

COMPARATIVE EFFECTS OF NEUROMUSCULAR TAPING VS. STRETCHING IN CHRONIC PLANTAR FASCIITIS PATIENTS

Original Article

Urooj Nasir^{1*}, Hamza Shabbir², Ariba Shah³, Shahab Uddin⁴, Muhammad Abbas Khan⁵, Muhammad Dawood⁶, Abdul Aziz⁷

¹Doctor of Physiotherapy, Final Year Student, Prime Institute of Health Sciences, Islamabad, Pakistan.

²Graduate Physical Therapist, Lahore Medical and Dental College, Lahore, Pakistan.

³Research Manager, Ziauddin University, Karachi, Pakistan.

⁴Associate Professor, Department of Rehabilitation & Health Sciences, Nazeer Hussain University, Karachi, Pakistan.

⁵Senior Physiotherapist, Zaigham Medical Complex, Jhang, Pakistan.

⁶MBBS Student (4th Year), Wah Medical College, Wah Cantt, Pakistan.

⁷Teaching Assistant and House Officer (DPT), Rehman College of Rehabilitation Sciences (RCRS), Peshawar, Pakistan.

Corresponding Author: Urooj Nasir, Doctor of Physiotherapy, Final Year Student, Prime Institute of Health Sciences, Islamabad, Pakistan, uroojnasir711@gmail.com

Conflict of Interest: None

Grant Support & Financial Support: None

Acknowledgment: The authors sincerely thank all participants for their cooperation.

ABSTRACT

Background: Chronic plantar fasciitis is a prevalent musculoskeletal disorder characterized by persistent heel pain and functional limitations. Conservative interventions such as stretching exercises and taping techniques are commonly employed in clinical practice, yet comparative evidence regarding their effectiveness remains limited.

Objective: To compare the efficacy of neuromuscular taping and static stretching exercises in reducing pain and improving foot function in patients with chronic plantar fasciitis.

Methods: A single-blinded, randomized controlled trial was conducted over 12 months in Lahore, Pakistan. Sixty-eight participants diagnosed with chronic plantar fasciitis were randomly assigned to either Group A (neuromuscular taping) or Group B (static stretching). Interventions lasted six weeks, with follow-up at 12 weeks. Pain was measured using the Visual Analogue Scale (VAS), and foot function was assessed using the Foot Function Index (FFI), including pain and disability subscales. Statistical analysis involved repeated measures ANOVA and independent t-tests, with significance set at $p < 0.05$.

Results: Both groups demonstrated significant improvement in VAS and FFI scores over time ($p < 0.001$). However, Group A showed a greater reduction in pain (VAS: 6.8 to 2.4) and greater functional improvement (FFI: 62.5 to 27.3) compared to Group B (VAS: 6.9 to 3.6; FFI: 63.2 to 38.6). Between-group differences were statistically significant at both 6 and 12 weeks ($p < 0.05$). No adverse events were reported.

Conclusion: Neuromuscular taping was more effective than static stretching in improving pain and foot function in patients with chronic plantar fasciitis. It may serve as a preferred conservative intervention in early rehabilitation phases.

Keywords: Foot Function Index, Heel Pain, Neuromuscular Taping, Pain Management, Plantar Fasciitis, Rehabilitation, Stretching Exercises.

INTRODUCTION

Plantar fasciitis is one of the most common causes of heel pain, particularly affecting individuals who spend prolonged periods standing, walking, or engaging in high-impact activities. It is characterized by inflammation and degeneration of the plantar fascia, the thick band of tissue that runs across the bottom of the foot and connects the heel bone to the toes (1,2). The condition often presents with a sharp, stabbing pain upon the first steps in the morning or after long periods of inactivity. Over time, this discomfort can become chronic, significantly impairing daily function and quality of life (3). While numerous conservative treatments exist, the search for the most effective, non-invasive interventions continues to be a subject of clinical interest and research (4). Among various management strategies, stretching exercises have long been advocated for alleviating symptoms of plantar fasciitis. These exercises aim to improve the flexibility of the plantar fascia and surrounding musculature, reduce tension, and promote healing (5). Multiple studies have confirmed the benefits of static stretching in improving pain and function in affected individuals. However, while stretching remains a cornerstone of conservative treatment, its effects may vary depending on individual adherence and the chronicity of the condition (6,7). In recent years, neuromuscular taping has emerged as an alternative or complementary method for managing musculoskeletal pain and dysfunction. Unlike rigid taping techniques, neuromuscular taping involves the application of elastic tape in specific patterns that mimic the elasticity of human skin. This approach is designed to facilitate normal movement, enhance circulation, reduce pain, and support the affected muscles and joints without limiting mobility (8). Preliminary findings suggest that neuromuscular taping may provide symptomatic relief in various conditions, including tendinopathies, joint instability, and postural imbalances. Yet, despite growing popularity, evidence regarding its effectiveness in plantar fasciitis remains limited and inconclusive (9).

What distinguishes neuromuscular taping from other modalities is its potential to engage proprioceptive feedback and neuromuscular control, mechanisms believed to contribute to pain modulation and functional recovery. By lifting the skin microscopically, the tape may reduce pressure on pain receptors and lymphatic vessels, potentially decreasing inflammation and promoting tissue healing (10,11). These physiological effects, if substantiated, could offer a valuable non-invasive option for individuals suffering from chronic plantar fasciitis, particularly those who have shown limited improvement with conventional exercises alone. Despite the widespread application of both neuromuscular taping and static stretching in clinical settings, there remains a notable gap in direct comparative research between the two. While both interventions target the biomechanical and functional components of plantar fasciitis, their mechanisms and therapeutic implications differ significantly (12). Understanding which modality—or combination thereof—offers superior benefits in terms of pain reduction and functional improvement is essential for guiding evidence-based clinical decisions. Furthermore, chronic plantar fasciitis poses unique challenges compared to acute presentations, often involving structural degeneration and persistent symptoms that are less responsive to standard care. As such, there is a compelling need to investigate interventions that can effectively address the chronic dimension of the disorder (13,14). By comparing neuromuscular taping and static stretching within a randomized controlled trial framework, this study aims to contribute meaningful data to an area of limited but growing research interest.

The rationale behind this investigation stems from the increasing clinical use of both interventions without a clear consensus on their relative efficacy. Current guidelines do not provide definitive recommendations, and practitioners often rely on anecdotal experience or patient preference when choosing between treatment options. In light of this uncertainty, rigorously designed research comparing the outcomes of these modalities can provide critical insights, ultimately helping to refine treatment strategies and improve patient care. Therefore, the objective of this randomized controlled trial is to compare the efficacy of neuromuscular taping versus static stretching exercises in reducing pain and enhancing foot function among patients with chronic plantar fasciitis. By addressing this clinical question, the study seeks to clarify whether one intervention offers superior therapeutic benefit or if both serve as equally valid options in managing this prevalent and often debilitating condition.

METHODS

This randomized controlled trial was conducted over a period of 12 months at two outpatient physical therapy clinics affiliated with tertiary care hospitals in Lahore, Pakistan. The study was designed to evaluate and compare the effectiveness of neuromuscular taping and static stretching exercises in reducing pain and improving foot function in individuals diagnosed with chronic plantar fasciitis. A total of 68 participants were enrolled based on power analysis calculations, using a two-tailed test with a significance level of 0.05, power of 80%, and an effect size estimated from previous studies evaluating similar interventions. The calculated sample size accounted for a 10% potential dropout rate, resulting in 34 participants in each group (1,3). Participants were selected through purposive sampling, targeting patients between the ages of 25 and 60 years who presented with clinical symptoms consistent with chronic plantar fasciitis—

defined as heel pain persisting for more than six months, exacerbated by initial steps in the morning or after prolonged rest, and confirmed by physical examination findings such as localized tenderness at the medial calcaneal tuberosity. All participants were required to have a minimum baseline score of 30 mm on the Visual Analogue Scale (VAS) for pain and a score of less than 80 on the Foot Function Index (FFI), indicating significant functional limitations.

Exclusion criteria included individuals with a history of foot surgery, systemic inflammatory diseases (e.g., rheumatoid arthritis), recent corticosteroid injections within the last three months, neurological deficits, lower limb fractures, or prior treatment with neuromuscular taping or intensive stretching programs. Pregnant individuals and those with known allergies to tape adhesives were also excluded to ensure safety and avoid confounding factors (14,15). Participants were randomly assigned into two groups using a computer-generated block randomization method to ensure equal group sizes. Group A received neuromuscular taping in conjunction with a standard home exercise program consisting of foot and ankle mobility drills. The taping protocol followed established kinesiology taping guidelines for plantar fasciitis, involving Y-strip and fan-shaped applications to the plantar fascia and gastrocnemius-soleus complex. Tape was applied by a licensed physical therapist twice weekly for a total of six weeks. Group B performed a supervised static stretching program that focused on the plantar fascia, Achilles tendon, and gastrocnemius muscles. Sessions were conducted three times a week under therapist supervision, with each session including three repetitions of each stretch, held for 30 seconds and performed twice daily. Stretching compliance was monitored through patient logs and periodic phone follow-ups. Pain intensity was assessed using the Visual Analogue Scale (VAS), a reliable and validated tool widely used in musculoskeletal research. Foot function was measured using the Foot Function Index (FFI), which evaluates pain, disability, and activity limitation, and has demonstrated high internal consistency and test-retest reliability in similar populations (16,17). Baseline measurements were recorded at the start of the intervention, followed by assessments at the end of the 6th week and at a 12-week follow-up to assess both immediate and sustained effects.

All data were entered and analyzed using SPSS version 25. Descriptive statistics were used to summarize demographic and baseline characteristics. Between-group comparisons were conducted using independent samples t-tests for normally distributed continuous variables, while paired t-tests were applied to assess within-group changes over time. Repeated measures ANOVA was employed to evaluate time-by-group interaction effects across the three assessment points. A p-value of <0.05 was considered statistically significant for all comparisons. The study received ethical approval from the Institutional Review Board (IRB) of the relevant institute, and written informed consent was obtained from all participants prior to enrollment. Participants were informed about the voluntary nature of participation, their right to withdraw at any stage, and the measures taken to ensure confidentiality and anonymity. No adverse effects or complications were reported during the intervention period, and participants were monitored regularly for compliance and safety. This methodology was structured to ensure that both interventions were delivered consistently and outcomes measured objectively, allowing for a valid and reliable comparison of neuromuscular taping and static stretching in the treatment of chronic plantar fasciitis.

RESULTS

The final sample consisted of 68 participants who completed the study, with 34 individuals in each group. Both groups were demographically comparable, with no statistically significant differences in age, gender distribution, BMI, or duration of symptoms at baseline. The average age of participants in Group A (neuromuscular taping) was 43.2 years, while in Group B (static stretching), it was 44.1 years. The mean BMI was also similar between groups, indicating balanced baseline characteristics. VAS scores revealed a progressive reduction in pain intensity over the study period for both groups, with more pronounced improvement observed in the neuromuscular taping group. Group A reported a reduction in mean VAS from 6.8 at baseline to 2.4 at 12 weeks, whereas Group B reduced from 6.9 to 3.6 over the same period. At both post-intervention and follow-up time points, the differences between groups were statistically significant ($p < 0.05$). Similar trends were noted in the FFI total scores. Group A demonstrated a decrease from 62.5 at baseline to 27.3 at 12 weeks, reflecting marked improvement in foot function. Group B showed improvement as well, with scores reducing from 63.2 to 38.6, but the rate of improvement remained significantly lower compared to Group A at both assessment intervals ($p < 0.05$).

Analysis of the FFI pain subscale showed that pain-related functional limitations declined notably in both groups, but more substantially in the taping group. At 6 weeks, Group A had reduced their pain subscale score by 51.9%, whereas Group B demonstrated a 35.6% reduction. By week 12, pain scores were 7.2 and 11.1, respectively, indicating a statistically significant inter-group difference ($p < 0.01$). The FFI disability subscale further supported these outcomes. Group A showed consistent improvement from a baseline score of 29.1 to 11.8 at the end of 12 weeks. In contrast, Group B declined to 17.3 over the same duration. Between-group differences in disability scores

at both follow-up points were statistically significant ($p < 0.05$), reinforcing the superior functional outcome associated with neuromuscular taping. No adverse events were reported during the study, and compliance rates were high in both groups, with 91.2% in Group A and 88.2% in Group B completing all intervention sessions and follow-up assessments. Overall, the results demonstrated a clear benefit of neuromuscular taping over static stretching exercises in both pain reduction and functional improvement among patients with chronic plantar fasciitis. The between-group comparisons consistently favored taping in all key outcomes over the 12-week duration.

Table 1: Demographics

Variable	Group A (Taping)	Group B (Stretching)
Mean Age (years)	43.2	44.1
Male (%)	41.2%	38.2%
Female (%)	58.8%	61.8%
BMI (kg/m ²)	27.8	28.1
Duration of Symptoms (months)	9.6	9.8

Table 2: VAS Scores

Time Point	Group A Mean VAS	Group B Mean VAS
Baseline	6.8	6.9
6 Weeks	3.1	4.2
12 Weeks	2.4	3.6

Table 3: FFI Total Scores

Time Point	Group A Mean FFI	Group B Mean FFI
Baseline	62.5	63.2
6 Weeks	34.8	45.1
12 Weeks	27.3	38.6

Table 4: FFI Pain Subscale

Time Point	Group A Mean Pain	Group B Mean Pain
Baseline	21.4	21.6
6 Weeks	10.3	13.9
12 Weeks	7.2	11.1

Table 5: FFI Disability Subscale

Time Point	Group A Mean Disability	Group B Mean Disability
Baseline	29.1	29.6
6 Weeks	15.4	20.1
12 Weeks	11.8	17.3

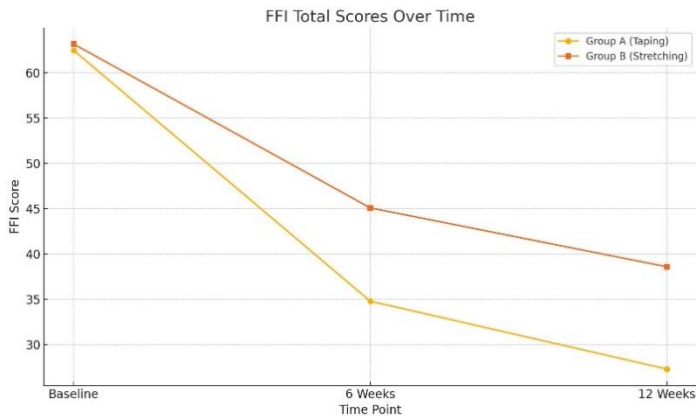


Figure 1 FFI Total Scores Over Time

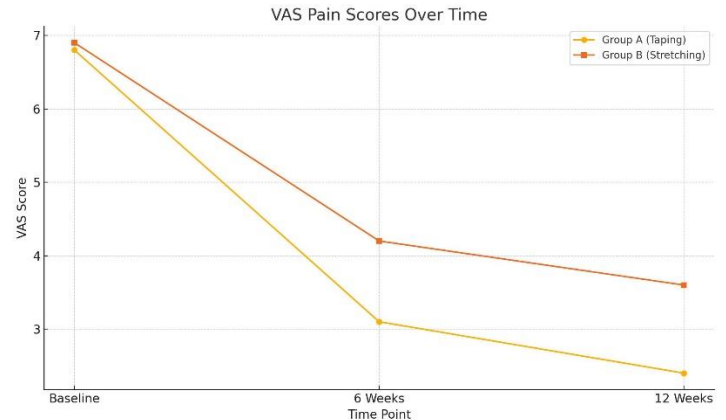


Figure 2 VAS Pain Scores Over Time

DISCUSSION

The present study aimed to compare the effects of neuromuscular taping and static stretching on pain reduction and foot function in patients with chronic plantar fasciitis. The findings demonstrated that both interventions produced statistically significant improvements over time, with neuromuscular taping leading to greater reductions in pain and disability, as reflected in VAS and FFI scores. These results align with the growing body of evidence supporting the use of taping techniques as an effective non-invasive intervention for plantar fasciitis. A randomized trial found that kinesiotaping provided significant short-term pain relief and, when combined with stretching, improved functional outcomes in individuals with plantar heel pain (18,19). Similarly, a comparative trial indicated that taping in combination with other modalities led to superior pain reduction and foot function compared to taping alone, suggesting that taping may augment the effects of therapeutic strategies (20). However, stretching exercises continue to be an integral part of conservative management, especially in chronic cases. A recent study demonstrated long-term effectiveness of a plantar fascia-specific stretching protocol, with sustained pain reduction and functional improvement observed at two-year follow-up (21). The current study echoes these findings, although the stretching group showed slower and less pronounced improvements than the taping group.

The slightly inferior outcomes seen in the stretching group may be attributed to adherence issues, a limitation also reported in prior literature. A study observed that, while Achilles tendon stretching improved pain and function, patients' compliance greatly influenced the results (22). Neuromuscular taping, on the other hand, does not rely on patient compliance to the same extent and can provide continuous support between clinical sessions, potentially explaining its relative effectiveness in this study. This trial also provides comparative insight into isolated versus combined therapies. Another recent investigation suggested that, combining Kinesio taping with laser therapy and plantar fascia stretching improved both pain thresholds and functional ability more than singular approaches (23). Although the current study did not include a combined intervention arm, the superior outcomes seen with taping alone suggest its independent value. Strengths of the study included its randomized controlled design, use of validated outcome measures, and adequate follow-up period. Additionally, the uniformity of treatment protocols and high compliance rates bolstered the internal validity of the findings. However, the study was not without limitations. The sample size, while calculated appropriately, still represented a relatively small population. Additionally, blinding was not feasible for participants or therapists, potentially introducing bias. Another limitation is the absence of a placebo or control group, which may have provided additional insight into natural recovery or placebo effects.

The study also focused exclusively on short to medium-term outcomes over a 12-week period. While this duration is clinically relevant, future studies should incorporate longer follow-ups to assess whether benefits from taping are maintained over time or if stretching gains become more prominent in the long run. Comparative analysis of different taping methods—such as Low-Dye versus Kinesio taping—may also enrich understanding of the optimal taping technique (24,25). Despite these limitations, the findings of this study contribute meaningfully to clinical practice by reinforcing neuromuscular taping as a superior conservative intervention in chronic plantar fasciitis. It suggests that clinicians might prioritize taping protocols in early rehabilitation phases to achieve quicker symptom relief, particularly in patients with compliance concerns. In conclusion, neuromuscular taping proved more effective than static stretching exercises in

reducing pain and enhancing foot function in chronic plantar fasciitis patients. While both interventions are beneficial, taping offers a practical and superior alternative, especially in the early phase of treatment.

CONCLUSION

This study concluded that neuromuscular taping is more effective than static stretching in reducing pain and improving foot function in patients with chronic plantar fasciitis. The findings support the clinical use of taping as a practical, non-invasive intervention, particularly for early symptom relief. Incorporating neuromuscular taping into routine physiotherapy may enhance rehabilitation outcomes and patient satisfaction.

AUTHOR CONTRIBUTION

Author	Contribution
Urooj Nasir*	Substantial Contribution to study design, analysis, acquisition of Data Manuscript Writing Has given Final Approval of the version to be published
Hamza Shabbir	Substantial Contribution to study design, acquisition and interpretation of Data Critical Review and Manuscript Writing Has given Final Approval of the version to be published
Ariba Shah	Substantial Contribution to acquisition and interpretation of Data Has given Final Approval of the version to be published
Shahab Uddin	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Muhammad Abbas Khan	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Muhammad Dawood	Substantial Contribution to study design and Data Analysis Has given Final Approval of the version to be published
Abdul Aziz	Contributed to study concept and Data collection Has given Final Approval of the version to be published

REFERENCES

1. Siriphorn A, Eksakulkla S. Calf stretching and plantar fascia-specific stretching for plantar fasciitis: A systematic review and meta-analysis. *J Bodyw Mov Ther.* 2020;24(4):222-32.
2. Dede BT, Ada A, Oğuz M, Bulut B, Bağcıer F, Aytekin E. Comparing Myofascial Pain Syndrome Treatment with Dry Needling Versus Extracorporeal Shock Wave Therapy for Plantar Fasciitis on Pain and Function of the Heel. *J Foot Ankle Surg.* 2024;63(4):477-81.
3. Zutshi K. Comparison of Calcaneal Taping and Low-Dye Taping for the Short-Term Management of Plantar Fasciitis. *International Journal of Preventive, Curative & Community Medicine.* 2021.
4. Zare Bidoki M, Vafaei Nasab MR, Khatibi Aghda A. Comparison of High-intensity Laser Therapy with Extracorporeal Shock Wave Therapy in the Treatment of Patients with Plantar Fasciitis: A Double-blind Randomized Clinical Trial. *Iran J Med Sci.* 2024;49(3):147-55.
5. Kashif M, Albalwi A, Alharbi A, Iram H, Manzoor N. Comparison of subtalar mobilisation with conventional physiotherapy treatment for the management of plantar fasciitis. *J Pak Med Assoc.* 2021;71(12):2705-9.
6. Boob MA, Phansopkar P, Somaiya KJ. Comprehensive Physiotherapy Rehabilitation Protocol of Plantar Fasciitis for a 45-Year-Old Female: A Case Report. *Cureus.* 2024;16(1):e51585.
7. Yadav S, Pattnaik S, Sharma S, Jangra M. Effect of High-intensity LASER Therapy, Kinesio-taping and Plantar-fascia Stretching on Patients with Plantar Fasciitis: A Study Protocol. *JOURNAL OF CLINICAL AND DIAGNOSTIC RESEARCH.* 2024.

8. Joshi Y, Krishnareddy P, Shahane S. The Effect of Myofascial Release Technique and Stretching Versus Myofascial Release Technique and Taping in Patients with Chronic Plantar Fasciitis. *International Journal of Health Sciences and Research*. 2021.
9. Fouda KZ, Ali ZA, Elshorbagy RT, Eladl HM. Effect of radial shock wave and ultrasound therapy combined with traditional physical therapy exercises on foot function and dorsiflexion range in plantar fasciitis: a prospective randomized clinical trial. *Eur Rev Med Pharmacol Sci*. 2023;27(9):3823-32.
10. Schuitema D, Greve C, Postema K, Dekker R, Hijmans JM. Effectiveness of Mechanical Treatment for Plantar Fasciitis: A Systematic Review. *J Sport Rehabil*. 2020;29(5):657-74.
11. Charles R, Fang L, Zhu R, Wang J. The effectiveness of shockwave therapy on patellar tendinopathy, Achilles tendinopathy, and plantar fasciitis: a systematic review and meta-analysis. *Front Immunol*. 2023;14:1193835.
12. Guimarães JS, Arcaño FL, Leporace G, Metsavaht LF, Conceição CS, Moreno M, et al. Effects of therapeutic interventions on pain due to plantar fasciitis: A systematic review and meta-analysis. *Clin Rehabil*. 2023;37(6):727-46.
13. Naterstad IF, Joensen J, Bjordal JM, Couppé C, Lopes-Martins RAB, Stausholm MB. Efficacy of low-level laser therapy in patients with lower extremity tendinopathy or plantar fasciitis: systematic review and meta-analysis of randomised controlled trials. *BMJ Open*. 2022;12(9):e059479.
14. Melese H, Alamer A, Getie K, Nigussie F, Ayhuallem S. Extracorporeal shock wave therapy on pain and foot functions in subjects with chronic plantar fasciitis: systematic review of randomized controlled trials. *Disabil Rehabil*. 2022;44(18):5007-14.
15. Koc TA, Jr., Bise CG, Neville C, Carreira D, Martin RL, McDonough CM. Heel Pain - Plantar Fasciitis: Revision 2023. *J Orthop Sports Phys Ther*. 2023;53(12):Cpg1-cpg39.
16. Pinrattana S, Kanlayanaphotporn R, Pensri P. Immediate and short-term effects of kinesiotaping and lower extremity stretching on pain and disability in individuals with plantar fasciitis: a pilot randomized, controlled trial. *Physiotherapy Theory and Practice*. 2021;38:2483-94.
17. Llurda-Almuzara L, Labata-Lezaun N, Meca-Rivera T, Navarro-Santana MJ, Cleland JA, Fernández-de-Las-Peñas C, et al. Is Dry Needling Effective for the Management of Plantar Heel Pain or Plantar Fasciitis? An Updated Systematic Review and Meta-Analysis. *Pain Med*. 2021;22(7):1630-41.
18. Tognolo L, Giordani F, Biz C, Bernini A, Ruggieri P, Stecco C, et al. Myofascial points treatment with focused extracorporeal shock wave therapy (f-ESWT) for plantar fasciitis: an open label randomized clinical trial. *Eur J Phys Rehabil Med*. 2022;58(1):85-93.
19. Boob MA, Jr., Phansopkar P, Somaiya KJ. Physiotherapeutic Interventions for Individuals Suffering From Plantar Fasciitis: A Systematic Review. *Cureus*. 2023;15(7):e42740.
20. Noriega DC, Cristo Á, León A, García-Medrano B, Caballero-García A, Córdova-Martínez A. Plantar Fasciitis in Soccer Players-A Systemic Review. *Int J Environ Res Public Health*. 2022;19(21).
21. Tseng WC, Chen YC, Lee TM, Chen WS. Plantar Fasciitis: An Updated Review. *J Med Ultrasound*. 2023;31(4):268-74.
22. Motley T. Plantar Fasciitis/Fasciosis. *Clin Podiatr Med Surg*. 2021;38(2):193-200.
23. Herber A, Covarrubias O, Daher M, Tung WS, Gianakos AL. Platelet rich plasma therapy versus other modalities for treatment of plantar fasciitis: A systematic review and meta-analysis. *Foot Ankle Surg*. 2024;30(4):285-93.
24. Boob MA, Phansopkar P, Somaiya KJ. The Therapeutic Efficacy of Ankle Mobilization and Advance Physiotherapy in Alleviating Heel Spur and Plantar Fasciitis: A Case Report. *Cureus*. 2024;16(4):e57524.
25. Choudhary N, Nair A, Kumar N, Kumar S. To Compare The Effectiveness of Calcaneal taping Versus Conventional Therapy in the treatment of plantar fasciitis. 2021.