

Effectiveness of Therapeutic Ultrasound and Pelvic Floor Muscle Training with Home Exercise Programme for Persistent Pelvic Floor Pain: A Randomized Controlled Trial

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Abstract:

➤ Background:

Persistent pelvic floor pain (PPFP) is a chronic condition that impairs pelvic floor function and quality of life. Evidence comparing conservative physiotherapy interventions remains limited.

➤ Objective:

To compare the effectiveness of pelvic floor muscle training (PFMT) plus home exercise programme (HEP), therapeutic ultrasound plus HEP, and HEP alone in women with persistent pelvic floor pain.

➤ Methods:

Sixty women with persistent pelvic floor pain were recruited using consecutive sampling and randomly allocated into three groups (n = 20 each): Group A (PFMT + HEP), Group B (therapeutic ultrasound + HEP), and Group C (HEP alone). Interventions were administered three times weekly for six weeks. Pain intensity was assessed using the Visual Analogue Scale (VAS), and pelvic floor muscle strength using the Modified Oxford Scale (MOS). Data were analyzed using paired t-tests, one-way ANOVA, and independent t-tests ($p < 0.05$).

➤ Results:

All groups showed significant improvements in VAS and MOS scores after six weeks ($p < 0.001$). Between-group analysis demonstrated significant differences in post-intervention outcomes. Group A showed the greatest improvement, followed by Group B, while Group C demonstrated the least improvement.

➤ Conclusion:

PFMT combined with HEP was more effective than therapeutic ultrasound combined with HEP and HEP alone in reducing pain and improving pelvic floor muscle strength in women with persistent pelvic floor pain.

Keywords: Persistent Pelvic Floor Pain; Pelvic Floor Muscle Training; Therapeutic Ultrasound; Home Exercise Programme; Randomized Controlled Trial.

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I. INTRODUCTION

Persistent pelvic floor pain (PPFP) is a persistent musculoskeletal disorder, which develops as a result of the pelvic floor muscles and related connective tissues and continues to last at least three months. It is known to be a

subgroup of chronic pelvic pain (CPP), which is a multifactorial disorder that impacts women of all ages and has a significant physical, psychological, sexual, and socioeconomic burden. Women who undergo PPFP often report dyspareunia, dysuria, bowel and urinary dysfunction, impaired mobility, sleep disturbances, anxiety, depression,

and decreased quality of life. Its intricate clinical manifestation frequently leads to the delay in its diagnosis and difficulties in its successful treatment, underlining the importance of evidence-based conservative treatment approaches (1,2).

The pathophysiology of PPFP is complex and multifactorial, it is based on musculoskeletal, neurological, visceral, and psychosocial factors. The dysfunction of the pelvic floor muscles, which is a high resting muscle tone, myofascial trigger points, lack of relaxation, muscle weakness, and abnormal neuromuscular coordination is regarded as a major cause of persistent symptoms. Persistent nociceptive input of dysfunctional pelvic floor muscles can cause central sensitization, which causes persistent pain and functional impairment. Thus, the modern management of PPFP is focused on a biopsychosocial approach, which includes the physical dysfunction and related psychosocial aspects (3,4).

The existing international guidelines suggest conservative physiotherapy as the initial intervention to treat women with chronic pelvic floor pain. The goals of pelvic floor rehabilitation include the restoration of normal muscle activity, pain reduction, neuromuscular coordination and functional performance by use of individualized treatment programmes. Pelvic floor muscle training (PFMT), manual therapy, relaxation, diaphragmatic breathing, stretching, posture correction, patient education, and behavioural changes are the common physiotherapy interventions. Recent systematic reviews have shown that physical therapy of the pelvic floor can greatly decrease pain and enhance pelvic floor function, but there is a high degree of heterogeneity in treatment regimens and outcome measures (5,6).

One of the most researched physiotherapy interventions to pelvic floor dysfunction is pelvic floor muscle training. Although PFMT is generally linked with strengthening exercises, women with PPFP need individualised programmes that initially focus on muscle relaxation, normalisation of muscle tone, motor control and progressive functional strengthening where suitable. The right activation and coordination of the pelvic floor muscles lead to better pelvic stability, less pain, and better functional outcomes. Although there is an increasing body of evidence to support PFMT, there is still doubt about the most effective combination of physiotherapy interventions to women with persistent pelvic floor pain (6,7).

Therapeutic ultrasound is a popular treatment method in musculoskeletal physiotherapy due to its thermal and non-thermal effects, such as increased local blood flow, improved tissue extensibility, decreased muscle spasm, and modulated pain. Such physiological effects imply possible advantages in decreasing pelvic floor muscle pain and enhancing the functioning of soft tissues. Nevertheless, in comparison to other conservative physiotherapy interventions, there is little evidence to support the effectiveness of therapeutic ultrasound in women with chronic pelvic floor pain. The majority of studies available have compared multimodal rehabilitation programmes thus it is hard to establish the

particular role of therapeutic ultrasound in clinical outcomes (8,9).

Structured home exercise programme has been viewed as part of pelvic floor rehabilitation as it supports supervised physiotherapy, enhances compliance with treatment, fosters self-management and enables lasting retention of therapeutic benefits. Pelvic floor relaxation, diaphragmatic breathing, stretching, postural correction, and functional mobility exercises may be used as supplementary exercises and enhance the overall outcome of rehabilitation. However, there is a paucity of evidence on the relative effectiveness of various physiotherapy interventions in conjunction with a standardized home exercise programme (5,9).

Despite the general recommendation of conservative physiotherapy in treating persistent pelvic floor pain, there is a lack of high-quality comparative research to assess the effectiveness of therapeutic ultrasound and pelvic floor muscle training with a standardized home exercise programme. Moreover, the incremental clinical value of these interventions in comparison to home exercise programme per session is not well defined. Hence, this randomized controlled trial was conducted to determine the efficacy of therapeutic ultrasound with a home exercise programme, pelvic floor muscle training with a home exercise programme and a home exercise programme in pain and functional outcomes in women with persistent pelvic floor pain.

II. MATERIALS AND METHODS

➤ Study Design

This randomized controlled trial was done to determine the efficacy of therapeutic ultrasound with a home exercise programme (HEP), pelvic floor muscle training (PFMT) with HEP, and HEP alone on pain and functional outcomes in women with persistent pelvic floor pain.

➤ Study Setting

The study was conducted in the Department of Physiotherapy, Dasmesh college of Physiotherapy, Faridkot, Punjab, India.

➤ Study Population

Women diagnosed with persistent pelvic floor pain attending the outpatient physiotherapy department were screened for eligibility. Participants fulfilling the inclusion criteria and providing written informed consent were recruited for the study.

➤ Sample Size

A total of 60 participants were enrolled and randomly allocated into three equal groups (n = 20 per group).

➤ Sampling Technique

Participants were recruited using consecutive sampling. Following baseline assessment, participants were randomly allocated to one of three intervention groups.

➤ *Inclusion Criteria*

Participants fulfilling the following criteria were included:

- Women aged 40 -65 years.
- Persistent pelvic floor pain lasting more than three months.
- Pain localized to the pelvic floor muscles confirmed by clinical examination.
- Pain intensity ≥ 6 on the Visual Analogue Scale (VAS).
- Ability to understand and perform the prescribed exercise programme.
- Willingness to provide written informed consent.

➤ *Exclusion Criteria*

Participants were excluded if they had:

- Pregnancy or postpartum status.
- Active pelvic infection or pelvic malignancy.
- Previous pelvic surgery within the preceding six months.
- Neurological disorders affecting pelvic floor function.
- Severe cognitive impairment.
- Current participation in another pelvic floor rehabilitation programme.

➤ *Intervention*

The participants were randomly assigned to any of three intervention groups and were provided with supervised treatment three times a week and a six-week period (18 sessions). The participants of all groups were advised to use a standardized home exercise programme two times a day during the intervention period. Adherence was checked with the help of an exercise diary and reinforced in weekly follow-up sessions (10,12).

- *Group A: Pelvic Floor Muscle Training + Home Exercise Programme*

Participants were given a six-week (three sessions/week; 18 sessions) supervised pelvic floor muscle training in conjunction with a standardized home exercise programme. Pelvic floor muscle training involved reverse Kegel exercises, low pelvic tilts and pelvic floor muscle contractions (Kegel exercises). Reverse Kegel exercises were relaxation of the pelvic floor muscles, achieved by a gentle expansion of the pelvis in the downward direction during the inhalation phase, and then returning to the rest posture. Pelvic tilts were done in the supine crook-lying position in a gentle manner, alternating the posterior and anterior tilting of the pelvis in synchrony with the breathing. Pelvic floor muscle contractions were done by voluntarily contracting the pelvic floor muscles without stimulating the abdominal, gluteal, and thigh muscles and then the relaxation was done in a controlled manner. The exercises were done in 10 repetitions with a 5-second hold and a 3-second relaxation period, twice a day. The home exercise programme was standardized with diaphragmatic breathing, hip and lower back stretching, and posture and ergonomic training of about 25-30 minutes a day. An exercise diary was used to monitor compliance and reinforced in follow-up sessions that were done weekly (10-12,14).

- *Group B: Therapeutic Ultrasound + Home Exercise Programme*

Participants received therapeutic ultrasound followed by the standardized home exercise programme. Ultrasound was applied over the painful lumbopelvic region with the participant in the prone position using a water-soluble coupling gel. Treatment was delivered in continuous mode at a frequency of 1 MHz, intensity of 1.0 W/cm², for 8 minutes using slow overlapping circular movements of the transducer while maintaining continuous skin contact.(13,15)

- *Group C: Home Exercise Programme*

Participants received the standardized home exercise programme only. Supervised sessions were conducted three times per week to ensure correct exercise performance, monitor adherence, and progress the exercise programme as required (10,12).

➤ *Standardized Home Exercise Programme*

All three groups were subjected to a standardized home exercise programme which was adhered to by participants twice a day over a period of six weeks with each session taking about 25-30 minutes. The programme involved diaphragmatic breathing, lower back and hip stretching, posture and ergonomic training. The slow, deep breathing in the crook-lying position enhanced relaxation of the pelvic floor muscle by means of diaphragmatic breathing. Stretching exercises were performed to stretch the hip and lumbopelvic muscles with painless movements that lasted 30 seconds and were repeated five times. Posture and ergonomic training involved instruction on sitting, standing and lifting with a neutral spine, not sitting and straining during bowel movements, lumbar support when necessary, and regular low impact walking. The participants were given an illustrated exercise booklet and asked to keep an exercise diary, which was evaluated after every week to check compliance and to encourage compliance (12,14).

➤ *Outcome Measures*

Outcome assessments were performed at baseline and after completion of the six-week intervention.

➤ *Primary Outcome*

Pain intensity was assessed using the Visual Analogue Scale (VAS), a 10-cm scale ranging from 0 (no pain) to 10 (worst imaginable pain).(16)

➤ *Secondary Outcomes*

Pelvic floor muscle strength was assessed using the Modified Oxford Scale (MOS), which grades voluntary pelvic floor muscle contraction from 0 (no contraction) to 5 (strong contraction).(17)

III. STATISTICAL ANALYSIS

Data were analyzed using SPSS software. Results are presented as mean $\pm$ standard deviation (SD). The paired t-test was used to compare pre- and post-intervention outcomes within each group.

One-way analysis of variance (ANOVA) was used to compare post-intervention outcomes among the three groups,

followed by independent (unpaired) t-tests for pairwise comparisons. Statistical significance was set at $p < 0.05$.

Table 1. Baseline Characteristics of Participants

Variable	Group A (n=20)	Group B (n=20)	Group C (n=20)
Age (years), Mean $\pm$ SD	52.95 $\pm$ 6.98	52.95 $\pm$ 6.98	53.00 $\pm$ 7.86

Table 1 presents the baseline characteristics of the participants. The mean age was comparable across the three groups before the intervention.

Table 2 Within-Group Comparison of VAS and MOS

Outcome	Group	Pre (Mean $\pm$ SD)	Post (Mean $\pm$ SD)	Mean Difference	Paired t	P-value
VAS	A	7.90 $\pm$ 0.718	2.95 $\pm$ 0.887	4.95	26.160	<0.001
VAS	B	7.85 $\pm$ 0.745	3.75 $\pm$ 0.910	4.10	20.107	<0.001
VAS	C	7.95 $\pm$ 0.759	5.45 $\pm$ 0.887	2.50	11.820	<0.001
MOS	A	2.50 $\pm$ 0.510	4.65 $\pm$ 0.489	2.15	26.246	<0.001
MOS	B	2.50 $\pm$ 0.512	3.55 $\pm$ 0.510	1.05	21.000	<0.001
MOS	C	2.55 $\pm$ 0.510	2.95 $\pm$ 0.223	0.40	3.559	<0.001

Table 2 shows the within-group comparison of VAS and MOS scores before and after the intervention. All three groups demonstrated statistically significant improvements in both outcomes ($p < 0.001$), with the greatest improvement observed in Group A.

Table 3 Between-Group Comparison of Post-Intervention Outcomes

Outcome	Group A	Group B	Group C	Overall A.NOVA (F)	Overall P-value	Pairwise comparison
VAS	2.95 $\pm$ 0.887	3.75 $\pm$ 0.910	5.45 $\pm$ 0.887	40.705	<0.001	A vs B = 0.007; A vs C <0.001; B vs C <0.001
MOS	4.65 $\pm$ 0.489	3.55 $\pm$ 0.510	2.95 $\pm$ 0.223	81.091	0.001	A vs B <0.001; A vs C <0.001; B vs C <0.001

Table 3 presents the between-group comparison of post-intervention VAS and MOS scores. Significant differences were observed among the three groups, with Group A showing the best outcomes, followed by Group B and Group C.

IV. DISCUSSION

The current randomized controlled trial involved the comparison of the effectiveness of therapeutic ultrasound with a home exercise programme (HEP), pelvic floor muscle training (PFMT) with HEP, and HEP in women with persistent pelvic floor pain. The three interventions were found to be very effective in reducing pain intensity and pelvic floor muscle strength after six weeks. PFMT with HEP however yielded the highest improvement, then therapeutic ultrasound with HEP and finally HEP alone yielded the least improvement.

The better results of PFMT are in line with the past evidence that pelvic floor muscle training is the first-line conservative therapy of persistent pelvic floor pain. The enhanced clinical progress could be due to an increased muscle strength of the pelvic floor and the neuromuscular control. (7)

The use of therapeutic ultrasound with HEP also resulted in significant improvements, but not as noticeable as those of PFMT. Therapeutic ultrasound could have helped reduce pain and functional recovery by the analgesic and tissue-healing effects of ultrasound. (15) Previous studies have reported similar benefits of conservative physiotherapy interventions. (9)

The results indicate that PFMT with HEP is the best conservative physiotherapy intervention in women with persistent pelvic floor pain, and therapeutic ultrasound could be applied as an adjunct to rehabilitation. The research had limitations in terms of single-center design, rather small sample size, and limited follow-up. These findings should be corroborated with further multicenter studies that have larger sample sizes with long follow-ups.

V. CONCLUSION

Pelvic floor muscle training plus a home exercise programme was superior to therapeutic ultrasound plus a home exercise programme and home exercise programme alone in alleviating pain and increasing pelvic floor muscle strength in women with persistent pelvic floor pain. The

preferred conservative physiotherapy intervention of this population should be supervised pelvic floor muscle training.

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