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EFFECT OF MYOFASCIAL RELEASE IN PLANTAR FASCIITIS: A RANDOMIZED CONTROLLED TRIAL

Low Chia Huei[1], Esha Arora[2], Yu Chye Wah[3], Syed Abudaheer K[4*]

[1]Postgraduate Scholar, School of Physiotherapy, Faculty of Allied Health Professions, AIMST University, Kedah, Malaysia

[2]Lecturer, School of Physiotherapy, Faculty of Allied Health Professions, AIMST University, Kedah, Malaysia

[3]Dean, Faculty of Allied Health Professions, AIMST University, Kedah, Malaysia

[4]Assistant Professor, School of Physiotherapy, Faculty of Allied Health Professions, AIMST University, Kedah, Malaysia

[1]lowchiahuei@aimst.edu.my, [2]esha@aimst.edu.my, [3]chyewah@aimst.edu.my and [4]syedabudaheer@aimst.edu.my

ABSTRACT

***Introduction**: In many countries, the common occurrence of plantar heel pain, affecting approximately ten percent of the population, leading to pain, discomfort, and functional impairment. Plantar fasciitis (PF) is identified as the primary cause, often observed in individuals over 50 years of age. Overuse stress is a significant risk factor, with hallmark symptoms including intense plantar heel pain, especially after rest. An additional characteristic of PF is the limited ankle dorsiflexion range of motion and increased thickness of plantar fascia, which evaluated through ultrasonography. While various treatments exist, myofascial release (MFR) is an effective intervention for addressing chronic conditions associated with soft tissue tightness. Despite demonstrated benefits in previous studies, there is lack of evidence regarding the changes in plantar fascia thickness after MFR. Therefore, the present study aims to assess the efficacy of MFR in relieving pain, improving ankle dorsiflexion, reducing plantar fascia thickness, and enhancing foot function in individuals with PF.*

***Methods**: This experimental study employed a single-blinded randomized controlled trial design with 32 participants selected through convenience sampling. The participants were divided into two groups, each comprising 16 individuals. Group 1 received myofascial release in addition to conventional treatments, including therapeutic ultrasound and stretching exercises for the plantar fascia and gastrocnemius-soleus muscles. Group 2 received only conventional treatment. The study assessed treatment effectiveness through measurements of the Numerical Rating Scale (NRS), Weight Bearing Lunge Test (WBLT), plantar fascia thickness through ultrasonography (US) as well as Foot Function Index (FFI). These measurements were taken at baseline and after a four-week intervention period. The collected data were analysed using IBM statistical software (Version 21).*

***Results**: In Group 1, the post intervention NRS scores as well as WBLT scores were improved significantly as compared to Group 2 (p-value <0.05). There were sound therapeutic effects in improving plantar fascia thickness in Group 1 (p-value <0.05) but not in Group 2 (p-value of 0.164). However, there were no significant different found in the comparison between Group 1 and Group 2 (p-value of 0.896). Although there were significant enhancement in foot function in Group 1 and 2 respectively, in comparison between both the groups showed no significant different (p-value of 0.970).*

***Conclusions**: The myofascial release treatment as compared to conventional treatment showed positive significance in alleviating pain and improving dorsiflexion range of motion in plantar fasciitis patients. In post intervention of myofascial release, there were significant effect in reducing plantar fascia thickness as well as foot function. Nevertheless, the effects were not superior to conventional treatment in managing plantar fasciitis.*

Keywords: Plantar fasciitis, Plantar heel pain, Myofascial Release Therapy, Plantar fascia thickness, Ultrasonography, Numerical Rating Scale, Weight Bearing Lunge Test, Foot Function Index

1. INTRODUCTION

Plantar heel pain is a prevalent issue in the community, affecting 3.6% to 9.6% of the population, leading to pain, discomfort, and functional impairment (1,2). Cotchett et al. (2020) emphasized the negative impact of plantar heel pain on health-related quality of life especially among female population who work in healthcare professionals (4). Foot problems, with reported pathologies ranging from 61 to 79%, can significantly affect one's quality of life (5). Despite the commonality of foot issues, individuals often neglect symptoms, potentially leading to chronic conditions. Klein et al. (2012) suggested that prolonged symptoms, such as those persisting for more than six months in PF patients, may not worsen in terms of pain intensity or functional limitations. PF is the primary cause of plantar heel pain, affecting 10% of the general population (7,8). Risk factors include obesity, sedentary lifestyle, inappropriate footwear, prolonged standing, and running (9). PF is a common musculoskeletal injury, affecting both athletic and non-athletic populations, with approximately 2 million individuals experiencing plantar heel pain yearly (10–12).

PF traditionally considered a result of mechanically induced trauma leading to inflammation, is now viewed as more of a degenerative process (13). Recent perspectives, supported by histological examinations, reveal granulation tissue, microscopic tears, disrupted collagen structure, and an absence of typical inflammation in PF cases. Besides that, ultrasonography (US) often detects calcifications, tissue tears, and irregulations in the plantar fascia, pointing to a non-inflammatory state and compromised blood circulation. The prevailing belief suggests that PF begins with minuscule tears caused by repetitive strain during weight-bearing activities, such as standing and walking. Ambulation induces stress on the plantar fascia, particularly during the toe-off phase, leading to microscopic tears within the ligament. Mechanotransduction, which known as a process involving gap junctions between fibrocytes, detects elevated strain, inducing alterations in the extracellular matrix, resulting in myxoid degeneration and deterioration of the plantar fascia and surrounding tissues. The continuous stretching of the plantar fascia eventually leads to chronic degeneration, resulting in pain during periods of rest and sleep. Biopsy examinations of surgical release specimens from patients with prolonged weight-bearing symptoms further support degenerative alterations in the planta fascia, aligning with ultrasound findings (14–16). This evolving understanding of PF as a degenerative rather than an inflammatory process contributes to refined diagnostic approaches and targeted interventions for improved patient management. Conservative treatments, such as medications, rest, exercises, orthosis, and various therapies, show positive outcomes in about 89% of patients (17). However, a combination of treatments is often recommended for better prognosis (18). Tahririan et al. (2012) mentioned that surgical intervention might be considered if conservative measures fail after 6 to 12 months. Understanding the prevalence, risk factors, and treatment options for plantar heel pain is crucial for effective management and improving the quality of life for the affected individuals.

MFR is a manual soft tissue technique involving gentle stretching of restricted fascia. The method includes applying sustained pressure to the restricted tissue barrier, leading to histological length changes after approximately 90 to 120 seconds, resulting in an initial release sensation. Repeated releases make the tissue more elastic and less tense, aiming to return the myofascial tissue to its proper length and health. This process helps relieve stress and pressure on delicate structures like nerves and blood vessels, improving joint alignment and mobility. MFR may also normalize the healing process and slow down the degenerative process in the plantar fascia. Pain relief may occur by restoring the fascia to its optimal functional length through collagen reorganization. Alternatively, it may involve initiating afferent pathways and triggering A-delta fibers, leading to localized pain regulation. The principles and mechanisms of myofascial release provides insights into its potential benefits for addressing issues related to fascial health and pain management.

2. LITERATURE REVIEW

In PF conditions, there will be a thickening of plantar fascia. The increased plantar fascia thickness as well as vascularity in PF patients were linked to foot dysfunction (19). It is believed that, the reduction of the plantar fascia thickness is associated with the symptom improvement (20). A thorough assessment of patient history and physical examination is suitable approach for diagnosis PF (21). A precise evaluation and examinations not only

for diagnose PF but also able to improve the effectiveness of the treatment in case of PF. According to Sullivan et al. (2020), the plantar heel pain has been linked to several factors, including a higher BMI in sedentary individuals, decreased ankle dorsiflexion and specific weakness in foot and ankle region. The mentioned risk factors are similar to the study done by Trojian & Tucker, 2019. However, the association between heel pain and foot alignment and flexibility of the great toe remains unclear. Besides that, management strategies for plantar heel pain should encompass evidenced-based interventions, such as the use of orthotic devices and targeted plantar fascia stretching exercise. Other than that, it is also crucial to address specific deficits in strength and flexibility. Modification of lifestyle and working nature can be effective in managing the condition.

There are various studies found the MFR is more significant to other conservative treatments including stretching exercises (24), strengthening exercises (25), and therapeutic ultrasound (26) in improving plantar heel pain, ankle mobility as well as enhancing foot function. The studies also concluded that with combination strategies among the interventions, such as MFR combined with stretching (27,28) or MFR combined with therapeutic ultrasound therapy (29), shows more beneficial effect in PF patients. Moreover, the existing knowledge indicates that patients with plantar fasciitis (PF) often exhibit increased thickness of the plantar fascia in the affected heel. Studies have suggested that a reduction in plantar fascia thickness following intervention is associated with the degree of symptomatic improvement. However, there is currently a lack of evidence regarding changes in plantar fascia thickness after MFR treatment. Tamartash et al. (2022) conducted a study demonstrating that lumbar MFR was effective in reducing the thickness of the lumbar fascia, thereby alleviating pain in patients with low back pain. The study suggests that MFR can relieve fascia restrictions and rebalance tension within the fascial network. Fascial restrictions, hindrances in the smooth gliding of fascia at macroscopic and microscopic levels, were addressed by MFR in the study. Additionally, the research highlighted that MFR enhances tissue length, alleviates pain, and improves functional activities. By influencing the alignment of collagen fibers, MFR has the potential to enhance the structure of fascial tissue, implying possible improvements in fascial thickness. This study contributes valuable insights into the positive effects of MFR on fascial restrictions and thickness, expanding our understanding of its potential benefits in treating conditions like PF.

The outcome measures selected in the present study are NRS, WBLT, US and FFI. Firstly, there are numerous types of pain scale measurement. According to the studies (31–33), the most reliable and valid is NRS. As compared to FPS-R, NRS is the most sensitive and stable among all the pain scales. The studies also mentioned that VAS is more practical compared to VRS and NRS. Secondly, there are two techniques available in WBLT, with different equipment including measuring tape and digital inclinometer. WBLT is considered reliable for measuring dorsiflexion range of motion (34). Measuring tape for measuring WBLT serve as more cost-effective and easy accessible as compared to digital inclinometer. For the reliability of inter-rater and intra-rater measurements, WBLT measurements also exhibit an outstanding reliability (35). Thirdly, there are many investigation tools to evaluating changes in plantar fascia thickness in PF patients. However, US is one of the reliable tool for this evaluation purposes (36,37). US not only used for diagnosis purposes, it is also can be used for monitoring the progression of the interventions and as a guidance for the modifications of future interventions (38,39). Furthermore, among all the foot function scales, FFI is recommended with good validity and reliability and is used widely in numerous clinical research studies (40–43).

3. METHODS

This study aimed to find out the efficacy of MFR treatment on pain, ankle dorsiflexion range of motion, plantar fascia thickness and foot function in PF patients. The present study is a single blinded, randomized controlled clinical trial, experimental study design. There are four main outcome measures selected in this study including NRS, WBLT, US and FFI. The participants were assessed at two points of time, which was pre-intervention (at the baseline) and post-intervention (after 4 weeks). The study focused on individuals who are clinically diagnosed as plantar fasciitis in Kuala Muda area. In this study, convenience sampling was chosen to select and assign individuals with PF to control and experimental groups. In order to achieve a fair and impartial allocation process, randomization was utilized. For this purpose, randomizer software used to create two distinct sets of 16 unique

numbers within the range of 1 to 32. These numbers were organized in ascending order, determining the sequence in which participants were assigned in the study. Thirty-two samples were selected based on inclusion and exclusion criteria. The inclusion criteria included plantar heel pain for more than three months or longer, both gender, aged between 40 to 60 years, experience pain during the first steps in the morning or after prolonged resting position, pain reduce with ambulation and activities and pain increased after prolonged weight bearing such as walking, standing or climbing stairs. Besides, exclusion criteria encompassed patient who did cortisone injections three months prior to the study, lower extremity injuries, calcaneal fracture, who experience radiating pain in lower limb and underwent physiotherapy treatment for the past 1 week.

Numerical Rating Scale (NRS) for Pain

NRS is one-dimensional assessment tool used to measure pain intensity in adults (44). The most commonly used is the 11-item NRS. In the NRS, where "0" means the lowest level of pain or no pain, and "10" means the highest level of pain. The recall period is depend upon participant by participant, but most frequently, the report of pain should cover the intensity within the past 24 hours or an average pain intensity is noted down.

Weight Bearing Lunge Test (WBLT) for Ankle Dorsiflexion

WBLT is a functional approach to evaluate dorsiflexion indirectly. The test measures the maximum forward movement of the tibia while a person bears weight on the foot, providing a reliable ankle range of motion assessment (45). The participants stand facing a wall with the affected foot aligned parallel to a tape measure on the floor. The second toe, center of the heel, and knee are positioned perpendicular to the wall. To maintain balance during the test, the other leg is placed approximately one-foot length behind the affected foot, creating a comfortable tandem stance, and participants place their hands on the wall. While maintaining this stance, participants are instructed to perform a lunge. The aim is to flex the knee, attempting to touch the anterior knee to wall while keeping the heel securely on the floor. The maximum lunge distance of WBLT is assessed with a tape measure anchored to the floor, with measurements recorded to the nearest 0.1cm (46).

Figure 1: Weight Bearing Lunge Test (WBLT)

Ultrasonography (US) for Plantar Fascia Thickness

The participants in prone lying position, hip and knee in full extension with the feet hanging over the edge of treatment bed and ankle in neutral position (47). The measurement of plantar fascia thickness is performed with a portable ultrasound (V2U Full Digital Ultrasonic Diagnostic System) and a 7.5MHz linear probe. The ultrasound transducer is accurately placed on the plantar surface of the heel, situated approximately 0.5cm medially to the midline longitudinal axis of the foot. This positioning allows for a longitudinal view of the plantar fascia. Subsequently, the thickness of the plantar fascia is assessed at the anterior margin of the calcaneus. All measurements are performed three times at each session. The ultrasonography is examined by a licensed physical therapist with four years of clinical expertise and had undertaken education course and hands on training related to ultrasonography.

Figure 2: Ultrasonography (US) for evaluating plantar fascia thickness

Foot Function Index (FFI) for Foot Function

It is a self-directed questionnaire used for assessing the foot pain and stiffness level, their impact on daily activities related to the foot, and the overall quality of life. The FFI assesses both the current state, covering the past week, and the changes in status. It consists of 23 items and aimed to evaluated three aspect of foot-related problems, there are foot pain, disability, and activity limitations. A score is determined for each item by dividing the associated horizontal line into 10 equal parts and assigning a number between 0 and 9 to each segment. The sub-scale scores vary from 0 to 100, where higher scores signify more impairment that is significant. The total amount of FFI score is obtained by averaging the scores from three sub-scales.

Study Procedure

All of the participants blinded for the group allocation. The participants randomly divided into 2 groups. There were Group 1 (Experimental group) receives MFR and conventional therapy and Group 2 (Control group) receives only conventional therapy. The conventional therapy included therapeutic ultrasound, plantar fascia and gastrocnemius-soleus stretching exercises. The participants assigned to receive treatment in 2 sessions at weekly intervals up to 4 weeks. Before the treatment begin and after the completion of treatment over 4 weeks, there were four main outcome measures to be taken to monitor the progression of each group and perform comparison at the end of the treatment, including NRS, WBLT, US as well as FFI.

Myofascial Release (MFR) Procedure

Firstly, the participants were in prone lying position with feet off the edge of treatment bed for allowing easy ankle dorsiflexion. The MFR applied to calf as well as plantar fascia area. The total duration for all the techniques of MFR was 20 minutes with each technique 5 minutes.

Figure 3: Technique 1, MFR on calf region using elbow

Figure 4: Technique 2, MFR on calf using index and middle fingers moving in superior direction

Figure 5: Technique 3, MFR on calf using index and middle fingers moving in inferior direction

Figure 6: Technique 4, MFR on plantar fascia using knuckle

Conventional Therapy Procedure

The conventional therapy in the study involved therapeutic ultrasound and stretching exercise of gastrocnemius-soleus and plantar fascia. The conventional therapy prescribed in both the Group 1 and Group 2. For the treatment of therapeutic ultrasound on plantar fascia region, the participant in prone lying position with feet over the edge of treatment bed. Ultrasound gel applied between the transducer head and plantar fascia region, to avoid direct contact of transducer head to the skin. The chosen mode was continuous mode for chronic condition, 1.0Hz deeper penetration of the ultrasound wave, and with the intensity of 1.2W/cm2 for 5 minutes (48,49). Besides that, participant also asked to do stretching exercise for both plantar fascia and gastrocnemius-soleus muscle. The stretching exercises were 20 seconds hold, repeated for eight times and 2 cycle per sessions.

Figure 7: Plantar fascia stretching exercise

Figure 8: Gastrocnemius-soleus stretching exercise

4. RESULTS

In Group 1, the post intervention NRS scores as well as WBLT scores were improved significantly as compared to Group 2 (p-value <0.05). There were sound therapeutic effects in improving plantar fascia thickness in Group 1 (p-value <0.05) but not in Group 2 (p-value of 0.164). The plantar fascia thickness were significantly reduced in Group 1 from before (M=4.9) to after the intervention (M=4.7) but not significantly reduced in Group 2 from before (M=4.7) to after the intervention (M=4.7). However, there were no significant different found in the comparison between Group 1 and Group 2 (p-value of 0.896). Moreover, the FFI score were significantly reduced in Group 1 from before (Median=42.8) to after the intervention (Median=41.5) and in Group 2 from before (M=37.5) to after the intervention (M=37.1). Although there were significant enhancement in foot function in Group 1 and 2 respectively, in comparison between both the groups showed no significant different (p-value of 0.970).

Variables	Group	Pre-Intervention Mean (SD)	Post-Intervention Mean (SD)	Mean of score diff. (95% CI)	t-statistic (df)	p-value[a]
NRS score	1	6.4 (1.36)	4.5 (1.37)	1.9 (1.5, 2.3)	10.4 (15)	<0.001
	2	6.4 (1.41)	5.6 (1.20)	0.8 (0.4, 1.2)	4.3 (15)	<0.001
WBLT score (cm)	1	9.5 (1.43)	10.7 (0.91)	-1.2 (-1.6, -0.8)	-6.3 (15)	<0.001
	2	9.6 (1.21)	9.9 (1.21)	-0.3 (-0.4, -0.1)	-4.4 (15)	<0.001
Plantar fascia thickness (cm)	1	4.9 (0.57)	4.7 (0.53)	0.2 (0.1, 0.3)	6.4 (15)	<0.001
	2	4.7 (0.54)	4.7 (0.54)	0.0 (-0.0, 0.0)	1.5 (15)	0.164
FFI score (%)	2	37.5 (13.05)	37.1 (13.07)	0.3 (0.2, 0.5)	5.2 (15)	<0.001

Variable	Group	Pre-Intervention Median (IQR)	Post-Intervention Median (IQR)	Z statistic	p-value[b]
FFI score (%)	1	42.8 (23.5)	41.5 (23.1)	-3.52	<0.001

Note: [a] *Paired t*-Test; [b] Wilcoxon Signed Ranks Test; SD = Standard Deviation; 95% CI = Confidence Interval; df = Degrees of Freedom; IQR = Interquartile range; NRS = Numerical Rating Scale; WBLT = Weight Bearing Lunge Test; FFI = Foot Function Index; Group 1 = Experimental group; Group 2 = Control group

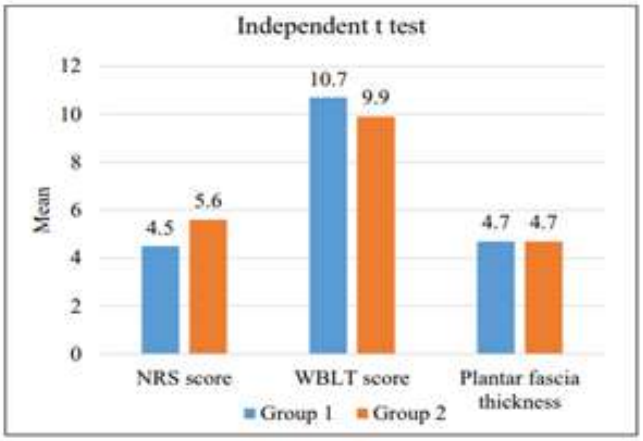
Table 1: Change of variables after intervention among 16 participants in Group 1 and Group 2

Variables	Group	n	Post-Intervention Mean (SD)	Mean of score diff. (95% CI)	t-statistic (df)	p-value[a]
NRS score	1	16	4.5 (1.37)	-1.1 (-2.1,-0.2)	-2.5 (30)	0.019
	2	16	5.6 (1.20)			
WBLT score (cm)	1	16	10.7 (0.91)	0.8 (0.1,1.6)	2.2 (30)	0.034
	2	16	9.9 (1.21)			
Plantar fascia thickness (cm)	1	16	4.7 (0.53)	0.0 (-0.4,0.4)	0.1 (30)	0.896
	2	16	4.7 (0.54)			

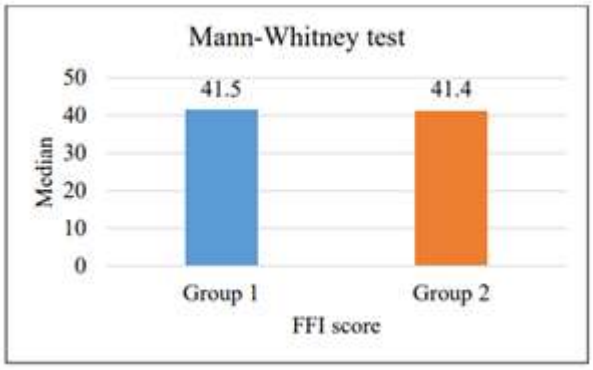
Variables	Group	n	Post-Intervention Median (IQR)	Z statistic	p-value[b]
FFI score (%)	1	16	41.5 (23.1)	-0.04	0.970
	2	16	41.4 (29.1)		

Note: *n* = Sample Size; [a] Independent *t*-Test; [b] Mann-Whitney test; SD = Standard Deviation; 95% CI = Confidential Interval; df = Degree of Freedom; IQR: Interquartile range; NRS = Numerical Rating Scale; WBLT = Weight Bearing Lunge Test; FFI = Foot Function Index; Group 1 = Experimental group; Group 2 = Control group

Table 2: Comparing mean of post-intervention between Group 1 and Group 2 participants



Graph 1: Mean differences of NRS, WBLT scores and plantar fascia thickness in Group 1 and Group 2



Graph 2: Mean differences of FFI scores in Group 1 and Group 2

5. DISCUSSION

The mechanism underlying the reduction in the plantar fascia thickness through MFR is still not fully understood, but current research suggests several theories. One study, focusing on the lumbar fascia in low back pain, demonstrated that MFR could reduce fascial thickness and improve pain by enhancing structural integrity and influencing collagen fiber alignment. The treatment also restored disrupted fascia tissue function, likely through elongating the elastic component, disrupting cross-links, and altering ground substance viscosity. This change promotes hyaluronic acid generation, facilitating smooth fascial movement. MFR not only reduces plantar fascia thickness but also alleviates pain, improves ankle range of motion (especially dorsiflexion), and enhances foot function. It activates vasomotor responses, improving blood circulation and lymphatic drainage, realigns fascial planes, improves proprioception, and restores limited range of motion by hydrating dehydrated ground substance. Pressure applied during MFR enhances the piezoelectric effect, potentially elevating tissue electrical potential to facilitate ground substance rehydration. Ground substance, or proteoglycan, lubricates connective tissue and preserves fiber spacing, allowing connective tissue to move freely. MFR techniques stimulate fibroblast proliferation, promoting collagen synthesis and potentially facilitating the healing of PF by replacing degenerated tissue with stronger, more functional tissue. This multifaceted impact highlights the comprehensive benefits of MFR in addressing and related conditions.

The effectiveness of the intervention measured by NRS, WBLT, US and FFI. NRS was one of the best pain scales with reliability and validity aspects. Additionally, it measures the intensity of pain. The participants able to use this pain scale to measure the level of their pain accurately. In Group 1, pre-intervention NRS scores ranged from 4 to 9, with a mean value of 6.4. Post-intervention NRS scores ranged from 2 to 7, with a mean value of 4.5, indicating a significant reduction in pain (1.9) as observed through statistical analysis ($p<0.001$). The pain reduction was both clinically and statistically evident, attributed to increased soft tissue flexibility, mechanical disruption of soft tissue spasm and adhesions, and theories related to pain control such as the Gate Control Theory, interpersonal attention, parasympathetic response, and the release of neurotransmitters like serotonin. In Group 2, pre-intervention NRS scores ranged from 4 to 9, with a mean value of 6.4. Post-intervention NRS scores ranged from 3 to 8, with a mean value of 5.6, indicating a statistically significant reduction in pain (0.8) as observed through a mean comparison ($p<0.001$). The pain reduction in NRS score was clinically and statistically proven. Comparing pain alleviation between Group 1 and Group 2 using Independent t-Test revealed a significant difference ($p=0.019$), indicating that Group 1 had a better pain reduction on the NRS score compared to Group 2. This aligns with other studies suggesting that MFR is more effective in reducing pain than other conventional interventions (26,29,50).

Besides that, WBLT is a functional method which assessing the ankle dorsiflexion indirectly. It is a reliable assessment of ankle dorsiflexion range of motion by measuring the maximum forward movement of tibia while the tested foot in weight bearing position. In Group 1, the pre-intervention WBLT scores ranged from 8.0cm to 12.0cm, with a mean value of 9.5. Post-intervention WBLT scores ranged from 9.5cm to 12.5cm, with a mean

value of 10.7. The improvement in ankle dorsiflexion in WBLT score was approximately -1.2, with a statistically significant difference ($p<0.001$) observed through Paired t-Test. In Group 2, pre-intervention WBLT scores ranged from 7.5cm to 11.5cm, with a mean value of 9.6. Post-intervention WBLT scores ranged from 7.5cm to 12.0cm, with a mean value of 9.9. The mean difference before and after the intervention was -0.3, indicating significant changes in pre and post-intervention comparison ($p<0.001$). Comparing the improvement of ankle dorsiflexion in WBLT measurements between Group 1 and Group 2 using Independent t-Test revealed a significant difference ($p=0.034$), indicating that Group 1 showed better improvement in ankle dorsiflexion on WBLT compared to Group 2. MFR treatment was effective in enhancing soft tissue extensibility, promoting increased blood flow and lymphatic drainage, disrupting adhesions, and lengthening the fascia. Besides that, the thixotrophic properties of fascia, which causes it to soften when subjected to disturbance. This change in viscosity might be because of myofascial release treatment (51). The myofascial release technique also helps to relieve the pressure in the fibrous band of connective tissue function or fascia. This technique has been used in physiotherapy treatments widely in chronic conditions, which lead to limitation and tightness in soft tissues.

Moreover, in Group 1, pre-intervention plantar fascia thickness measured by US ranged from 4.0mm to 52.9mm, with a mean value of 4.9. Post-intervention, there was a reduction of approximately 0.2mm, with a statistically significant difference observed ($p<0.001$) through Paired t-Test. This result indicates that MFR treatment led to a clinically and statistically proven improvement in plantar fascia thickness. In Group 2, pre-intervention plantar fascia thickness ranged from 4.0mm to 5.7mm, with a mean value of 4.7. Post-intervention, there was no significant change, with a mean value of 0.0, and the analysis showed no significant difference ($p=0.164$) through Paired t-Test. The results indicate that there was no significant difference in plantar fascia thickness between pre and post-intervention in Group 2. Comparing plantar fascia thickness between Group 1 and Group 2 using Independent t-Test revealed no significant difference ($p=0.896$). Therefore, the study suggests limited evidence to evaluate the effect of myofascial release on plantar fascia thickness in plantar fasciitis, and there is an indication that myofascial release has no significant effect on alleviating plantar fascia thickness.

Furthermore, The Foot Function Index (FFI) is a self-administered questionnaire developed in 1991 to assess foot function, including pain, disability, and activity limitations. In Group 1, pre-intervention FFI scores ranged from 15.9% to 52.9%, with a median value of 42.8. Post-intervention scores ranged from 21.0% to 50.2%, with a median of 41.5. The Wilcoxon Signed Rank Test showed a significant difference ($p<0.001$) before and after intervention. In Group 2, pre-intervention FFI scores ranged from 11.6% to 53.2%, with a mean value of 37.5. Post-intervention scores ranged from 20.0% to 53.1%, with a mean of 37.1. The Wilcoxon Signed Rank Test indicated a significant difference ($p<0.001$) before and after intervention in Group 2. Comparison of foot function improvement between Group 1 and Group 2 using FFI scores through the Mann-Whitney test found no significant difference ($p=0.970$). The study concludes that myofascial release has no significant effect on improving foot function among individuals with plantar fasciitis. However, there are various studies proved that myofascial release treatment able to enhance foot function and improve quality of life (25,27,29). According to previous conducted studies, it is believed that in plantar fasciitis condition, the pain worsen during weight bearing activities, especially the first step after rest or prolonged sitting position. These symptoms have the potential to cause significant restrictions in functionality and long lasting disabilities. Once the pain symptoms of plantar fasciitis can be reduced, patients able to engage more in the daily or social activities, the functional ability and quality of life can be improved (52).

6. LIMITATIONS OF THIS STUDY

The study has several limitations that need consideration. Firstly, it employed a single-blinded design, with the therapist being aware of the treatment group, potentially introducing bias. A double-blinded design involving unaware participants and assessors could enhance accuracy. Secondly, the study lacked an extended follow-up period to assess the long-term effects of myofascial release on plantar fasciitis outcomes. Future research should include follow-ups at various intervals to capture lasting effects. Geographically, the study was limited to a specific area in Kuala Muda, affecting the findings' generalizability. Future studies should involve a more diverse

population for broader applicability. Overcoming these limitations, conducting double-blinded randomized controlled trials with diverse demographics and longer follow-ups, is recommended to provide more robust evidence on the efficacy of myofascial release in plantar fasciitis. Recognizing and addressing these constraints will enhance the interpretation of study outcomes and contribute to improving care for individuals with plantar fasciitis. Additionally, controlling confounding variables, such as daily activities, remains challenging in this study.

7. CONCLUSION

This study investigated the effectiveness of MFR treatment in managing PF. The results indicated significant improvements in pain (NRS) and ankle dorsiflexion (WBLT) in the MFR group compared to the conventional treatment group. Both groups showed significant improvements in plantar fascia thickness and FFI, but the MFR group demonstrated superior outcomes in reducing pain and improving ankle dorsiflexion. However, there was no significant difference between the two groups in reducing plantar fascia thickness and enhancing foot function. These findings suggest that MFR treatment is effective in alleviating pain and improving ankle dorsiflexion in plantar fasciitis patients, outperforming conventional therapy. The study underscores the importance of MFR as a valuable management option for PF. Future research with extended follow-up durations is recommended to further validate these results and explore the underlying mechanisms of myofascial release treatment. Overall, these findings provide valuable insights for healthcare professionals aiming to develop comprehensive and effective management strategies for plantar fasciitis patients.

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