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SCREENING OF RISK FACTORS AND THEIR CORRELATION WITH MEDIAL TIBIAL STRESS SYNDROME SCORE AMONG RECREATIONAL ATHLETES

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ABSTRACT

Background: Medial Tibial Stress Syndrome (MTSS) is a lower leg injury that frequently impacts athletes and disrupts their ability to participate. Numerous prospective studies have identified the risk factors associated with MTSS but very few identified the same on Indian population. Furthermore, MTSS score is a new Patient Reported Outcome Measure (PROM) yet to be extensively explored on recreational athletes.

Objective: Screening of the risk factors of MTSS in Indian recreational athletes and their correlation with MTSS score.

Methods: An analytical study including 52 recreational athletes were included in the study. Socio-demographic and training routines details were collected and physical examination (body composition, Palpation over the posteromedial tibial border, Navicular drop test, ROM and Manual Muscle Testing) was performed. In addition, a new PROM; MTSS score was subjected to all the recreational athletes.

Results: 15 out of 52 recreational athletes aged 34±8.17 years with a BMI and Body fat% of 23±9.40 kg/m2 and 25±10.60 % respectively showed a higher navicular drop. These athletes even reported reduced Range of Motion (ROM) and muscle strength with a positive palpatory finding on the posteromedial tibial border and an increased MTSS score. MTSS score showed significant positive correlation with body fat% ($r = 0.266$, $p = 0.057$) and a significant negative correlations with palpation, ROM, Muscle strength and Navicular drop Test ($r = -0.818$, $p = 0.000$; $r = -0.320$, $p = 0.021$; $r = -0.494$, $p = 0.000$ and $r = -0.232$, $p = 0.098$).

Conclusion: Recreational athletes with higher navicular drop showed a positive correlation with all the risk factors screened in the present study. Except for body fat percentage, all the other screened risk factors showed negative correlations with MTSS score. Therefore, MTSS score is an easy PROM tool that can be used in clinical settings.

KEYWORDS : Athletes, Medial Tibial Stress Syndrome, MTSS Score, Risk factors, Shin splints

INTRODUCTION

Medial Tibial Stress Syndrome (MTSS) or Shin-Splint Syndrome is a clinical pain condition defined as an exercise-induced pain along the posteromedial tibial border (distal third) caused by repetitive loading stress during running. [1] Shin splint is a common overuse sports injury with incidence rates from 4% to 19% in athletic populations. In recreational runners, it has been identified as the most common musculoskeletal injury with an incidence rate ranging from 13.6% to 20.0% and a prevalence of 9.5%.[2] Studies have shown that the risk of developing MTSS is noticeably greater among recreational runners as compared to professional athletes.[3]

Despite the high prevalence, biomechanical risk factors for developing MTSS are not well understood. [4] In order to identify, treat and ideally prevent development of MTSS, several review studies have prominently featured numerous biomechanical risk factors.[5] The most significant risk factors are female sex, history of MTSS and a higher navicular drop. Other significant risk factors are high body mass index (BMI), increased weight, high plantar flexion range of motion (ROM), high hip external ROM, lower internal rotation ROM, lower calf girth, previous running injury, running experience and orthotic use. Numerous other potentially pertinent factors have been investigated for their association with MTSS, including shin pain at palpation, shin edema, knee Varus-valgus, Q-angle, running performance, sudden increase in intensity and/or duration of training and an uneven training surface. [5,6,7,8] However, neither of the studies mentioned in the reviews were specifically reported on Indian population.

Studies have shown that history and physical examination, principally through palpation are crucial for evaluating the biomechanical risk factors and for the diagnosis of MTSS. [3,9] Studies have even reported that imaging modalities are keys to confirming the presence of MTSS [3] but on the contrary fewer studies have reported that it does not seem logical to use imaging to establish or rule out MTSS as they are unable to differentiate between athletes with and without clinically diagnosed MTSS. [9] Measuring outcomes from a patient's perspective are considered the cornerstone of outcome assessment. To measure the severity of MTSS, a patient reported outcome measure (PROM) named Medial Tibial Stress Syndrome Score (MTSS score) was developed. MTSS score is a valid, reliable (intraclass correlation coefficient=0.81) and a cost effective outcome measure including 15 items specifically measuring pain along the shin and limitations due to shin pain. [2]

Even though history and physical examination aids in diagnosing MTSS it may vary between clinicians and is unclear if that can be reliably performed. [2] Using imaging modalities can be costly especially considering Indian population. Hence, the study first aimed at screening the risk factors of MTSS in Indian recreational athletes using history and physical examination. Secondly MTSS score was applied to the same recreational athletes and the risk factors were correlated with the MTSS score to understand the feasibility of the outcome measure to diagnose MTSS and identify the significant risk factors contributing to the syndrome.

METHODS

An analytical cross-sectional study was done that evaluated MTSS among recreational marathon runners. The study was approved by the Institutional Ethics and Research Committee at D.Y. Patil University, Navi Mumbai, India. Recreational marathon runners were screened based on the inclusion and exclusion criteria. Runners between the age of 20 to 50 years and with a year's experience of marathon running were included and were excluded if there was suspicion of a stress fracture or compartment syndrome and if they refused to willingly participate in the study. The study was explained to the screened participants and informed consent was obtained.

Procedure

Demographic Information And Physical Examination

Demographic valves were obtained using a standardized self-made questionnaire. The questionnaire recorded the age, training routine, modifications in training routine, training terrain, past medical and pain history and footwear. The weight and height were measured and BMI and body fat % was calculated. With the physical examination, the following parameters were measured: Palpation over the posteromedial tibial border, Navicular drop test, ROM and Manual Muscle Testing (MMT).

Palpation over the posteromedial tibial border was performed until a recognizable pain is present over 5 cm or more.

Knee flexion and extension ROM were measured after reaching a firm-end feel with the patient in the supine position using a goniometer.

The *strength* of the knee flexors and extensors were measured with the patient in supine performing the movement against resistance and grading it according to the grades (0= no visible contraction and 5= full ROM again gravity and maximal resistance).

The navicular drop test was performed after marking the navicular tuberosity with the subject sitting in a chair and the feet on the ground (non-weight bearing) in neutral subtalar position. The distance from

the prominence to the floor was then measured. This test was repeated with the subject standing on both feet, shoulder width apart (weight bearing) and the two measurements were subtracted for further analysis. [10,11]

Participants were also subjected to MTSS score. The MTSS score helps in diagnosing the syndrome and is designed to evaluate the treatment outcomes. It consists of 15 items ranging from the score 0 to 10 (0= strongly disagree with pain present, 10= strongly agree with pain present). [2]

DATA ANALYSIS

Statistical procedure was carried using statistical package for the social sciences (spss version 16). Shapiro wilk test was used to assess the data normality. Descriptive statistics including the demographic values, ROM, MMT and Navicular drop test was represented as mean and standard deviation. As the data was not normally distributed, Spearman's rank correlation test was performed to find the correlation between MTSS score and risk factors. For all these statistical treatments, the level of significance was set up at $p<0.05$.

RESULTS

In total, 52 recreational runners participated in the study, 27 male and 25 female. Training routine including warm up and cool down was meticulously followed by only 22 (42.31%) recreational runners out of 52. Gradual increase in the pace of running was followed by majority of the participants. Modifications in the frequency and intensity of the exercise program were followed by all the participants and the change in the routine was performed once in 15 days. Uphill running was the preferred training terrain among the participants. 33 (61.53%) out of 52 participants complained of pain post run and 29 (55.76%) out of 52 had shoes specifically designed for marathon running.

Table 1: Demographic Values And Physical Examination

Variable	Mean±SD	n (%)
Age (years)	34±8.17	
Body fat %	25±10.60	
BMI (kg/m2)	23±9.40	
Palpation		Present: 22 (42.30%) Not present: 30 (57.69%)
ROM (knee flexion)	124±7.28	
MMT	4.42±1.07	

Table 2: Foot Posture Assessment Using Navicular Drop Test And MTSS Score

Category	Frequency (n)	MTSS score (Mean±SD)
Pronated	15	3.93±1.38
Supinated	28	0.71±1.04
Neutral	9	0.22±0.44
Total	52	1.55±1.87

The demographic values and physical examination are represented in table 1. Descriptive statistics showed an increase in the body fat % and the BMI ranged from normal to obese. Pain while palpation was experienced by 42.30% recreational runners at the posteromedial tibial border. The physical examination revealed that the participants with reduced ROM had reduced muscle strength. Table 2 evaluates the navicular drop and abnormal foot postures among recreational runners and MTSS score is represented. 53.84% and 28.85% recreational runners had supinated and pronated foot respectively but MTSS score was observed higher in recreational runners with pronated feet.

Table 3: Correlation Between MTSS Score And Risk Factors

Variable	r*	p-value**
Body fat %	.266	0.057
Palpation	-.818	0.000
ROM	-.320	0.021
MMT	-.494	0.000
NDT	-.232	0.098

*Correlation coefficient
**p-value<0.05

Correlation between MTSS score and the risk factors are represented in Table 3 and it is found to be significant. Except for body fat%, the other risk factors showed a negative correlation with the MTSS score. The strength of relationship between MTSS score and palpation, ROM, MMT and NDT is strong, weak, moderate and weak respectively suggesting that pain is present on palpation, reduced ROM and reduced strength can lead to MTSS. A weak positive relationship is noted between body fat% and MTSS score suggesting increased fat % can lead to MTSS.

DISCUSSION

In this study, factors that increase the risk of developing MTSS among 52 recreational runners were screened. Our main findings indicate that the development of MTSS is multifaceted involving an increase in BMI and body fat%, pain present during palpation, reduced knee ROM and strength along with foot deformities. All these findings were compared with MTSS score which specifically measures shin pain. In the current study, an average MTSS score of greater than 1 out of 10 and a score greater than 3 out of 10 were found in athletes with pronated foot.

Body fat % of the athletes was on the higher side of scale and showed a significant positive correlation implicating that the runners are more prone to MTSS and the BMI was high which is one of the common risk factors for developing MTSS. Both these variants were found to be greater in athletes with higher MTSS score. Singh R et al concluded in his study that higher BMI and female gender were shown to be associated with an increased incidence of MTSS symptom due to repeated movements/ micro damage causing bone adaptation. [12] Dynamic forces produced by muscle on bone during strengthening provide greatest stimuli for osteogenesis. However, when load exceeds the bone micro damage threshold, injury can occur. [13]

Focussing on the risk factors, palpation was done on the posteromedial tibial border where 42% of the individuals had a positive palpatory result. M winters et al stated that when recognisable pain present on palpation over 5 cm or more and no atypical symptoms were present, the diagnosis of MTSS was confirmed. [9] A significant strong negative correlation was found in all the runners with greater MTSS score.

Navicular drop is often used as a measure of foot pronation and arch height. Pronation is thought to be a protective mechanism during running because of decrease in tibial rotation and it allows for impact forces to be decreased. An increased navicular drop has been found as a risk factor in many systematic reviews and meta-analysis. [3,7] The current study compared the navicular drop test with MTSS score and found a significant negative correlation in athletes with higher navicular drop. Singh R et al stated that excessive pronation at the subtalar joint contributed to the altered biomechanics of running and changed the normal stresses placed on the tibia. This tendency of altered biomechanics that predisposes structures to anatomical damage is characteristic of stress injuries, including MTSS. [12]

Various studies have confirmed that reduced ROM at the hip and ankle joint are risk factors for developing MTSS and only few have reported about knee ROM. [3,7,13] Current study included the measurement of knee flexion ROM and found it to be reduced only in athletes with higher navicular drop and showed a significant relationship. These findings were similar with a systematic review done by Claudia Menéndez et al which concluded that reduced knee flexion as a statistical contributing factor to MTSS. [3] M winters et al stated that reduced knee flexion and hip abduction are associated with MTSS. [9] Athletes with reduced ROM even showed a decrease in muscle strength and showed a significant negative correlation suggesting a decrease in muscle strength due to higher navicular drop. Studies have shown that hip abductor muscles play a critical role in preventing the injuries at knee joint [4] but none mentions about the muscles surrounding the knee joint. Hence, this requires further exploration.

LIMITATION

Main limitation of our study was that the sample size was too small. A generalized body fat% was assessed and factor analysis of individual items of the questionnaire was not done.

CONCLUSION

MTSS is a common overuse injury affecting many recreational athletes. Various risk factors contribute to the development of MTSS including higher BMI and body fat%, pain present on palpation, higher navicular drop, reduced ROM and muscle strength. These risk factors showed significant relationships with MTSS score suggesting that MTSS score can be used as a primary outcome measure to diagnose MTSS. Though individual items of the questionnaire were not analyzed it is recommended that further studies should be done using MTSS score.

Conflict Of Interest
The author(s) have no conflicts of interest relevant to this paper.

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REFERENCES

1. Brotzman B. Clinical Orthopaedic Rehabilitation (2003)-S. Brotzman, KE Wilk.
2. Winters M. Medial tibial stress syndrome: diagnosis, treatment and outcome assessment (PhD Academy Award). British journal of sports medicine. 2018 Mar 23.
3. Menéndez C, Batalla L, Prieto A, Rodríguez MÁ, Crespo I, Olmedillas H. Medial Tibial Stress Syndrome in Novice and Recreational Runners: A Systematic Review. International Journal of Environmental Research and Public Health. 2020 Jan;17(20):7457.
4. Becker J, Nakajima M, Wu WF. Factors Contributing to Medial Tibial Stress Syndrome in Runners: A Prospective Study. Medicine and science in sports and exercise. 2018 Oct 1;50(10):2092-100.
5. Mattock J, Steele JR, Mickle KJ. A protocol to prospectively assess risk factors for medial tibial stress syndrome in distance runners. BMC Sports Science, Medicine and Rehabilitation. 2018 Dec;10(1):1-0.
6. Bliekendaal S, Moen M, Fokker Y, Stubbe JH, Twisk J, Verhagen E. Incidence and risk factors of medial tibial stress syndrome: a prospective study in Physical Education Teacher Education students. BMJ open sport & exercise medicine. 2018 Oct 1;4(1):e000421.
7. Reinking MF, Austin TM, Richter RR, Krieger MM. Medial tibial stress syndrome in active individuals: a systematic review and meta-analysis of risk factors. Sports health. 2017 May;9(3):252-61.
8. Gallo RA, Plakke M, Silvis ML. Common leg injuries of long-distance runners: anatomical and biomechanical approach. Sports health. 2012 Nov;4(6):485-95.
9. Winters M. The diagnosis and management of medial tibial stress syndrome. Der Unfallchirurg. 2020 Jan;123(1):15-9.
10. Vinicombe A, Raspovic A, Menz HB. Reliability of navicular displacement measurement as a clinical indicator of foot posture. Journal of the American Podiatric Medical Association. 2001 May;91(5):262-8.
11. Moen MH, Bongers T, Bakker EW, Zimmermann WO, Weir A, Tol JL, Backx FJ. Risk factors and prognostic indicators for medial tibial stress syndrome. Scandinavian journal of medicine & science in sports. 2012 Feb;22(1):34-9.
12. Singh R. Medial tibial stress syndrome: who's at risk? a systematic review. J Phys Med Rehabil Disabil. 2016;2:014.
13. Winkelmann ZK, Anderson D, Games KE, Eberman LE. Risk factors for medial tibial stress syndrome in active individuals: an evidence-based review. Journal of athletic training. 2016 Dec;51(12):1049-52.