



Conservative Treatment Options In Acute Medial Tibial Stress Syndrome- A Narrative Review

¹**Sriraghunath. S**, Principal, VYMAK College of Physiotherapy and PhD Scholar, Garden City University, Bangalore.

²**Dr Annie Thomas**, PT, PhD, Professor, Director Physiocare & Research Coordinator, Garden City University, Bangalore.

Corresponding Author- Sriraghunath. S, Principal, VYMAK College of Physiotherapy, PhD Scholar, Garden City University, Bangalore.

Abstract:

Medial Tibial Stress Syndrome (MTSS) is a chronic lower-limb injury that effects a large population of athletes and exercisers. MTSS, commonly known as “shin splints,” is one of the most common causes of exertional leg pain in athletes. It is one of the most common overuse issues in runners and the community, affecting almost 35% of the athletic population. Overuse injuries like MTSS can impact up to 70% of runners in a year. Many risk factors are associated with MTSS, and lower extremity performance may become altered in athletes suffering from prior symptoms, potentially increasing risk of future injury. Although often not serious, it can be quite disabling and progress to more serious complications if not treated properly. There is no definitive knowledge on what causes this injury, making prevention and treatment difficult. Often, the cause of MTSS is multi-factorial and involves training errors and various bio-mechanical abnormalities. Few advances have been made in the treatment of MTSS over the last few decades. Current treatment options are mostly based on expert opinion and clinical experience. The purpose of this article is to review published literature regarding conservative treatment options for Acute MTSS and provide recommendations for physiotherapists and sports medicine clinicians for improved and faster treatment outcomes.

Key Words: Medial Tibial Stress Syndrome (MTSS), conservative management, exertional leg pain, runners, shin pain

Introduction and Background:

One of the most typical overuse injuries in contemporary sports medicine and physiotherapy is medial tibial stress syndrome (MTSS)^{1,2}. Exercise-related pain along the posteromedial border of the tibia that is also aggravated by palpation over five or more consecutive centimeters is referred to as MTSS². MTSS appears to have existed for quite some time. A 500–800-year-old skeleton from a Byzantine cemetery was discovered by University of Athens archaeologists in Rhodes, Greece. Along the posteromedial tibial boundary, they noticed significant cortical tissue deposition and surface cortical lesions. The researchers came to the conclusion that this person most likely had bilateral MTSS².

A shin area overuse or repetitive stress injury is known as medial tibial stress syndrome. When the body is unable to repair effectively in response to repeated muscular contractions and tibial tension, various stress reactions of the tibia and surrounding musculature take place. In addition to other ballistic sports like football, basketball, soccer, and dancing, MTSS is most frequently seen in runners.

Pathogenesis:

Numerous theories have been put forth and researched in the literature. Here is a quick summary of some of the major conclusions:

Factors related to biomechanics: Aberrant bio mechanical forces acting on the lower leg causes MTSS. According to studies, people with MTSS frequently exhibit aberrant foot pronation, tibial rotation, and hip muscular strength. These elements may enhance the tibia's stress, resulting in micro trauma and inflammation.

Bone remodeling: MTSS is brought on by abnormal bone remodeling brought by repetitive stress. According to studies, people with MTSS have a decrease in bone density and an increase in bone turnover in the affected area. This may damage the bone structure and make people more vulnerable to injury.

Overuse and muscle fatigue: According to some studies, MTSS may be brought on by these factors. Repeatedly stressing the tibia can cause inflammation and micro trauma in the muscles and surrounding tissues.

Vascular considerations: It has also been proposed that vascular factors, such as reduced blood flow to the affected area, may contribute to MTSS. According to studies, people with MTSS have decreased blood flow and oxygenation in the affected limb, which can cause inflammation and tissue damage.

Many people think that underlying tibial periostitis brought on by load-induced tibial strain is the primary cause of MTSS. However, recent research suggests that a variety of tibial stress injuries, such as tendinopathy, periostitis, periosteal remodeling, and tibial stress reaction, are potential contributing factors in MTSS³⁵⁶. The soleus and tibialis anterior muscles, as well as their dysfunction, are frequently mentioned³⁵⁶. The abnormal strain and bending of the tibia brought on by chronic, repetitive loads appear to represent the root of these different tibial stress injuries³. MTSS and tibial stress fractures may be viewed as being on a continuum of bone-stress reactions, despite the fact that they occasionally have different aetiologies³.

The impact of MTSS:

Running and other sports like American football and basketball have been demonstrated to have a high MTSS. Overuse injuries, such as shin splints, account for 18.5% of all soccer-related disabilities⁷. In several groups, exercise-related leg pain is the common cause of MTSS, but the exact reason is unknown. As soon as feasible, MTSS must be identified and handled. Otherwise, restrictions develop as a result of frequent shocks⁸. As recreational running and jogging have grown in popularity, so has the number of ailments classed as overuse injuries. Shin splints are the most prevalent exercise-related injuries. Because of the vagueness of the term "shin splint," appropriate diagnosis, treatment, and prevention can be challenging. According to research, exercise-induced shin discomfort is responsible for 10-20% of all runner injuries and 60% of all lower-limb overuse injuries⁹. According to military studies, shin splints are also the most common injury among ballet dancers, with 4-10% of recruits diagnosed with them throughout their eight to 12 weeks of basic training¹⁰. There are numerous hypotheses about how MTSS pathology occurs. According to certain theories, MTSS is a localized tibial bone overload injury¹⁷ or a "traction-induced" periostitis^{14,15}, crural fasciitis¹⁸. Others have claimed that MTSS affects two or all three of these structures¹⁸.

Despite the fact that the precise pathophysiology of MTSS is not yet fully known, there is evidence to suggest that a combination of bio-mechanical elements, muscular weakness, and low bone mineral density may be responsible for the condition's onset. To fully comprehend the underlying mechanisms and create efficient treatments for MTSS, more study is required.

Prevention of MTSS:**Identifying Potential Risk Factors**

The most effective way to stop something from developing is to identify the potential causes and put a stop to them as quickly as possible. Therefore, a crucial first step in preventing MTSS is being able to recognize the risk factors that contribute to its development. In addition, identifying prevention also the dearth of knowledge regarding the etiological variables¹⁹. Intrinsic and extrinsic risk factors must both be taken into account when trying to prevent a disorder. Risk factors that are intrinsic to an individual, such as their gender, or their anatomical make-up are of concern.

Extrinsic risk factors are more focused on environmental elements that are not related to the individual in consideration. Over 100 potential inherent risk variables of MTSS were discovered in a recent systematic review that included 21 separate research. Nine of these risk factors were found to be moderately to strongly prevalent in clinical practice. Body mass index (BMI), ankle plantar flexion range of motion (ROM), ankle dorsiflexion range of motion (ROM), navicular drop, ankle eversion range of motion (ROM), ankle inversion

range of motion (ROM), quadriceps angle, and hip internal rotation range of motion (ROM) were among the nine. The systematic review identified the strongest risk factors among these nine, including BMI, navicular drop, ankle plantar-flexion range of motion, and hip external range of motion²⁰.

Tightness or weakness in the triceps surae has been mentioned by certain researchers as a possible risk factor for MTSS. The gastrocnemius, soleus, and plantaris muscles constitute the triceps surae. It is believed that athletes with weakness in this region are more likely to experience muscle fatigue, which can cause changed running mechanics and tibial strain²¹. Gender was mentioned as a potential risk factor for MTSS in a different study looking into risk variables for navy recruits. According to the findings of this particular study, female recruits were twice as likely as male recruits to experience MTSS. It is noteworthy that a number of researchers have discovered that women appear to have a 1.5 to 3.5 times higher risk of MTSS developing into a stress fracture. Additionally, as women are more likely to experience decreased bone density and osteoporosis, it is crucial for specialists to keep an eye on women whose MTSS is not healing rapidly and to be cautious of amenorrhea or disordered eating as both of these conditions can be harmful to bone health²¹. Numerous extrinsic risk factors have been found in addition to probable intrinsic risk factors. Inappropriate footwear, jogging in a shoe not made for running, is one extrinsic risk factor. Running in worn-out shoes can also result in shin splints since the shock-absorbing capabilities of the shoes are diminished after many miles of use²². Since certain materials, like concrete, impact the body more forcefully than a surface like grass, a bad training surface is also an extrinsic risk factor. Low levels of conditioning or deconditioning before to beginning a program and a quick increase in volume or intensity of training are two additional extrinsic risk factors²³. The ACSM advises against training increases of more than 10% every week²⁴. It is probable that diverging from these could result in a person developing a chronic injury like MTSS.

The ACSM recommendations for exercise progression are most likely the best choice right now in consideration of this and the scientific investigation is still required in this area. This highlights how crucial it is to spread awareness of these suggestions among trainers, medical experts, and people who participate in physical exercise. The intrinsic risk factor of a high BMI is combated by progressing at a safe rate, in addition to the extrinsic risk factors of a high BMI and being deconditioned at the beginning of exercise. When discovered, extrinsic risk factors are easier to address than intrinsic risk factors since they involve problems that are not specific to the individual.

Treatment of MTSS:

Diagnosing MTSS

Usually, a comprehensive history and physical exam are enough to diagnose MTSS. To rule out stress fractures or other disease, patients may need additional imaging or testing. The clinical diagnosis of MTSS has always been shrouded in mystery. The foundation of clinical diagnosis for the majority of sports injuries is a history and physical examination. There are no studies demonstrating the validity of a clinical MTSS diagnosis. In addition, there are various lower limb injuries that can result in excruciating leg pain, including chronic exertional compartment syndrome and lower extremity stress fractures²⁴. Imaging methods (such as x-ray, MRI, and CT scan) are not always reliable diagnostic tools for MTSS, in contrast to many other sports injuries. In fact, MTSS can be accurately identified using patient history and physical examination, according to a recent study by a group of Dutch researchers²⁵.

Patients with MTSS most frequently complain of vague, diffuse lower extremity pain along the middle-distal tibia that worsens with effort. In the early stages of MTSS, pain is worse at the start of exercise and gradually lessens throughout training and minutes after exercise stops. However, when the damage worsens, pain may appear while at rest or with reduced physical activity.

Three steps were related to the history and asked the patient about the pain's location, whether it provoked by exercise and relieved by rest, and whether there are any compartment syndrome signs that would rule out MTSS. The final two steps of a physical examination were carried out if the patient stated that the pain was exercise-induced, along the distal two-thirds of the medial tibial border, that it was triggered by physical activity, and that no signs of compartment syndrome were present. The posteromedial tibial boundary was palpated as part of the physical examination. The clinician would then check to see if there were any symptoms that were not characteristic of MTSS, like a visible swelling along the medial border of the tibia, if the area was uncomfortable and extended beyond five centimeters. If no unique symptoms were discovered, MTSS was diagnosed.

Conservative Treatment Options:

When treating MTSS, many clinicians identify two stages of care: the acute stage and the sub-acute stage²¹. Clinically, the acute stage is characterized by discomfort, redness, swelling, and functional loss. Usually, the patient feels pain when they are at rest, when they are active during the acute period, or when stress is placed on a particular location. Acute treatment objectives include reducing discomfort and swelling, limiting painful positions or activities, maintaining aerobic fitness, and preserving the integrity of the soft tissue²⁶. For dealing with MTSS in the acute phase for many years, healthcare professionals have favoured a simple and conventional treatment approach. Resting and applying ice to the affected area is the most popular acute phase therapy option²⁷. The American College of Sports Medicine (ACSM) advises taking at least 7 to 10 days off from pain-inducing activities. Athletes can maintain their aerobic fitness levels in the meantime by taking part in cross-training exercises like cycling or swimming. On the other hand, depending on the individual athlete, some may need a two- to six-week extended break.

The return to pain-free active and passive range of motion and a general decrease in pain are characteristics of the sub-acute stage. Although the pain has subsided, the person is still not fully recovered at this point because stimulus on the area that has been injured will still create pain²⁶. Many of the risk factors related to MTSS prevention are addressed and overlapping in the sub-acute period of treatment. After the acute part of treatment is over, the sub-acute stage concentrates on helping the patient resume their normal activities by altering their training schedules and taking care of any bio-mechanical problems they may be experiencing. Due to its low-impact nature, cross-training can be quite beneficial for athletes in the sub-acute stage. Elliptical machines, pool running, swimming, or riding a stationary bike are all excellent cross-training activities. During the sub-acute treatment phase, athletes should be encouraged to refrain from running on hills, uneven terrain, or particularly hard surfaces. Additionally, the amount of jogging done should be reduced by 50% in both intensity and time²¹.

Athletes may gradually start to raise their training length and intensity while incorporating sport-specific movements over the course of several weeks, as long as they experience no pain. Athletes should modify any exercises that hurt or make their symptoms worse. A clinician can examine a person for these issues even if they have never undergone a preparticipation assessment to detect potential risk factors for MTSS. The shortcomings can be adequately addressed in therapy when they have been discovered, whether through gait retraining or a focus on good technique²¹.

Less Conventional Forms of Treatment:

There are various other unconventional treatment options for MTSS in addition to the more typical ones. While some of these have had limited or no research, others have undergone some research with varying degrees of success. When Kinesio tape (KT) is used correctly, it raises the fascia and soft tissue, creating additional space beneath the area of application. This is supposed to promote proprioceptive input, realign the fascial tissue, and improve circulation while also restoring normal muscle function²⁹.

ESWT, or extracorporeal shock-wave therapy. Since there is the possibility that it could speed up recovery and lessen discomfort from MTSS³⁰, this therapy approach is now being explored. ESWT makes use of shock-wave generation, and it has been demonstrated to promote tissue regeneration and repair³¹.

Many different musculoskeletal diseases have been treated with prolotherapy, which includes injecting a non-surgical substance into painful locations in order to encourage the formation of healthy cells and tissues. Although there is little data on this technique's effectiveness for MTSS, it has been utilized with some degree of success in treating a range of various musculoskeletal illnesses. Despite this, it continues to be an exciting option for treatment that needs further study³².

Instrument assisted soft tissue mobilization (IASTM) or the Graston technique. IASTM is a technique that helps the clinician assess and mobilize soft tissue by using specialized tools with sloping edges. The method involves stroking the devices across the skin in multiple directions at angles ranging from 30 to 60 degrees³³. An IASTM approach that is frequently used to locate and relax the constrictions in soft tissue is the use of Graston tools³⁴. This therapy may be helpful for someone who is starting to experience triceps surae tightness-related MTSS symptoms or for someone who is resuming running after recovering from MTSS to lessen the risk of suffering the injury again.

MTSS score:

A valid, reliable and responsive PROM to gauge the severity of MTSS is the MTSS score. Its purpose is to assess how well treatments work in clinical research. The 15 items that make up the MTSS score are item generation for a patient reported outcome measure of current sporting activities, current amount of sporting activities, current content of sporting activities, time to pain onset during sporting activities, pain throughout sporting activities, pain after sporting activities, pain while standing, pain while walking, and pain while walking up or down stairs, pain while performing common daily activities, pain at rest, pain at night and pain to touch.

Discussion:

The fact that those with a history of MTSS are between 20.09 and 32.213 times more likely to experience MTSS once again than those without a history, recovery times for MTSS frequently range from 4 weeks to 18 months^{11,12}. The literature on MTSS has significant gaps that prevent further research in the area. At this time, it is unclear what the underlying pathophysiology of MTSS is, and it is therefore difficult to diagnose. The optimal way to treat MTSS is unknown, and there is no tool to assess the degree of the injury or the effectiveness of the treatment. With little knowledge of the pathophysiology, diagnosis, and outcome measurement for MTSS, it appears challenging to target preventative and therapeutic measures. Before additional research can look into topics like (secondary) prevention, prognostic variables, and treatment of MTSS in epidemiological and randomised controlled studies with long-term follow-up, these gaps must be filled.

Conclusion:

Regarding MTSS treatment possibilities, numerous review articles and case reports were found. There was a general lack of randomized controlled trials (RCTs), and the majority of the data was based on expert opinion and clinical experience. Instead of focusing on treatment, several investigations investigated MTSS's genesis and risk factors³⁶.

Even while MTSS research has made amazing strides, much more work is still required. This is evident from the fact that MTSS is still a contentious topic in the medical world, despite advances in scientific technology. Finally, future research in the field of MTSS should not be discouraged by the lack of agreement on viable treatment approaches. Even though rest seems to be the most effective current treatment, a revolutionary treatment discovery could be just around the corner. Ultimately, there is a greater need for high-quality investigative studies of conservative treatment options, including potentially useful tools that have not yet been thoroughly studied, for this common condition.

This review article intends to illustrate how MTSS can be effectively treated, which lessens pain and enhances functionality quickly so that the activity can be continued. This article offers a brief overview of the condition to aid clinical practitioners, which will be useful for future studies on the same issue.

References-

1. Beck BR, Osternig LR, Oregon E. Medial tibial stress syndrome. The location of muscles in the leg in relation to symptoms. J Bone Joint Surg Am 1994;76(7):1057-1061.
2. Bhatt R, Lauder I, Finlay DB. et al. Correlation of bone scintigraphy and histological findings in medial tibial syndrome. Br J Sports Med 2000;34:49-53
3. Beck B. Tibial stress injuries: an aetiological review for the purposes of guiding management. Sports Med. 1998;26(4):265-79.
4. Anderson M, Ugalde V, Batt M, Gacayan J. Shin splints: MR appearance in a preliminary study. Radiology. 1997;204:177-80.
5. Detmer D. Chronic shin splints. Classification and management of medial tibial stress syndrome. Sports Med. 1986;3(6):436-46.
6. Fredericson M, Bergman G, Hoffman K, Dillingham M. Tibial stress reaction in runners: correlation of clinical symptoms and scintigraphy with a new magnetic resonance imaging grading system. Am J Sports Med. 1995;23:427-81.
7. Alfayez SM, Ahmed ML, Alomar AZ: A review article of medial tibial stress syndrome . J Musculoskelet Surg Res. 2017, 1:2-5.
8. Bates P: Shin splints--a literature review . Br J Sports Med. 1985, 19:132-7. 10.1136/bjsm.19.3.132.
9. Wilder RP, Sethi S: Overuse injuries: tendinopathies, stress fractures, compartment syndrome, and shin splints. Clin Sports Med. 2004, 23:55-81. 10.1016/S0278-5919(03)00085-1

10. Ross J: A review of lower limb overuse injuries during basic military training. Part 1: types of overuse injuries. *Mil Med.* 1993, 158:410-5. 10.1093/milmed/158.6.410
11. Moen MH, Holtslag L, Bakker E et al. The treatment of medial tibial stress syndrome in athletes; a randomized clinical trial. *Sports Med Arthrosc Rehabil Ther Technol* 2012; 4(1). <http://dx.doi.org/10.1186/1758-2555-4-12>.
12. Newman P, Adams R, Waddington G. Two simple clinical tests for predicting onset of medial tibial stress syndrome: shin palpation test and shin oedema test. *Br J Sports Med* 2012; 46(12):861–864.
13. Hubbard TJ, Carpenter EM, Cordova ML. Contributing factors to medial tibial stress syndrome: a prospective investigation. *Med Sci Sports Exerc* 2009; 41(3):490–496.
14. Davidson M, Keating J. Patient-reported outcome measures (PROMs): how should I interpret reports of measurement properties? A practical guide for clinicians and researchers who are not biostatisticians. *Br J Sports Med.* 2014;48:792–6.
15. Dawson J, Doll H, Fitzpatrick R, et al. The routine use of patient reported outcome measures in healthcare settings. *BMJ.* 2010;350:c186
16. Deshpande PR, Rajan S, Sudeepthi BL, et al. Patient-reported outcomes: A new era in clinical research. *Perspect Clin Res.* 2011 Oct;2(4):137-44. doi: 10.4103/2229-3485.86879.
17. Food and Drug Administration. "Guidance for industry: patient-reported outcome measures: use in medical product development to support labeling claims" [Draft Guidance, Food and Drug Administration]. Washington, DC: US Department of Health and Human Services; 2006.
18. Speight J, Barendse SM. FDA guidance on patient reported outcomes. *BMJ.* 2010; 340: c2921.
19. Hamstra-Wright, K. L., Huxel Bliven, K. C., & Bay, C. (2015). Risk factors for medial tibial stress syndrome in physically active individuals such as runners and military personnel: a systematic review and meta-analysis. *British Journal Of Sports Medicine*, 49(6), 362-369. doi:10.1136/bjsports-2014-093462.
20. Winkelmann, Z., Anderson, D., Games, K., & Eberman, L. (2016). Risk factors for medial tibial stress syndrome in active individuals: An evidence-based review. *Journal of Athletic Training*, 51(12), 1049-1052. 10.4085/1062-6050-51.12.13
21. Galbraith, R. M., & Lavallee, M. E. (2009). Medial tibial stress syndrome: Conservative treatment options. *Current Reviews in Musculoskeletal Medicine*, 2(3), 127-133. doi:10.1007/s12178-009-9055-6
22. Mahoney, K. (2017). Stop shin splints: Don't let this common high-impact injury throw you off your fitness game. *Muscle & Fitness/Hers*, 18(3), 66.
23. Gardner, P. (2003). Shin Splints. *Athletic Therapy Today*, 8(2), 52-53.
24. Becker, J. A., Richardson, B. M., Brown, S. T., & Richardson, B. M. (2016). A stepwise approach to exertional leg pain. *Journal Of Family Practice*, 65(10), 672-679.
25. Winters, M., Bakker, E. W. P., Moen, M. H., Barten, C. C., Teeuwen, R., & Weir, A. (2018). Medial tibial stress syndrome can be diagnosed reliably using history and physical examination. *British Journal of Sports Medicine*, 52(19), 1267.
26. Dutton, M. (2017). Duttons Orthopaedic examination, evaluation, and intervention. New York: McGraw-Hill Medical.
27. Carr, K., Sevetson, E., & Aukerman, D. (2008). Clinical inquiries. How can you help athletes prevent and treat shin splints?. *The Journal Of Family Practice*, 57(6), 406-408.
28. Beck, B. R. (2016). Exercise-Induced Leg Pain. Retrieved February 5, 2019, from https://www.acsm.org/docs/default-source/files-for-resourcelibrary/basics_exercise_induced-leg-pain.pdf?sfvrsn=8c62186b_2
29. Sinha, A. K., & Sharma, U. (2017). Comparison of effectiveness of kinesio taping with nonelastic taping and no taping in players with acute shin splints. *Physiotherapy - The Journal of Indian Association of Physiotherapists*.
30. Garcia, S. G., Rona, S. R., Tinoco, M. C., Rodriguez, M. B., Ruiz, D. M., Letrado, F. P. Garcia, J. M. (2017). Shockwave treatment for medial tibial stress syndrome in military cadets: A single-blind randomized controlled trial. *International Journal of Surgery*, 46, 102-109. doi:10.1016/j.ijsu.2017.08.584.
31. Wang, C. (2012). Extracorporeal shockwave therapy in musculoskeletal disorders. *Journal of Orthopaedic Surgery and Research*, 7(1), 11. doi:10.1186/1749-799x-7-11
32. Hauser, R. A., Lackner, J. B., Steilen-Matias, D., & Harris, D. K. (2016). A systematic review of dextrose prolotherapy for chronic musculoskeletal pain. *Clinical Medicine Insights: Arthritis and Musculoskeletal Disorders*, 2016(9), 139-159. doi:10.4137/CMAMD.S39160
33. Gulick, D. T. (2018). Instrument-assisted soft tissue mobilization increases myofascial trigger point pain threshold. *Journal of Bodywork & Movement Therapies*, 22(2), 341-345. doi:10.1016/j.jbmt.2017.10.012

34. Stanek, J., Sullivan, T., & Davis, S. (2018). Comparison of compressive myofascial release and the graston technique for improving ankle-dorsiflexion range of motion. *Journal of Athletic Training*, 53(2), 160-167. doi:10.4085/1062-6050-386-16
35. Yates B, While S. The incidence and risk factors in the development of medial tibial stress syndrome among naval recruits. *Am J Sports Med*. 2004;32(3):772–80.
36. Thacker S, Gilchrist J, Stroup D, Kimsey C. The prevention of shin splints in sports: a systematic review of literature. *Med Sci Sports Exerc*. 2002;34(1):32–40.

