***Journal of Advanced Sport Technology*** *7(2):1-11.*

*Received: April, 16, 2023* *Accepted: June, 23, 2023*

**Original Research**

# The Effects of Lower Leg Kinesio Taping on Ankle Proprioception, Static and Dynamic Balance in Athletes with Medial Tibial Stress Syndrome

**Farzaneh Saki[1*], Amir Shayesteh[2], Farzaneh Ramezani[3], Sareh Shahheidari[4]**

1. *Department of Exercise Biomechanics and Corrective Exercises, Faculty of Sport Sciences, Bu-Ali Sina University, Hamedan, Iran. E-mail: f_saki@basu.ac.ir, ORCID: 0000-0003-3627-1737.*
2. *Department of Exercise Biomechanics and Corrective Exercises, Faculty of Sport Sciences, Bu-Ali Sina University, Hamedan, Iran. E-mail: amir.shayesteh1371@gmail.com,ORCID: 0000-0001-6474-1164.*
3. *Department of Exercise Biomechanics and Corrective Exercises, Faculty of Sport Sciences, Bu-Ali Sina University, Hamedan, Iran. E-mail: f.ramezani@phe.basu.ac.ir, ORCID: 0000-0001-9368-4103.*
4. *Department of Sort Injury and Corrective Exercises, Faculty of Sport Sciences, Guilan University, Rasht, Iran. E-mail:sarehshahheidari@gmail.com, ORCID: 0000-0001-7933-8239.*

## ABSTRACT

Medial Tibial Stress Syndrome (MTSS) is an injury caused by vigorous exercise along the posterior medial part of the tibia. Kinesio Taping (KT) has emerged as a preferred approach for the management of MTSS due to its non-invasive, minimal discomfort, less time-consuming, and lower side effects. It has been used as a therapeutic tool in prevention and rehabilitation protocols. The purpose of this study was to investigate the effects of lower leg KT on ankle proprioception, static and dynamic balance in athletes suffering from MTSS. Thirty-two male athletes (20 – 32 years old) with MTSS participated in this study. They were randomly divided into two experimental (KT) and control (placebo) groups. The way athletes entered the study was based on the leg pain questionnaire based on Yates and White criteria. Measurement tools included a universal goniometer, a single-leg stance test, and a Y-balance test. Ankle proprioception, static and dynamic balance were measured in both groups before and after 24 hours of use of lower leg KT. The results showed that lower leg KT was effective in improving the ankle proprioception of dorsiflexion and plantar flexion, static and dynamic balance in athletes with MTSS and the difference between the experimental and control groups in all study variables was significant. Based on the findings of this study, it can be suggested that athletes with MTSS use lower leg KT to enhance their proprioception and balance, which could lead to improved performance.

**Keywords**: Shin splints, Overuse injury, Kinesio tape, Proprioception, Balance.

**Corresponding Author:** Farzaneh Saki, Department of Exercise Biomechanics and Corrective Exercise, Faculty of Sport Sciences, Bu-Ali Sina University, Hamedan, Iran. Email: f_saki@basu.ac.ir. Tel: +989188503783

## INTRODUCTION

Medial tibial stress syndrome (MTSS) is pain and irritation in the tibia caused by repetitive strain. From a clinical point of view, MTSS is considered a separate injury from stress fracture, chronic compartment syndrome, and other neuropathies affecting the distal region of the lower leg [1]. In this syndrome, after any intense physical activity that puts a lot of pressure on the lower leg, the muscles around the tibia become inflamed and painful. MTSS is also known as periostitis, shin splints, and exercise-related lower leg pain. Anatomical structures that are the common location of symptoms of this syndrome include more than one-third to one-half of the distal region of the medial posterior border of the tibia, soleus muscle, flexor hallucis longus, and deep fascia of the crural [2]. This syndrome is one of the most common injuries caused by overuse, which has a high prevalence in runners and young athletes of 20 to 30 years of age. Studies have shown that this complication has a prevalence of 13.6 to 20% among runners [3].

Generally, the risk factors causing this syndrome are divided into two groups: intrinsic and extrinsic risk factors. Extrinsic risk factors are related to the duration and intensity of exercises, history of activity, inappropriate shoes, and hard and uneven surfaces. Intrinsic factors also include an increase in body mass, a decrease in the foot arch, a drop in navicular, an increase in foot pronation, an increase in range of motion of ankle plantar flexion, an increase in external rotation of the hip joint during flexion in men [4], kinematic changes in the forefoot and hindfoot [5] and high and prolonged soleus muscle activity during the acceleration phase of running, and biomechanical alterations when running [3, 6, 7].

Some researchers believe that the low biomechanical changes at the base of support affect balance and postural control [8]. It has been reported that there are noticeable changes in balance, especially medial-lateral stability in the military with MTSS. In some studies, the importance of proprioception as the most critical system for balance control and stability is emphasized through two feedback and feed-forward mechanisms [9]. Scientists believe that shin splint pain in the posterior and medial areas of the lower leg reduces people's proprioception and performance. So that the stimulation of pain receptors causes disrupted reports from the proprioceptive to the central nervous system. As a result, proprioception information is not properly analyzed [10].

Generally, it is difficult to prevent MTSS, because its causes are not fully recognized. But for a long time, kinesio taping (KT) has been used by elite athletes to provide mechanical support for the musculoskeletal system for injury prevention and post-rehabilitation [11, 12]. KT is a thin tape that has elastic properties similar to the skin, which allows it to function in its natural range of motion [13]. In athletes, strong proprioceptive feedback is required not only from muscles but also from other proprioceptive sources such as the skin. KT has been reported to increase proprioceptive information due to direct contact with the skin [14]. KT is more flexible than traditional orthopedic tapes, covers a wider area, and can be used for a longer time [15].

Most of the studies on the effectiveness of KT have been done on healthy people. Results of a meta-analysis showed that KT can lead to improvement in strength, force sense error, and active range of motion, but does not have a significant effect in improving pain or joint position sense of the lower extremity [16]. Studies that have examined the effects of KT on injury have shown mixed results for pain in the foot [17], knee [18-20], and shoulder [21, 22]. In a recent study focusing on college athletes with chronic ankle instability, researchers looked at how ankle KT affected the biomechanics of single-leg drop landing. The results showed that ankle KT caused a reduction in ankle joint range of motion, ground reaction force rate of loading, and mediolateral time to stability. It can also lower calf muscle energy consumption and aid in dynamic balance [23]. Although the use of KT is popular to treat musculoskeletal injuries, there is still a research gap investigating its effect on MTSS. Because research documents in this field are limited, and their results are conflicting. In addition, no standard has been found for the tape, duration, direction, tension, and location of attaching the tape [15]. Therefore, the purpose of this research is to examine the effect of lower leg KT on proprioception of dorsiflexion and plantar flexion, static and dynamic balance in athletes with MTSS. We hypothesize that the application of KT may increase ankle proprioception and balance. One major benefit of our research was including a sham treatment option. If it is effective, this method can be used as a solution to expedite the rehabilitation of this injury, which sometimes takes between 9 and 12 months to recover [24], in improving proprioception and balance.

## MATERIAL AND METHODS

The statistical population of this study contained male track and field athletes from Hamedan city, Iran, aged between 20 and 32 years, who were selected purposefully. The statistical sample included 32 people with MTSS, 16 people were in the experimental group (KT) and 16 people were in the control group (placebo). The G-Power software (version 3.1.9.2) was used to calculate the sample size required for this study. With a medium effect size of 0.35, an alpha level of 0.05, and a power of 0.8, a minimum of 24 participants were necessary, and because of the dropout, 32 people were considered for the sample size [25]. The way athletes entered the study was based on the criteria of Yates and White, who had to complete a questionnaire related to shin splint pain [1] to check their conditions to enter the study. To ensure the participants' consent to participate in this study, a written consent form was provided to them. All the potential risks of the test were explained to the participants. The athletes present in the study were free to participate or not participate in the test, and after declaring their cooperation, they could withdraw from the research anytime they wanted. The inclusion criteria of the study include diffuse pain over five centimeters in the distal two-thirds of the medial-posterior part of the tibia, itching in the anterior muscles of the tibia, the onset of pain based on palpation of the medial-posterior part of the tibia, pain remaining for more than a few days, the feeling of pain reduction during warm-up and its intensification with the increase of training intensity, the feeling of the inside blade of the shin bone being uneven due to touch [24]. Participants who possessed these conditions in any of their limbs met the criteria to be included in the study. Exclusion criteria included fractures, surgery, and other musculoskeletal injuries in the lower extremities during the previous six months, balance disorders (caused by problems other than MTSS), and participation in lower leg and ankle rehabilitation programs in the last six months.

### Process of Study

After selecting the participants, the single-leg stance test was used to measure static balance, and the Y-balance test was used for dynamic balance. Ankle proprioception was also measured with a goniometer. Then, KT was applied to the affected lower leg muscle, and 24 hours after its continuous use, the previous tests were performed again. During 24 hours, participants were allowed to continue with their usual daily activities.

### Assessment of Balance Tests

Participants' static balance was assessed using the single-leg stance test. After the warm-up, the participants stood barefoot on the affected foot [26], and the heel was slightly removed from the ground. The other leg was bent from the knee and placed next to the support leg's knee. Both hands were placed on the hip joint. The time from the moment of starting this state to the disruption of the balance was recorded in seconds. If the participant's foot was separated from the knee, hopped, the heel of the support foot hit the ground, or the hands were separated from the waist, time would stop. Before the test, the participants were allowed to practice how to perform the test. For each participant, two measurements were taken and the better performance was noted as their record [27].

The Y-balance test was used to measure dynamic balance. The kit used for this test included a central plate (on which the test foot was placed) and three arms in the anterior, posteromedial, and posterolateral directions. The angle between the anterior direction and the other two directions is 135 degrees. The angle between the posteromedial and posterolateral directions is 90 degrees. The participant stands in the center of the kit with the MTSS foot. The other foot performed maximum reach without error in the direction chosen by the examiner and returned to the initial position. Before the assessment, each participant practiced and performed the test twice. After five minutes of rest, the participant performed the test three times. The distance between where the foot touched and the center of the Y-balance test was measured in centimeters and an average was recorded. Then, the average record was divided by the leg length and multiplied by 100 to get the reach distance as a percentage of the leg length. The errors of this test included: moving the foot that was in the center, disturbing the person's balance and placing the soles of the feet on the ground, and removing the hands from the hip [4].

## Assessment of Ankle Proprioception

A 360-degree plastic goniometer was used to evaluate ankle proprioception and restore joint position sense. The participant sat on the chair in such a way that the angle formed by the trunk with the hip and the thigh with the knee was 90 degrees. The height of the chair was high enough so that the person's feet did not touch the ground. During the test, the person was leaning on the back of a chair and his head and neck were fixed and motionless in alignment with his body. Afterward, the goniometer was positioned in the center of the lateral malleolus. The stationary arm of the goniometer was set in line with the fibula and the moving arm was set parallel to the fifth metatarsal bone. Then, the participant was asked to move his ankle three times to the target angle with his eyes open. He was also asked to keep it in the same position for five seconds and keep it in his short-term memory. Also to remove the visual intervention during the measurement, the participant was asked to close his eyes. After seven seconds, he actively moved his ankle and restored the target angle. When he reached the target angle, he said the word "here" and informed the examiner. The amount of difference between the angle restored by the participant and the target angle was recorded as the error angle in ankle joint motion (joint position sense error) regardless of the positive or negative direction of the error. Each angle was repeated twice. Finally, the average of the two error angles was recorded as the major record. In this study, the target angles in dorsiflexion and plantar flexion movements were considered to be 10 and 20 degrees, respectively [28].

## Intervention

In this study, two types of KT were used: purple KT with 75% tension in the experimental group, and yellow KT without tension in the placebo control group. Before using the KT, the participants' tibia hair was shaved. The medial-posterior part of the tibia was cleaned from top to bottom with alcohol-soaked cotton. KT application method for both groups on the affected foot: first, the KT was cut in a Y-shape. The tape application was applied to the proximal third of the medial part of the tibia affected by MTSS. Then, one-half of the Y-shaped strip passed over the anterior part of the tibia and the medial malleolus. The other half passed over the posterior part of the leg and inner ankle and ended under the medial longitudinal arch of the foot (Fig.1) [29].

Fig. 1. Kinesio taping application method

## Statistical Analysis

The Shapiro-Wilk test assessed data distribution normality. Mean and standard deviation were used for descriptive statistics. The independent t-test was used to check the homogeneity of groups in demographic information. To examine whether there was any association between the KT and placebo groups and the

pre- and post-intervention time factors, a repeated measures ANOVA was employed. Furthermore, in order to evaluate the discrepancies within the KT and placebo groups independently, the paired t-tests were utilized to compare the pre-test and post-test. All statistical analyses performed in SPSS® 26 software at the significance level were set to 95% ($P < 0.05$).

## RESULTS

The results of the Shapiro-Wilk test showed the normality of the data ($p \geq 0.05$). The demographic information of both groups and the results of the independent t-test are presented in Table 1. The results of this test showed that there is no significant difference between the groups in terms of demographic characteristics.

**Table 1. The demographic characteristics of the participants (mean ± SD).**

| | Experimental Group (KT) | Control Group (placebo) | P-value |
|---|---|---|---|
| **Age (years)** | 26.25 ± 3.94 | 24.63 ± 2.72 | 0.18 |
| **Height (cm)** | 176.12 ± 5.53 | 180.00 ± 6.16 | 0.07 |
| **Body mass (kg)** | 76.62 ± 11.06 | 79.45 ± 11.66 | 0.49 |

Results from repeated measure ANOVA displayed significant interaction effect of group * time in ankle proprioception of dorsiflexion ($p = 0.001$, $\eta^2 = 0.458$) and ankle proprioception of plantar flexion ($p = 0.001$, $\eta^2 = 0.637$), static balance ($p = 0.004$, $\eta^2 = 0.247$), total dynamic balance ($p = 0.001$, $\eta^2 = 0.352$), dynamic balance in anterior direction ($p = 0.001$, $\eta^2 = 0.298$), posteromedial direction ($p = 0.006$, $\eta^2 = 0.227$) posterolateral direction ($p = 0.002$, $\eta^2 = 0.284$; Table 2).

The results of the paired sample t-test demonstrated that the ankle position sense error decreased and static and dynamic balance increased in the KT group from pre-test to post-test ($p < 0.05$; Table 2).

**Table 2. The effect of KT on ankle proprioception, static and dynamic balance.**

| | Experimental Group (KT) mean ± SD | | | Control Group (placebo) mean ± SD | | | Group*time | | |
|---|---|---|---|---|---|---|---|---|---|
| | ***Pre test*** | ***Post test*** | ***$p^1$*** | ***Pre test*** | ***Post test*** | ***$p^1$*** | ***F(1,30)*** | ***$p^2$*** | ***$\eta^2$*** |
| **Proprioception (dorsiflexion) (°)** | 3.73 ± 0.61 | 2.67 ± 0.39 | 0.001* | 3.78 ± 0.88 | 3.74 ± 0.51 | 0.79 | 28.26 | 0.001* | 0.458 |
| **Proprioception (plantar flexion) (°)** | 4.37 ± 0.85 | 3.03 ± 0.58 | 0.001* | 4.46 ± 0.79 | 4.31 ± 0.74 | 0.21 | 52.60 | 0.001* | 0.637 |
| **Static balance (s)** | 10.87 ± 7.39 | 18.37 ± 9.36 | 0.001* | 11.23 ± 5.05 | 12.10 ± 6.38 | 0.60 | 9.83 | 0.004* | 0.247 |
| **Total Y-balance test (cm)** | 92.11 ± 7.59 | 99.36 ± 4.25 | 0.001* | 92.30 ± 6.86 | 93.05 ± 3.84 | 0.50 | 16.29 | 0.001* | 0.352 |
| **Anterior direction of Y-balance test (cm)** | 78.3 ± 5.5 | 83.53 ± 4.85 | 0.001* | 79.36 ± 6.52 | 79.91 ± 5.19 | 0.64 | 12.73 | 0.001* | 0.298 |
| **Posteromedial direction of Y-balance test (cm)** | 97.97 ± 9.42 | 105.64 ± 5.9 | 0.001* | 97.48 ± 8.72 | 99.17 ± 5.01 | 0.22 | 8.80 | 0.006* | 0.227 |
| **Posterolateral direction of Y-balance test (cm)** | 100.05 ± 9.47 | 108.92 ± 5.52 | 0.001* | 100.05 ± 9.07 | 100.08 ± 5.89 | 0.98 | 11.89 | 0.002* | 0.284 |

$P^1$: The P value was derived from a paired t-test (within group comparison)
$P^2$: The P value was derived from a mixed repeated measure ANOVA (within-between group interactions)

## DISCUSSION

The purpose of this study investigates the effect of lower leg KT on the variables of proprioception and balance in athletes with MTSS. Results of this study showed that there is a significant difference between the experimental group (KT) and the control group (placebo) in the average variables of proprioception of dorsiflexion and plantar flexion, static and dynamic balance. In this study balance and ankle proprioception were improved by using KT in male athletes with MTSS.

A previous study found that individuals with MTSS have reduced ankle proprioception [9]. For runners with MTSS, improving proprioception of dorsiflexion and plantar flexion is crucial, as it allows for better ankle motion control and reduces stress on the tibial periosteum and bone [30]. Proprioception refers to the sense of position and movement of body parts and is vital for maintaining balance and coordination while running [30]. Dorsiflexion and plantar flexion involve raising and lowering the foot at the ankle joint, respectively, and are important for absorbing impact forces, generating propulsion, and adapting to different terrains [31]. Runners with MTSS may have impaired proprioception due to pain, inflammation, and biomechanical abnormalities [32], which can affect ankle stability and alignment, increase the risk of excessive pronation and decreased ankle dorsiflexion, and elevate hip adduction [32]. These factors can also increase negative tibial bending and stress on the tibial periosteum and bone [32]. Based on this information and current study findings, KT can aid in restoring ankle motion and posture, enhancing overall stability and coordination while running, and preventing excessive loading on the lower extremity by improving proprioception of dorsiflexion and plantar flexion.

The application of KT was found to increase static balance and Y-balance scores in three directions in individuals with MTSS after 24 hours of use, according to our study. This improvement is significant as it can help restore functional symmetry and reduce injury risk in runners with MTSS [33]. Additionally, it can correct alignment and posture, improve stability and coordination, and prevent excessive loading on the lower extremity [34]. Maintaining static balance is crucial for runners as it contributes to dynamic balance during movement. Runners with MTSS may have weak dynamic balance due to pain, inflammation, and biomechanical abnormalities [24, 31]. Improving Y-balance scores in all directions can help runners restore stability and coordination, enhance efficiency and speed, and reduce stress on the tibial periosteum and bone [24, 34]. The three directions - anterior, posteromedial, and posterolateral reaches - measure the ability to control sagittal, frontal, and transverse plane motion of the lower extremity and trunk, as well as hip adduction, internal rotation, abduction, and external rotation [34]. Improving these abilities can help runners adapt to varied surfaces and conditions, such as uneven terrain, turns, hills, and obstacles [24]. In conclusion, our study highlights the positive impact of KT application on Y-balance scores and static balance in individuals with MTSS after 24 hours of use.

The most common MTSS treatments are traditional, supported by limited evidence in background literature. These treatments include cold therapy, strengthening and stretching exercises, non-steroidal anti-inflammatory drugs, and adjustment of exercise programs to be considered individually for each person, use of orthosis to correct biomechanical abnormalities, and rest [6]. Sports KT is a temporary therapeutic technique or assisted mechanism for post-injury rehabilitation. KT is a modern and new approach to tapping, which is a solution for athletes to be active despite micro-injuries, faster recovery from serious injuries, and an ideal method in therapeutic tool [11]. KT is effective in reducing pain, improving proprioception, joint stability, muscle function, and correcting improper movement patterns. It is therefore beneficial in the prevention and management of sports-related injuries [15]. KT helps athletes return to their sport without experiencing pain or discomfort. This is due to its ability to facilitate blood circulation by increasing interstitial space and reducing interstitial fluid. It also enhances the function of the lymphatic system and reduces pain and muscle tension through neurological mechanisms [35]. The theory of gate control and the folding effect explains the hypothesized mechanisms for the pain-reducing effect of KT such that KT can reduce nerve fiber input of sensitive transmission by increasing stimulation of the sensory pathway and thus increasing afferent feedback. According to the theory of folding effect, KT, by stretching the skin, directly reduces pressure in the subcutaneous pain receptors. The effects of pressure and tension created on the skin by KT stimulate mechanical receptors that transmit information about the position and

movement of the joint and strengthen proprioception [15]. In fact, it stimulates the skin receptors and enhances the feedback from the muscles and joints to the brain, which can improve proprioception and neuromuscular control. This can help with postural control and coordination. Also, KT improves proprioception by shortening the distance between the origin and the insertion of the muscle and correcting the length-tension relationship [36].

Research on the impact of KT on proprioception in healthy individuals has overwhelmingly suggested that KT does not significantly affect proprioception [37-39]. However, studies have shown that individuals with sprains and instability of the ankle [14], patella-femoral syndrome [40], knee arthritis in elderly individuals [41], and anterior cruciate ligament rupture [42] have experienced improvements in proprioception upon using KT. While studies on the effect of KT on balance in healthy individuals and athletes have generally found no significant impact [43, 44], one study showed that balance was immediately improved after KT application [45]. Additionally, individuals with various conditions like MTSS [46], patellofemoral pain syndrome [47, 48], chronic ankle instability [49, 50], acute ankle sprain [51], and anterior cruciate ligament rupture [42] reported increased balance after using KT. Studies examining the effect of KT on posture control and posture swing in healthy and injured individuals have yielded conflicting results; some have shown increased postural control and decreased postural swing [52, 53]. The diversity in results across studies can be attributed to differences in KT application methodology and location, variations in the tests and assessment tools used, and other factors. Therefore, without taking these differences into account, it is not reasonable to compare study results.

One major benefit of the current research was including a sham treatment option, whereas its limitations absence of female participants due to the homogeneity of the subjects in terms of gender, coach and exercise training, the lack of accurate control of the participants' daily activity and rest, and the lack of examining the long-term effect of the KT, it is suggested that researchers consider these issues in their future studies.

## CONCLUSION

The study demonstrated the efficacy of lower leg KT in enhancing the proprioception of dorsiflexion and plantar flexion as well as static and dynamic balance among MTSS-afflicted athletes. Elevating proprioception and balance levels has the potential to enhance overall athletic performance. As a result of this study's outcomes, it is recommended for MTSS-suffering athletes employ the lower leg KT technique implemented in this research to enhance their proprioceptive and balancing abilities.

**Author Contributions:** Conceptualization, methodology, FS, ASH; formal analysis, FS, ASH; investigation, ASH; resources, FS, ASH; data curation, FS, ASH, SSH, FR; writing—original draft preparation, FS, SSh, FR; writing—review and editing, FS, FR; supervision, FS;
project administration, FS, ASH. All authors have read and agreed to the published version of the manuscript.

**Funding:** This research received no external funding.

**Institutional Review Board Statement:** This study was approved by the study Ethics Committee of BU-Ali Sina University, Hamedan, Iran (IR.BASU.REC.1398.046) and was registered in the Iranian Registry of Clinical Trials (IRCT20210629051737N1).
**Informed Consent Statement:** Informed consent was obtained from all subjects involved in the study.

**Data Availability Statement:** Data will be available at request.

**Acknowledgments:** The authors are thankful to all the participants for their participation in this study.

## REFERENCES


1. Yates B, White S. The incidence and risk factors in the development of medial tibial stress syndrome among naval recruits. The American journal of sports medicine. 2004; 32(3): 772-780.
2. Mita T. A Review and Analysis of Current Treatment Approaches Used by Athletic Trainers for Medial Tibial Stress Syndrome. North Dakota State University. 2021; 73.
3. Hamstra-Wright KL, Bliven KCH, Bay C. 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. 2015; 49(6). 362-369.
4. Mendez-Rebolledo G. The protective effect of neuromuscular training on the medial tibial stress syndrome in youth female track-and-field athletes: A clinical trial and cohort study. Journal of sport rehabilitation. 2021; 30(7): 1019-1027.
5. Okunuki T. Forefoot and hindfoot kinematics in subjects with medial tibial stress syndrome during walking and running. Journal of Orthopaedic Research®. 2019; 37(4): 927-932.
6. Deshmukh NS, Phansopkar P, Deshmukh NS. Medial tibial stress syndrome: a review article. Cureus. 2022; 14(7).
7. Hubbard TJ, Carpenter EM, Cordova ML. Contributing factors to medial tibial stress syndrome: a prospective investigation. Medicine and science in sports and exercise. 2009; 41(3): 490-496.
8. Milgrom C. The effect of muscle fatigue on in vivo tibial strains. Journal of biomechanics. 2007; 40(4): 845-850.
9. Garcia SG. Shockwave treatment for medial tibial stress syndrome in military cadets: A single-blind randomized controlled trial. International Journal of Surgery. 2017; 46: 102-109.
10. Sedaghati P, Zolghare H, Shahbazi M. The effect of proprioceptive, vestibular and visual changes on posture control among the athletes with and without medial tibial stress syndrome. KAUMS Journal (FEYZ). 2019; 23(1): 68-74.
11. Jafarnezhadgero, A., Shad, M. M., Majlesi, M., Zago, M. Effect of kinesio taping on lower limb joint powers in individuals with genu varum. Journal of bodywork and movement therapies. 2018; 22(2), 511-518.
12. Kim T, Park JC. Short-term effects of sports taping on navicular height, navicular drop and peak plantar pressure in healthy elite athletes: A within-subject comparison. Medicine. 2017; 96(46).
13. Huang C. Effect of the Kinesio tape to muscle activity and vertical jump performance in healthy inactive people. Biomedical engineering online. 2011; 10(1): 1-11.
14. Spanos S, Brunswic M, Billis E. The effect of taping on the proprioception of the ankle in a non-weight bearing position, amongst injured athletes. The foot. 2008; 18(1): 25-33.
15. Guo S. Efficacy of kinesiology taping on the management of shin splints: a systematic review. The Physician and Sportsmedicine. 2022; 50(5): 369-377.
16. Williams S. Kinesio taping in treatment and prevention of sports injuries: a meta-analysis of the evidence for its effectiveness. Sports medicine. 2012; 42: 153-164.
17. Tsai CT, Chang WD, Lee JP. Effects of short-term treatment with kinesiotaping for plantar fasciitis. Journal of Musculoskeletal pain. 2010; 18(1): 71-80.
18. Aytar A. Initial effects of kinesio® taping in patients with patellofemoral pain syndrome: A randomized, double-blind study. Isokinetics and Exercise Science. 2011; 19(2): 135-142.
19. Campolo M. A comparison of two taping techniques (kinesio and mcconnell) and their effect on anterior knee pain during functional activities. International journal of sports physical therapy. 2013; 8(2).
20. Osorio JA. The effects of two therapeutic patellofemoral taping techniques on strength, endurance, and pain responses. Physical Therapy in Sport. 2013; 14(4): 199-206.
21. Kaya E, Zinnuroglu M, Tugcu I. Kinesio taping compared to physical therapy modalities for the treatment of shoulder impingement syndrome. Clinical rheumatology. 2011; 30: 201-207.

22. Thelen MD, Dauber JA, Stoneman PD. The clinical efficacy of kinesio tape for shoulder pain: a randomized, double-blinded, clinical trial. journal of orthopaedic & sports physical therapy. 2008; 38(7): 389-395.
23. Sarvestan J. Acute Effect of Ankle Kinesio™ Taping on Lower-Limb Biomechanics During Single-Legged Drop Landing. Journal of Sport Rehabilitation. 2020; 30(5): 689-696.
24. Winters M. The diagnosis and management of medial tibial stress syndrome: An evidence update. Der Unfallchirurg. 2020; 123(Suppl 1): 15-19.
25. Park J, Kim T. Acute effect of taping on plantar pressure characteristics in athletes with exercise-induced leg pain: a description and comparison of groups. The Physician and sportsmedicine. 2019; 47(2): 212-219.
26. Ko J. Performance differences between the modified star excursion balance test and the Y-balance test in individuals with chronic ankle instability. Journal of Sport Rehabilitation. 2019; 29(6): 748-753.
27. Kranti PB. A study to associate the Flamingo Test and the Stork Test in measuring static balance on healthy adults. The Foot and Ankle Online Journal. 2015; 8(3): 1-4.
28. Nobakht S, Seidi F, Rajabi R. A comparison of ankle joint position sense in female students with and without pronated and supinated foot. Sport Sciences and Health Research. 2016; 8(1): 99-113.
29. Griebert MC. Lower-leg Kinesio tape reduces rate of loading in participants with medial tibial stress syndrome. Physical therapy in sport. 2016; 18: 62-67.
30. Mattock J, Steele JR, Mickle KJ. Lower leg muscle structure and function are altered in long-distance runners with medial tibial stress syndrome: a case control study. Journal of Foot and Ankle Research. 2021; 14: 1-8.
31. Becker J, Nakajima M, Wu WFW. Factors Contributing to Medial Tibial Stress Syndrome in Runners: A Prospective Study. Med Sci Sports Exerc. 2018; 50(10): 2092-2100.
32. Saeki J. Ankle and toe muscle strength characteristics in runners with a history of medial tibial stress syndrome. Journal of foot and ankle research. 2017; 10(1): 1-6.
33. Kuwabara A. Evidence-Based Management of Medial Tibial Stress Syndrome in Runners. Current Physical Medicine and Rehabilitation Reports. 2021; 1-9.
34. Menéndez C. Medial tibial stress syndrome in novice and recreational runners: A systematic review. International Journal of Environmental Research and Public Health. 2020; 17(20): 7457.
35. Pourkhani T. The effect of ankle taping on dynamic stability and active range of motion in the female athletes with and without chronic ankle instability. Physical Treatments-Specific Physical Therapy Journal. 2014; 3(4): 16-23.
36. Keenan KA. Kinesiology taping does not alter shoulder strength, shoulder proprioception, or scapular kinematics in healthy, physically active subjects and subjects with Subacromial Impingement Syndrome. Physical Therapy in Sport. 2017; 24: 60-66.
37. Bailey D, Firth P. Does kinesiology taping of the ankles affect proprioceptive control in professional football (soccer) players? Physical Therapy in Sport. 2017; 25: 94-98.
38. Halseth T. The effects of kinesio™ taping on proprioception at the ankle. Journal of sports science & medicine. 2004; 3(1): 1.
39. Magalhães I. Prolonged use of Kinesiotaping does not enhance functional performance and joint proprioception in healthy young males: Randomized controlled trial. Brazilian journal of physical therapy. 2016; 20: 213-222.
40. Kooroshfard N, Alizadeh MH, Kahrizy S. The effect of patellar taping on knee joint position sense in healthy and patellofemoral pain syndrome futsalist women. The Horizon of Medical Sciences. 2011; 17(2): 29-39.
41. Cho H. Kinesio taping improves pain, range of motion, and proprioception in older patients with knee osteoarthritis: a randomized controlled trial. American journal of physical medicine & rehabilitation. 2015; 94(3): 192-200.

42. Liu K. Effects of Kinesio taping of the knee on proprioception, balance, and functional performance in patients with anterior cruciate ligament rupture: A retrospective case series. Medicine. 2019; 98(48).
43. Willeford K, Stanek JM, McLoda TA. Collegiate Football Players' Ankle Range of Motion and Dynamic Balance in Braced and Self-Adherent–Taped Conditions. Journal of athletic training. 2018; 53(1): 66-71.
44. Wilson V. The immediate and long-term effects of kinesiotape® on balance and functional performance. International journal of sports physical therapy. 2016; 11(2): 247.
45. Tomruk MS. Is Ankle Kinesio Taping Effective to Immediately Change Balance, Range of Motion, and Muscle Strength in Healthy Individuals? A Randomized, Sham-Controlled Trial. Korean Journal of Family Medicine. 2022; 43(2): 109.
46. Fadaei Dehcheshmeh T, Shamsi Majelan A. Effect of kinesio Tape on Function of Lower Extremity and Pain Severity in Athletes with and without Medial Tibial Stress Syndrome. Journal of Mazandaran University of Medical Sciences. 2016; 26(137): 105-114.
47. Hedayat M. The Effect of Patellar Taping on Balance in Patients with Patellofemoral Pain Syndrome. Jundishapur Scientific Medical Journal. 2015; 14(5): 589-597.
48. Mostamand J. Comparing the effect of kinesiology taping on dynamic balance and pain of men and women with unilateral patellofemoral pain syndrome. Archives of Rehabilitation. 2020; 21(4): 470-487.
49. Raeisi S. The Effect of Kinesio Tapping and Neuromuscular Exercises on Balance, Function and Pain in Basketball players with Ankle Instability. Anesthesiology and Pain. 2020; 11(3): 98-113.
50. Jackson K, Simon JE, Docherty CL. Extended use of kinesiology tape and balance in participants with chronic ankle instability. Journal of athletic training. 2016; 51(1): 16-21.
51. Yousefpour K, Shojaedin S. Determining the effectiveness of Kinesio Taping on balance in athletes with acute sprain and chronic ankles instable. 2015.
52. Choi HS, Lee JH. Immediate effect of balance taping using kinesiology tape on dynamic and static balance after ankle muscle fatigue. in Healthcare. 2020. MDPI.
53. Kodesh E, Cale'Benzoor M, Dar G. Effect of dynamic tape on postural sway in individuals with chronic ankle instability. Journal of Bodywork and Movement Therapies. 2021; 28: 62-67.

# تأثیر کینزیوتیپ ساق پا بر حس عمقی مچ پا و تعادل ایستا و پویا ورزشکاران مبتلا به سندرم استرس داخلی تیبیا

فرزانه ساکی*[1]، امیر شایسته[1]، فرزانه رمضانی[1]، ساره شاه حیدری[2]

۱. گروه بیومکانیک ورزشی و آسیب شناسی ورزشی و حرکات اصلاحی، دانشکده علوم ورزشی، دانشگاه بوعلی سینا، همدان، ایران.

۲. گروه آسیب شناسی ورزشی و حرکات اصلاحی، دانشکده تربیت بدنی و علوم ورزشی، دانشگاه گیلان، رشت، ایران.

**چکیده:** سندرم استرس داخلی تیبیا (MTSS) یک آسیب ناشی از ورزش شدید در طول لبه خلفی - داخلی تیبیا است. کینزیوتیپ (KT) به دلیل غیرتهاجمی بودن، ایجاد کمترین ناراحتی، تأثیرگذاری در زمان کم و عوارض جانبی محدود، به‌عنوان یک رویکرد ترجیحی برای مدیریت MTSS ظاهر شده است. از KT به‌عنوان یک ابزار درمانی در پروتکل‌های پیشگیری و توانبخشی استفاده شده است. هدف از این مطالعه بررسی تأثیر KT ساق پا بر حس عمقی مچ پا، تعادل ایستا و پویا ورزشکاران مبتلا به MTSS بود. در این مطالعه نیمه‌تجربی ۳۲ ورزشکار مرد (۲۰ تا ۳۲ ساله) مبتلا به MTSS شرکت کردند. آنها به طور تصادفی به دو گروه تجربی (KT) و کنترل (دارونما) تقسیم شدند. نحوه ورود ورزشکاران به مطالعه بر اساس پرسش‌نامه درد ساق پا بر اساس معیار یاتس و وایت بود. ابزارهای اندازه‌گیری شامل گونیامتر پلاستیکی، تست ایستادن تک پا، و تست تعادل Y بود. حس عمقی مچ پا، تعادل ایستا و پویا در هر دو گروه قبل و بعد از ۲۴ ساعت استفاده از KT ساق پا اندازه‌گیری شد. نتایج نشان داد که KT ساق پا در بهبود حس عمقی دورسی‌فلکشن و پلنتارفلکشن مچ پا، تعادل ایستا و پویا در ورزشکاران مبتلا به MTSS مؤثر است همچنین تفاوت بین گروه تجربی و کنترل در تمامی متغیرهای موردمطالعه معنی‌دار بود. بر اساس یافته‌های این مطالعه، پیشنهاد می‌شود که ورزشکاران مبتلا به MTSS از KT ساق پا برای تقویت حس عمقی و تعادل خود استفاده کنند؛ زیرا بهبود این متغیرها می‌تواند منجر به بهبود عملکرد آن‌ها شود.

**واژه‌های کلیدی:** شین اسپلینت، آسیب استفاده بیش از حد، **کینزیوتیپ**، حس عمقی، تعادل.