International Journal of Science and Healthcare Research
Vol.7; Issue: 2; April-June 2022
Website: ijshr.com
Original Research Article *ISSN: 2455-7587*

The Immediate Effect of Muscle Energy Technique Versus Active Release Technique on Hamstring Tightness in Footballers

Ruhi Sheth[1], Syed Rais Akhter Rizvi[2]

[1]MPT student, KTG College of Physiotherapy, Bangalore
[2]Professor & Principal, Anuradha College of Physiotherapy, Bangalore

Corresponding Author: Ruhi Sheth

DOI: https://doi.org/10.52403/ijshr.20220440

ABSTRACT

Background and purpose: Most often, attention is focused on management of pain and injuries and decreased muscle strength in football players while little attention is given to flexibility. The objective of this study was to assess and compare the immediate effectiveness of a type of Muscle Energy Technique (MET), Post Isometric Relaxation (PIR) and Active Release Technique (ART) in increasing hamstring flexibility among recreational and professional footballers aged 18-30 years. MET is used to lengthen a tight muscle, strengthen weak muscles, reduce localised oedema or mobilize an articulation with adhesion or restriction MET consists of different techniques, one of which is Post Isometric Relaxation Technique (PIR). PIR uses an agonistic isometric contractual phase after a passive stretch. On the other hand, ART is a soft tissue manipulation technique developed my Dr. Leahy which breaks tissue adhesions thereby relieving muscle stiffness/ tightness. There is abundant literature on these techniques. However there is a dearth of documentation comparing these two techniques. So the effort of the study is to compare the effectiveness of MET (PIR) and ART on hamstring tightness in footballers.

Method: This study was an experimental study. The subjects were selected on the basis of Simple Random Sampling method. 30 subjects were selected, in the age ranging from 18-30 years. They were assigned to two groups- Group A (n=15) received a type of Muscle Energy Technique (MET), Post Isometric Relaxation (PIR) and Group B (n=15) received Active Release Technique (ART). Both the groups performed a set of 3 exercises- eccentric and core stability and pilates after the intervention. Pre and post intervention measures were taken to assess the hamstring tightness. This was done by Active Knee Extension Test (AKET) and Sit and Reach Test (S&R Test).

Results: When means were analyzed using Paired 't' test as a parametric and Wilcoxon signed rank test as a non-parametric test have been used to analyse the variables pre-intervention to post-intervention with calculation of percentage of change, there was a statistically significant improvements in means of AKET and S&R Test. The findings of the study suggest that both the interventions have an immediate effect on hamstring tightness. More importantly, the results revealed that the intervention of Group B showed more reduction in hamstring tightness than the interventions delivered of Group A.

Conclusion: Th present study concludes that both MET (PIR) and ART are effective in reducing hamstring tightness and increasing knee extension range of motion in recreational and professional footballers. However, there existed a significant difference between both the techniques on hamstring tightness. ART was more effective in increasing hamstring flexibility and increasing knee extension range of motion among footballers.

Implications: Muscle Energy Technique (Post Isometric Relaxation) and Active Release Technique both can be used to treat people and athletes with hamstring tightness. But effects of Active Release Technique in increasing

hamstring flexibility and increasing knee extension range of motion among footballers is more dominant over the effects of Muscle Energy Technique (Post Isometric Relaxation). Hence, in sport physiotherapy protocols, ART can be used.

Keywords: Hamstring Tightness, Muscle Energy Technique, Post Isometric Relaxation, Active Release Technique, Active Knee Extension Test, Sit and Reach Test.

INTRODUCTION

The Hamstring Muscle Complex (HMC) is a multi-joint muscle complex that exerts a strong contracting force repeatedly in a lot of exercises and daily activities. It consists of three main muscles: Biceps Femoris (Short head and Long Head), Semitendinosus and Semimembranosus.[1] The HMC contributes significantly in hip extension and knee flexion. Furthermore, it plays a cardinal role in the gait cycle. The HMC gets activated in the final 25% of the gait cycle just as the extension of hip begins and continues to do so for 50% of the swing phase to bring about hip extension and resist knee extension. In addition to this, the HMC alongside the Anterior Cruciate Ligament (ACL) wields the role of dynamic stabilization of the knee joint. During the heel strike phase of the gait cycle, the HMC elongates over both, hip and knee joints and manages to decelerate the anterior translation of the tibia while knee extension occurs and the weight of the body is shifted forward. [2,3] When the muscle is not able to elongate enough or deform, it is said to be tight. Flexibility is the capacity of any muscle to deform.[4] Flexibility is a very significant aspect of physical fitness for maximizing musculoskeletal function.[5] Prevalence of tightness in the HMC, even among normal individuals, is quite high. The HMC tends to get shortened quickly, losing flexibility. [2]

Several studies have also shown the prevalence of hamstring tightness in athletes, specially footballers. [6,7] Footballers are often subjected to intensive training on consecutive days, often multiple times in a week. Each training session and game exacts high physical stress as they experience repeated accelerations and decelerations of varied intensity; muscle damage because of elevated impact trauma and explosive jumps. Escalated frequency of such extreme training, with sparse recovery time can prove to be demanding.[8] Tightness in the HMC decreases the performance and coordination of athletes leading to an increase in the risk and recurrence of injuries and post-training soreness. [2] It has also been debated that tightness in the HMC might predispose it to strains.[9] Hamstring strains are among the most common injuries and reinjuries in athletes.[10] These are characterized by sudden, maximal acceleration during sprinting. The prevalence of hamstring strain has increased in the past few years-superseding ankle sprains amongst footballers.[11] When a group of football players with hamstring strain were considered, more than half had HMC tightness, and no other difference in strength of the HMC was noticed.[9] It has also been proposed that stretching of the HMC to relieve its tightness is effective in the rehabilitation programme for HMC strains.[12]

Numerous ways to stretch the HMC have been scrutinized in the past several years. [13,14] There is a plethora of literature supporting numerous conventional techniques. [13-17] and modalities. [18-21] There is proof regarding the effectiveness of other techniques such as Muscle Energy Technique[22-27] and Active Release Technique to improve the flexibility of the HMC.[25] Muscle Energy Technique (MET) has been identified as a category of Manual Therapy in the present, however it was originally designed and practised as a part of Osteopathy.[23,24] MET has been used widely to lengthen tight muscles, strengthen weak muscles, reduce localised oedema, mobilize an articulation with adhesion or restriction or as a part of warm up to prepare the muscle for subsequent stretch.[23-25] This soft tissue manipulation technique is

peculiar because it is not an absolutely active or passive process.

MET consists of difference techniques such as Reciprocal Inhibition (RI) and Post Isometric Relaxation Technique (PIR).[26] RI is an antagonist mediated mechanism in the skeletal muscle, whereas PIR uses an agonistic isometric contractual phase. Initially the muscle is placed in a stretched position after which a minimal isometric contraction is elicited. Subsequently, the muscle is relaxed and then a gentle stretch is readministered.[28] This technique can be applied to tight or tender muscles that are usually associated with musculoskeletal pain.[28] Both these types of MET are used to elongate a tight skeletal muscle. But when compared, Several studies proved the superiority of PIR over RI to improve the flexibility of HMC.[29,30]

A newer technique which has been proven effective for hamstring tightness is ART. This approach was developed by a chiropractor, Dr. P. Michael Leahy. He explained it as a soft tissue manipulation technique to work on a variety of tissue, muscle, tendon, fascia and nerve unrelated issues.[31] This multidisciplinary technique is used to locate the specific tissues that are restricted and then alleviate it, so that the soft tissue can return to its normal texture, tension and length. This is achieved by numerous hand positions and soft tissue manipulation techniques.[32] He further proposed 'a mechanism to explain increased tissue stiffness or tension called the cumulative injury cycle.' In this cycle, repetitive micro-injury in a tight muscle leads to an increase in the friction and tension within the myofascial structures.[31]

ART has been used as conservative treatment for a lot of conditions. There are 3 basic principles - restoring free and unimpeded motion of all soft tissues; the release of entrapped nerves, vasculature and lymphatics; and to re-establish optimal strength, texture and function of soft tissues.[33] When applied for HMC tightness, ART was quite potent and showed immediate effect. [31,32] ART releases tissue adhesions allowing the muscle to fully lengthen. By doing so, it also alleviates pain permitting it to reach its normal condition.[31] This was confirmed by a pilot study done by James W, et.al. (2006); to determine the effect of ART on hamstring tightness. The experiment revealed that even a single bout of ART increased the hamstring flexibility among a group of young healthy males.[34] This was further demonstrated when studies were carried out to compare the effectiveness of ART with other techniques and ART proved to be superior. [31,32,35]

Furthermore, exercises have always been the cornerstone of physical therapy protocols. Eccentric exercises are active contractions of the muscle while it is lengthening under load. These exercises are characterized by their low energy cost and high force production.[36] Eccentrically training a muscle through a full range of motion could improve athletic performance, reduce injury rates and improve flexibility. HMC is most commonly injured when working eccentrically while decelerating or landing.[37] Eccentric training has been considered to have great potential as a part of rehabilitation programmes.[37-40] There is evidence that proves the influence of eccentric exercises not only on muscle morphology, but also on neuromuscular control which eventually plays a key role in altering the risk of injury.[41] Amongst footballers, eccentric exercises have been potent in battling HMC tightness as well as injury occurrence and recurrence rates.[42,43]

Another exercise programme that is known to develop agility and performance amongst footballers is Core Stability.[44] These exercises activate the deep core muscles of the body.[45] Core muscles stabilize the entire body- that is they control and maintain the position and movement. The core of the body is also involved in aiding other movements of the limbs with precision. Thus making core stability an important component for maximizing athletic efficiency.[46] These exercises also

have a positive effect on HMC flexibility.[47] An exercise regimen that improves flexibility by emphasizing on core stability along with breathing, posture and coordination is Pilates. Founded by Joseph Pilates, this method focuses on using the mind to control muscles and movements.[48] Pilates is a comprehensive method with six key principles- centering, concentration, control, precision, breath, and flow.[49] It is a body conditioning technique that offers improved control through stretching and strengthening of muscles thus reducing pain and avoiding injuries. The main goal is to perform a whole body movement while seeking to maintain the natural curves of the spine and a neutral pelvis.[50] Used over decades, this method is not merely a list of exercises but a way of connecting and conditioning the whole being-body and mind.[51] Pilates also helps in maintaining lumbo-pelvic stability along with flexibility.[52] Taking the HMC flexibility into account, there are some credible observations displaying the merits of the Pilates method.[50] A study carried out in 2007, amongst sub-indoor soccer athletes revealed that there was a significant increase in hamstring flexibility following the Pilates technique.[53] In 2015, another trial was conducted amongst 30 footballers. HMC tightness was treated with Pilates and showed excellent results.[48]

METHODOLOGY

30 footballers were recruited for this randomized control trial and divided into 2 groups by random sampling. Group A had 15 subjects and MET-PIR was used as the intervention. Group B also had 15 participants; intervention used was ART. A set of 3 exercises was performed by both the groups post intervention.

As the study includes human subjects, ethical clearance is obtained from ethical committee of K.T.G. College of physiotherapy and KTG Hospital, Bangalore as per the ethical guidelines for Bio-Medical research on human subjects, 2000 ICMR, New Delhi.

Male footballers with HMC tightness aged 18-30 years were included. Subjects with Hamstring Strain or Injury-fractures/ subluxation/ dislocation to the knee joint and hip joint, fractures/ subluxation/ dislocation to the knee joint or hip joint ligament injuries, low back pain, Intervertebral disc prolapse- acute and chronic, neurological disease/ tumours of hip/knee were excluded from the study.[54] The players were assessed for HMC tightness by Active Knee Extension Test (AKET) and Sit and Reach Test (S&R Test). These outcome measures were taken pre and post intervention.

Players in Group A were assessed with outcome measures. PIR was performed in supine position. A passive stretch was applied to the HMC after which the subject was asked to isometrically contract the HMC. These was repeated 3 times. After PIR, the subjects performed 3 exercises. Stiff-Legged Deadlift: The subject was asked to stand with knees locked in an extended position and bend forward while holding a neutral back posture and knee extension. Eccentric Hamstring Curls on Swiss ball: The subject was in supine position on a gym mat with feet placed on the Swiss ball. With the hands placed beside, the subject then flexed his knees to roll the Swiss ball towards his buttocks and then straightened them thereby rolling the to the starting position. Wrist Plank to Downward Dog on Swiss ball: The subject was in a wrist plank position with the hands on a bench and feet (and lower 1/3rd of shin if needed by the subject for balance) on the Swiss ball. The subject then contracted his core and moved to a downward dog position while maintaining the knees in an extended position. Post intervention, outcome measures were checked.

Fig.1: MET-PIR

Fig. 2: Stiff-legged Deadlift

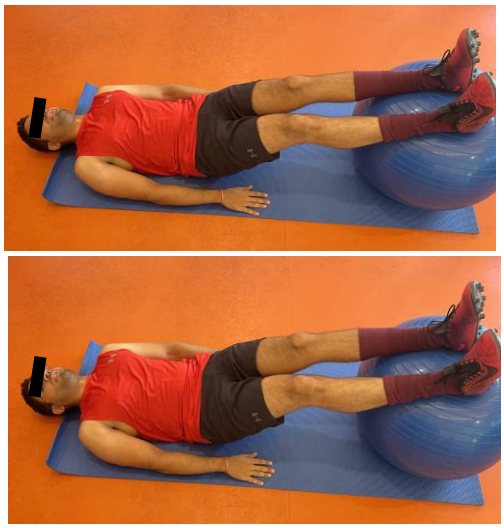

Fig. 3: Eccentric Hamstring Curls

Fig. 4: Wrist plank to Downward Dog

Players in Group B, after pre intervention testing were given ART in the side lying position with the affected leg on top with HMC shortened position. (Hip extension, knee flexion) Th therapist palpated knots/ adhesions and applied deep pressure to them while the subject performed hip flexion and knee extension-lengthened HMC. This was repeated 3 times. After this, exercises same as Group A were performed. Post intervention, outcome measures were checked.

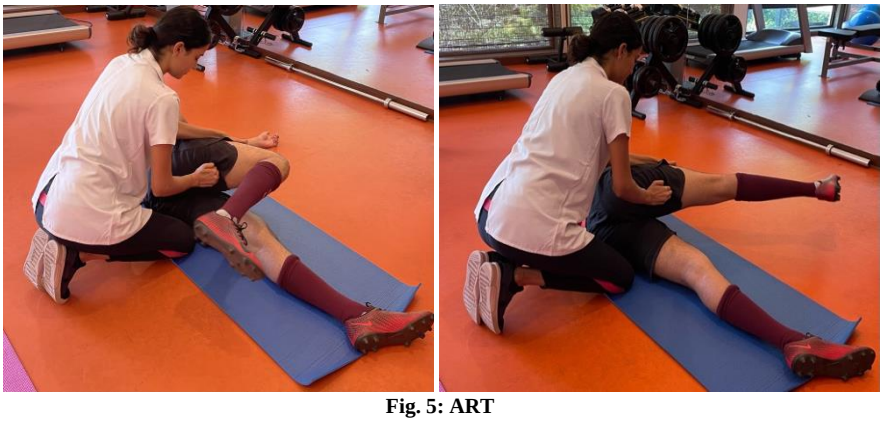

Fig. 5: ART

Outcome Measures:

Active Knee Extension Test: The test was performed in supine position with hip flexion without lifting the contralateral leg. The subject was then asked to extend his knee as much as possible. Following this, the therapist measured the angle of

knee extension and popliteal angle with a goniometer.

Sit and Reach Test: The test was done in a long sitting position on a yoga mat with the heels at the 15 cm mark on a yardstick. The subject then tried to bend forward and touch the furthest point on the yardstick with both his hands while maintaining complete knee extension. The furthest point that was held for 2s was considered as the outcome.

Fig. 6: Active Knee Extension Test

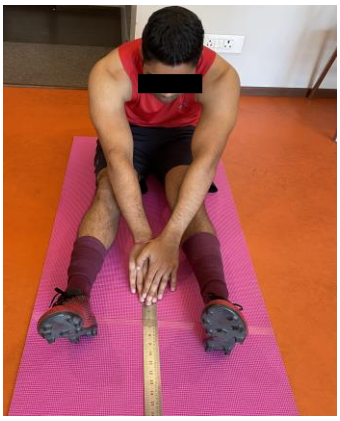

Fig. 7: Sit and Reach Test

RESULTS

Table-1: Range, mean and SD of base line variables of the footballers with hamstring tightness in both the groups

Sr. No.	Variable	Group-A(MET-PIR)		Group-B (ART)		Unpaired t-test
		Range	Mean ± SD	Range	Mean ± SD	
1	Age in years	18-29	23.60±3.60	18-30	23.20±3.38	t=0.3.13, p>0.05, NS
2	Experience in years	3months-14 years	7.48±3.30	4months -17years	7.28±4.30	t=0.162, p>0.05, NS
3	Practice in days	2-8	4.53±1.64	2-6	4.40±1.24	t=0.281, p>0.05, NS

NS-Not significant. ie.,p>0.05.

The table-1 presents the outcomes of base line variables of the footballers with hamstring tightness in both the groups. It revealed that the baseline characteristic of the footballers' age, experience in years and practice days per week was similar in both the groups.

Table-2: Range, mean and SD of outcome measures of footballers with hamstring tightness in group-A

Sr. No	Outcome measures	Group-A: MET (PIR)				Paired t-test	p-value
		Pre test		Post test			
		Range	Mean ±SD	Range	Mean ±SD		
1	AKET	34-62	51.40±7.92	16-56	40.53 ± 10.84	t=10.258*	p<0.001
2	Sit and Reach test (cm)	8.1-24.6	15.41±4.59	10.5-32.6	18.48±5.61	t=6.828*	p<0.001

Note; * denotes –Significant (p<0.05)

The above table-2 shows the pre and post test outcomes of outcome measures among the footballers with hamstring tightness in group-A. In pre test, the AKET was ranging within 34-62 with mean and SD of 51.40±7.92. But in post test, it was found to be decreased (increase knee extension ROM) to the range of 16-56 with mean and SD of 40.53 ± 10.84. The parametric test for comparison of dependent outcomes and measurable the paired t-test was carried out and it was found to be significant (p<0.001). Regarding Sit and reach test(cm) in pre test, the scores were ranging within 8.1-24.6 with mean and SD of 15.41±4.59. But in post test, the scores were found to be increased to the range of 10.5-32.6 with mean and SD of 18.48±5.61.. The parametric test for comparison of dependent outcomes and measurable the paired t-test was carried out and it was found to be significant (p<0.001).

It is evident that there is a significant increase in knee extension ROM in AKET and improvement in sit and reach test (cm)

of footballers with hamstring tightness in group A.

Table-3. Range, mean and SD of outcome measures of footballers with hamstring tightness in group-B

Sr. No.	Outcome measures	Group-B: ART				Paired t-test	p-value
		Pre test		Post test			
		Range	Mean ±SD	Range	Mean ±SD		
1	AKET	26-66	48.80±10.68	18-59	33.73 ± 10.19	t=12.476*	p<0.001
2	Sit and Reach test (cm)	2.7-30.9	16.24±7.51	3.4-33.2	20.01±7.81	t=7.612*	p<0.001

Note; * denotes –Significant (p<0.05)

The above table-3 shows the pre and post test outcomes of outcome measures among the footballers with hamstring tightness in group-B. In pre test, the AKET was ranging within 26-66 with mean and SD of 48.80±10.68. But in post test, it was found to be decreased (increase extension ROM) to the range of 18-59 with mean and SD of 33.73 ± 10.19. The parametric test for comparison of dependent outcomes and measurable the paired t- test was carried out and it was found to be significant (p<0.001). Regarding Sit and reach test(cm) in pre test, the scores were ranging within 2.7-30.9 with mean and SD of 16.24±7.51.But in post test, the scores were found to be increased to the range of 3.41-33.2 with mean and SD of 20.01±7.81.. The parametric test for comparison of dependent outcomes and measurable the paired t-test was carried out and it was found to be significant (p<0.001).

It is evident that there is a significant increase in knee extension ROM in AKET and improvement in sit and reach test (cm) of footballers with hamstring tightness in group-B.

Table-4: Comparison of pre and post test outcome measures of footballers with hamstring tightness in between the groups

Sr. No.	Outcome measures	Pre test		Post test	
		Group-A	Group-B	Group-A	Group-B
		Mean ±SD	Mean ±SD	Mean ±SD	Mean ±SD
1	AKET	51.40±7.92	48.80±10.68	40.53 ± 10.84	33.73 ± 10.19
2	Sit and Reach test (cm)	15.41±4.59	16.24±7.51	18.48±5.61	20.01±7.81
Between group comparisons: Unpaired t-test		• AKET: t=1.024, p>0.05, NS • Sit &reach test: , t=0.896 p>0.05, NS		• AKET: t=4.213, p<0.05, S • Sit &reach test: , t=3.864, p<0.05, S	

S-denotes significant (p<0.05); NS – not significant (p>0.05)

RESULTS

- Both the interventions, group-A and group-B were found to be individually effective in treating footballers with hamstring tightness.
- But, when the post test outcomes were compared between the two groups, the intervention of ART in group-B was found to better on increasing knee extension ROM in AKET and improving sit and reach test scores (cm) among footballers with hamstring tightness.

Note:

- The analyses were done using statistical software SPSS 21.0 version
- Both descriptive and inferential analyses were used
- Both parametric and non-parametric tests were used

MS-EXCEL, MS- WORD and SPSS graphical editors were used to generate the tables and graphs suitably.

DISCUSSION

In the present study, a comparative experimental study design of 30 football players with HMC tightness were randomized in 2 groups- Group A (n=15) and Group B (n=15).

Subjects in Group A received one session of MET and subjects in Group B received one session of ART. Both the groups received the same set and repetitions of exercises which included 3 exercises- 2 eccentric and 1 core stability + pilates. The pre and post intervention assessment was done with ROM and AKET (Active Knee Extension Test) and S&R Test (Sit and Reach Test). It was found that both the groups were effective in reducing HMC

tightness. There was a significant difference between the outcomes of Group A and Group B. There was relief in HMC tightness for footballers who received MET and for those who received ART.

HMC tightness affects the function of the muscle which is used in activities as simple as walking. In the biomechanics of the gait cycle, once the heel strike has occurred, the HMC needs to elongate over both the hip and knee joint to its optimal length to provide hip extension and stabilize the knee. (George Couloris, 2005) [2] Taking football into account, these players undergo vigorous training and competition schedules for consecutive days, multiple days a week with lack of rest period. Each session places extreme demands with sudden sprinting, deceleration, high jumps and explosive kicks along with eccentric loading and contact trauma.[8] Despite such high demands, the prevalence of HMC tightness is high among athletes, especially ones who play contact sports. (Weerasekara, et al., 2010) It has also been suggested that the presence of HMC tightness has no association with body height and femoral length.[6] It was also been found that soccer players when compared to non-players have less lower limb flexibility. (Ekstrand; Gillquist, 1982) [7]

In **Group A**, MET (PIR) coupled with a set of exercises was performed. Some difference between HMC tightness, pre and post intervention was noted. This suggests that the immediate effect of MET was somewhat significant on HMC tightness. MET primarily targets soft tissues, also making some contribution to joint mobilisation. It has been termed as active muscular relaxation technique. (Waseem, 2019)[24] The term mainly comes up because while the stretch given might be passive, there is active participation of the subject with the isometric contraction in the process of relaxation. Adkitte, R; et al. (2016) said that the contraction is done in a precisely controlled direction and with varying intensities giving benefits such as decreasing tightness, increasing strength and improving mobility. The study was done on national level football players for HMC tightness, MET proved to be very helpful.[26]

There are two main types of MET: Reciprocal Inhibition (RI) and Post Isometric Relaxation (PIR) both with their own sets of gains. As the name suggests, the subject contracts the muscle isometrically and voluntarily and post contraction, there is relaxation through another passive stretching. RI is similar, but in this the isometric contraction is done by the antagonist. K, Lewit and DG Simons (1984) observed that PIR helped with increased tension of the affected muscles and the resulting pain and dysfunction were both relieved by restoring the full stretch length of the muscle. They suggested that the method produced immediate pain relief in 94%, lasting pain relief in 63%, as well as lasting relief of point tenderness in 23% of the sites treated.[28] Agarwal, S (2016)[30] advocated PI over RI in the treatment of HMC tightness suggesting that while both were favourable, PI was more advantageous against HMC tightness.

PIR was performed on **Group A** in this study. The age of the participants varied from 18-29 years (23.60 ± 3.60). The footballers had varying experience from 3 months to 14 years (7.48 ± 3.30). Some players were recreational footballers while others played professionally. Due to this, the number of days in a week that the players practiced were also quite diverse from 2-8 days a week (4.53 ± 1.64). Some professional footballers also practiced twice in a week. The data was collected during an ongoing tournament, with matches generally on weekends. The outcome measures AKET and S&R test showed significant improvement in HMC tightness in this group. The decrease in the mean AKET scores from 51.40 ± 7.92 to 40.53 ± 10.84 shows an increase in the knee extension ROM. The S&R scores were measured in cms and also showed an improvement (Pre: 15.41 ± 4.59; Post: 18.48 ± 5.61) implying an increase in HMC flexibility.

Another technique used in the study was Active Release Technique (ART). In this technique, the soft tissue lesions and dysfunctions are addressed. These lesions occur due to the repetitive physical activity. Leahy (1999),[55] the founder of the technique- proposed a mechanism to explain increased tissue stiffness, or tension, called the cumulative injury cycle. In this cycle, repetitive micro-injury in tight muscles leads to an increase in the friction and tension within the myofascial structures. This causes due to decreased circulation to the tissue. The term "chronic cycle", or "inflammation cycle" was used. Both of these cycles lead to the same result: an accumulation of adhesions and fibrosis within the tissue. These adhesions then lead to increased tone and stiffness of the muscle. As such, this vicious cycle is self-perpetuating and the downward spiral continues. The goal of ART is to break this cycle by breaking the adhesions, thus relieving stiffness.[56]

In this study, the therapeutic intervention for **Group B** was ART. 15 participants aged 18-30 years (23.20±3.38) were considered. The mean experience of this group's subjects was similar to that of group A (4 months-17 years; 7.28±4.30) Just like the other group, some players were recreational footballers, while others were professional. The number of days per week, the players practised was also corresponding to the other group (2-6 days; 4.40±1.24). The outcome measures in this group showed significant improvement in the AKE ROM (Pre: 48.80±10.68; Post: 33.73 ± 10.19) and S&R test (Pre: 16.24±7.51; Post: 20.01±7.81). This was in accordance with another study that was piloted by James W. (2006). The pilot study confirmed the benefits of ART on HMC flexibility.[34]

In the past, several studies have also supported the benefits of ART over other techniques. V, Kage (2014) suggested that ART and Mulligan's bent leg raise had immediate effects on HMC flexibility- but ART was more effective possibly due to the breakage of the adhesions caused by the cumulative injury cycle.[31] S, Kothawale (2018) supported ART over positional release technique proposing the possible release of scar tissue and adhesions in ART. It was also suggested that this release of scar tissues and adhesions allowed the muscle to fully lengthen.[32] A similar study as this one was done among Acute ACL tear patients was done to compare the effect of MET and ART. However the results concluded that both the techniques were significantly but equally advantageous.[25] S,Khan (2021) also performed a similar study comparing the same methods- ART and MET for HMC tightness. The results of that study however revealed ART to be more effective.[57]

From all the data that was collected an analysed in this study among footballers, it is obvious that MET (PIR) and ART are both immediately effective in battling HMC tightness. However on comparing the data and following statistical analysis, it is apparent that there is a difference between both the techniques. When compared between both the groups- Group A (MET-PIR) and Group B (ART), difference between the effectiveness of the both treatments is evident in improving knee extension ROM and S&R Test scores. (Group B > Group A) This implies that one session of ART is statistically better than one session of MET (PIR) in battling HMC tightness.

Acknowledgement: None
Conflict of Interest: None
Source of Funding: None
Ethical Approval: Approved

REFERENCES

1. T. Kumazaki , Y. Ehara , T. Sakai. Anatomy and Physiology of Hamstring Injury; Int J Sports Med 2012; 33(12): 950-954 DOI: 10.1055/s-0032-1311593.
2. George Koulouris, David Connell. Hamstring Muscle Complex: An Imaging Review; RadioGraphics (MAY-JUNE 2005) Vol. 25, No. 3.
3. Rodgers CD, Raja A. Anatomy, Bony Pelvis and Lower Limb, Hamstring Muscle. [Updated 2022 Jan 29]. In: StatPearls

[Internet]. Treasure Island (FL): StatPearls Publishing; 2022 Jan.
4. Koli, B. K., & Anap, D. B. (2018). Prevalence And Severity Of Hamstring Tightness Among College Students: A Cross Sectional Study. International Journal of Clinical and Biomedical Research, 4(2), 65–68.
5. Fatima G, Qamar MM, Ul Hassan J, Basharat A. Extended sitting can cause hamstring tightness. Saudi J Sports Med 2017;17:110-4.
6. Weerasekara, Ishanka Kumari, Iresha, et al. (2013). The Prevalence of Hamstring Tightness among the Male Athletes of University of Peradeniya in 2010, Sri Lanka. International Journal of Physical Medicine & Rehabilitation. 01. 10.4172/2329-9096.1000108.
7. Ekstrand J, Gillquist J. The frequency of muscle tightness and injuries in soccer players. The American Journal of Sports Medicine. 1982;10(2):75-78. doi:10.1177/036354658201000202.
8. Rey E, Lago-Peñas C, Casáis L, Lago-Ballesteros J. The effect of immediate post-training active and passive recovery interventions on anaerobic performance and lower limb flexibility in professional soccer players. J Hum Kinet. 2012;31:121-129. doi:10.2478/v10078-012-0013-9.
9. J. Ekstrand, J. Gillquist. The Avoidability of Soccer Injuries. Int J Sports Med 1983; 04(2): 124-128 DOI: 10.1055/s-2008-1026025.
10. Clanton, Thomas O. MD; Coupe, Kevin J. MD Hamstring Strains in Athletes: Diagnosis and Treatment, Journal of the American Academy of Orthopaedic Surgeons: July 1998 - Volume 6 - Issue 4 - p 237-248.
11. Arnason, T. E. Andersen, I. Holme, L. Engebretsen, R. Bahr. Prevention of hamstring strains in elite soccer: an intervention study. Scandinavian Journal of Medicine & Science in Sports; Volume18, Issue1, February 2008, Pages 40-48.
12. Nikolaos Malliaropoulos, Emmanuel Papakostas. The Role of Stretching in Rehabilitation of Hamstring Injuries: 80 Athletes. Article in Medicine and Science in Sports and Exercise · June 2004 DOI: 10.1249/01.MSS.0000126393.20025.5E
13. D. Scott Davis, Paul E. Ashby, Kristi L. McCale, et al. The Effectiveness Of 3 Stretching Techniques On Hamstring Flexibility Using Consistent Stretching Parameters. Journal of Strength and Conditioning Research, 2005, 19(1), 27–32, 2005 National Strength & Conditioning Association.
14. Emilio J. Puentedura, Peter A. Huijbregts, Shelley Celeste, et al. Immediate effects of quantified hamstring stretching: Hold-relax proprioceptive neuromuscular facilitation versus static stretching, Physical Therapy in Sport, Volume 12, Issue 3, 2011, Pages 122-126.
15. Fasen, Jo; O'Connor, Annie; et al. A Randomized Controlled Trial of Hamstring Stretching: Comparison of Four Techniques, Journal of Strength and Conditioning Research: March 2009 - Volume 23 - Issue 2 - p 660-667.
16. Durga Girish Joshi, Ganesh Balthillaya, Anupama Prabhu. Effect of remote myofascial release on hamstring flexibility in asymptomatic individuals – A randomized clinical trial. Journal of Bodywork and Movement Therapies, Volume 22, Issue 3, 2018, Pages 832-837.
17. Tai M, Bandawde M, J. T, Gondkar D. To compare effectiveness of mulligan bent leg raise versus myofascial release in physiotherapy students with hamstring tightness. IJPBR [Internet]. 31Mar.2017 [cited 27Apr.2022];5(01):42-7.
18. Ahmed, Emad T; Alghamdy, Mohammed Saleh; et al. Comparative effect of ultrasound therapy versus static stretching on the extensibility of hamstring muscles. IMSEAR (2014)| ID: sea-153381.
19. Kang S-H, Hwang S-J. Effects of Superficial and Deep Thermotherapy with Hot-pack and Ultrasound on Flexibility on Hamstring Muscles [Internet]. Vol. 24, The Journal of Korean Academy of Physical Therapy Science. Korean Physical Therapy Science; 2017. p. 45–52.
20. McBernard S. Gregorio, Ronalie L. Bernabe, Leonard Paul C. Bondoc, et al. A comparison of stretching with ice vs stretching with heat on hamstring flexibility among physical therapy students. UERM Health Sciences Journal, VOL. 5 NO. 1 • JANUARY - JUNE 2016, 15-19.
21. Brent F. Taylor, Christopher A. Waring, and Teresa A. Brashear. The Effects of Therapeutic Application of Heat or Cold Followed by Static Stretch on Hamstring

Muscle Length. Journal of Orthopaedic & Sports Physical Therapy 1995 21:5, 283-286.
22. Fiona Ballantyne, Gary Fryer, Patrick McLaughlin, The effect of muscle energy technique on hamstring extensibility: the mechanism of altered flexibility, Journal of Osteopathic Medicine, Volume 6, Issue 2, 2003, Pages 59-63, ISSN 1443-8461.
23. Sambandam, Cheraladhan & Alagesan, Jagatheesan & Shah, Shilpi. (2011). Immediate Effect of Muscle Energy Technique and Eccentric Training on Hamstring Tightness of Healthy Female Volunteers - A Comparative Study. International journal of current research and review. 3. 122-26.
24. Mohd. Waseem, Shibili Nuhmani and C. S. Ram. Efficacy of Muscle Energy Technique on hamstring muscles flexibility in normal Indian collegiate males. Calicut Medical Journal 2009; (7): e4.
25. Vibhuti Gaur, Angela Kapoor, Pratik P. Short Term Effects of Muscle Energy Technique vs. Active Release Technique in Improving Hamstring Flexibility and Pain in Patients with Acute Anterior Cruciate Ligament (ACL) Tear - A Randomized Control Trial. J Evolution Med Dent Sci / eISSN - 2278-4802, pISSN - 2278-4748 / Vol. 10 / Issue 03 / Jan. 18, 2021/ 137-142.
26. Roshan Adkitte, Shruti Gajendra Rane, Ujwal Yeole, et al. Effect of muscle energy technique on flexibility of hamstring muscle in Indian national football players. Saudi Journal of Sports Medicine, Year : 2016 | Volume : 16 | Issue : 1 | Page : 28-31.
27. Sailor, S., Mehta, Y., Shah, N., & Trivedi, A. (2018). A comparative study of muscle energy technique and positional release technique on hamstring flexibility in healthy individuals. Journal of Integrated Health Sciences, 6(2), 64.
28. Lewit K, Simons DG. Myofascial pain: relief by post-isometric relaxation. Arch Phys Med Rehabil. 1984 Aug;65(8):452-6. PMID: 6466075.
29. Agrawal Sonal, Comparison between post isometric relaxation and reciprocal inhibition manoeuvres on hamstring flexibility in young healthy adults: randomized clinical trial. International Journal of Medical Research & Health Sciences, Year : 2016, Volume : 5, Issue : 1, First page : (33) Last page : (37).
30. Lalnunsanga, K (2018) Effectiveness of post isometric relaxation versus reciprocal inhibition in improving the range of motion of male adult basketball players with hamstring tightness: A comparative study. Masters thesis, Mohamed Sathak A.J College of Physiotherapy, Chennai.
31. Vijay Kage, Rakhi Ratnam. Immediate Effect of Active Release Technique versus Mulligan Bent Leg Raise in subjects with Hamstring Tightness: A Randomized Clinical Trial. International Journal of Physiotherapy and Research, Int J Physiother Res 2014, Vol 2(1):301-04.
32. Shraddha Kothawale, Keerthi Rao. Effectiveness Of Positional Release Technique Versus Active Release Technique On Hamstring Tightness. International Journal of Physiotherapy and Research, Int J Physiother Res 2018, Vol 6(1):2619-22. ISSN 2321-1822.
33. Scott Howitt, DC, FCCSS(C), FCCRS(C), et al. The conservative treatment of Trigger Thumb using Graston Techniques and Active Release Techniques. J Can Chiropr Assoc. 2006;50(4):249-254.
34. James W. George, Andrew C. Tunstall, Rodger E. Tepe, Clayton D. Skaggs, The Effects of Active Release Technique on Hamstring Flexibility: A Pilot Study, Journal of Manipulative and Physiological Therapeutics, Volume 29, Issue 3, 2006, Pages 224-227, ISSN 0161-4754.
35. Shah, Shlesha; Kage, Vijay. Comparative effectiveness of Active Release Technique and Rolfing Soft Tissue Manipulation in Normal Subjects with Hamstring Tightness - A Randomised Clinical Trial.Indian Journal of Physiotherapy & Occupational Therapy . Apr-Jun2013, Vol. 7 Issue 2, p207-210. 4p.
36. Paul LaStayo, Robin Marcus, Lee Dibble, Fernando Frajacomo, and Stan Lindstedt. Eccentric exercise in rehabilitation: safety, feasibility, and application. Journal of Applied Physiology 2014 116:11, 1426-1434.
37. Nelson RT. A Comparison of the Immediate Effects of Eccentric Training vs Static Stretch on Hamstring Flexibility in High School and College Athletes. N Am J Sports Phys Ther. 2006;1(2):56-61.
38. Jönhagen, Sven; Ackermann, Paul; Saartok, Tönu. Forward Lunge: A Training Study of Eccentric Exercises of the Lower Limbs,

Journal of Strength and Conditioning Research: May 2009 - Volume 23 - Issue 3 - p 972-978
39. Croisier JL, Forthomme B, Namurois MH, Vanderthommen M, et al. Hamstring muscle strain recurrence and strength performance disorders. Am J Sports Med. 2002 Mar-Apr;30(2):199-203. doi: 10.1177/03635465020300020901. PMID: 11912088.
40. LaStayo P, Marcus R, Dibble L, Frajacomo F, et al. Eccentric exercise in rehabilitation: safety, feasibility, and application. J Appl Physiol (1985). 2014 Jun 1;116(11):1426-34.
41. Lepley LK, Lepley AS, Onate JA, et al. Eccentric Exercise to Enhance Neuromuscular Control. Sports Health. 2017 Jul/Aug;9(4):333-340. doi: 10.1177/1941738117710913. Epub 2017 Jun 1. PMID: 28571492; PMCID: PMC5496707.
42. Ponce, David & Guzmán-Muñoz, Eduardo. (2019). Effects of a program of eccentric exercises on hamstrings in youth soccer players Effects of a program of eccentric exercises on hamstrings in youth soccer players. Archivos de Medicina del Deporte. 36. 19-24.
43. Askling C, Karlsson J, Thorstensson A. Hamstring injury occurrence in elite soccer players after preseason strength training with eccentric overload. Scand J Med Sci Sports. 2003 Aug;13(4):244-50. doi: 10.1034/j.1600-0838.2003.00312.x. PMID: 12859607.
44. Afyon, Y. A., & Boyac, A. (2016). The effects of 8-week core training on the development of some motoric features among 18 year-old footballers. Journal of Human Sciences, 13(3), 4595–4603.
45. Sekendiz, Betül; Cuğ, Mutlu; Korkusuz, Feza. Effects of Swiss-Ball Core Strength Training on Strength, Endurance, Flexibility, and Balance in Sedentary Women, Journal of Strength and Conditioning Research: November 2010 - Volume 24 - Issue 11 - p 3032-3040 doi: 10.1519/JSC.0b013e3181d82e70.
46. Dr. Biju Thomas and Faazil M Khan. Effect of core stability training on selected fitness components among cricket players. SSN: Techniques: a case report. J Can Chiropr Assoc. 2007;51(1):23-29.
2456-0057, IJPNPE 2020; 5(1): 139-142 © 2020 IJPNPE.
47. A L Na'ima, et al. Combination effect of core stability exercise and contract relax exercise on hamstring flexibility 2019 J. Phys.: Conf. Ser. 1146 012035.
48. Chinnavan E, Gopaladhas S, Kaikondan P. Effectiveness of Pilates training in improving hamstring flexibility of football players. Bangladesh Journal of Medical Science Vol.14(3) 2015 p.265-269.
49. Joseph E. Muscolino, Simona Cipriani, Pilates and the "powerhouse"—I, Journal of Bodywork and Movement Therapies, Volume 8, Issue 1, 2004, Pages 15-24, ISSN 1360-8592.
50. Noelia González-Gálvez, María Carrasco Poyatos, Pablo Jorge Marcos. Effects Of A Pilates School Program On Hamstring Flexibility Of Adolescents. ev Bras Med Esporte – Vol. 21, No 4 – Jul/Ago, 2015.
51. Penelope Latey, The Pilates method: history and philosophy. Historical Review| Volume 5, Issue 4, P275-282, October 01, 2001.
52. Kloubec JA. Pilates for improvement of muscle endurance, flexibility, balance, and posture. J Strength Cond Res. 2010 Mar;24(3):661-7. doi: 10.1519/JSC.0b013e3181c277a6. PMID: 20145572.
53. Flávia Bertolla, Bruno Manfredini Baroni, Ernesto Cesar Pinto Leal Junior. Effects of a training program using the Pilates method in flexibility of sub-20 indoor soccer athletes. Rev Bras Med Esporte _ Vol. 13, No 4 – Jul/Ago, 2007, 222-226.
54. Kaniz Rabia, Rashid Hafeez Nasir, Danish Hassan. Immediate effect of muscle energy technique in comparison with passive stretching on hamstring flexibility of healthy individuals: A randomized clinical trial. Isra Med J. | Volume 11 - Issue 4 - Part B | Jul – Aug 2019.
55. Leahey PM. Functional Soft Tissue Examination & Treatment by Manual Methods. 2. Gaithersburg, Maryland: Aspen; 1999. Active Release Techniques: A logical approach to soft tissue treatment; pp. 549–52.
56. Spina AA, BKin, DC. External coxa saltans (snapping hip) treated with Active Release Techniques: a case report. J Can Chiropr Assoc. 2007;51(1):23-29.
57. Sarfraj Khan, Bhoomika Patel, Bansari Limbani. Immediate Effect of Active Release Technique Versus Muscle Energy

Technique in Subjective with Hamstring Tightness: A Randomized Clinical Trial. Indian Journal of Physiotherapy and Occupational Therapy, April-June 2021, Vol. 15, No. 2. Pg. 59-64.

How to cite this article: Ruhi Sheth, Syed Rais Akhter Rizvi. The immediate effect of muscle energy technique versus active release technique on hamstring tightness in footballers. *International Journal of Science & Healthcare Research.* 2022; 7(2): 282-294.
DOI: *https://doi.org/10.52403/ ijshr.20220440*

******