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THE IMPACT OF MYOFASCIAL RELEASE VERSUS CONVENTIONAL EXERCISE ON FUNCTIONAL ACTIVITIES AND CALF MUSCLE PAIN WITH DIABETIC NEUROPATHY- A PILOT STUDY

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ABSTRACT
Background: Diabetic peripheral neuropathy (DPN) is a common complication of diabetes mellitus, characterized by pain, muscle stiffness, and reduced functional mobility. Calf muscle dysfunction significantly affects the quality of life of patients. Myofascial release (MFR) and conventional exercise (CE) are widely used physiotherapy interventions; however, their comparative effectiveness remains unknown.
Methods: A comparative experimental study was conducted on 24 patients with DPN. Participants were randomly allocated to two groups: Group A (n = 12) received myofascial release, and Group B (n = 12) received conventional exercise therapy. The interventions were administered 20 minutes per session, three days per week for six weeks. Pain was assessed using the Numerical Rating Scale (NRS), and functional activity was measured using the Lower Extremity Functional Scale (LEFS). Statistical analyses were performed using paired and independent t-tests.
Results: Both groups demonstrated significant improvements in pain and functional activity ($p < 0.05$). However, Group A showed a greater reduction in Numerical Rating Scale (NRS) (2.5 ± 0.5) than Group B (4.0 ± 0.6). Group A showed a greater improved in LEFS and Range of Motion of Ankle than Group B, Group A showed a greater improvement in Biothesiometer than Group B, improved significantly more in Group A than in Group B ($p < 0.05$).
Conclusion: Myofascial release and conventional exercise is more effective than conventional exercise alone in reducing pain and improving functional activity in patients with diabetic peripheral neuropathy.

KEYWORDS: Diabetic peripheral neuropathy, Myofascial Release, Lower Extremity Functional Scale, Numerical Rating Scale

INTRODUCTION
Diabetic neuropathy is a common complication of diabetes mellitus, characterised by sensory, motor, and autonomic nerve dysfunction. It predominantly affects the lower limbs, leading to pain, muscle stiffness, and mobility impairment. Calf muscle dysfunction in individuals with diabetic neuropathy significantly reduces their quality of life.Patients with diabetic neuropathy often seek medical attention primarily because of pain, which is a major subjective symptom. Approximately 50% of individuals with diabetes develop neuropathy, although the actual prevalence may be higher due to underreporting of symptoms until they become severe. Chronic musculoskeletal pain is frequently observed in individuals with diabetes, with higher incidence rates than in non-diabetic populations. Additionally, patients with diabetes are more prone to rheumatic conditions, such as joint stiffness, carpal tunnel syndrome, adhesive capsulitis, and tenosynovitis.
Pain in diabetic neuropathy can be multifactorial, necessitating accurate identification for its effective management. Myofascial pain, characterised by the presence of myofascial trigger points (MTrPs), is a significant cause of shoulder pain. These trigger points produce local and referred pain upon palpation and may coexist with neuropathic pain, complicating the diagnosis and treatment. Studies have indicated that myofascial trigger points are present in a considerable proportion of patients with painful diabetic neuropathy, particularly in the calf muscles. This suggests that myofascial pain may represent a distinct subgroup within diabetic neuropathy and should be routinely assessed. Patients with peripheral neuropathy commonly present with symptoms such as numbness, tingling, burning sensation, weakness, hyperalgesia, and allodynia. Early detection and management are crucial for preventing complications such as foot ulcers, infections, and potential limb loss.
The pathophysiology of diabetic peripheral neuropathy involves metabolic, vascular, and inflammatory mechanisms that are often exacerbated by chronic hyperglycemia. These changes lead to progressive nerve damage, starting distally and advancing proximally to the nerve.
Myofascial release is a manual therapy technique that targets the fascial system, a three-dimensional connective tissue network surrounding the muscles, bones, nerves, and organs. The fascia provides structural support, stability, and

flexibility. Trauma, inflammation, or chronic stress can lead to fascial restrictions, resulting in reduced elasticity, increased tissue stiffness, and pain. These changes impair biomechanics and functional movements. MFR involves the application of sustained pressure to restricted fascial tissues, typically for 90–120 s, allowing gradual tissue elongation and release. This technique helps restore tissue flexibility, improve circulation, reduce pain, and enhance the functional mobility.

Approximately 50% of individuals with diabetes develop diabetic neuropathy, with up to one-third experiencing pain. The mechanisms underlying pain include peripheral and central sensitization and impaired pain modulation.
In addition to neuropathic mechanisms, musculoskeletal contributors such as myofascial dysfunction are often overlooked in the literature. This may lead to suboptimal treatment outcomes when only pharmacological interventions are used for treatment.
Peripheral neuropathy in individuals with diabetes may develop many causes. The most common cause is metabolic dysfunction associated with diabetes mellitus, which results in progressive damage to peripheral nerves. Other factors may include alcoholic disorder, nutritional deficiencies like vitamin B12 deficiency, autoimmune and inflammatory conditions, exposure to neurotoxic agents including chemotherapeutic drugs, and endocrine disorders such as hypothyroidism. These factors may independently or collectively contribute to the development and progression of peripheralneuropathy.

METHODS

This comparative experimental study was conducted to evaluate the effectiveness of myofascial release combined with conventional exercise in patients with diabetic peripheral neuropathy. A total of 24 participants who were clinically diagnosed with diabetic peripheral neuropathy is recruited for the study and equally divided into two groups, with 12 participants in each group. Group A received myofascial release in addition to a conventional exercise program, Group B received conventional exercise alone. The intervention is conducted over a period of six weeks to compare their effects on pain, functional ability, joint mobility, and sensory function.

The present study was conducted at two canters in Chennai, Tamil Nadu, India. The first study site was Phyiotherapy OPD, ACS Medical College and Hospital, Dr. M.G.R. Educational and Research Institute, ,located on Poonamallee High Road, Velappanchavadi, Chennai – 600077. The second study site was PhysioPlus, located at 73/38, Appu Street, Mylapore, Chennai – 600004. Participants were recruited and the study procedures were carried out at these two canters in accordance with the study protocol

The myofascial release technique was applied to the calf muscles for 20 minutes per session, three sessions per week, over a period of six weeks. The conventional exercise program included stretching exercises for the gastrocnemius and soleus muscles, strengthening exercises, and functional training.

Outcome measures were assessed before and after the intervention and included pain using the Numeric Rating Scale (NRS), functional ability using the Lower Extremity Functional Scale (LEFS), ankle range of motion using a digital goniometer, and vibration perception using a biothesiometer.

Participants is eligible for inclusion if they had a clinical diagnosis of diabetic neuropathy and have calf muscle pain with a score of 3 or higher on the NRS and were able to walk independently. Individuals with severe musculoskeletal disorders, recent lower limb surgery, or uncontrolled diabetes were excluded from the study.

Procedure

The patient is positioned in the prone (face-down) position on a treatment couch with the feet extending slightly beyond the edge of the table to allow complete relaxation of the calf muscles. A small pillow or towel roll may be placed under the ankles if additional comfort is required. The knee is usually maintained in full extension when treating the gastrocnemius muscle; however, slight knee flexion of approximately 20–30° may be used to specifically target the soleus muscle. The patient should be instructed to remain relaxed throughout the procedure and avoid actively contracting the calf muscles. This position helps maximum relaxation of the gastrocnemius and soleus muscles, allows deeper penetration into the fascial layers, and provides optimal access to the entire posterior aspect of the calf.

The therapist stands comfortably beside the affected lower limb while facing the patient's calf muscle throughout the treatment. A stable stance with the feet shoulder width apart should be maintained, along with a neutral spinal posture. The therapist slightly bends the knees and applies pressure by transferring body weight forward rather than relying solely on upper limb strength. The shoulders remain relaxed to minimize fatigue and improve treatment efficiency. This posture enables the therapist to deliver controlled, sustained pressure while reducing unnecessary strain on the wrists, elbows, shoulders, and lower back.

For deep myofascial release, the therapist's elbow is flexed to approximately 90°, and the broad proximal forearm or the flat surface near the olecranon is used instead of the sharp tip of the elbow. The wrist should remain in a neutral position throughout the technique. Pressure is generated primarily through body weight transfer rather than muscular effort from the upper limb. Slow, controlled, and sustained pressure is maintained during treatment, allowing effective release of the fascial tissues while minimizing therapist fatigue and ensuring patient comfort through even distribution of force.

Before beginning treatment, the therapist performs a thorough tissue assessment by palpating the gastrocnemius and soleus muscles to identify areas of tightness, tenderness, trigger points, or fascial restriction. Comparison with the opposite limb may be performed when appropriate to identify asymmetries. Initial contact is made by gently placing the forearm over the calf muscle and applying light pressure to allow the tissues to adapt gradually. The therapist then progresses with the myofascial release technique by moving from the Achilles tendon toward the popliteal fossa (distal to proximal), following the direction of the muscle fibers. Pressure gradually increased until the first tissue barrier is encountered, after which slow, sustained pressure is maintained without rapidly sliding over the skin. Each restricted area is held for approximately 60–120 seconds until a tissue release is perceived before progressing to the next restriction. This sustained loading allows gradual deformation of the fascia and restoration of tissue mobility.

Following treatment, the therapist reassesses tissue mobility, calf muscle flexibility, and ankle dorsiflexion range of motion when indicated. The patient is also asked about changes in pain, comfort, and overall mobility to evaluate the immediate effectiveness of the intervention. Each myofascial release point is typically treated for 60–120 seconds, with treatment of the entire calf muscle lasting approximately 20 minutes.

Pressure should always begin lightly and gradually increase to a moderate or firm level according to patient tolerance. Patient discomfort should remain within a tolerable range of approximately 3–5 on a 10-point pain scale (NRS), and sharp or excessive pain should always be avoided. Steady pressure is maintained until tissue resistance decreases and fascial release is achieved. Research indicates that sustained pressure for 60–120 seconds is more effective than brief compression because it promotes gradual fascial relaxation and improved tissue extensibility. Clinical evidence also demonstrates that MFR can improve ankle dorsiflexion range of motion, reduce myofascial restrictions, and decrease pain. Furthermore, combining MFR with conventional exercises has been shown to produce superior long term outcomes compared with conventional exercise alone.

Statistical Analysis:
The collected data were tabulated and analyzed using both descriptive and inferentialstatistics. All the parameters were assessed using statistical package for social science (SPSS) version 24, with a significance level of p value less than 0.05 and a 95%confidence interval set for all analysis. The Shapiro Wilk test was used to determine the normality of the data at $P > 0.05$.

In this study, Data on the Numerical Rating Scale (NRS),Lower Extremity Functional Scale (LEFS), Range of Motion (Dorsiflexion, Plantar flexion, Inversion, and Eversion), and Biothesiometercan yield both parametric and non-parametric statistical methods were considered appropriated depending on the nature and distribution of the variables.
As several variables showed p-values less than 0.005, the data did not follow a normal distribution. Even though some variables showed a normal distribution, the presence of non-normal data, ordinal scale, and sample size violated the assumption of parametric test. Hence, non-parametric test (Wilcoxon Signed-Rank Test and Mann–Whitney U Test) were used for statistical analysis.

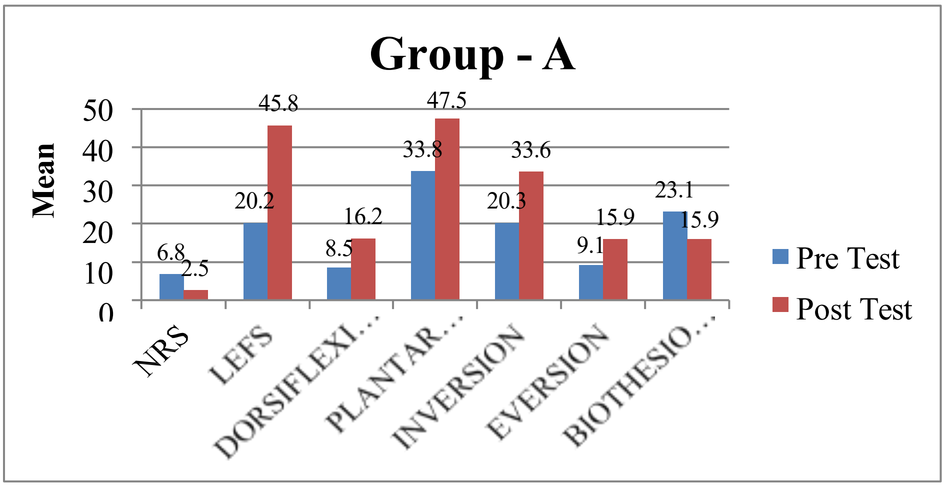
Wilcoxon signed rank test was adopted to find the statistical differencewithin the groups &Mann–Whitney U testwas adopted to find statisticaldifference between the groups.
P value and statistical significance:
The P value with two tails is less than 0.001. This difference is deemed to be very statistically significant by traditional standards.

Table-1: Comparison of pre-test & post-test values for Group A

Group A			Mean	SD	Z test	p value
NRS		Pre	6.8	0.9	-3.140	0.002
		Post	2.5	0.5		
LEFS		Pre	20.2	1.7	-3.077	0.002
		Post	45.8	3.0		
Range of Motion	Dorsiflexion	Pre	8.5°	0.9	-3.084	0.002
		Post	16.2°	1.9		
	Plantar Flexion	Pre	33.8°	3.2	-3.077	0.002
		Post	47.5°	1.2		
	Inversion	Pre	20.3°	1.6	-3.126	0.002
		Post	33.6°	1.2		
	Eversion	Pre	9.1°	1.1	-3.075	0.002
		Post	15.9°	2.2		
BIOTHESIOMETER		Pre	23.1 V	1.4	-3.074	0.002
		Post	15.9 V	1		

(*P value< 0.05 - Statistically Significant)

The above table reveals the Mean, SD, z-value and p-value between pre-test and post-test.This Group A table shows that there is highly significant difference between pre-test and post-test.



Graph - 1: Comparison of pre-test & post-test values for Group A

Table-2: Comparison of pre-test & post-test values for Group B

Group B			**Mean**	**SD**	**Z test**	**p value**
NRS		Pre	6.8	0.7	-3.115	0.002
		Post	4.0	0.6		
LEFS		Pre	20.2	1.5	-3.126	0.002
		Post	28.8	2.0		
Range of Motion	Dorsiflexion	Pre	8.4°	1.0	-3.213	0.001
		Post	12.5°	1.2		
	Plantar Flexion	Pre	33.8°	2.1	-3.090	0.002
		Post	43.3°	1.6		
	Inversion	Pre	20.2°	1.5	-3.134	0.002
		Post	24.8°	2.2		
	Eversion	Pre	9.2°	1.1	-3.140	0.002
		Post	12.7°	1.2		
BIOTHESIOMETER		Pre	22.9V	1.6	-3.108	0.002
		Post	19.8 V	1.5		

(*P value< 0.05 - Statistically Significant)

The above table reveals the Mean, SD, z-value and p-value between pre-test and post-test.This Group A table shows that there is highly significant difference between pre-test and post-test.

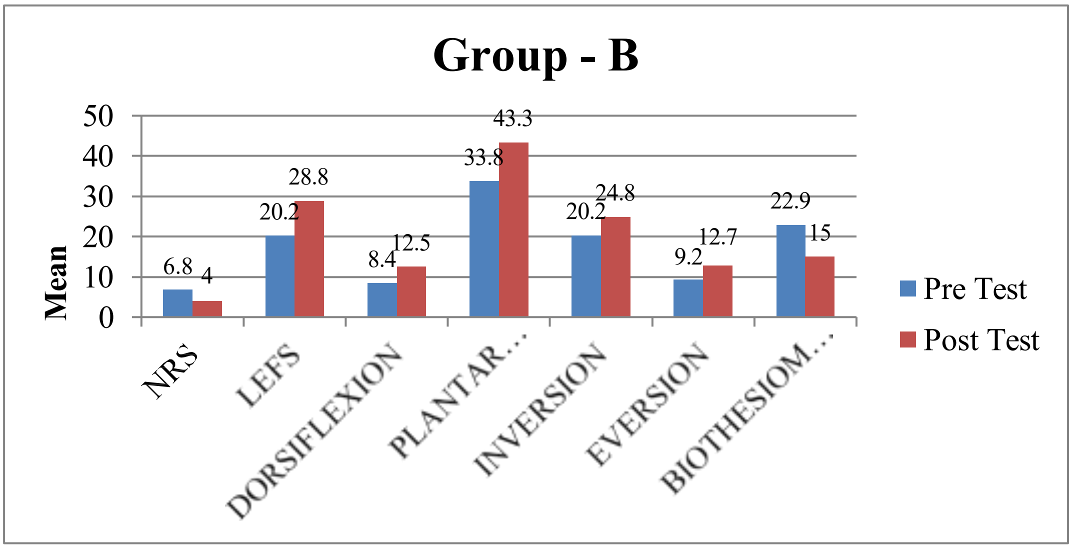
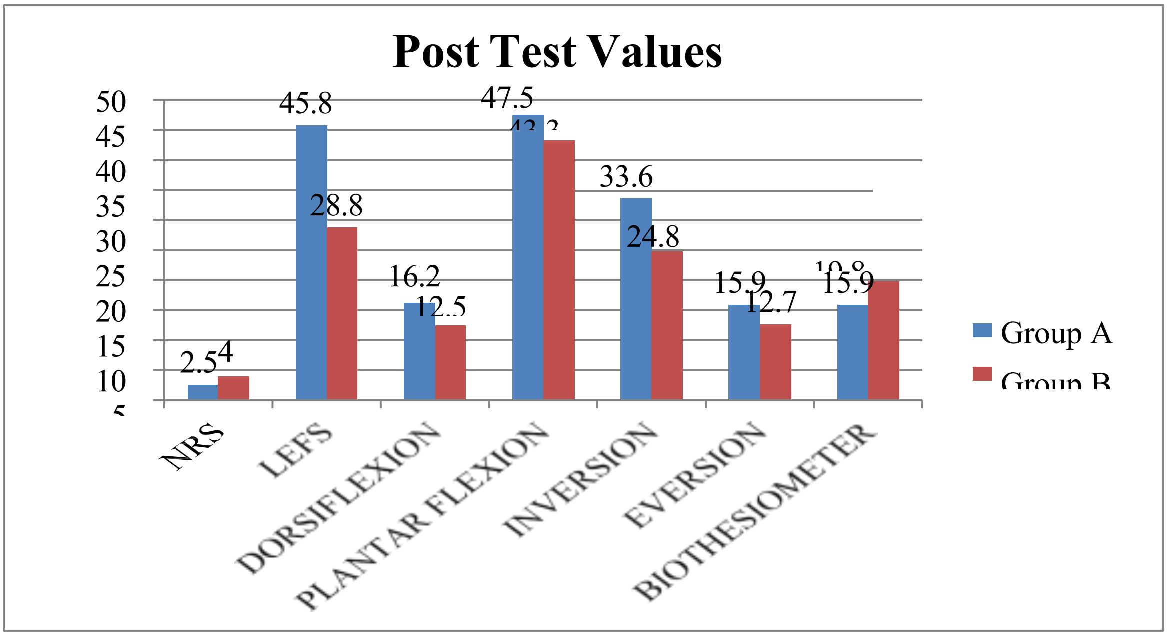


Table -3: Comparison of post-test values of Group A & Group B

Parameter		Post Test Values				Z Score	U value	Significance
		Group A		Group B				
		Mean	SD	Mean	SD			
NRS		2.5	0.5	4.0	0.6	-3.992	6	< 0.001
LEFS		45.8	3.0	28.8	2.0	-4.166	0	< 0.001
Range of Motion	Dorsiflexion	16.2°	1.9	12.5°	1.2	-3.705	9	< 0.001
	Plantar flexion	47.5°	1.2	43.3°	1.6	-4.035	3	< 0.001
	Inversion	33.6°	1.2	24.8°	2.2	-4.188	0	< 0.001
	Eversion	15.9°	2.2	12.7°	1.2	-3.683	10	< 0.001
BIOTHESIOMETER		15.9 V	1	19.8 V	1.5	-4.113	1.5	< 0.001

(*P value< 0.05 - Statistically Significant)

The above table reveals the Mean, SD, Z score, U-value and p-value between pre-test and post-test within Group – A & Group – B. There is a statistically significant difference between the post-test values of Group A and Group B.



Graph- 3: Post Test Values of Group A & Group B

RESULTS

Statistical analysis of the quantitative data revealed significant improvements both within the groups and between Group A and Group B following the intervention period.

In Group-A pre intervention mean to NRS was 6.8(±0.9), LEFS was 20.2(±1.7), Dorsiflexion ROM was 8.5°(±0.9), Plantar flexion ROM was 33.8°(±3.2), Inversion ROM was 20.3°(±1.6), Eversion ROM was 9.1°(±1.1), and Biothesiometer was 23.1V(±1.4). After treating the subject with Myofascial Release, the mean value NRS was 2.5°(±0.5), LEFS was 45.8°(±3), Dorsiflexion ROM was 16.2°(±1.9), Plantar flexion ROM was 47.5°(±1.2), Inversion ROM was 33.6°(±1.2), Eversion ROM was 15.9°(±2.2), and Biothesiometer was 15.9 V(±1), which show statistical significant difference within the groups. This group received Myofascial Release therapy, demonstrated significant improvement in pain reduction, lower extremity functional ability, ankle range of motion, and vibration perception threshold after the intervention. The findings indicated that participants showed considerable improvement following the treatment protocol.

In Group-B pre intervention mean to NRS was 6.8(±0.7), LEFS was 20.2(±1.5), Dorsiflexion ROM was 8.4°(±1), Plantar flexion ROM was 33.8°(±2.1), Inversion ROM was 20.2°(±1.5), Eversion ROM was 9.5°(±1.1), and Biothesiometer was 22.9(±1.6). After treating the subject with Conventional Exercise Therapy, the mean value NRS was 4(±0.6), LEFS was 28.8(±2), Dorsiflexion ROM was 12.5°(±1.2), Plantar flexion ROM was 43.3°(±1.6), Inversion ROM was 24.8°(±2.2), Eversion ROM was 12.7°(±1.2), Biothesiometer was 19.8V(±1.5), which show statistical significant difference within the groups. This group Conventional Exercise Therapy, also demonstrated significant improvement in pain, functional ability, ankle range of motion, and vibration perception threshold following the intervention. However, the degree of improvement was comparatively lesser than that observed in Group A.

The post-intervention comparison between the two groups showed statistically significant differences in all outcome measures. Group A exhibited greater improvement when compared to Group B. Therefore, the alternative hypothesis was accepted, indicating that Myofascial Release therapy was more effective than Conventional Exercise Therapy in reducing pain, improving lower extremity function, enhancing ankle range of motion, and improving vibration perception threshold in subjects with diabetic peripheral neuropathy.

DISCUSSION

This study evaluated the effectiveness of Myofascial Release (MFR) combined with Conventional Exercise compared with Conventional Exercise (CE) alone in patients with diabetic peripheral neuropathy (DPN) presenting with calf pain. The findings shows statistically significant improvements in pain,functional, activityankle range of motion, and vibration perception threshold in both groups following the intervention.However, the improvement was always greater in Group A that received Myofascial Release in addition to conventional exercise. These findings suggest that the Myofascial Release and conventional exercise is more effective in DPN patients and fascial restrictions, improving soft tissue mobility, reducing pain, and enhancing functional activity.

Pain (Numerical Rating Scale)

Pain reduction was one of the most significant findings of the present study. Group A demonstrated a reduction in NRS score from 6.8 ± 0.9 to 2.5 ± 0.5, representing a mean improvement of 4.3 points, whereas Group B improved from 6.8 ± 0.7 to 4.0 ± 0.6, showing a reduction of 2.8 points. Although both interventions produced statistically significant pain relief, the reduction was substantially greater in the Myofascial Release group.

The systematic review by Hernández-Secorún et al. (2021), who concluded that combining manual therapy with exercise provides greater pain relief than exercise alone in patients with diabetic peripheral neuropathy. The authors suggested that manual therapy enhances outcomes by reducing musculoskeletal dysfunction while improving mobility and quality of life.

The superior pain reduction observed in the present study may be explained by the physiological effects of Myofascial Release on fascial tissue. Gao and Gao (2026) reported that sustained fascial loading improves fascial glide, restores connective tissue elasticity, enhances local circulation, reduces inflammatory mediators, and decreases mechanical stress on nociceptors. Similarly, the integrative model proposed in Frontiers in Pain Research (2025) suggested that myofascial trigger points contribute significantly to chronic pain through peripheral sensitisation and altered fascial biomechanics. Release of these restrictions reduces nociceptive input and improves pain modulation.

Therefore, the greater reduction in calf pain observed in Group A supports the hypothesis that fascial dysfunction is an important contributor to pain in diabetic peripheral neuropathy and that Myofascial Release effectively complements conventional exercise by targeting both musculoskeletal and neuropathic components of pain.

Functional Activity (Lower Extremity Functional Scale)

Functional ability improved significantly in both groups; however, participants receiving Myofascial Release demonstrated considerably greater improvement. LEFS scores increased from 20.2 ± 1.7 to 45.8 ± 3.0 in Group A, representing an improvement of 25.6 points, whereas Group B improved from 20.2 ± 1.5 to 28.8 ± 2.0, showing an improvement of only 8.6 points.

The present findings are consistent with the systematic review by Hernando-Garijo et al. (2024), which concluded that structured exercise programmes significantly improve neuropathic symptoms, physical function, and quality of life in patients with diabetic peripheral neuropathy. Likewise, Kluding et al. (2012) demonstrated that exercise interventions improve functional performance while also enhancing nerve function and cutaneous innervation.

The larger functional gains observed in the present study may be attributed to the additional effects of Myofascial Release on soft tissue flexibility and movement efficiency. Reduction in fascial tightness likely enabled improved ankle mobility, more efficient gait patterns, reduced muscular effort during walking, and increased confidence during functional activities. These findings are also supported by Melese et al. (2020), who reported that multicomponent rehabilitation programmes incorporating flexibility, strengthening, balance, and mobility exercises significantly improve lower extremity function and walking performance in patients with diabetic peripheral neuropathy. Thus, although conventional exercise effectively enhances functional performance, the addition of Myofascial Release appears to accelerate functional recovery by reducing pain and restoring normal tissue mobility.

Range of Motion

Significant improvements in ankle dorsiflexion, plantar flexion, inversion, and eversion were observed in both groups, with consistently greater improvements in Group A. Dorsiflexion increased by 7.7° in Group A compared with 4.1° in Group B. Plantar flexion improved by 13.7° versus 9.5°, inversion improved by 13.3° versus 4.6°, and eversion improved by 6.8° versus 3.5°, respectively. These findings support the effectiveness of Myofascial Release in restoring ankle mobility through improved fascial extensibility and reduced soft tissue adhesions. Dengiz et al. (2026) demonstrated that gastrocnemius functional massage significantly improved lower limb flexibility, gait characteristics, and functional mobility through improved muscle compliance and reduced tissue stiffness.

Similarly, Gao and Gao (2026) reported that fascial-targeted interventions restore normal tissue mechanics by reducing fascial densification, improving hydration of connective tissue, and increasing collagen fibre mobility. These physiological changes enhance joint mobility and movement efficiency. The findings also agree with Streckmann et al. (2014), who concluded that exercise interventions improve joint mobility and physical performance in peripheral neuropathy. However, the present results suggest that combining Myofascial release with exercise provides superior improvements in ankle range of motion compared with exercise alone. Improved ankle mobility has important clinical implications because restricted ankle movement contributes to abnormal gait mechanics, increased plantar pressure, impaired balance, and a higher risk of diabetic foot ulceration.

Biothesiometer (Vibration Perception Threshold)

Improvement in vibration perception threshold was significantly greater in the Myofascial Release group. Biothesiometer readings decreased from 23.1 ± 1.4 V to 15.9 ± 1.0 V in Group A, whereas Group B improved from 22.9 ± 1.6 V to 19.8 ± 1.5 V. Lower vibration perception threshold values indicate improved sensory function and peripheral nerve performance.

The present findings are supported by Kluding et al. (2012), who demonstrated that exercise improves neuropathic symptoms, nerve function, and cutaneous innervation in patients with diabetic peripheral neuropathy. Furthermore, Singleton et al. (2014) reported that regular exercise increases cutaneous nerve fibre density, suggesting improved neural regeneration and peripheral sensory function. The American Diabetes Association Position Statement by Boulton et al. also recognises that improved peripheral circulation, glycaemic control, and structured rehabilitation contribute to preservation of peripheral nerve function and delayed progression of diabetic neuropathy.

Although Myofascial Release does not directly regenerate peripheral nerves, improved local circulation, decreased fascial compression around neurovascular structures, and enhanced tissue mobility may create a more favourable environment for neural conduction and sensory recovery. Consequently, the combination of Myofascial release(MFR) and exercise appears to provide greater improvements in sensory function than exercise alone.

Comparative Interpretation;

The comparative analysis clearly demonstrated that both intervention protocols produced statistically significant improvements across all measured variables. However, participants receiving Myofascial Release combined with conventional exercise consistently achieved superior reductions in pain, greater improvements in functional activity, larger gains in ankle range of motion, and better sensory recovery than those receiving conventional exercise alone.

These findings are consistent with current evidence supporting the integration of Myofascial release(manual therapy) with structured exercise in the rehabilitation of diabetic peripheral neuropathy. Systematic reviews by Hernández-Secorún et al. (2021) and Hernando-Garijo et al. (2024) concluded that combining manual therapy with exercise provides greater improvements in pain, mobility, physical function, and quality of life than exercise alone. Furthermore, recent fascial research by Gao and Gao (2026) suggests that Myofascial release(MFR) influences both mechanical and neurophysiological pathways by improving fascial mobility, reducing nociceptive input, and enhancing tissue perfusion, thereby complementing the benefits of conventional exercise.

The present study provides additional clinical evidence supporting the incorporation of Myofascial Release into physiotherapy programmes for patients with diabetic peripheral neuropathy. Myofascial release(MFR)seems to improve rehabilitation outcomes more than conventional exercise alone by treating both neuromuscular deficits and fascial dysfunction.

CONCLUSION

The present study concludes that both Myofascial Release combined with Conventional Exercise and Conventional Exercise alone significantly improved pain intensity, lower extremity functional activity, ankle range of motion, and vibration perception threshold in patients with diabetic peripheral neuropathy. However, the improvements were consistently greater in participants who received Myofascial Release in addition to conventional exercise. The superior outcomes observed in pain reduction, functional recovery, ankle mobility, and sensory function suggest that Myofascial Release provides additional therapeutic benefits by reducing fascial restrictions, improving tissue extensibility, enhancing local circulation, and facilitating more efficient neuromuscular function. These findings are consistent with current evidence supporting the combined use of Myofascial release (manual therapy)and exercise in the rehabilitation of diabetic peripheral neuropathy. Therefore, Myofascial Release can be recommended as a safe, effective, and clinically valuable adjunct to conventional excercise for managing calf pain and functional limitations in individuals with diabetic peripheral neuropathy.

REFERENCES

1. Hernández-Secorún M, Vidal-Peracho C, Márquez-Gonzalvo S, et al. Exercise and Manual Therapy for Diabetic Peripheral Neuropathy: A Systematic Review. Applied Sciences. 2021;11(12):5665.
2. Hernando-Garijo I, Medrano-de-la-Fuente R, Mingo-Gómez MT, et al. Effects of Exercise Therapy on Diabetic Neuropathy: A Systematic Review and Meta-analysis. Physiotherapy Theory and Practice. 2024;40(9):2116-2129.
3. Lepesis V, Marsden J, Rickard A, Latour JM, Paton J. Systematic Review and Meta-analysis of the Effects of Foot and Ankle Physical Therapy, Including Mobilisations and Exercises, in People with Diabetic Peripheral Neuropathy. Diabetes/Metabolism Research and Reviews. 2023;39:e3692.
4. Çakici N, Fakkel TM, van Neck JW, Verhagen AP, Coert JH. Systematic Review of Treatments for Diabetic

Peripheral Neuropathy. Diabetic Medicine. 2016;33(11):1466-1476.
5. Kluding PM, Pasnoor M, Singh R, et al. The Effect of Exercise on Neuropathic Symptoms, Nerve Function, and Cutaneous Innervation in People with Diabetic Peripheral Neuropathy. Journal of Diabetes and Its Complications. 2012.
6. Singleton JR, Marcus RL, Jackson JE, et al. Exercise Increases Cutaneous Nerve Density in Diabetic Patients. Annals of Clinical and Translational Neurology. 2014.
7. Morrison S, Colberg SR, Mariano M, et al. Balance Training Reduces Falls Risk in Older Individuals with Type 2 Diabetes and Peripheral Neuropathy. Diabetes Care.
8. Richardson JK, Sandman D, Vela S. A Focused Exercise Regimen Improves Clinical Measures of Balance in Patients with Peripheral Neuropathy.
9. Allet L, Armand S, de Bie RA, et al. Gait Alterations of Diabetic Patients While Walking on Different Surfaces. Gait & Posture.
10. Mueller MJ, Minor SD, Sahrmann SA, Schaaf JA, Strube MJ. Differences in the Gait Characteristics of Patients with Diabetes and Peripheral Neuropathy Compared with Controls.
11. Dixit S, Maiya AG, Shastry BA. Effect of Aerobic Exercise on Peripheral Nerve Functions in Patients with Type 2 Diabetes Mellitus.
12. Kiani J, Moghimbeigi A, Azizkhani H. The Effect of Exercise Training on Neuropathic Symptoms and Functional Performance in Diabetic Neuropathy.
13. Song CH, Petrofsky JS, Lee SW, Lee KJ, Yim JE. Effects of an Exercise Program on Balance and Trunk Proprioception in Patients with Diabetic Neuropathies.
14. Lee K, Lee S, Song C. Whole Body Vibration Training Improves Balance and Mobility in Patients with Diabetic Neuropathy.
15. Jain S, Sharma N, Sharma S. Effect of Balance Training in Patients with Diabetic Peripheral Neuropathy.
16. Talebi GA, Saadat P, Javadian Y, et al. Manual Therapy Versus TENS in Patients with Diabetic Neuropathy and Carpal Tunnel Syndrome.
17. Singh N, Armstrong DG, Lipsky BA. Preventing Foot Ulcers in Patients with Diabetes.
18. Boulton AJM, Vinik AI, Arezzo JC, et al. Diabetic Neuropathies: A Statement by the American Diabetes Association. Diabetes Care.
19. Tesfaye S, Boulton AJM, Dyck PJ, et al. Diabetic Neuropathies: Update on Definitions, Diagnostic Criteria, Estimation of Severity, and Treatments. Diabetes Care.
20. Callaghan BC, Cheng HT, Stables CL, Smith AL, Feldman EL. Diabetic Neuropathy: Clinical Manifestations and Current Treatments. Lancet Neurology.
21. Feldman EL, Nave KA, Jensen TS, Bennett DLH. New Horizons in Diabetic Neuropathy. Cell Metabolism.
22. Vinik AI, Casellini C. Diabetic Neuropathy and Peripheral Nerve Regeneration.
23. Gao Y, Gao D. Myofascial Release and Fascial-Targeted Mechanical Interventions in Musculoskeletal Rehabilitation: Mechanisms, Modalities, and Integrative Physiology. Frontiers in Physiology. 2026.
24. Exploring Fascia in Myofascial Pain Syndrome: An Integrative Model of Mechanisms. Frontiers in Pain Research. 2025.
25. Dengiz A, Sekeroz S, Baskan E, Kara G. Effects of Gastrocnemius Functional Massage on Lower Extremity Spasticity, Gait Variables and Fall Risk. Frontiers in Physiology. 2026.
26. Van Laake-Geelen CCM, Smeets RJEM, Quadflieg SPAB, Kleijnen J, Verbunt JA. The Effect of Exercise Therapy Combined with Psychological Therapy on Physical Activity and Quality of Life in Patients with Painful Diabetic Neuropathy: A Systematic Review.
27. Paton JS, Bruce GK, Jones RB, Stenhouse E. Effectiveness of Foot and Ankle Mobilisation and Exercise in Diabetic Peripheral Neuropathy.
28. Toth C, Brussee V, Martinez JA, et al. The Effects of Aerobic Exercise on Neuropathic Symptoms and Physical Function in Diabetic Peripheral Neuropathy.
29. Gholami M, et al. Effect of Exercise Training on Glycemic Control in Diabetic Peripheral Neuropathy: A Systematic Review and Meta-analysis.
30. Gu Y, Dennis SM, Zang Y, et al. The Effects of Moderate-Intensity Aerobic Exercise on Neural Function in Patients with Type 2 Diabetes and Diabetic Neuropathy.