Research Article

Investigating the Effect of Dry Needling on Myofascial Trigger Point in Soleus Muscle of Soccer Players with Medial Tibial Stress Syndrome

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ABSTRACT

Introduction: This study investigates the impact of dry needling on myofascial trigger points in the soleus muscles among soccer players with medial tibial stress syndrome (MTSS).

Materials and Methods: Soccer players diagnosed with MTSS were enlisted and randomly divided into two groups (11 participants in the experimental group [Group 1] and 11 participants in the control group [Group 2]). Pre-intervention measurements included repeated shuttle sprint ability, MTSS score, and pain pressure threshold (PPT) for both groups. In the experimental group, dry needling was performed on the soleus muscle, followed by active stretching and cryotherapy. The control group underwent active stretching of the soleus muscle and cryotherapy exclusively. Post-intervention measurements of repeated shuttle sprint ability, MTSS score, and PPT were taken for both groups after 2 days.

Results: The experimental group exhibited a statistically significant improvement in PPT, MTSS score, and repeated shuttle sprint ability. Conversely, within the control group, statistically significant changes were observed only in PPT values through paired t-test assessment. Between-group analysis using an independent t-test revealed significant enhancement in PPT (P=0.000) and MTSS score (P=0.01) within the experimental group compared to the control group.

Conclusion: Addressing myofascial trigger points in the soleus muscle through dry needling offers a more effective approach to treating MTSS than relying solely on muscle stretching.

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Introduction

Medial tibial stress syndrome (MTSS) constitutes an overuse injury characterized by pain typically located at the junction of the distal one-third of the tibia. This pain tends to intensify upon activity initiation, diminish during exercise, and alleviate with rest [1]. The discomfort in the shin area, often called "shin splints", arises due to overuse or repetitive strain, hindering the muscles from properly healing [2]. Commonly prevalent in high-impact sports, such as running, soccer, and basketball, MTSS exhibits a notable incidence rate [3]. MTSS accounts for approximately 20% of all soccer-related disabilities [4]. Various contributing factors, such as female gender, pronated foot structure, hip external rotation, elevated body mass index, and navicular drop have been associated with MTSS [5, 6]. Research indicates that traction on the tibial periosteum, caused by the attachment of the soleus muscle fibers is among the primary factors responsible for MTSS [7]. Individuals with MTSS demonstrate heightened peak soleus muscle activity [8]. Preventive measures for MTSS often involve activities, such as strengthening the soleus, managing hyperpronation, using insoles, and engaging in low-intensity exercises [9, 10].

Muscle overuse, as seen in MTSS or other muscle injuries, serves as a prominent trigger for the development of myofascial trigger points (MTrPs). Disruption of regular muscle activity under significant tension leads to the emergence of MTrPs [1, 11]. MTrPs represent palpable hyperirritable nodules within taut bands of skeletal muscles, producing remote motor and autonomic effects [12]. Sustained muscle strain triggers sarcomeric contractions, forming taut bands of hardened muscle known as contraction knots. These knots evolve into tender spots, resulting in discomfort and pain, which eventually culminate in MTrP formation. Depending on the level of irritability, MTrPs can be categorized as active or latent [13].

Dry needling, a technique employed by skilled physical therapists, involves the use of fine filiform needles to penetrate the skin and stimulate underlying myofascial trigger points, as well as muscular and connective tissues. This approach is employed to manage neuromusculoskeletal pain and movement impairments [13, 14]. Deep dry needling induces a local twitch response through central nervous system modulation, while superficial dry needling stimulates A-delta fibers by stretching tissue fibroblasts and promoting the relaxation of structures. Dry needling has exhibited effectiveness in addressing various musculoskeletal conditions, with MTrPs being a primary focus. It is cost-effective, easily learnable, and carries minimal risk [15].

To the best of our knowledge, no prior study has explored the impact of dry needling on myofascial trigger points within the soleus muscle as a treatment for MTSS among college-level soccer players in India. Accordingly, this study assesses the efficacy of dry needling on the soleus muscle in managing myofascial trigger points associated with medial tibial stress syndrome in soccer players.

Materials and Methods

Study participants

The study employed a pre-test and post-test experimental study design. A convenience sample of 22 participants was recruited from Delhi University and Delhi Soccer Association in New Delhi, India. The participants were then randomly assigned to either the experimental group (Group 1) or the control group (Group 2) using computer-generated random numbers.

The inclusion criteria comprised the following items: College-level soccer players aged 18-25 years, of both genders, diagnosed with MTSS based on Yates and White criteria, experiencing pain in the posterior medial part of the tibia during exercise and exhibiting an area of diffuse pain on palpation measuring at least 5 cm; sustained pain lasting for at least 3 weeks; pain triggered by exercise, occurring during and after exercise; unilateral pain; presence of a palpable taut band within the soleus muscle and recognition of current pain complaint through pressure on the tender nodule, alongside painful limitation to the full stretch range of motion of the soleus muscle at the ankle joint. Meanwhile, participants were excluded if they had a tibial stress fracture, compartment syndrome, peripheral vascular disease, nerve entrapment syndrome, soleus muscle strain, history of adverse reactions to needling or injections, were on anticoagulant therapy or had thrombocytopenia, or had skin infections [10, 16].

Study procedure

Written informed consent was obtained from all participants after explaining the study's objectives and methods. Based on the inclusion and exclusion criteria, the participants were recruited and then randomly allocated to either the experimental (Group 1) or control group (Group 2). Each participant underwent an assessment to establish baseline measures. Group 1 received dry needling of soleus trigger points, followed by active stretching of the soleus muscle for 30 s, repeated 5 times, and concluded with a 15-min ice pack application. Meanwhile, Group 2 solely underwent active stretching of the soleus muscle, with each stretch held for 30 s, repeated 5 times, and followed by a 15-min ice pack application. The treatment duration was 45 min for Group 1 and 30 min for Group 2. Post-treatment measurements were conducted 2 days after the treatment session to mitigate potential muscle soreness from dry needling.

Study interventions

Diagnosis of soleus muscle trigger point

The participants assumed a prone position with the knee flexed to 90 degrees for the diagnosis of trigger point 1, and knee extension for the diagnosis of trigger points 2 and 3. Identification of soleus MTrPs was based on four essential diagnostic criteria as follows: A palpable taut band in the soleus muscle, hypersensitive tender spot/nodule within the taut band, recognition of current pain complaint upon pressure application to the tender nodule, and restricted stretch range of motion causing discomfort [17].

Experimental group

The participants in the experimental group were placed in a prone position with the affected leg supported by a bolster. After skin disinfection, dry needling of the soleus muscle was performed. Using flat palpation, the needle (0.30 × 40 mm) was held by the handle and inserted through the skin using a guide tube. The needle was maneuvered in a slow, steady motion in and out of the muscle until a local twitch response was elicited [18]. This was followed by five active stretches for the soleus muscle, each held for 30 s, and then a 15-min cryotherapy session. The stretching protocol involved the participant standing facing a wall with the unaffected leg forward, a slight knee bend, and the affected leg behind with a bent knee and toes slightly pointed inward. Both heels were kept flat on the floor, and the hip was moved toward the wall [19].

Control group

The control group participants received soleus muscle active stretching and cryotherapy identical to the experimental group.

Outcome measures

Repeated shuttle sprint ability

Repeated shuttle sprint ability (RSSA) was evaluated through six 40-m shuttle sprints, with a 20-s passive recovery interval between each sprint. The participants sprinted 20 m, touched a designated line with their feet, and rapidly returned to the starting position. This process was repeated with 20 s of passive recovery between sprints. RSSI's construct validity has been established for soccer players [20].

Medial tibial stress syndrome score

MTSS Score is a patient-reported outcome measure ranging from 0 to 10, assessing functional outcomes in MTSS participants. It demonstrates good test-retest reliability (intraclass correlation coefficient [ICC]=0.81) and construct validity with significant correlations (r=0.34-0.52, P<0.01) [21].

Pain pressure threshold

Pain perception thresholds (PPT) were measured using a pressure algometer (model ALGO-AN-01), which has demonstrated good intra-rater reliability (ICC=0.53-0.90) in MTSS individuals [22]. The algometer features a 1 cm diameter tip. Three PPT readings were taken from each of the three identified trigger points, with a 10-s interval between readings, and the mean of the three readings was calculated.

Data analysis

The data were analyzed using the SPSS software, version 21, with statistical significance set at P<0.05. Demographic characteristics were compared between both groups at baseline using an independent t-test. Pre- and post-intervention differences were analyzed within each group using paired t-tests. Differences between groups after the intervention were evaluated using an independent t-test.

Results

The data exhibited a normal distribution at the baseline assessment. Out of the initial 22 recruited participants, 2 were female and 20 were male, with an average age of 21.55±2.405 years.

In the experimental group, noteworthy pre- and post-treatment changes were observed, demonstrating statistical significance for PPT (P=0.000), MTSS score (P=0.004), and RSSA (P=0.025) (Table 1). Conversely, within the control group, statistically significant changes were observed solely in PPT (P=0.003) (Table 2).

Table 1. Comparison of pre- and post-intervention outcome measures of experimental group

Outcome Measure	Mean±SD	n	t	P
Pre-MTSS score	3.6±0.81	11	3.708	0.004*
Post-MTSS score	2.6±1.36	11		
Pre-PPT	5.3±0.57	11	-12.3	0.000*
Post-PPT	5.7±0.59	11		
Pre-RSSA	226.0±36.7	11	-2.6	0.025*
Post-RSSA	229.2±35.2	11		

JMR

Abbreviations: MTSS: Medial tibial stress syndrome; PPT: Pain pressure threshold; RSSA: Repeated shuttle sprint ability.

Notes: * indicates P≤0.05.

Comparison between the groups using an independent t-test revealed notably higher and statistically significant improvements in the experimental group's PPT (P=0.001) and MTSS score (P=0.01) in contrast to the control group (Table 3). The post hoc statistical power analysis, with PPT as the primary outcome measure, yielded a value of 56.9%.

Discussion

The primary objective of this study was to assess the efficacy of dry needling applied to the soleus muscle as a treatment for myofascial trigger points associated with MTSS in soccer players. The findings of this investigation demonstrate a significant enhancement in PPT and MTSS scores following a single session of combined dry needling intervention and soleus stretching when compared to soleus stretching in isolation. The results are consistent with the idea that dry needling elicits an anti-nociceptive response, as indicated by the observed improvement in PPT following the single dry needling session [23]. These findings are in alignment with a separate study that reported superior outcomes in myofascial pain when dry needling was accompanied by active stretching as opposed to active stretching alone, underscoring the validity of our results [24].

The control group, consisting solely of soleus muscle stretching, also displayed improved PPT measurements; however, the experimental group exhibited a more pronounced enhancement in post-intervention measurements. This discrepancy can be attributed to the invasive nature of dry needling, which directly targets myofascial trigger points, an aspect not covered by active stretching alone. Additionally, the alleviation of pain linked to myofascial trigger points necessitates some degree of de-

Table 2. Comparison of pre- and post-intervention outcome measures of control group

Outcome Measure	Mean±SD	n	t	P
Pre-MTSS score	3.82±0.75	11	2.887	0.16
Post-MTSS Score	3.36±0.9	11		
Pre-PPT	4.9±0.94	11	-3.996	0.003*
Post-PPT	5.04±0.93	11		
Pre-RSSA	211.27±39.19	11	-1.421	0.186
Post-RSSA	212.55±38.16	11		

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Abbreviations: MTSS: Medial tibial stress syndrome; PPT: Pain pressure threshold; RSSA: Repeated shuttle sprint ability.

Notes: * indicates P≤0.05.

Table 3. Between-group comparison of outcome measures post-intervention

Outcome Measure	Groups	Mean±SD	n	t	P
MTSS score	Experimental	1.27±0.78	11	2.875	0.010*
	Control	0.45±0.52	11		
PPT	Experimental	0.44±0.12	11	7.781	0.000*
	Control	0.10±0.08	11		
RSSA	Experimental	3.18±3.99	11	1.272	0.219
	Control	1.27±2.97	11		

JMR

Abbreviations: MTSS: Medial tibial stress syndrome; PPT: Pain pressure threshold; RSSA: Repeated shuttle sprint ability.

Notes: * indicates P≤0.05.

activation before muscle release through stretching, a requirement that dry needling effectively fulfills [25]. This likely accounts for the superior improvement achieved through the combination of dry needling and stretching, compared to sole active stretching of the soleus muscle.

The results indicated no significant impact of dry needling and stretching on RSSA. This outcome might be linked to the multifaceted etiology of MTSS, where foot hyperpronation emerges as a significant contributing factor [5]. Individuals with foot hyperpronation could potentially be experiencing repetitive soleus muscle overuse during running, an issue that dry needling alone may not fully address.

This study uniquely employed the MTSS Score as a subjective measure to monitor participant progress. To the best of our knowledge, this is the first instance of using this measure to evaluate the effects of dry needling in MTSS. The MTSS Score exhibited improvement in the dry needling group, while no significant changes were noted in the stretching-alone group. This outcome mirrors the findings of PPT improvement. As the dry-needling group experienced increased PPT values, the functional status of the participants likely improved as well since pain significantly affects MTSS. This improvement is reflected in the MTSS score for the dry-needling group [1, 8].

Conclusion

MTrP in the soleus muscle can be treated effectively with dry needling in participants with MTSS. This intervention effectively improves the functional activity as well as pain threshold in participants suffering from MTrP.

Study limitations

Several limitations characterize this study. Follow-up data was not collected to explore the prolonged effects of a single session of soleus muscle dry needling on MTSS. Furthermore, the relatively small sample size restricts the generalizability of the findings. Future research endeavors could potentially establish a specific dry-needling protocol for addressing myofascial trigger points in MTSS among young soccer players.

Ethical Considerations

Compliance with ethical guidelines

The study received approval from the Ethics Committee of the Indian Spinal Injuries Center Institute of Rehabilitation Sciences, New Delhi (Code: ISIC/HRS/RP/2015/094).

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Authors' contributions

All authors equally contributed to preparing this article.

Conflict of interest

The authors declared no conflict of interest.

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