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Effect of Theraband Strengthening on Hip Abductors, Adductors, Flexors, and Plantar Flexors in Footballers with Medial Tibial Stress Syndrome

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ABSTRACT

Background: Medial tibial stress syndrome also known as shin splint is commonly seen in running related injuries and football players. Its prevalence is 12% to 18% in running related injuries. It is essential that strength of hip, calf, abductors and adductor strength helps in preventing these injuries.

Materials and methods: The study design is an experimental study. This study aims to study the effect of Theraband strengthening on hip abductors, adductors, flexors, and plantar flexors in footballers with medial tibial stress syndrome. The data was analysed using SPSS version 13 and Graph Pad Instat3.

Results: The 6- week theraband strengthening regimen showed significant impact on strengthening of hip, calf, abductors and adductor strength. It also showed strengthening of these muscles had significant reduction while pain on hopping pre and post intervention.

Conclusion: This study concludes that 6 weeks of theraband strengthening exercises for hip abductors, adductors, flexors and plantar flexors are effective in male football players with MTSS.

Journal of Coastal Life Medicine

1. INTRODUCTION

Football is a high impact and most complex sport which was reported that 4.96% of population played regularly. In India, football is not played recreationally but also professionally¹.

Various studies have reported that vertical ground reaction force (GFR), one of the substantial elements of ground reaction force plays an important role in running injury biomechanics. The correlation seen between running related injuries and vertical ground reaction force is the vertical load rate. Higher vertical load rates have shown association with running related injuries such as medial tibial stress syndrome².

Medial tibial stress syndrome (MTSS) also known as shin splint is characterized as tenderness over postero-medial aspect of distal two third of tibia. Its prevalence is 12% to 18% in running related injuries³.

Few studies also suggest that sufficient strength of leg muscles is important to protect the bone and absorb the biomechanical force of leg from excessive shock during sporting activity. MTSS can be developed due to muscle dysfunction which consists of lack of endurance or strength and inadequate balance between agonist and antagonist muscles^[4]. Therefore, it is important to prescribe a rehabilitation program for the injured athlete which consists of strengthening lower limb muscles, to decrease the symptoms if muscles weakness is the reason for overuse injury^{[5][4]}. To develop the strength and power theraband is most widely used, portable and inexpensive tools available in rehab center. It helps to

increase exercise intensity without excessively increasing the loading weight⁶.

Clinically, it is difficult to diagnose shin splint without appropriate imaging since the symptoms of shin pain can lead to differential diagnosis. A comprehensive examination consisting of players history, related risk factors, in-depth physical examination and radiographic imaging is required to diagnose MTSS. Tests such as palpation, a fulcrum test, single leg hop test and use of a tuning fork if performed alone can lack both sensitivity and specificity. Therefore, "Shin pain scoring system (SPSS)" can be used as a screening tool to evaluate the risk factors of MTSS and helps in diagnosis of MTSS⁷.

It is important to assess the physical aspect, strength and power which can be determined by using Push Pull dynamometer. Dynamometer is the principal method for assessing muscle imbalance and function and quantifies variety of muscle function indices, which is considered as gold standard criterion⁸.

There are studies done previously, who studied about various muscle group strengths, ground reaction force and tibial bone strength in runners, recreational runners and athletes with exertional medial tibial pain and effect of strengthening of major muscle groups with theraband in runners with medial tibial stress syndrome. There is dearth of literature regarding the effect of theraband strengthening on major muscle groups of lower limbs in footballers with medial tibial stress syndrome.

2. MATERIAL AND METHODS

Aim: To study the effects of theraband strengthening on hip abductors, adductors, flexors, and plantar flexors in footballers with medial tibial stress syndrome.

Objectives:

1. To study the effect of theraband strengthening on hip muscles (flexors, abductors, and adductors) and calf muscles (plantar flexors).
2. To study the effect of theraband strengthening hip muscles (flexors, abductors, and adductors) and calf muscles (plantar flexors) on MTSS.

Study setting and design: The study subjects i.e., male football players were identified from Sports Academy using an experimental study design.

Sampling Method: Purposive sampling
For sample size calculation, the standard deviation of population is considered as

2.03 and mean of difference as 1.85, $Z_{1-\frac{\alpha}{2}} = 1.96$, $Z_{1-\beta} = 0.84$, the sample size is estimated as 20. Sample size was calculated using the following formula:

$$n \geq 2$$

$$\left[\frac{Z_{1-\frac{\alpha}{2}} + Z_{1-\beta}}{\frac{\delta_{diff}}{\sigma_{diff}}} \right]^2 + \frac{z^2_{1-\frac{\alpha}{2}}}{2}$$

Inclusion criteria: Football players were identified with Grade 1 shin pain (Grade 1: pain present after athletic activity), scoring result between 0-1 on shin pain scoring system aged between 20-29 years of age, club players with minimum 2 years of experience.

Exclusion criteria: Football players with other neuromusculoskeletal injuries and conditions of lower extremity.

Materials: Tools used for the study were study consent form, demographic data with pre and post assessment sheet, Push Pull Dynamometer (Fig.1), Theraband of Red, Green, and Black (Fig.2) and Kinovea version 0.5.18.



Fig.1 Push-Pull Dynamometer



Fig.2 Theraband (Red, Green, and Black)

Procedure: Ethical approval was obtained from Institutional Ethical Committee. Potential participants were identified from

Sports academy. All subjects were explained the purpose of the study and players were selected according to study

Journal of Coastal Life Medicine

criteria and consent was taken from the players participating in the study. A total of 20 players were participated in the study. A pre intervention assessment was done for the players which included using push pull dynamometer for assessing muscle strength on hip abductors, adductors, flexors and plantar flexors and vertical single leg hop test for determining the pain and return to play of the player.

A six-week intervention program was conducted where players performed seven exercises with theraband, in which each exercise consisted of 2 sets of 10 repetitions; duration was 30 minutes per session and 3 times a week. After every 2nd week the intensity of theraband was

changed i.e., 1st and 2nd week consisted Red Theraband, 3rd and 4th week consisted Green and 5th and 6th week of Black theraband.

After 6 week of intervention program, post assessment for all the players was done where all the outcome measures were reassessed. The data obtained were analysed.

Methods of measurement:

A. Push-pull Dynamometer: Muscle strength of Hip Abductors, Adductors, Flexors and Plantar Flexors using push pull dynamometer. Following are the pictures showing the measurement of desired muscle groups.

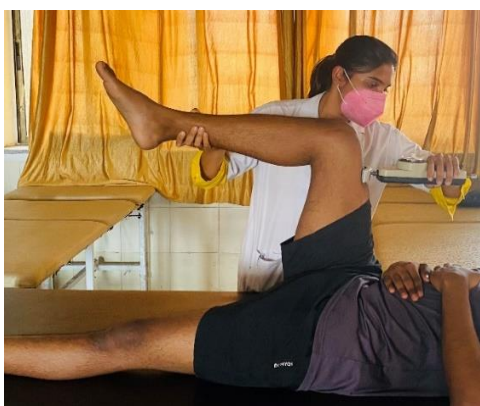


Fig.3 Push Pull dynamometer for hip flexion



Fig.4 Push Pull dynamometer for hip Abductor



Fig.5 Push Pull dynamometer for hip adductor



Fig.6 Push Pull dynamometer for plantar flexion

B. Single leg hop test:

It was used to determine the increased in jump height, decreased in landing time and pain while hopping. After the game play, players were asked to perform single leg vertical hop test (SLH) for 10 repetitions for both non-injured and injured leg

respectively. After jumps, players were asked to mark their pain on hop in Numerical Pain Rating Scale (NPRS). Jumps were then uploaded in kinovea software to determine the increased in jump height and decrease in landing time of the individual player.



Fig.7 Single Leg Hop Test (SLH)

C. Exercise protocol:

Week of study	Resistance band	Exercise Protocol
Week 1-2	Red	Exercises performed with Theraband: Side stepping Sumo squats Standing hip-flexion Side-lying hip abduction Side-lying hip adduction Clam shell Ankle plantar flexion
Week 3-4	Green	
Week 5-6	Black	

Table.1: Six weeks exercise protocol with theraband

Outcome measures:

The Shin Pain Scoring System (SPSS) and Numerical Pain Rating Scale (NPRS) have been used to assess the grade of shin pain and pain after hoping respectively.

Data analysis:

- Paired sample test was used to find out hip adductor, flexor, abductor, plantar flexors

- Data was analysed using SPSS version 23 and Graph Pad Instat3.
- Descriptive statistics was used to report demographic characteristics and frequencies was used to report the responses in percentages muscle pre and post intervention for right and left leg, Increase in landing, decrease

Journal of Coastal Life Medicine

in jump height pre and post intervention

for right and left leg

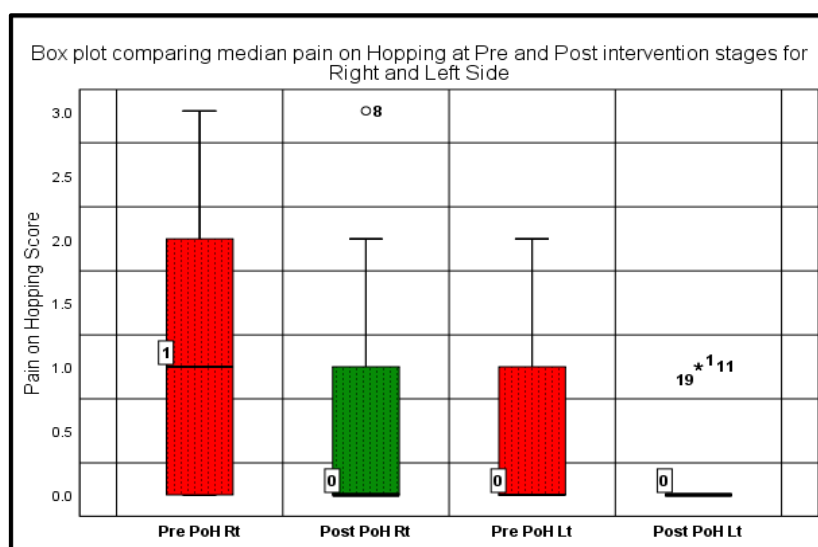
3. RESULTS AND DISCUSSION

The objective of this study is to find out whether there is any effect of strengthening on hip abductors, adductors, flexors, and plantar flexors in footballers with medial tibial stress syndrome. The data of the players participating in the study were statistically analyzed and showed significant improvement in the strength of group of muscles and pain.

a. Effects of theraband strengthening on group of muscles:

A total of 13 participants in the study were affected with right leg (65%) and 7 participants with left leg (35%). The mean difference observed pre and post

intervention of hip adductors, flexors, abductors, and plantar flexors was <0.001 which shows that there is statistically significant change, which was in line with the study conducted by Kelsey J Picha et al⁹. They reported that elastic resistance using a load cell is as effective as supervised training and can be used in home exercise programs where the exercise training is unsupervised. This was in line with the study conducted by Jaqueline et al. they concluded that training with theraband provides strength gains similar to training with conventional resistance¹⁰.



Graph 1: Box plot- comparison of median pain on hopping at pre and post intervention stages for right and left side

b. Effects of theraband strengthening on

MTSS:

The effect of theraband strengthening on MTSS can be identified based on pain on

performing single leg hop test and decreased jump height and increased

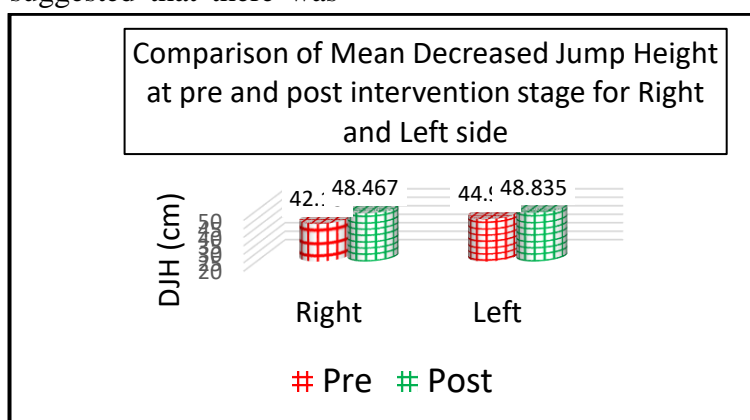
Journal of Coastal Life Medicine

landing time while performing single leg hop test. The pain on hopping for right leg ranged between 0 to 3 pre intervention and 0 to 2 post interventions. There is statistically significant change seen between pre and post intervention for pain on hopping with P value <0.001 which was in line with the study conducted by Ryan C A et al. They reported that Theraband Band loop has been shown effective in reducing pain, stabilizing the knee joint by increasing the activation of agonistic muscles and helped in strengthening of lower extremity muscles. According to few studies, biomechanics of running injuries focuses on vertical ground reaction force which is greatest component of GRF. Here, the vertical load rate shows persistent relationship with running related injuries⁴. In a study conducted by Shreen A. lashein showed significant decrease in the peak torque of hip muscles in subjects with MTSS. Lawrence et al concluded that reduced function of hip muscles results in higher vertical ground reaction while performing single leg hop landing¹¹. A study conducted by Luke T Madeley et al., in his study suggested that there was

reduced endurance of ankle joint plantar flexion in individuals with MTSS⁶. These were in line with the results obtained from our study. Therefore, strengthening the hip and calf muscles with exercise program can reduce the symptom since muscles weakness is the cause of injury³. It suggests that strengthening the hip and calf muscles in beginner players with MTSS can help to prevent the overuse injuries.

According to the study conducted by Ani Agopyan, increased lower limb muscle strength is an important component of improving vertical jump performance¹². Therefore; leg muscle should be developed as a part of complete strengthening program. When elastic bands are used, eccentric loading also increases, which is associated with greater force values than concentric loading.

After 8 weeks of training, eccentric and concentric loads with theraband training have improved performance of jump height significantly and lower-body peak power significantly¹³.



Graph 2: Comparison of decreased jump height pre and post intervention for right and left leg

Journal of Coastal Life Medicine

The limitations of this study were that the size of the sample was small, players with only grade 1 of MTSS were taken into consideration, this study only had experimental group and only male football players were included in the study. Theraband strengthening exercises for group of hip and calf muscles can be incorporated in the training program for football players overcome MTSS.

To the best of our knowledge, this is the first study to develop a 6-week exercise regimen of Theraband strengthening exercises for hip and calf muscles for training program for football players to overcome MTSS.

Ethical Clearance: The study was reviewed and approved by the Institutional Ethics and Research committee of D.Y. Patil School of physiotherapy, Navi Mumbai, Maharashtra, India with IEC Ref. No. DYP/IECBH/2021/210, Dated 17 November 2021.

Conflict of interest: There was no conflict of interest to conduct and publish this study.

Fund for the study: It was a self financed study.

4. CONCLUSION

This study concludes that 6 weeks of theraband strengthening exercises for hip abductors, adductors, flexors and plantar flexors are effective in male football players with MTSS..

Author's Contribution

Ms. Mayanka Parag Pande and Dr. Sathya P. conceived of the presented idea. Ms. Mayanka Parag Pande developed the theory and performed the computations

and literature for backing the study. Dr. Sathya P. verified the analytical methods and supervised the study. Dr. Jibi Paul and Dr. Sai Bhavani contributed on discussion part related with results of the study. They also involved to fine tune the final manuscript.

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Journal of Coastal Life Medicine

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