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RESEARCH ARTICLE

HIP MUSCLES TORQUE IN RUNNERS WITH MEDIAL TIBIAL STRESS SYNDROME.

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Abstract

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Background: Medial tibial stress syndrome also called shin splints; the incidence ranges 4-35% in athletic& military populations present with medial tibial stress syndrome .Pain at posteromedial tibia. The pain is cumulative with activity & persists for a long time.
Purpose: this study was conducted to determine the hip muscles' peak torque in medial tibial stress syndrome.
Subjects and methods: forty participants were included in this study divided into two groups, group A (20 subjects with MTSS) ,While group B(20 normal subjects) both groups were assessed for hip abductors, adductors, external rotators and internal rotators peak torque through Isokinetic Biodex system.
Results: indicated that there was a significant decrease in the hip abductors' peak torque (p = 0.001) and the hip adductors' peak torque (p = 0.008) in the MTSS group compared with normal group, but There was no significant difference in the hip internal rotators' peak torque (p=0.059) and the hip external rotators' peak torque (p = 0.8) between the MTSS and normal.
Conclusion : Participants with medial tibial stress syndrome demonstrated significantly decrease in the hip abductors' and adductors' peak torque, with regard to this study results, we concluded that, weakness of hip abductors is one of the causes of medial tibial stress syndrome Accordingly, it is needed to focus in our (rehabilitation and prevention strategies) on strengthening exercises for hip abductors .

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Introduction:-

Medial tibial stress syndrome (MTSS); also known as "shin splint" is a common injury in runner athletes. It is characterized by distal medial tibial pain that is often worse in the mornings and again in the evenings. If not treated at least by rest and unloading the tibia, it can lead to debilitating functional loss not only in the patients' sport but also affecting their work in recalcitrant cases. While the symptomology of MTSS is fairly well understood, the etiology of the injury is still unclear **(Franklyn & Okas, 2015).**Various studies have been published to highlight the underlying risk factors for shin splints. Some of the proposed intrinsic risk factors are lack of running experience, inadequate warm-up, incomplete stretching, increased running frequency, excessive weekly running distances, and

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sudden increase in training mileage and lack of flexibility training. Other intrinsic factors which may contribute are navicular drop, hyperpronation of foot, increased femoral neck anteversion, greater plantarflexion ROM, increased hip external rotation ROM and imbalance between quadriceps and hamstring muscles. Few extrinsic or environmental risk factors for shin splints are type of sport, time of day, always running on the same side of the road, hard running surface, shoes, in-shoe orthoses, climate, weather conditions. **(Patil , 2016)**. **Chuter& others (2012)** described the important role of distal and proximal contributions to lower extremity injury. Hip abductors play a very important role in lower extremity alignment, both in frontal and transverse plane movements. Consequently, weakness of these hip muscles can result in altered motions of the femur, which may have an important influence further down the kinetic chain**(Powers, 2010; Ireland et al., 2003).**So there will be greater hip adduction and internal angular rotation during single limb movements**(Ferber et al., 2003).**Therefore, runner athletes with hip abductor weakness are more vulnerable to large external forces experienced by the hip and trunk, which reduces the ability to stabilize these segments **(Leetun et al., 2004; Ferber et al., 2003).**

While there is some debate whether abnormal hip kinematics are the result of diminished hip muscle strength or impaired motor control, both aspects of muscle performance should be considered when implementing a rehabilitation or injury prevention program**(Powers,2010)** .It seems that one of the important factors is misalignments of runner's bodies that occurred because of compliance with the requirements qualification. There are Studies that shown such adaptations and motor skill patterns in athletes. Considerable deviations from optimal posture may be aesthetically unpleasant, adversely influence muscle efficiency, and predispose individuals to musculoskeletal or neurological pathologic conditions **(Novak and Mackinnon,1997).**

Subjects and methods:-

Twenty runners with MTSS participated in this study were compared with twenty normal runners.

Who were referred from orthopedic out clinic of Faculty of Physical therapy, Cairo University, between February 2018 and September 2018.

Inclusion Criteria were: bilateral affected limb, Patient`s (male and female) age between 20-30years , Patients had MTSS for at least 1 month and Patients Athletes with BMI between18.5-25. Exclusion Criteria were: history of previous lower extremity surgery, Neurological problems that would affect lower extremity function, Recent or old fractures at lower limbs, Cognitive impairment and inability to understand the scale, Medications and Tumors.

Isokinetic evaluation was performed using Biodex multi-joint system 3 isokinetic dynamometer (Biodex Medical Systems, Shirley, New York, USA). Figure 1,2,3.

Figure 1

Figure 2

figure 3

(Anthropometric measure) was performed before proceeding Weigh, height and BMI calculation, Concentric and eccentric torque of the hip abductors and external rotators, ,For the hip abduction: The position of the dynamometer orientation 0 degree, dynamometer tilt 0 degree, seat orientation 0 degree, and seatback tilt fully reclined. The attachment of the hip of involved side was attached to the dynamometer. The patient was told to assume a side lying position on the chair of the apparatus with face away from dynamometer, the tested limb on top of the non-tested limb, and the thigh of the non-tested leg and trunk was stabilized with straps. The dynamometer's rotation was aligned superior and medial to greater trochanter on the tested leg, and the seat height and position was adjusted for accurate alignment. The hip attachment length was adjusted to be proximal to the patient's lateral femoral condyle. The dynamometer range of motion was set, with 30 degrees hip abduction and 0 degree neutral position toward (concentric away and eccentric toward), the knee joint in extension position, the anatomical position of the patient was calibrated , and the patient's limb weight was measured by the apparatus , neutral position was used as starting position. After 3 times trial repetitions the test was conducted. The patient performed 5 repetitions eccentric\concentric contraction velocity 60 degree\second**(Mohamed et al.,2016)**.For the hip external rotation test: each participant was placed in a supine position with the hip in a neutral position. The test was performed with the hip in 0° of flexion **(Delp et al, 1999)**. The knee of the tested limb was in 90° flexion. The axis of the dynamometer was aligned with the center of the patella (long axis of the femur). Three stabilization straps were used: one around the distal thigh of the tested limb, one across the pelvic crest and one across the chest. The padded dynamometer arm was attached 5 cm above the lateral malleolus using straps **(Lindsay et al, 1992)**. The range of motion of this test was from 10° of hip internal rotation to 20°of hip external rotation **(Silva et al, 2013).**

Results:-

The data were statistically analyzed by using the statistical package for social studies (SPSS) version 19 for windows. (IBM SPSS, Chicago, IL, USA). Descriptive statistics and t-test were conducted for comparison of mean age and BMI between both groups. T test was conducted for comparison of peak torque of hip muscles between both groups. The level of significance for all statistical tests was set at $p < 0.05$.

The statistical analysis results showed that both groups were matched in age(p=0.11) and BMI (p=0.61) perior to evaluation ,the results of the comparison showed that There was a significant decrease in the hip abductors' peak torque in the MTSS group compared with normal group (p = 0.001) and the hip adductors' peak torque in the MTSS group compared with normal group (p = 0.008),but There was no significant difference in the hip internal rotators' peak torque between the MTSS and normal groups (p = 0.059)and There was no significant difference in the hip external rotators' peak torque between the MTSS and normal groups (p = 0.8)(.table1)(figure4).

Table 1:-T test for comparison of mean value of hip abductors', adductors', internal rotators' and external rotators' peak torque between MTSS and normal groups:

Peak torque (Nm)	**MTSS group**	**Normal group**	**MD**	**t- value**	**p-value**	**Sig**
	$\bar{X}$ ±SD	**$\bar{X}$ ±SD**				
Hip abductors	95.38 ± 31.42	138.63 ± 45.81	-43.25	-3.48	0.001	**S**
Hip adductors	109.66 ± 37.36	145.9 ± 44.32	-36.24	-2.79	0.008	**S**
Hip internal rotators	50.06 ± 8.09	56.33 ± 11.87	-6.27	-1.95	0.059	**NS**
Hip external rotators	76.9 ± 30.49	79.4 ± 31.36	-2.5	-0.25	0.8	**NS**

$\bar{X}$: Mean	**SD: Standard deviation**		**MD: Mean difference**
t value: Unpaired t value	**p value: Probability value**	**S: Significant**	**NS: Non significant**

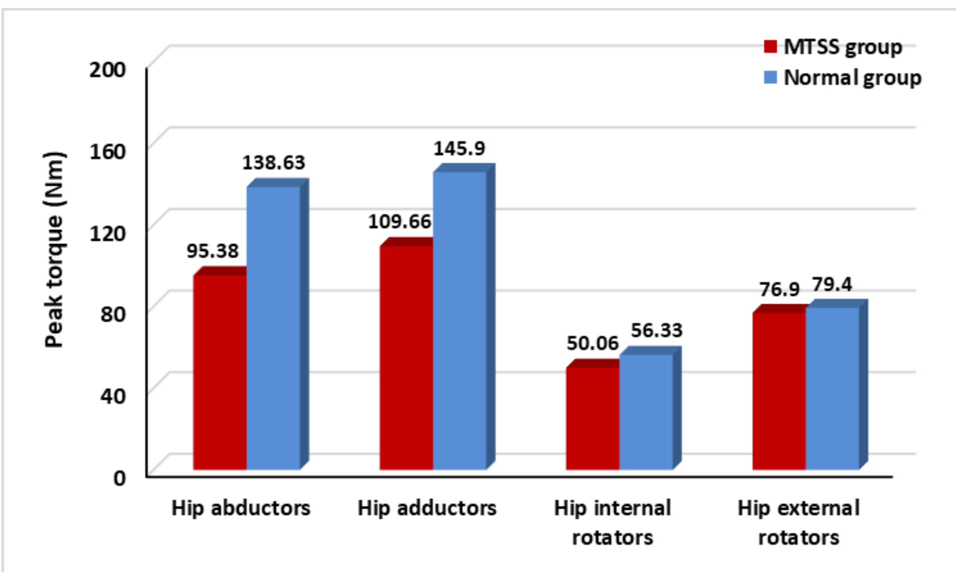

Figure 4:-Mean hip abductors', adductors', internal rotators' and external rotators' peak torque of MTSS and normal groups.

Discussion:-

The purpose of this study was to determine the hip muscles' peak torque in medial tibial stress syndrome. Forty participants were included in this study divided into two groups, group A (20 subjects with MTSS) and group B (20 normal subjects).

Our study proved that there was statistically There was a significant decrease in the hip abductors' peak torque and the hip adductors' peak torque in the MTSS group compared with normal group and there was no significant difference in the hip internal rotators' peak torque and the hip external rotators' peak torque between the MTSS and normal groups.

Previous literature has suggested that The hip-abductor muscles are eccentrically control hip adduction and, thus, knee genu valgum angle during the stance phase of running **(Cichanowskit et al., 2007; Dierks et al., 2008; Ireland et al., 2003; Robinson & Nee , 2007; Willson & Davis , 2008; Mascal et al., 2003; Bolgla et al.,2008; Ferber et al., 2003; Powers,2003)**. Kinetic chain is important in any sport/activity that involves walking/running. Rotational or translations abnormalities in any segment affect the entire chain. Bottom can affect the top. Top can affect the bottom. "Impaired proximal function increased the likelihood of uncontrolled joint displacements or unsolicited accessory movements throughout the lower kinetic chain" **(Ridder et al., 2017).** During the loading response phase of walking (first 10% of the gait cycle after heel contact), the hip flexes, adducts, and internally rotates**(Perry ,1992 ;Simoneauet al.,2002)**.This triplanar motion is caused by the external moments acting at the joint and is resisted by actions of the hip extensors, abductors, and external rotators, respectively. The amount of hip flexion excursion during loading response is minimal (0°-2°) compared to the amount of adduction and internal rotation motion (10°-15°)**(Chumanov et al., 2008; Perry ,1992)**.

During higher demand activities, such as walking on an inclined surface and running, peak frontal and transverse plane angles and joint excursions increase significantly**(Chumanov et al.,2008)**. It also has been reported that females display greater nonsagittal plane motion at the hip during walking and running than males**(Chumanov et al.,2008 ;Ferber et al., 2003)**.

Hip-abductor and external-rotator weakness may predispose the body to injury by altering trunk or lower extremity kinematics, resulting in increased mechanical stresses on various joints and soft tissues **(Cashman , 2012)** .Also, may permit excessive femoral internal rotation and adduction and diminished control of dynamic knee valgus (**(Boling et al., 2009 ;Ireland et al., 2003 ;Powers,2003).**

Excessive hip adduction and internal rotation during weight bearing has the potential to affect the kinematics of the entire lower extremity. More specifically, excessive hip adduction and internal rotation can cause the knee joint center to move medially relative to the foot. Because the foot is fixed to the ground, the inward movement of the knee joint causes the tibia to abduct and the foot to pronate, the end result being dynamic knee valgus which has been shown to be related to diminished hip muscle strength**(Claiborne et al., 2006 ;Hollman et al., 2009 ;Jacobs et al., 2007;Willson et al., 2006)** and has been implicated in contributing to numerous knee injuries, including anterior cruciate ligament (ACL) injury**(Hewett et al., 2005)** and patellofemoral joint dysfunction**(Powers, 2003)**.

Lawrence et al (2008) showed that participants with strong hip external rotators demonstrated significantly lower vertical ground reaction forces during single-leg landing, hence it can be speculated that decreased function of these hip muscles results in higher vertical ground reaction forces during single leg landings.

Clinicians are increasingly prescribing hip-strengthening exercises to patients. It is not yet clear whether these exercises should be applied for injury prevention, rehabilitation, or both since the influence of hip strength on lower extremity kinematics is not yet well understood. It is also unclear whether the mechanism of influence might be directly a result of the action of the hip abductors and external rotators or via a synergistic effect on the larger thigh muscles or gluteus maximus. **(Bobbert &Van Zandwijk ,1999 ; Conneely &O'Sullivan , 2008).**

Conclusion:-

Participants with medial tibial stress syndrome demonstrated significantly decrease in the hip abductors' and adductors' peak torque, with regard to this study results, we concluded that, weakness of hip abductors is one of the causes of medial tibial stress syndrome Accordingly, it is needed to focus in our (rehabilitation and prevention strategies) on the biomechanical features (whole kinetic chain) of lower limb specifically the relationship between medial tibial stress syndrome and hip muscles torque (balance between hip abductors and external rotators) and lower extremity alignment. The program should include strengthening exercises for hip abductors .Further research is needed to investigate other causes.

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