

Original Article

Comparative Effects of Active Release Technique and Positional Release Therapy in Female Students with Tightened Calf Muscles

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ABSTRACT

Background: Prior research has established that regular use of high-heeled shoes significantly alters the gait pattern, impacts ankle joint motion, increases joint forces and moments in the lower extremities, modifies foot pressure distribution, and affects posture and balance. These biomechanical changes can lead to tightened calf muscles and associated discomfort in frequent high heel wearers.

Objective: The main objective of this study is to compare the effect of Active Release Technique and Positional Release Therapy in female students with tightened calf muscles.

Methods: A randomized clinical trial including 26 subjects by using convenient sampling technique, with subject age ranging from 20-30 years wearing high heels with minimum duration (5 hours a day, 5 times a week and for more than 1 year) with heel height minimum of 2". The outcome measures were ankle dorsiflexion plantar flexion range of motion measured by goniometer, and pain measured by Numerical Pain Rating Scale. Data was collected for 4 months (Feb-May 2023) from The University of Faisalabad and Government College University Faisalabad. Over four weeks & 3 times per week both groups received ultrasound and traditional Physiotherapy of conventional calf muscle stretching as baseline treatment. Group 1 received Positional Release Therapy, while Group 2 received Active Release Technique.

Results: Friedman test showed within-group improvements in NPRS, Dorsiflexion, Plantar flexion, and Cadence ($p < 0.05$) for both groups. Mann Whitney U test revealed significant improvements in NPRS, Dorsiflexion, Plantar flexion, and Cadence at post-treatment ($p < 0.05$) for Positional Release Therapy group more than Active Release Therapy.

Conclusion: Positional Release Therapy (PRT) has more significant effects for calf muscle tightness, exhibiting increased cadence, ankle dorsiflexion, and plantar flexion range of motion, along with significant pain reduction than Active Release Therapy (ART)

Keywords: Active Release Technique, Positional Release Therapy, Calf Muscles, Stretching, high heels, manual techniques.

INTRODUCTION

The utilization of high-heeled footwear by women has become a prevalent fashion choice, yet its long-term impact on lower limb biomechanics and muscle health is a growing concern in the medical community. This study focuses on the comparative effects of two distinct physiotherapeutic interventions – Active Release Technique (ART) and Positional Release Therapy (PRT) – on female students experiencing tightened calf muscles, a common consequence of prolonged high heel use(1). The research delves into the biomechanical alterations induced by high heels, such as changes in gait pattern, muscle activity, and posture, and examines how these changes contribute to the formation of myofascial trigger points and associated pain syndromes in the calf muscles. This initial exploration sets the stage for a detailed investigation into the efficacy of ART and PRT in addressing these musculoskeletal issues(2).

Recent studies have indicated that the habitual use of high-heeled shoes significantly impacts the biomechanics of female gait. This modification in walking pattern is known to alter the myoelectric activity of specific muscles in the trunk and lower extremities(3). Additionally, it influences the range of motion in the ankle joint, increases the joint forces and moments in the lower extremities,

alters foot pressure distribution, and affects posture and balance control (4). A survey highlights the prevalence of this trend, revealing that approximately 69% of women regularly wear high heels. This widespread usage underscores the need for understanding its long-term effects on muscle health and posture(4).

One of the notable consequences of prolonged high heel usage is the development of trigger points due to sustained improper posture. These trigger points are essentially tight bands within the muscles that can cause pain when compressed or stretched (5). The formation of these trigger points leads to myofascial pain syndrome, a condition primarily characterized by the presence of these painful muscle bands. The continuous pressure exerted on the muscles, resulting from defective posture, leads to the injury of muscle fibers and the emergence of these trigger points(6, 7). Prolonged contractions in the muscles, induced by these trigger points, compress the local blood supply, hampering the area's ability to meet its energy needs. This energy crisis sensitizes local nociceptive nerves, which react with the region's nociceptive chemicals, potentially resulting in localized pain at the neuromuscular junction within the muscle (8).

The Active Release Technique (ART) is a therapeutic method designed to address such issues. In ART, professional therapists assess the soft tissue with their hands and employ targeted patient movement(4, 5). This involves lengthening the muscle over the range of motion while applying site-specific manual pressure. What sets ART apart from other manual treatment methods is the active involvement of the patient in the therapy (9). During ART, deep pressure is applied to areas of tenderness and stiffness. The patient is then instructed to actively move from a position of shortening to lengthening, which helps break the adhesions. This method reduces tissue tension by removing fibrosis or adhesion that forms in overloaded tissue due to frequent use (10). ART plays a significant role in breaking adhesions in the cross-fibers. It involves exerting pressure and providing tension, along with the movement of muscles and tissues, to function in a coordinated manner. Patients may experience pain during the movement phase of the treatment as adhesions and scars are broken down. However, this discomfort is temporary and typically subsides immediately after the session. ART is known for its effectiveness in decreasing inflammation and muscle hypertonicity, altering biomechanical properties to reduce myofascial trigger points, and resolving pathology swiftly (11, 12).

In contrast, Positional Release Therapy (PRT), also referred to as stress pawn tint rehabilitation, is a completely passive form of manual rehabilitation. It does not involve active patient participation(8, 13). Instead, it increases muscle elasticity by holding the muscle in a reduced position, allowing for further muscle relaxation. PRT involves the application of steady manual pressure for 90 seconds while maintaining the muscle in a comfortable position (9). This technique includes passive body alignment, believed to result in immediate and long-term reductions in soreness at trigger points, providing pain relief and alleviating musculoskeletal disorders (10, 14).

Despite the effectiveness of both ART and PRT in treating myofascial pain associated with trigger points, comparative research between the two is scarce. Therefore, this study aims to evaluate the relative effectiveness of the active release approach (involving patient participation) and positional release therapy (administered passively)(15, 16). Determining whether ART or PRT is more beneficial could significantly enhance clinical practices and patient rehabilitation for calf pain caused by trigger points. The primary objective is to ascertain the effects of Active Release Technique and Positional Release Therapy on active trigger points in the calf muscles, focusing on pain alleviation, range of motion enhancement, and cadence improvement in the subjects (17). This research will provide comparative insights into the effects of positional release therapy and active release technique in treating tightened calf muscles, enabling physiotherapists to identify the most effective treatment modality for stiffened calf muscles. It will also serve as a benchmark for clinicians conducting similar future studies(18, 19).

MATERIAL AND METHODS

This randomized clinical trial (RCT), designed to assess the comparative effectiveness of Active Release Technique (ART) and Positional Release Therapy (PRT) in treating tightened calf muscles, adhered to a robust methodological framework suitable for clinical intervention investigations. The trial, registered with the Iranian Registry of Clinical Trials (reference number IRCT20230418057955N1), was conducted over a four-month period, from February to May 2023, following the approval of the institutional review board of The University of Faisalabad's Board of Advanced Studies and Research (vide letter no TUF/Addl Reg/SB/352)(10).

The study's participant pool consisted of 26 females, selected using a convenient sampling method to represent the target demographic accurately. This method ensured the inclusion of individuals who regularly wore high heels and were willing to participate. The age range for participants was set between 20 to 30 years. Inclusion criteria focused on subjects with reduced range

of motion (ROM) in the ankle, a pain level of more than 3 on the Numerical Pain Rating Scale (NPRS), and the presence of tender nodules within palpable taut zones of leg muscles on shallow palpation. Criteria for high heel usage included wearing heels for a minimum of one year, at least five times per week, for five hours per day, with a heel height of 2 inches or above. Exclusion criteria were comprehensive, eliminating any subjects with lower limb musculoskeletal injuries or surgeries, acute cardio-respiratory or neurological diseases, medical or surgical complications, diabetic neuropathy, or peripheral vascular disease (9).

Upon agreeing to participate, all subjects signed an informed consent form. Randomization of participants into two groups, Group A and Group B, was accomplished using a lottery method. This approach ensured an unbiased distribution of subjects across the treatment modalities. The primary objective was to evaluate the effects of ART and PRT on trigger points in the calf region causing pain(20).

For outcome measures, the NPRS was employed to quantify pain levels. Participants chose a number from 0 (no pain) to 10 (most excruciating agony) on this 11-point numeric scale, with the common layout being a horizontal bar or line (21). Additionally, a universal goniometer was used for assessing joint angles, and cadence was measured to evaluate the efficacy of the treatments(21).

Both groups received conventional physiotherapy treatment, including stretching of the gastrocnemius and soleus muscles (9). Ultrasound therapy was utilized as a baseline treatment for all participants (19). For a duration of four weeks, treatments were administered three times weekly.

Group 1, undergoing Positional Release Therapy, received specific treatments for the gastrocnemius and soleus muscles. For the gastrocnemius, subjects were positioned prone with ankle plantar-flexed and knee flexed to 90 degrees. The therapist then applied deep manual pressure to the palpable taut band for 90 seconds, repeating this technique three times (7). For the soleus muscle, participants were again in a prone position, with the knee extended and the ankle in plantar flexion. Similar to the gastrocnemius treatment, deep manual pressure was applied to the taut band site for 90 seconds, repeated thrice (7).

Group 2, subjected to Active Release Therapy, received distinct procedures for each muscle. For the gastrocnemius muscle, participants lay on their backs with knees flexed at 90 degrees and ankles in plantar flexion. While maintaining the taut band, the therapist applied firm pressure as the subject dorsiflexed the ankle and flexed the knee. This procedure was repeated 15 times (7). In treating the soleus muscle, individuals lay on their backs outside the plinth, with one ankle plantar-flexed and one knee extended. The therapist applied pressure to the taut band as the subject performed a forceful dorsiflexion of the ankle. This was done in 10-minute repetitions, three times a week for four weeks (7).

The comprehensive treatment approach began with a detailed case history and physical examination of each participant, followed by a thorough assessment of the calf muscles. The primary aim was to discern the relative effectiveness of ART and PRT in alleviating calf muscle pain, improving range of motion, and enhancing cadence. The results of this study are anticipated to provide valuable insights into the best practices for treating myofascial pain in the calf region induced by high heel usage.

RESULTS

SPSS version 23 was used to interpret the data. The study included 26 participants who were divided into two groups randomly, with 13 individuals in each. Group 1 received Positional Release Therapy, while Group 2 received Active Release Technique. The study assessed various outcome measures such as pain by Numeric Pain Rating Scale (NPRS), and ankle range of motion (including dorsiflexion and plantar flexion) and Cadence. Data normality was assessed using the Shapiro-Wilk test, and since it did not meet the normality criteria, non-parametric tests were used.

Group 1 consisted of 13 participants with ages distributed as follows: yielding a Mean \pm SD of 23.4615 ± 1.12660 . Group 2 included 13 participants with the following age distribution: resulting in a Mean \pm SD of 23.5385 ± 1.56074 . In Group 1, the NPRS scores decreased from 6.23 ± 0.439 at baseline and further to 1.15 ± 0.689 at the 4th week, indicating the effectiveness of Positional Release Therapy in pain reduction. In Group 2, the NPRS scores decreased from 6.38 ± 0.768 at baseline to 3.31 ± 0.751 at the 4th week, highlighting the effectiveness of Active Release Technique.

In Group 1, the dorsiflexion mean increased from 14.62 ± 1.121 at baseline and further to 24.54 ± 0.660 at the 4th week, indicating the effectiveness of Positional Release Therapy in improving dorsiflexion. In Group 2, the dorsiflexion mean increased from 15.00 ± 0.707 at baseline to 21.23 ± 1.166 at the 4th week, highlighting the effectiveness of Active Release Technique.

In Group 1, baseline plantarflexion mean was 14.77 ± 0.832 , increasing further to 24.31 ± 0.751 at the 4th week, illustrating the efficacy of Positional Release Therapy in enhancing plantarflexion. In Group 2, baseline plantarflexion mean was 14.46 ± 0.967 , and then rising to 20.23 ± 1.092 at the 4th week, indicating the effectiveness of Active Release Technique.

In Group 1, the baseline cadence mean was 81.92 ± 4.173 , which increased further to 109.38 ± 6.332 at the 4th week, indicating the effectiveness of Positional Release Therapy in enhancing cadence. In Group 2, baseline cadence mean was 82.23 ± 4.106 , and then rising to 93.92 ± 3.968 at the 4th week, highlighting the impact of Active Release Technique.

Table 1 Descriptive Statistics of NPRS between Group 1 and Group 2 Analysis

	N	Mean	Std. Deviation	Minimum	Maximum
NPRS at baseline	26	6.31	.618	5	7
NPRS at 4th week	26	2.23	1.306	0	4
Groups of participants	26	1.5000	.50990	1.00	2.00

Table 1 presents initially, the Mean \pm SD for both groups was 6.31 ± 0.618 at baseline, and after treatment at 4th week, it decreased to 2.23 ± 1.306

Table 2 Descriptive Statistic of Dorsiflexion & Plantar flexion Range of Motion between Group 1 and Group 2 Analysis

	N	Mean	Std. Deviation	Minimum	Maximum
Dorsiflexion at baseline	26	14.81	.939	12	16
Dorsiflexion at 4th week	26	22.88	1.925	20	25
Plantar flexion at baseline	26	14.62	.898	13	16
Plantar flexion at 4th week	26	22.27	2.273	19	25
Groups of participants	26	1.5000	.50990	1.00	2.00

Table 2 illustrates Ankle Dorsiflexion Range of Motion, the Mean \pm SD for both groups was 14.81 ± 0.939 at baseline and after the treatment at the 4th week, it increased to 22.88 ± 1.925 . Also, it illustrates Ankle Plantar flexion Range of Motion, the Mean \pm SD for both groups was 14.62 ± 0.898 at baseline and after the treatment at the 4th week, it increased to 22.27 ± 2.273

Table 3 Descriptive Statistic of Cadence between Group 1 and Group 2 Analysis

	N	Mean	Std. Deviation	Minimum	Maximum
cadence at baseline	26	82.08	4.059	75	90
cadence at 4th week	26	101.65	9.432	89	120
groups of participants	26	1.5000	.50990	1.00	2.00

After the treatment, Group 1 and Group 2, each consisting of 13 participants (N=13), exhibited a substantial increase in their mean score from 82.08 ± 4.059 at baseline to 101.65 ± 9.432 at the 4th week.

DISCUSSION

This study aimed to compare the effects of Positional Release Therapy (PRT) and Active Release Technique (ART) in alleviating pain and improving functional outcomes in female students with tightened calf muscles. Participants, totaling 26 in number, were drawn from the GC University and The University of Faisalabad. They were divided into two groups of 13 each, with Group 1 receiving

ultrasound, PRT, and conventional stretching exercises, while Group 2 was treated with ultrasound, ART, and conventional stretching exercises.

The results after four weeks, comprising three sessions per week, indicated substantial improvements in both groups in terms of pain reduction, range of motion, and cadence. Notably, Group 1 exhibited a more significant decrease in pain levels compared to Group 2 ($P < 0.001$). This could be attributed to the proprioceptive theory, which suggests that gently shortening the overactive muscle can reduce neuromuscular imbalance, a notion supported by the use of PRT. This therapy is thought to facilitate the restoration of healthy muscle spindle activity, thereby reducing abnormal neuromuscular activity and reinstating normal function.

The study aligns with findings by Soumik Basu et al., which demonstrated that PRT reduced tissue tension, normalized local vascularization, and decreased pain from ischemia (16). It also corroborates research by Jane et al. in 2020, which concluded that both ART and PRT effectively decreased pain and increased range of motion in patients with gastro-soleus trigger points, but with PRT showing superior results in terms of ankle dorsiflexion and pain reduction (9). Additionally, Parth Trivedi et al.'s research supports the effectiveness of ART, particularly in reducing pain scores in lateral epicondylitis, mirroring the outcomes observed in Group 2 of this study (13).

A key strength of this research is its randomized design and the use of a standard Numeric Pain Rating Scale and universal goniometer, which enhances the reliability and comparability of the results. The study also benefits from a clear demarcation of participant groups and a standardized treatment protocol across both groups, allowing for a more direct comparison of ART and PRT.

However, the study is not without limitations. The sample size, while adequate for initial findings, is relatively small, potentially affecting the generalizability of the results. Additionally, the study's focus on a specific demographic (female students with tightened calf muscles due to high heel usage) may limit the applicability of the findings to broader populations with varied etiologies of calf muscle tightness. Future studies could expand the participant profile to include a more diverse range of subjects and conditions.

In conclusion, the research presents compelling evidence for the effectiveness of both PRT and ART in treating tightened calf muscles, with a notable advantage for PRT in pain reduction. These findings provide valuable insights for clinicians in selecting the most appropriate therapeutic approach for such conditions. The study also lays the groundwork for further research in this area, suggesting a need to explore these therapies in more diverse populations and a variety of musculoskeletal conditions.

CONCLUSION

The study conclusively demonstrated that both treatment modalities, Positional Release Therapy (PRT) and Active Release Technique (ART), were effective in enhancing pain relief, dorsiflexion, plantar flexion, and cadence in individuals with tightened calf muscles. However, it was notably observed that the PRT group exhibited a more significant improvement, particularly in terms of pain reduction, enhanced ankle range of motion, and improved cadence. These findings contribute valuable insights to the existing body of knowledge and provide strong evidence in support of employing Positional Release Therapy as a preferred treatment approach for patients with tightened calf muscles. The results from this study not only underscore the effectiveness of PRT but also offer a compelling case for its integration into clinical practice for the targeted management of calf muscle tightness.

ETHICAL CONSIDERATION

This research constituted the project thesis for a Master of Physical Therapy degree and received due approval from the Board of Advanced Studies & Research at The University of Faisalabad.

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