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A comparative study on efficacy of antipronation taping Vs orthosis in medial tibial stress syndrome

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Abstract

Objective: Physical examination of athletes involves in field and track event consistently demonstrates overuse injuries of lower limb. Hyperpronation is found to be ultimate culprit in the development of overuse injuries such as Medial tibial stress syndrome (MTSS), Compartment syndrome and Stress fractures. There is a dearth of studies conducted on the athletes for reducing hyperpronation. This study endeavors to compare the effect of antipronation taping and orthosis on Medial tibial stress syndrome. **Methods:** Total 30 subjects with mean age of 20.96±2.46 years participated in the current study, who presented with symptoms of MTSS. These subjects were randomly allocated to two groups: Group A and B (n=15) and given antipronation taping and orthosis respectively. The outcomes of the study were assessed by using navicular drop test, visual analogue scale and hop distance. Total duration of study was for one week. R**esults**: Group-A i.e. antipronation taping group has shown the more improvement as compared to group B i.e orthosis group in pain and hop distance, whereas there was no significant difference in navicular drop test between both groups. Both groups were benefited by treatment but response from orthosis was slower than the taping. **Conclusion**: Overall our study indicates that augmented low dye taping and orthosis along with stretching and strengthening exercises were useful technique for reducing pain and improving functional activity, suggests that biomechanical factors play an important role in etiology and should be considered, while giving treatment to these patients. There was improvement in both group, but improvement was much better in participants who received augmented low dye taping.

Key Words: Medial Tibial Stress Syndrome, Shin Splint, Antipronation Taping, Orthotics

INTRODUCTION

Medial tibial stress syndrome (MTSS), commonly known as 'shin splints', is a frequent injury of the lower extremity and one of the most common causes of exercise- related leg pain in athletes.[1] It is reported that MTSS is one of the most common causes of exerciserelated leg pain. It has been reported that MTSS injuries comprised 13.1% of all running.[2] Medial Tibial Stress Syndrome is described as pain along the distal two-thirds of the posterior medial border of the tibia, as a result of periostitis (i.e. inflammation of the periosteum). Pain is often described by patients as a dull ache to intense pain that is exacerbated with repetitive weight-bearing activities, and may be continuous or intermittent.[3] Many believe the main cause of MTSS involves underlying periostitis of the tibia due to tibial strain when under a load. However, new evidence indicates that a spectrum of tibial stress injuries is likely involved in MTSS, including tendinopathy, periostitis, periosteal remodeling, and stress reaction of the tibia. Dysfunction of the tibialis posterior, tibialis anterior, and soleus muscles are also commonly implicated.[4-6] These various tibial stress injuries appear to be caused by alterations in tibial loading, as chronic, repetitive loads cause abnormal strain and bending of the tibia [4]. Although sometimes composed of different etiologies, MTSS and tibial stress fractures may be considered on a continuum of bone–stress reactions [4,6]. The most common complaint of patients with MTSS is vague, diffuse pain of the lower extremity, along the middle-distal tibia associated with exertion.[4] In the early course of MTSS, pain is worse at the beginning of exercise and gradually subsides during training and within minutes of cessation of exercise. As the injury progresses, however, pain presents with less activity and may occur at rest.

Various authors have proposed a wide variety of etiological factors for MTSS, including training on hard surfaces or uneven terrain, improper training techniques, increasing training intensity too quickly, changes in footwear, muscle imbalances or inflexibility, and biomechanical abnormalities.[7-12] Abnormal subtalar joint pronation has been associated with MTSS in a number of static and dynamic studies.[13] The only prospective study that determined foot pronation as a risk factor for MTSS is that of Bennett et al,[3] who followed high school cross-country runners through a training period. They measured the degree of foot pronation by recording the amount the navicular bone lowered between two standing positions, the neutral calcaneal stance position and the relaxed calcaneal stance position. This distance is termed the navicular drop, and the procedure measures the amount the medial longitudinal arch (MLA) lowers in the sagittal plane.

An excessively pronated foot and increased navicular drop, a measure of pronation, appear to be associated with MTSS injury. Bennett et al found that excessive navicular drop measurements correctly identified 64% of MTSS cases in high school cross-country runners.

Studies have been investigated the effect of augmented low dye taping technique and find it effective in controlling pronation in both static and dynamic activity. In addition to this electrical stimulation, iontophoresis ultrasound and flexibility

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and strengthening exercise play important role in controlling the symptoms. The key to successful conservative management of overuse injuries relies on the clinical reasoning process employed. Antipronation treatments such as rigid sports tape and temporary orthotics are used to test the relationship between the excessive pronation and the patient's symptoms. A reduction in symptoms when the antipronation technique is used is thought to confirm the association between excessive pronation and the patient's symptoms.[14]

Although MTSS is often not serious, it can be quite disabling and progress to more serious complications if not treated properly. Often, the cause of MTSS is multi-factorial and involves training errors and various biomechanical abnormalities. Few advances have been made in the treatment of MTSS over the last few decades. The purpose of this study was to compare the effect of antipronation treatment techniques (augmented LowDye) and orthosis on Medial tibial stress syndrome.

MATERIALS AND METHODS

Total 30 subjects who presented with symptoms of Medial tibial stress syndrome with mean age of 20.96±2.46 years were participated in the current study. Subjects were selected from the Nahar Singh Cricket Stadium Faridabad, were assessed for inclusion/exclusion criteria and obtained written informed consent for their participation. The inclusion criteria for the subjects included age 18-25years, both males and females, hyperpronated foot (Navicular drop 10mm), An atraumatic history at least one week of medial tibial pain, exacerbated by running, The presence of at least 10 cm of diffuse palpatory tenderness at the distal two third of the posteromedial aspect of leg with positive provocative test, Pain during forced passive ankle dorsiflexion, pain during active ankle planter flexion against resistance**.** Exclusion criteria for the subjects included: stress fractures, bone tumor, compartment syndrome, congenital anomaly, vascular insufficiency, known allergy to tape, Any current injuries to the lower extremities that had required a reduction in activity and treatment by other health care practitioner. These subjects were randomly allocated to two groups: Group A and B (n=15) and given antipronation taping and orthosis respectively. The outcomes of the study were assessed Pain by using visual analog scale (VAS) .VAS is a line scale with anchor at 0 and 10 (0 indicating no pain, 10 the worst pain imaginable). The subject self-rated their leg pain based on their present experiences, by placing a mark on the 10cm line. Difficulty in functional activity was assessed by using 6 meter one leg distance hop test. In this subject was asked to hop on the affected leg and try to cover as much distance as possible without any pain and discomfort. The distance covered by subject without pain was taken as a measurement. Hyperpronation of the foot was assessed by Navicular drop test, the subject seated and subtalar joint in the neutral position, placed a ruler at the medial aspect of the rearfoot and placed a corresponding mark at the level of the navicular. The mark was drawn with an indelible ink pen onto the skin for accurate relocation between all trials. The subject then assumed a full weight bearing position, allowing the foot to relax. The navicular level was noted. The difference between the two measurements is called navicular drop and indicates the amount of foot pronation. Any measurement greater than 10mm is considered abnormal. Total duration of study was for one week. The pain scores of VAS, Navcular drop height and distance covered by one leg hop test were recorded on the 0 day and then post treatment, which constitute orthosis (shoe insoles with medial arch support) and augmented low dye taping with conventional exercises which include stretching and strengthening of muscle around the leg. Taping group was instructed to leave tape on for a day and have to come for 6 sessions daily for a week. Exercise program was started along with taping or orthosis. Anti pronation taping Augmented Low-Dye Taping, which has previously been described in detail by Vicenzino et al, was used in this study. The technique involves applying a device consisting of a spur and mini stirrups to the foot and then adding reverse sixes and cancaneal slings to an anchor on the distal one-third of the leg. Clinician who advocates the use of taping for shin splints must know the procedure and principle of applying taping. A rigid 38mm sports tape with zinc oxide adhesive was used for all of the taping procedures.[21,28] The taping technique which is followed, is given below: A strip of tape was applied from the first metatarsal head, around the posterior heel, and finishing on the fifth metatarsal head (spur). Transverse strips were then added, starting over the spur on the lateral side of the foot, coursing under the plantar surface of the foot, and anchoring on the medial side. These strips continued to be applied in a distal to proximal direction, so that each covered half the width of the previous strip, until the heel and the plantar surface of the foot were covered. A second spur locked off the mini-stirrups. Calcaneal slings. With the ankle fully dorsiflexed, a circumferential anchor strip was applied at one third of the distance from the distal end of the leg. The calcaneal sling began anteriorly on the anchor, then coursed in a posterior and distal direction to cover the Achilles tendon and heel obliquely, under the plantar heel surface, and up the medial side of the rearfoot-midfoot to end where it started. Two of these slings were applied. Reverse Six. Each reverse six originated at the medial malleolus and just proximal to the medial malleolus, passed over the dorsum of the ankle to the midfoot region, and then coursed medially under the plantar aspect of the midfoot and along the medial side of the leg to the anchor. Three reverse 6s were applied. The augmented low Dye taping was completed with the addition of lock-off strips, which were similar to the anchor strip Orthosis - Foot orthosis that were non-custom semi rigid shoe insoles with medial arch support, given to all the subjects' lies in orthosis group. Bing previously used this type of orthosis in their study. Orthosis (shoe insoles with medial arch support) were given according to the size of foot. Participants in this group were initially trained with the insoles in their shoes, so that they accustomed to the modification done in their shoes. They were asked to perform the stretching and strengthening exercise three times per day .The exercises were Stretching exercises consist of Stand on a step with heels over the edge keeping your knees straight and lower your body so the heels are below the step hold 10 - 20 sec. Stand on a step with heels over the edge squat slightly so both knees bent and lower your body so heels are below the step hold for 10-20 sec and repeat it 10 times. Strengthening exercises consist of Heel walking (walk on heels and pull toes toward your shin walk 10 step), Heel raise (stand on floor next to a table for support rise on toes and hold for 10 –15sec), Towel gathering exercise, Marble pick up.

RESULTS

The descriptive data for age, height and mass for both the groups was matched and no statistical difference was found. Results from VAS scale -Comparison between two groups reveal no significant differences between them at the beginning of the study, that is both groups were at the same platform (p value >0.05). After completion of the study with in-group analysis of two groups reveals that both of them improved significantly with a p value (<0.05).), Suggesting that there was a difference pre and

post intervention values in both treated group. Comparison of mean values for pain variables between the groups reveals more significant improvement in taping group as compare to orthosis group. Results from Navicular drop test-Comparison of first step pain between two groups reveals that there was no significant differences between them at the beginning of the study that is both groups were at same platform with p value (>0.05). After the completion of the study, the results from each group pre and post treatment intervention were analyzed for differences within groups. Result from within group analysis reveals non-significant changes in both groups (p value >.05) after a week application of orthosis and taping. But some changes were found in mean values after completion of study, which shows that both treatments have some effects over the navicular height. Comparison of mean value at the completion of study between the group gave non-significant results (p>0.05) this suggest that there is no significant difference in the navicular drop scores post treatment between the groups. Improvement in hop distance between two groups reveal no significant differences between them at the beginning of the study, that is both groups were at the same platform (p value >0.05). After the completion of the study comparison between two groups gave a significant p value. With in-group analysis of taping and orthosis groups reveals that both of them improved with significant p value. Comparison of mean values for all the variables at seventh day between taping and orthosis group found more significant changes in taping group. There is more improvement in taping group as compare to orthosis group. Both groups were benefited by treatment but response from orthosis was slower than the taping. On the whole taping group demonstrated recovery on VAS scale and functional activity (hop distance) but orthosis group recovery was slower in comparison to taping group Table 1 and 2.

DISCUSSION

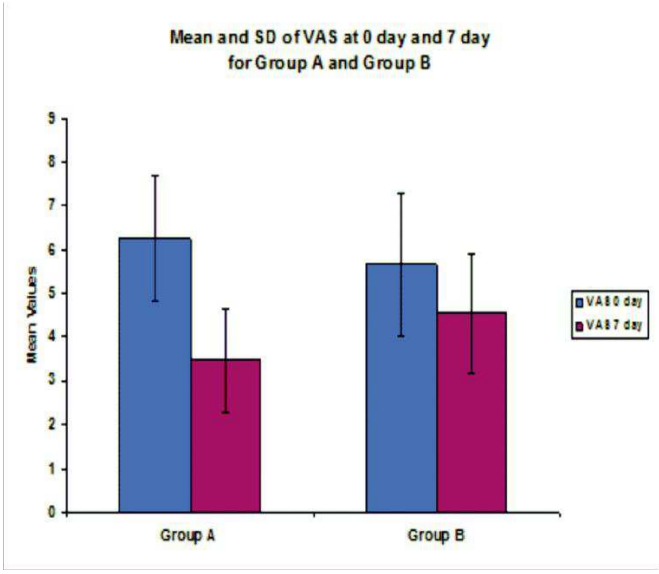
The purpose of study was to test the hypothesis that the Antipronation taping will show more improvement as compare to orthosis in medial tibial stress syndrome for reducing symptoms. This study set out to compare the efficacy of taping and orthosis in the management of MTSS. In the current study showed there was statistically significant improvement in both group for the VAS and hop distance Graph 1.1, 1.3. Although the results on the navicular drop was not statistically significant Graph 1.2. But change in mean value after six days of intervention were suggest that longer duration of study would be more useful in this direction. There have been various studies on patients suffering from shin splints. The present can be seen as an extension of those studies. This study set out to compare the efficacy of taping and orthosis in the management of MTSS. Current study showed

Table 1 Within group comparison of variables from baseline to 7th day

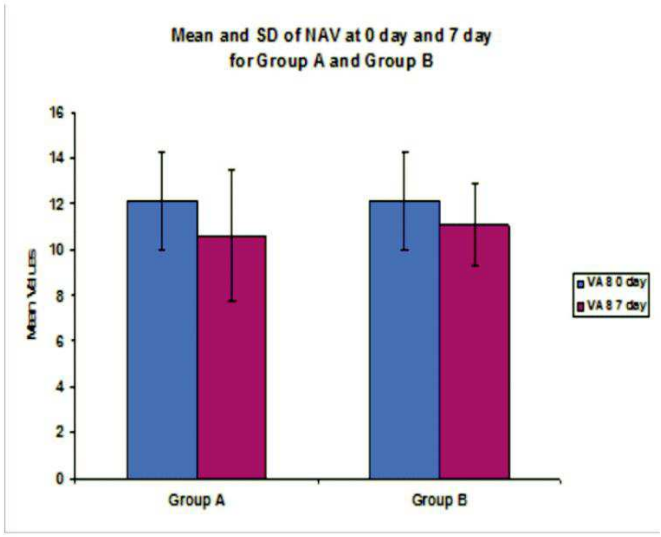
Groups	VAS 0	VAS 7	NAV 0	NAV 7	HOP 0	HOP 7
Group-A	6.26±1.43	3.46±1.18	12.13±2.13	10.60±2.87	2.60±0.73	4.66±0.81
p-value	P < 0.05		P > 0.05		P < 0.05	
Group-B	5.66±1.63	4.53±1.35	12.13±2.13	11.06±1.79	3.26±1.16	3.66±1.29
p-value	P < 0.05		P > 0.05		P < 0.05	

Table 2 Between groups' comparison of variables from baseline and 7th day

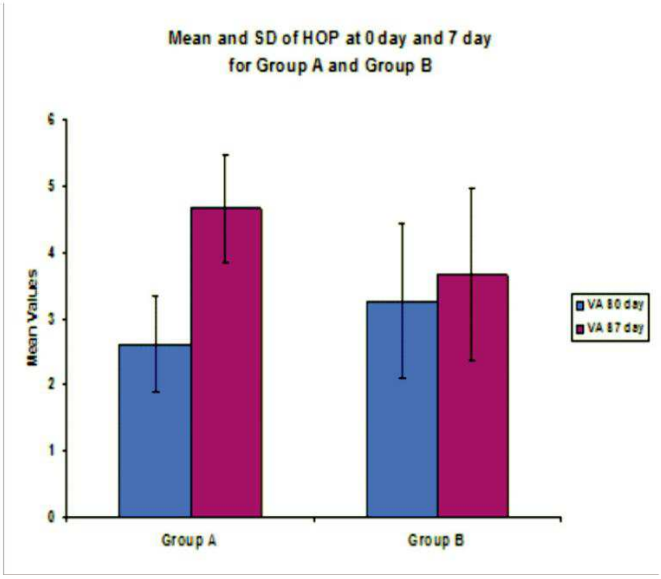
Variables	VAS 0	NAV 0	HOP 0	VAS 7	NAV 7	HOP 7
t value	1.068	0.000	1.876	2.29	0.534	2.535
p-value	P > 0.05	P > 0.05	P > 0.05	P < 0.05	P > 0.05	P < 0.05



Graph 1.1 Comparison on of VAS pre and post intervention between groups



Graph 1.2 Comparison on of NAV pre and post intervention between groups



Graph 1.3 Comparison on of HOP pre and post intervention between groups

statistically significant improvement in both group for the VAS and hop distance. Although the results on the navicular drop were not statistically significant. This is supported by a previous study which demonstrated that both the augmented LowDye tape and temporary felt orthotics are effective in controlling vertical navicular height following 20 minutes of exercise. Although there was no statistically significant difference in the control of vertical navicular height provided by the tape and orthotic.[15] Previous study also indicated that the tape was more effective in controlling vertical navicular height immediately following application, whereas the orthotic maintained correction more effectively than tape did over the 20-minute period of exercise.[15] These biomechanical findings supports the clinical practice of using antipronation taping at the first consultation to control abnormal pronation, so as to determine the association between abnormal pronation and the patient's symptoms. In addition, it supports the use of temporary orthotics as a treatment technique to provide antipronation control over a relatively extended period of time as a means of assessing the effect of an in shoe device, prior to the prescription and fabrication of more expensive orthotic devices.[15] The results of current study suggested that more medial tibial pain reduction existed between patients who received taping than those who used orthosis. Pain recovery of taping group was better in comparison to orthosis group present study consistent with that of Alison Hadley and Bill Vicenzino, who showed the effectiveness of anti pronation taping and temporary orthosis on tibial rotation position after exercise and finds taping superior to temporary orthosis and control group after ten minutes of exercises and showed significant improvement in pain and functional outcome.[18] McPoil and Hunt explained that the antipronation techniques may prevent deformation of the soft tissue beyond the elastic region of the load-deformation curve, and thus provide a means to rest over-stressed tissues.[16] A lateral shift in peak plantar pressures was found to occur with application of low-Dye taping in the midfoot area. That is, less pressure was
exerted in the medial midfoot (1.4 N/cm^2) and more pressure in the lateral midfoot (2.6 N/cm^2) with the application of tape [17]. These phenomena may also support for taping group for more decrease in pain. The orthosis, like the unaugmented low dye technique, exerts no direct leverage and appears to exert less of an influence on lower limb alignment in comparison with the taping technique used in this study. Current study both groups were trained for stretching and strengthening exercise along with taping and orthosis. Stretching and strengthening exercises were a useful approach of conservative management in shin splint. This program of exercises is valuable because they can correct functional risk factors. Prime focus of this programme was muscle around the leg (soleus, gastronemius, tibialis posterior, tibialis anterior, flexor digitorum longus, flexors hallucis longus). This approach of conservative management is widely used by the therapist for the reduction of symptoms and improvement of functional activity. Participants of taping group showed more significant improvement than orthosis group. Stretching and strengthening exercises Literature has widely supported a daily regimen of calf stretching and eccentric calf exercises to prevent muscle fatigue.[4,6] These conventional exercise regime added pain free lower extremity strength and shown improvement in HOP test.

This study recommends extending the duration of the study with a larger sample size to corroborate these findings. There is a reduction in symptoms following the application of a tape or orthosis that corrects hyper pronation indicates that there is an association between altered foot biomechanics and the condition producing the symptoms. The amount of biomechanical correction required to relieve symptoms is unknown. Thus future studies are required to address how much pronation control required being effective in the treatment of MTSS.

CONCLUSION

Overall our study indicates that augmented low dye taping and orthosis along with stretching and strengthening exercises were useful technique for reducing pain and improving functional activity, suggests that biomechanical factors play an important role in etiology and should be considered, while giving treatment to these patients. There was improvement in both group, but improvement was much better in participants who received augmented low dye taping. Therefore augmented low dye taping is a useful intervention modality in the rehabilitation of patients with MTSS (shin splint).

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