40	1.06	0.19	2.91	1.76	0.10	3.42	1.16	<0.01*
2	Time									
	Week 2 (ref.)									
	Week 4	1.36	1.40	0.34	-1.72	1.93	0.37	1.04	1.24	0.41
	Week 8	1.14	2.12	0.59	-2.30	2.31	0.32	-1.94	1.40	0.17
	Week 12	6.96	2.76	<0.05*	-1.56	2.11	0.46	2.25	1.34	0.10
	No. of effective PFM contractions	0.41	1.57	0.80	1.80	1.71	0.30	4.74	1.13	<0.001*

Group 1 = PFD without POP; Group 2 = PFD with POP

\*statistically significant

Abbreviations: B, unstandardized beta; ISVC, increased sustained voluntary contraction; No., number; PFM, pelvic floor muscle; PFME,



亞東紀念醫院  
FAR EASTERN MEMORIAL HOSPITAL