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

DISSERTATION

Submitted for the partial fulfilment of the requirement for the degree of

MASTER OF PHYSIOTHERAPY (MPT)

ELECTIVE: ADVANCED PHYSIOTHERAPY IN SPORTS

Done by

K.LALNUNSANGA

Bearing Regn.No: 271650223

Submitted to

THE TAMILNADU Dr. M.G.R. MEDICAL UNIVERSITY

CHENNAI – 600 032

APRIL - 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

DISSERTATION

Submitted for the partial fulfilment of the requirement for the degree of

MASTER OF PHYSIOTHERAPY (MPT)

ELECTIVE: ADVANCED PHYSIOTHERAPY IN SPORTS

Done by

K.LALNUNSANGA

Bearing Regn.No: 271650223

MOHAMED SATHAK A.J. COLLEGE OF PHYSIOTHERAPY

Nungambakkam, Chennai - 600034

MOHAMED SATHAK A.J. COLLEGE OF PHYSIOTHERAPY

Nungambakkam, Chennai – 600034.

This is to certify that the dissertation entitled **"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"** was done by bearing Registration No: **271650223**. This work has been done as a partial fulfilment for the degree of **Master of Physiotherapy** done **at Mohamed Sathak A.J. College of Physiotherapy**, Chennai, and submitted in the year of April 2018 to **The Tamil Nadu Dr. M.G.R. Medical University.**

Place: Chennai

Date:

Seal & Signature of Principal

……

PROF. R.RADHAKRISHNAN, M.P.T., PGDHM.

MOHAMED SATHAK A.J. COLLEGE OF PHYSIOTHERAPY

Nungambakkam, Chennai – 600034.

This is to certify that the dissertation entitled **"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"** was done by bearing Registration No:**271650223**. This work has been done under my direct guidance and supervision for the partial fulfilment of the requirement of Master of Physiotherapy degree at **Mohamed Sathak A.J. College of Physiotherapy**, Chennai, and submitted in the year of April 2018 **to The Tamilnadu Dr. M.G.R. Medical University.**

Place: Chennai

Date:

Signature of Guide

……

PROF. R.RADHAKRISHNAN, M.P.T., PGDHM

Mohamed Sathak A.J. College of Physiotherapy

CERTIFICATE

MOHAMED SATHAK A.J. COLLEGE OF PHYSIOTHERAPY

Nungambakkam, Chennai – 600034.

This is to certify that the dissertation entitled **"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"** was done by bearing Registration No:**271650223.** The undersigned examiner has duly verified and examined the submitted dissertation done by the above candidate.

INTERNAL EXAMINER **EXTERNAL EXAMINER**

…….. …….

Place: Chennai

Date:

DECLARATION BY THE CANDIDATE

I hereby present and declare my dissertation titled **"EFFECTIVENESS OF POST ISOMETRIC RELAXATION VERSUS RECIPROCAL INHIBITION IN IMPROVING THE RANGE OF MOTION OF MALE ADULT BASKETBALL PLAYERS WITH HAMSTRING TIGHTNESS"** Is the outcome of original research work undertaken and carried out by me, under the guidance of **PROF. R.RADHAKRISHNAN, M.P.T., PGDHM** at **Mohamed Sathak A.J. College of Physiotherapy**, for the partial fulfilment of the requirement of Master of Physiotherapy degree and submitted the same during the year April 2018 to **The Tamilnadu Dr.M.G.R. Medical University.**

Place: Chennai

Date:

.....

Signature of the Candidate

ACKNOWLEDGEMENT

I thank **ALMIGHTY** for blessing me in all aspects to complete my dissertation successfully.

I thank our **Management** for providing sufficient books, good faculties and facilitating us to gain a wide knowledge.

My sincere thanks to our Correspondent **Mr. Alhaj E.S.M.A Basheer Ahmed** and our **Director Janab Mohamed Arshad,** Mohamed Sathak A.J. College of Physiotherapy, Chennai.

I have great pleasure to express my deep sense of gratitude and prideful thanks to our college **Principal PROF. R.RADHAKRISHANAN, MPT.PGDHM.**

I wish to express my sincere and heartfelt thanks to my Guide **PROF.R.RADHAKRISHNAN, M.P.T., PGDHM**, for continual support, profound interest and timely and valuable suggestion throughout the period of the study.

It is my privilege to render my heartfelt thanks to all teaching and non-teaching faculty for whose constant support encouragement and constructive criticisms made me to work more.

Heartfelt thanks to my parents, family members and my friends for their immense support and help for all these years in my studies.

I extend my thanks to all who motivated and helped me in all aspects to complete the study.

ABSTRACT

ABSTRACT

TITLE:

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.

BACKGROUND:

Tightness in hamstring muscles leads to hamstring injuries and hamstring injuries are the most common type of injury among athletes. These injuries are slow to recover, make high health expenditure and decrease the performance level of the athlete. Flexibility can be achieved by a variety of stretching techniques, yet little research has been performed on the most effective method. MET has shown beneficial effects on improving the flexibility of muscles. Thus far, no study has directly investigated the relative effects of Post Isometric Relaxation and Reciprocal Inhibition .This study compared the effects of Post Isometric Relaxation and Reciprocal Inhibition in improving the range of motion of male adult basketball players with hamstring tightness.

METHODLOGY:

A sample of 60 basketball players suffering from hamstring tightness where identified after proper assessments and were divided into 3 group with 20 members each. Group-A members received Post Isometric Relaxation, Treadmill running and Hamstring curls exercise. Group-B members received Reciprocal Inhibition, Treadmill running and Hamstring curls exercise. Group-C members received only Treadmill running and Hamstring curls exercise. They were treated twice daily for three weeks. Range of Motion was measured with Goniometry before and after the treatment.

RESULT:

The paired t-test revealed that the knee range of motion of both experimental groups improved significantly after the therapy.

CONCLUSION:

Post Isometric Relaxation is one of the renounce techniques in increasing the range of motion in basketball players with hamstring tightness and its effect is much better when compared with Reciprocal Inhibition.

KEYWORDS:

Post Isometric Relaxation, Reciprocal Inhibition and Hamstring tightness.

INTRODUCTION

INTRODUCTION

The colloquial term ‘‘hamstrings’’ refers to four muscles located in the posterior compartment of the thigh: the semimembranosus, the semitendinosus, and the long and short heads of the biceps femoris. The ischial tuberosity is the site of origin of the hamstring muscles except for the short head of the biceps femoris. Hamstring muscle strain is one of the most common injuries in sports medicine.[1]

Tightness in hamstring muscles leads to hamstring injuries and hamstring injuries are the most common type of injury among athletes. These injuries are slow to recover, make high health expenditure and decrease the performance level of the athlete.[2]

If your muscles have tightened up then blood has been squeezed out of them therefore your muscles are working at less than 100 % of capacity and your performance will be down as a result. Regular sports massage for hamstring muscles and hamstring stretching to improve muscle condition will not only reduce the likelihood of injury but may also improve sporting performance. Tight hamstrings can cause the hips and pelvis to rotate back flattening the lower back and causing back problems. Tight hamstrings can also be responsible for postural problems and other back problems such as sacroiliac joint pain, as they will tend to pull the pelvis out of normal position.[3]

Muscle energy technique (MET) is a manual technique developed by osteopaths that is now used in many different manual therapy professions. It is claimed to be effective for a variety of purposes, including lengthening a shortened or contractured muscle, strengthening muscles, as a lymphatic or venous pump to aid the drainage of fluid or blood, and increasing the range of motion (ROM) of a restricted joint.[4]

Handel et al. identified significant increases in hamstring flexibility along with an increase in passive torque (increase in force used to stretch the hamstring) after a contract-

relax exercise program**. Wallin et al.** claimed that contract relax techniques were more effective than ballistic stretching for improving muscle flexibility over a 30-day period, whereas other researchers, however, have reported no differences between the two techniques.[7]

MET is claimed to be useful for lengthening a shortened muscle, improving range of motion at a joint and increasing drainage of fluid from peripheral regions.[8] This approach which targets primarily the soft tissue is also known as active muscular relaxation.[9]

NEED FOR THE STUDY

NEED FOR THE STUDY:

Hamstring tightness one of the leading problems faced by athletes, but very little research had been done in this matter. These injuries are slow to recover, make high health expenditure and decrease the performance level of the athlete.

.

AIM OF THE STUDY

AIM OF THE STUDY:

To determine the effectiveness of Post Isometric Relaxation versus Reciprocal Inhibition in improving the range of motion of male adult basketball players with hamstring tightness

OBJECTIVE OF THE STUDY

OBJECTIVE OF THE STUDY:

To evaluate the effectiveness of Post Isometric Relaxation for increasing range of motion in subjects with hamstring tightness.

To evaluate the effectiveness of Reciprocal Inhibition for increasing range of motion in subjects with hamstring tightness.

Comparing the effectiveness of Post Isometric Relaxation and Reciprocal Inhibition in subjects with hamstring tightness.

HYPOTHESIS

HYPOTHESIS:

Alternative hypothesis:

There will be a significant effectiveness in Post Isometric Relaxation in improving the range of motion of male adult basketball players with hamstring tightness.

There will be a significant effectiveness in Reciprocal Inhibition in improving the range of motion of male adult basketball players with hamstring tightness.

Null hypothesis;

There will be no significant effectiveness in using Post Isometric Relaxation and Reciprocal Inhibition in improving the range of motion of male adult basketball players.

REVIEW OF LITERATURE

REVIEW OF LITERATURE

I. Weerasekara et.al, Inability to achieve greater than 160° of knee extension with hip at 90° of flexion is considered as hamstring tightness [3]. Hamstring tightness leads to hamstring injuries and hamstring injuries are the most common type of injury among athletes. These injuries are slow to recover, make high health expenditure and decrease the performance level of the athlete.[2]

Leon Chaltow, In this respect, an increase in hamstring tension might well be part of a defensive arthrokinematic reflex mechanism of the body to diminish spinal load.[10]

John Gibbons, The main effects of MET can be explained by two distinct physiological processes: post- isometric relaxation (PIR) and reciprocal inhibition (RI). The prolonged muscle stretch will increase overall stretching capability due to the protective relaxation of the Golgi tendon organs overriding the protective contraction.[11]

L.S.Krivikas, Among men, lower extremity injuries were associated with lower ligamentous laxity scores (p = .008) and greater muscle tightness (p = .04).[12]

Kengo Sato, Hamstring is one of the most injured muscle in sports medicine.[1]

Wallin D, Ekblom B, Grahn R, Nordenborg T, It is claimed to be effective for a variety of purposes, including lengthening a shortened or contractured muscle, strengthening muscles, as a lymphatic or venous pump to aid the drainage of fluid or blood, and increasing the range of motion (ROM) of a restricted joint.[6]

Gribble PA, Guskiewicz KM, Prenctice WE, Shields EW, claimed that contractrelax techniques were more effective than ballistic stretching for improving muscle flexibility over a 30-day period.[7]

Brockett, C.L., Morgan, D.L. and Proske U, The hamstrings muscles are the most common musculo-tendinous injuries in athletic activities.[13]

Handel, M., Horstmann, T., Dickhuth, H.H. and Gülch, R.W, It was reported that the application of post-isometric stretching technique, such as MET, produce greater changes in range of motion and muscle extensibility than static or ballistic stretching.[14]

William DB, Flexibility is considered as an essential element of normal biomechanical functioning. Flexibility including improves athletic performance, reduced injury risk, prevention or reduction of post exercise soreness and improved co- ordination.[15]

Fellingham G.W. , Measom G.W, Tight hamstring muscle also can increase the patellofemoral compressive force because of the increased passive resistance during the swing phase of ambulation and running[16]

Webster G, PIR group showed significant improvement on both right side and left side among males and also in females. This can be correlated with study conducted by Patrick J H which showed significant improvement in the flexibility of hamstrings with PIR.[17]

Thampi J, Concluded that PIR technique given for 3 weeks significantly improved (P=0.001) hamstring flexibility and increased knee extension range of motion (17.40±4.4)[18]

Healy P.J, After a phase of isometric contraction, the muscle would show an increased flexibility due to decreased resting tension which was due to the post contraction inhibition of alpha motor neuron and/or by reduced motor neuron excitability.[19]

Osternig et al, the Agonist Contract Relax (reciprocal inhibition) showed an improvement of 9% to13% (approximately 2007) in knee joint range of motion than the Contract Relax and static stretch[20]

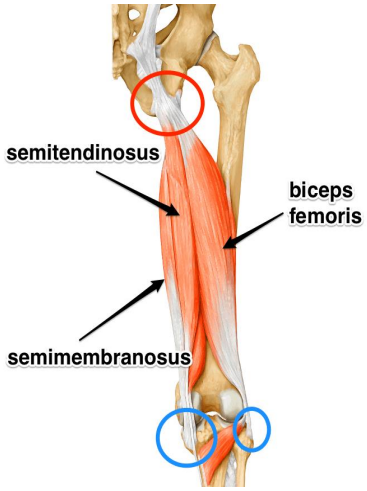
Webster G, In Reciprocal inhibition, the muscle spindles discharge nerve impulses, which excite the afferent nerve fibers of the agonist muscle; they synapse with the excitatory motor neuron of the agonist muscle (in spinal cord) and at the same time inhibit the motor neuron of the antagonist muscle which prevents it from contracting .This results in the relaxation of the antagonist[21]

Fryer G, PIR may principally be a biomechanical event, a combination of viscoelastic creep and plastic change in the parallel and series connective tissue elements of the muscle, above and beyond that obtained by passive stretch.[22]

KINESIOLOGY

KINESIOLOGY

The term ‘hamstrings’ refers to three muscles located in the posterior thigh; the semitendinosus (ST) and the semimembranosus (SM) are located at the medial side, and the biceps femoris at the lateral side. The biceps femoris has two anatomically and functionally distinct heads, the long (BFlh) and the short head(BFsh). The BFlh, ST and SM cross the hip and the knee joint (biarticular muscles) and due to this configuration they are primary knee flexors and major hip extensors.



Hamstring function during sprints:

Its configuration allows hamstrings to act as both hip extensors and knee flexors. During running, hamstrings activation starts at the mid-swing phase and continues through the late swing to the stance or early swing phase.

During the late swing phase, hamstrings undergo eccentric loading to decelerate the forward movement of both the thigh and the shank. After the successful control of the knee extension, and prior to the subsequent foot contact, a transition of the hamstrings action from eccentric to concentric occurs as knee flexion commences (stretch-shortening cycle). This

concentric activity continues throughout the stance phase contributing to the hip extension as the body moves forwards.

However, some eccentric activity has also been reported during the late stance phase for the BFlh and ST or the BFsh**.** Studies have shown that muscle-tendon unit stretch increases with increasing running velocity up to ~80% of maximum, but remains relatively constant at faster velocities. However, the magnitude of strain differs between the hamstrings muscles. Musculoskeletal modelling studies have shown that, during the late swing phase, it is the BFlh muscle-tendon unit that exhibits the greatest extension (9.8-13.0% change in length relative to upright standing length) compared to SM (7.7-11.0%) and ST (8.4-11%).

Current data show that hamstrings activation is greatest during the late swing and early stance phases. The former involves a stretch-shortening cycle with a large eccentric action of the hamstrings that imposes different loading on each of the different hamstrings muscles, while the latter involves a high concentric loading. The high biomechanical load imposed on this muscle group highlights their significance during high-speed running activity.

Hamstring function during jumps:

Before the body takes off in a vertical jump, the preparatory phase of the body begins by attaining flexion positions in the lower extremities. This will coil up the body, thus giving more potential energy to the muscle to be used. It is eccentric with gravity acting as the driving force.

Take off phase starts with the extension of the hip joint, the biarticular hamstrings (semitendinosus, the semimembranosus and biceps femoris long head) will contract at their

proximal ends thus extending the hip joint and at the same time relax their distal ends allowing the extension of the knee.

Landing phase begins as the body touches the ground with gravity pulling the body downwards the legs go into flexion again, for cushioning the landing. Here the hamstrings and the quadriceps take most of the strains (30% hamstrings and 30% quadriceps of total). The hamstrings will go eccentric with the proximal heads slowing down the hip flexion.

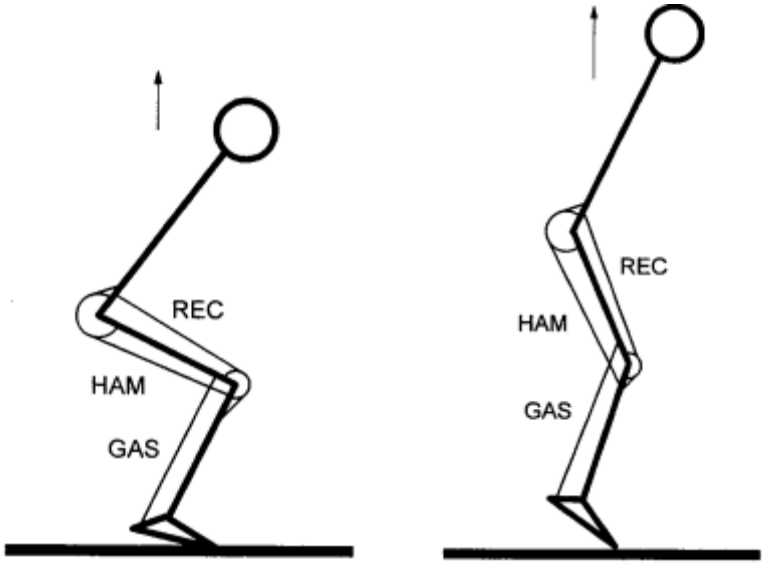


Figure: Preparatory phase and take off phase

Kinematics of hamstring:

The hamstring muscle-tendons are shortening at foot contact, and continue to shorten throughout the stance phase of sprinting. Hamstring muscle-tendon lengthening started at 45% of the gait cycle, which is during swing just before the knee is reversing direction and starting to extend. Muscle-tendon lengthening persisted from this point until reaching peak lengths at 90% of the gait cycle, which slightly preceded maximum knee extension during terminal swing.

The individual hamstring muscle-tendons are stretched an average of 7.4% (SM), 8.1% (ST) and 9.5% (BF) beyond nominal upright lengths. During late swing, the hip is flexed and the knee is extending. The hamstring muscles are active at this stage while lengthening, which could induce an eccentric contraction injury. Alternatively, hamstring muscles remain active into stance when they are presumably.

PATHOPHYSIOLOGY

PATHOPHYSIOLOGY

Muscle tightness is caused by a decrease in the ability of the muscle to deform, resulting in a decrease in the range of motion at the joint on which it acts. Inability to achieve greater than 160° of knee extension with hip at 90° of flexion is considered as hamstring tightness.

There can different causes of hamstring tightness:

1) **Protective Tension of the Hamstrings:**

This is readily apparent in some with excessive anterior pelvic tilt, which puts a higher stretch on the hamstrings, which posteriorly tilt the pelvis. When someone is highly anteriorly tilted, the hamstrings are constantly activated to prevent extension-based back pain, such as spondylolysis, spondylolisthesis and lumbar erector tightness/strains. This is a problem most commonly seen in females (greater anterior pelvic tilt than men) and athletes.

2) **Neural Tension:**

It is not uncommon at all for those with lumbar disc issues to present with radicular pain, tightness, or numbness/tingling into the legs - especially the hamstrings. The symptoms may come from nerve entrapment (most commonly the sciatic nerve) on soft tissue structures further down the chain.

3) **Prolonged contracture:**

This is developed when the hamstrings are kept in a shortened position for extended period of time. Thus, decreasing the length of the muscle fibres, which usually lead to contractures.

4) Previous Hamstring Strains:

Best predictor of hamstrings strains is a previous hamstrings injury. If an injury had occurred before, that area may never be the same from a tissue density standpoint - whether it's the surrounding fascia or the muscle or tendon itself. A previous injury can leave athletes feeling "tight" in the region.

5) Acute hamstring strain or tendinosis:

It can be due to injury to the actual muscle. Maybe a strain or just a tendinosis (due to overuse where tissue loading exceeds tissue tolerance for loading), depending on the grade as a grade 1 is more tolerable than grade 3 strain where bruising occurs all along the posterior thigh.

METHODOLOGY

METHODOLOGY

RESEARCH DESIGN: A comparative study

SAMPLING DESIGN: Non probability convenient sampling

SAMPLING SIZE: 60 subjects

GROUP A: 20 subjects in experimental group A (Post Isometric Relaxation)

GROUP B: 20 subjects in experimental group B (Reciprocal Inhibition)

GROUP C: 20 subjects in control group

INCLUSION CRITERIA:

- Male adult basketball players
- Subjects with Hamstring tightness
- Subjects with age 20 to 30 years

EXCLUSION CRITERIA:

- Subjects without Hamstring tightness
- Non- basketball players
- Subjects with deformities
- Subjects presenting health problems unassociated with hamstring tightness

STUDY SETTING:

Clinical based setting

STUDY DURATION:

20-25 minutes per session, 2 sessions per day, daily for 3 weeks

VARIABLES MEASURED:

Independent variables:

- Post Isometric Relaxation
- Reciprocal Inhibition

Dependent variable:

- Range of motion

OUTCOME MEASUREMENT SCALE:

- Goniometer

MATERIALS REQUIRED:

1. Pillows
2. Couch
3. Footstool
4. Towels
5. Goniometer
6. Stop Watch

Method of data collection

Consent for the study:

As the study includes human subjects, all subjects fulfilling the inclusion criteria will be informed about the study and written consent (Annexure 1) will be taken from the subjects.

Randomisation into groups:

All the subjects who fulfil the inclusion criteria will be assigned to three groups based on simple random sampling. The subjects were randomly allocated into three groups of twenty each. Sixty pieces of paper will be used where twenty papers written with the letter "A" identify the subjects to take into Group-A and twenty with the letter "B" identify the subjects to take into Group-B and twenty papers written with the letter "C" identify the subjects to take into Group-C. All the sixty pieces of paper will be tightly folded and placed in a box. After checking the box, each subject will be asked to withdraw a paper. Twenty subjects with the letter "A" will be enlisted under Group-A, twenty subjects with the letter "B" will be enlisted under Group-B and twenty subjects with the letter "C" will be enlisted under Group-C.

Pre-intervention evaluation:

All the groups will be assessed by physiotherapist using goniometer for the Range of motion for the subjects with hamstring tightness.

MEASUREMENT TOOLS

Goniometry:

Testing Position:

Subject is lying supine on the table. The hip is positioned in 90 degree of flexion and mid range of external and internal rotation.

Normal knee extension: 160-180 degrees

Goniometric Alignment:

Axis is placed over the lateral epicondyle of the femur about midway between the maximum anterior to posterior flares of the condyle. The stationary arm is placed parallel to the lateral midline of the femur (through greater trochanter) and the moving arm is placed lateral at the midline of the fibula (through the lateral malleolus).

PROCEDURE

PROCEDURE

Sixty subjects who satisfy the inclusion criteria were selected for the study and informed consent was taken from them before starting the study. Initial assessment was taken and then the procedure was explained to the subjects properly. All the subjects selected for the study will undergo a pre and post treatment assessment with goniometry. The treatment was given twice daily for three weeks to all the groups. All the subjects had a common exercise program at home.

Treatment Protocol:

Group A – Experimental Group

-Post Isometric Relaxation

Frequency:

2 cycles per minute

Duration:

5 minutes

Rest period:

10 seconds rest after each minute

-2 sessions per day**.**

a. Treadmill running for 10 mins.

b. Hamstring curls at ½ RM for 10 repetitions at 3 sets.

Home exercises:

1) Static hamstring stretch

2) Straight-leg raise (sitting)

3) Squats

- All exercises were done in 10 repetitions on a daily basis of 3 weeks.

Group B – Experimental Group

- Reciprocal Inhibition

Frequency:

2 cycles per minute

Duration:

5 minutes

Rest period:

10 seconds rest after each minute

-2 sessions per day**.**

a) Treadmill running for 10 mins.

b) Hamstring curls at ½ RM for 10 repetitions at 3 sets.

Home exercises:

1) Static hamstring stretch

2) Straight-leg raise (sitting)

3) Squats

- All exercises were done in 10 repetitions on a daily basis of 3 weeks.

Group C – Control group:

- Treadmill running for 10 mins
- Hamstring curls at ½ RM for 10 repetitions at 3 sets.

Home exercises:

1) Static hamstring stretch

2) Straight-leg raise (sitting)

3) Squats

- All exercises were done in 10 repetitions on a daily basis of 3 weeks.

POST ISOMETRIC RELAXATION:

The patient is comfortably positioned in supine lying at the edge of the plinth. On standing laterally to the affected side, facing the patient, the therapist takes the affected leg onto his inner shoulder with 180 degrees of knee extension. The inner hand is placed in front of the patella to stabilize the knee joint and prevent flexion of the knee. The outer hand is placed onto the posterior aspect of the thigh to feel the hamstring contraction.

The therapist applies upward force from the shoulder, placing the leg at hip maximum hip extension in the pain free range or range with tolerable pain while the inner hand is used for stabilisation. The patient is the asked to press the leg against the shoulder which will be counteracted by and equal and opposite force through the therapist's shoulder thus creating an isometric effect on the patients hamstring.

After ten seconds of contraction, the patient is asked to relax the leg. Then the therapist will apply force to the leg. This takes the joint to a further range which is held for another 10 seconds. The patient is asked to contract for 10 seconds and relax for 5 seconds and new stretching position maintained for 10 seconds. This PIR is done at the rate of 2 cycles per minute for 5 minutes with a rest period of 10 seconds between each minute.(Fig.1)

RECIPROCAL INHIBITION:

The patient is comfortably positioned in supine lying at the edge of the plinth. On standing laterally to the affected side facing the patient, therapist places his outer hand on the muscle bulk of the quadriceps muscle to feel the contraction. The inner hand is placed in front of the knee to prevent knee flexion.

The therapist applies upward force from the shoulder, placing the leg at hip maximum hip extension in the pain free range or range with tolerable pain while the inner hand is used for stabilisation. The patient is then asked to bring the leg towards them, thus trying to create

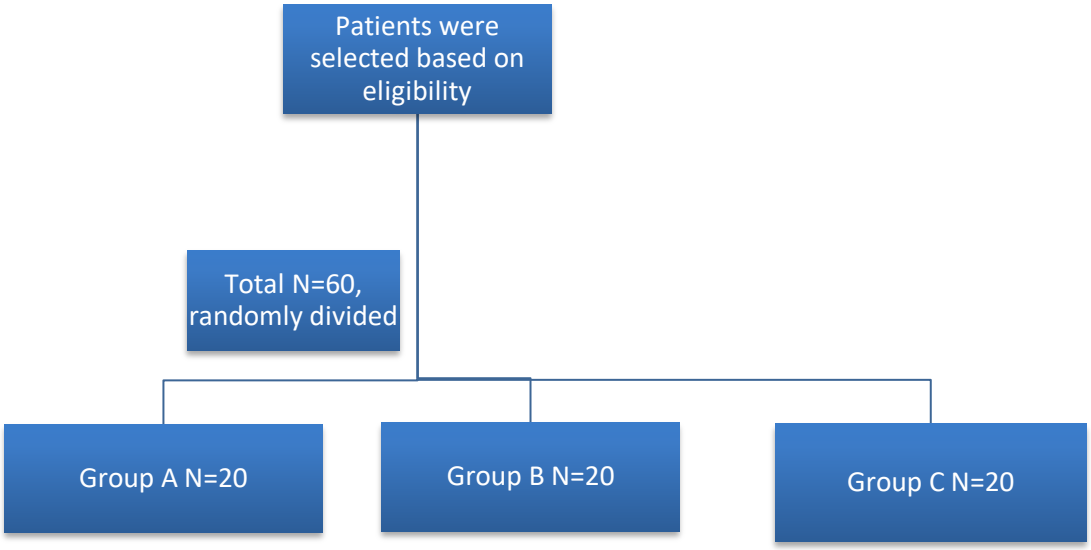
more flexion to the hip joint. This will activate the quadriceps muscles while the leg knee is still stabilized at 180 degree extension.

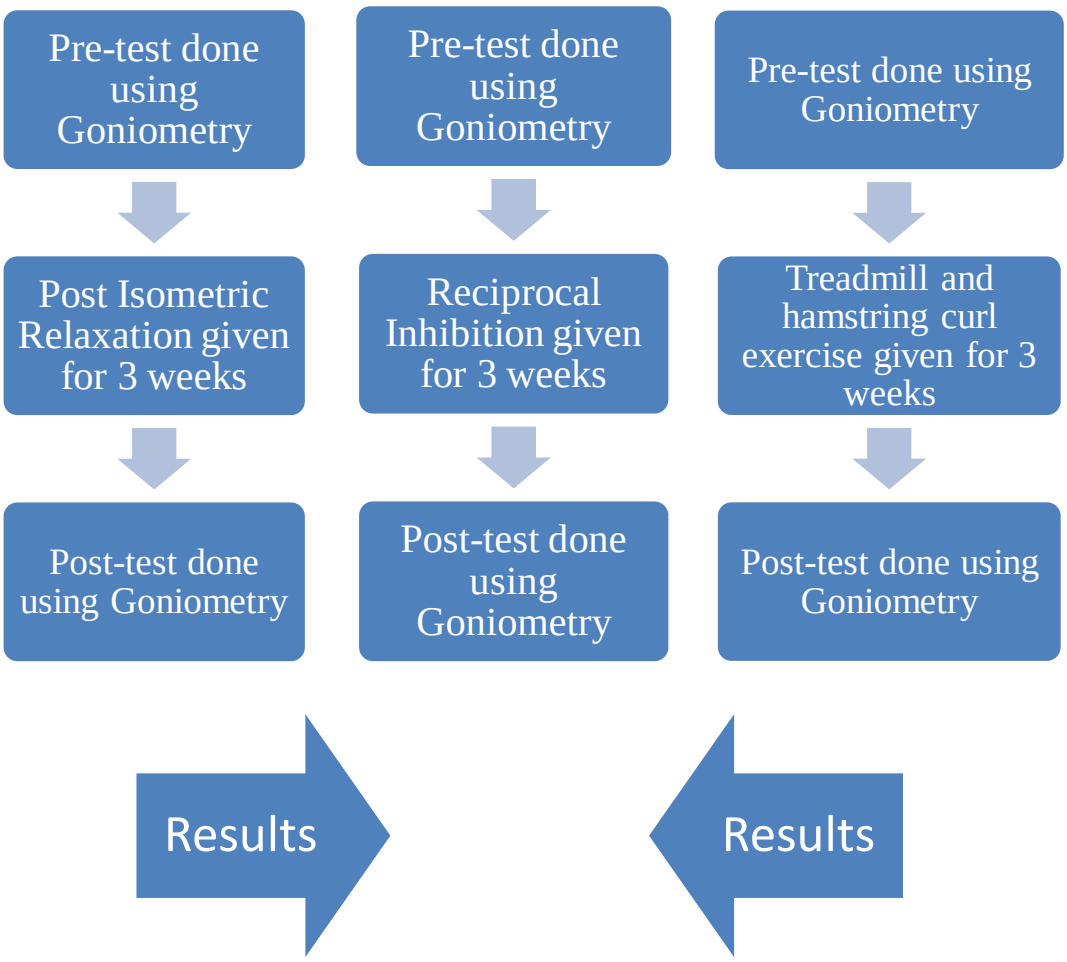
After ten seconds of contraction, the patient is asked to relax the leg for 5 seconds. Then the therapist will apply force to the leg. This takes the joint to a new stretch range which is held for 10 seconds. The patient is asked to contract for 10 seconds and relax for 5 seconds and new stretching position maintained for 10 seconds. This RI is done at the rate of 2 cycles per minute for 5 minutes with a rest period of 10 seconds between each minute.(Fig.2)

POST ISOMETRIC RELAXATION (Fig.1):

RECIPROCAL INHIBITION (Fig.2)

Flowchart of the study





DATA ANALYSIS

DATA ANALYSIS

T-Test for Goniometry:

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Pre test A	151.45	20	2.762	.618
	Pre test C	152.70	20	2.003	.448
Pair 2	Pre test B	152.05	20	2.350	.526
	Pre test C	152.70	20	2.003	.448
Pair 3	Post test A	174.35	20	2.815	.629
	Post test C	152.70	20	2.003	.448
Pair 4	Post test B	167.15	20	2.412	.539
	Post test C	152.70	20	2.003	.448

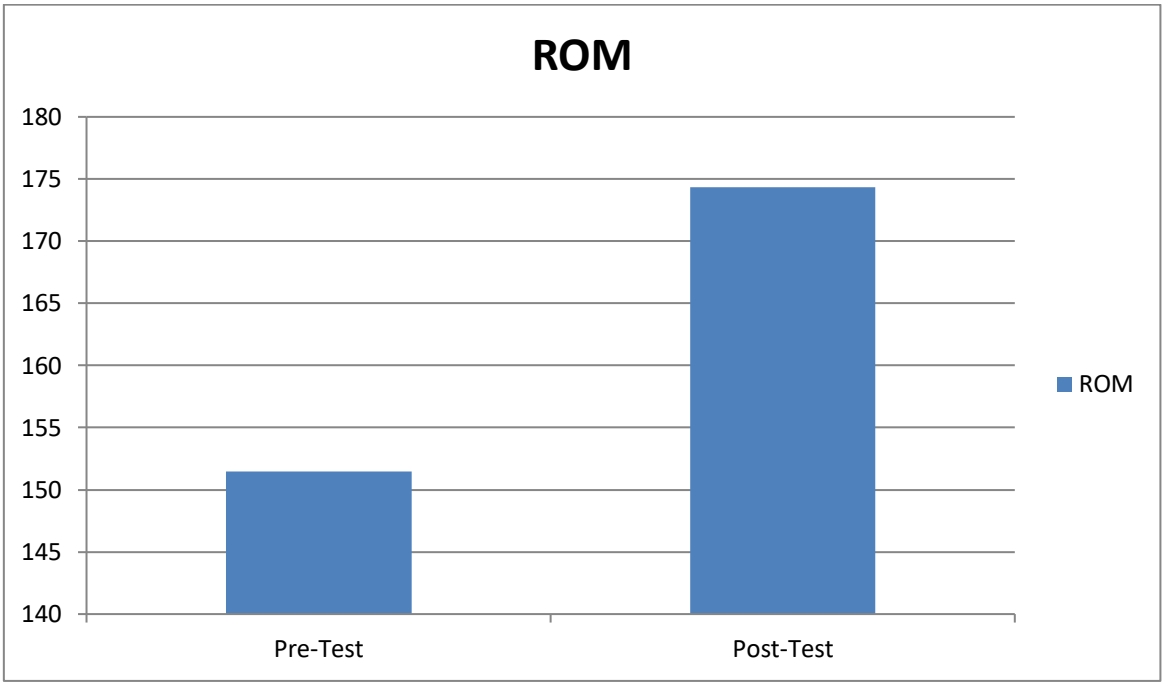
Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	PretestA & PretestC	20	.197	.405
Pair 2	PretestB & PretestC	20	.451	.046
Pair 3	PosttestA & PosttestC	20	-.046	.848
Pair 4	PosttestB & PosttestC	20	-.056	.816

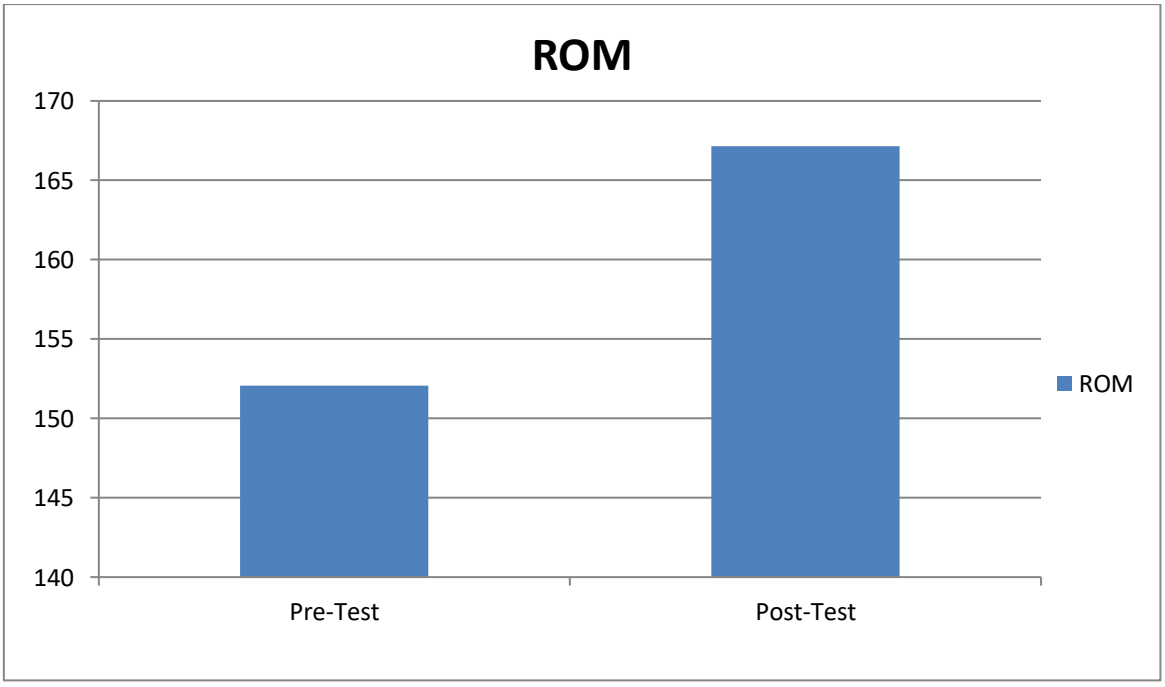
Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Pre test A – Pre test C	-1.250	3.076	.688	-2.690	.190	-1.817	19	.000
Pair 2	Pre test B- Pre test C	-.650	2.300	.514	-1.727	.427	-1.264	19	.000
Pair 3	Post test A- Post test C	21.650	3.528	.789	19.999	23.301	20.440	19	.000
Pair 4	Post test B- Post test C	14.450	3.220	.720	12.943	15.957	13.072	19	.000

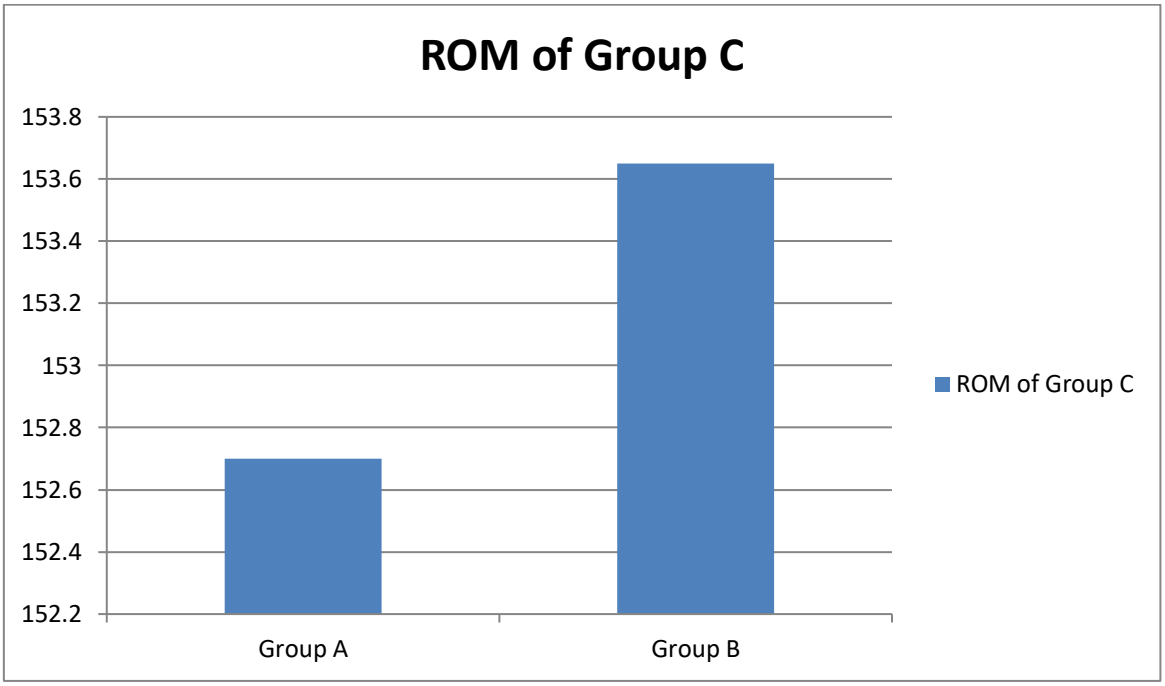
GROUP A(PRETEST & POSTTEST)



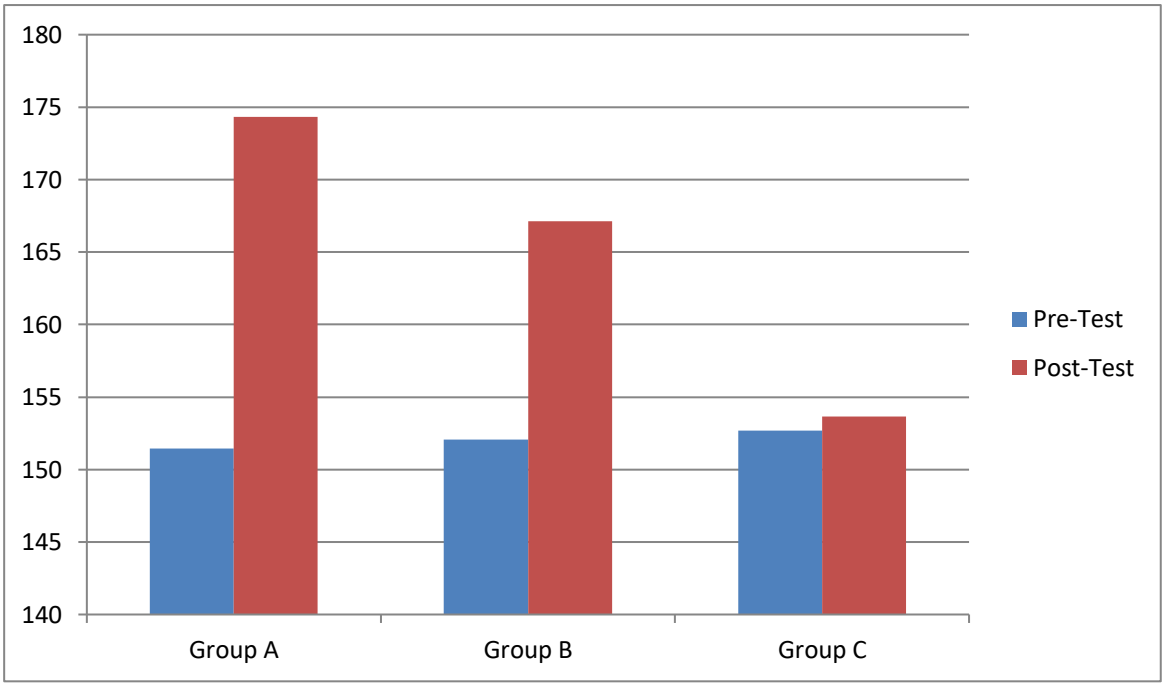
GROUP B (PRETEST & POSTTEST)



GROUP C (PRETEST & POSTTEST)



COMPARISON OF GROUP A,B& C



RESULTS

RESULTS

GROUP –A (POST ISOMETRIC RELAXATION)

At the base line mean of goniometric values in pre-test for extension 151.45 was and post-test was 174.35. All the values were found statistically with $p<0.001$ and 95% Confidence Interval.

GROUP – B (RECIPROCAL INHIBITION)

At the base line mean of goniometric values in pre-test for extension was 152.05 and post-test was 167.15 All the values were found statistically with $p<0.001$ and 95% Confidence Interval.

GROUP – C (CONTROL GROUP)

At the base line mean of goniometric values in pre-test for extension was 152.70 and post-test was 152.70 All the values were found statistically with $p<0.001$ and 95% Confidence Interval.

DISCUSSION

DISCUSSION

The study was taken to find a better treatment for players with hamstring tightness. Hamstring tightness is seen as a painful and restrictive disorder. So, rather than the application of electrotherapy measures, a more advanced manual therapy measure can be applied for better results.

PIR group showed significant improvements in the Range of Motion of the knee joint. In PIR subject was instructed to perform isometric contraction for 10 seconds, (Lewit)[20] ·Study done by Cornelius, W. L Rauschuber, M. R [20] found that an isometric contraction greater than 6 seconds up to 10 seconds was sufficient to produce desired outcome. This is followed by the second phase, where the muscle was held in relaxed position for 5 seconds and then knee was passively stretched to new barrier and held for 30 seconds. After a phase of isometric contraction, the muscle would show an increased flexibility due to decreased resting tension which was due to the post contraction inhibition of alpha motor neuron and/or by reduced motor neuron excitability. [19]

The RI group also showed improvement in hamstring flexibility. Reciprocal inhibition works on Agonist Contract Relax technique with the use of sub maximal contraction. Study done by Feland and Marin suggested that the use of sub maximal contraction strength is generally thought to reduce the risk of treatment injury or injury aggravation. Feland and Marin recommended the sub maximal contraction intensity was 65% of maximum contraction, and is sufficient to achieve optimal gain in joint ROM and produce desired outcome [20]

There is a considerable improvement in all the groups except group C which is a control group. Groups A and B had significant improvement in their extension range while the Group-A participants had a greater improvement than Group-B.

CONCLUSION

CONCLUSION

Group A (Post Isometric Relaxation) and Group B (Reciprocal Inhibition) which were experimental groups were compared with Group C which was a control group. The results were taken and measure from this comparison.

As the study is all about the comparison of the efficacy of the two techniques in Muscle Energy Technique on basketball players with hamstring tightness, it was found on direct observation and by statistical values that Group-A patients improved better than Group-B patients.

The study clearly states that all the players who received Post Isometric Relaxation improved in their Extension range of motion and are undergoing better progressions in sports activities.

This study concludes that Post Isometric Relaxation is more effective in comparison to Reciprocal Inhibition on the basketball players with Hamstring tightness.

LIMITATION AND RECOMMENDATION

LIMITATION AND RECOMMENDATION

- Only Basketball players with hamstring tightness are included. Other sports can be included.
- PIR and RI for 3 weeks. Longer duration study can be done.

REFERENCES

REFERENCE:

1. **Kengo Sato • Akimoto Nimura • Kumiko Yamaguchi • Keiichi Akita** Anatomical study of the proximal origin of hamstring muscles 13 May 2012 DOI 10.1007/s00776-012-0243-7 Page -1

2. **Ishanka Weerasekara[1*], Iresha Kumari[1], Nilushika Weerarathna[1], Charith Withanage[1], Chamika Wanniarachchi[1], Yancy Mariyanayagam[1], Shyamala Vigneshwaran[1], Priyanthi Shivaraja[1] and Hilary Suraweera[2]** The Prevalence of Hamstring Tightness among the male athletes of University of Peradeniya in2010, Sri Lanka, Int J Phys Med Rehabil 2013, 1:1 DOI: 10.4172/2329-9096.1000108 Page – 1
3. Tight Hamstring Muscles Sportsinjuryclinic.net 2017 Page -1

4. **Greenman P**. Principles of Manual Medicine. 2nd ed. Baltimore: Williams &Wilkins; 1996: 93-98

5. **Handel M, Horstmann T, Dickhuth HH,Gulch RW**. Effects of contract-relax stretching training on muscle performance in athletes. European Journal of Applied Physiology. 1997; 76:400-408

6. **Wallin D, Ekblom B, Grahn R, Nordenborg T**. Improvement in muscle flexibility. A comparison between two techniques. American Journal of Sports Medicine. 1985; 13(4): 263-8

7. **Gribble PA, Guskiewicz KM, Prenctice WE, Shields EW.** Effects of static and hold-relax stretching on hamstring range of motion using the FlexAbility LE1000. Journal of Sport Rehabilitation. 1999;8:195-208

8. **Greenman, P.E.**: Principles of Manual Medicine, third ed. Lippincott Williams and Wilkins, Baltimore, 2003.

9. **Waseem, M., Nuhmani, S.H. and Ram, C.S**.: Efficacy of Muscle Energy Technique on hamstring muscles flexibility in normal Indian collegiate males. Calicut Medical Journal; 7(2):e4, 2009.

10. **Leon Chaltow,** Muscle Energy Techniques, 1st edition, sept 02 2012 Page -120

11. **John Gibbons**, Muscle Energy Technique, Sports Osteopath, International Therapist, Issue 97, June 2011, Page-28.
12. **Krivickas LS[1], Feinberg JH,** Lower extremity injuries in college athletes: relation between ligamentous laxity and lower extremity muscle tightness Arch Phys Med Rehabil. 1996 Nov;77(11):1139-43.

13. **Brockett, C.L., Morgan, D.L. and Proske, U.:** Predicting hamstring strain injury in elite athletics. Med Sci Sports Exerc; 36: 379-387, 2004.

14. **Handel, M., Horstmann, T., Dickhuth, H.H. and Gülch, R.W**.: Effects of contract-relax stretching training on muscle performance in athletes. Europian Journal of Applied Physiology and Occupational Physiology; 76(5): 400-408, 1997

15. **William DB**. The effect of static stretch and dynamic range of motion training on the flexibility of the hamstring muscles. Journal of orthopedic and sports physical therapy. 1998;27(4): 295-300

16. **Fellingham G.W. , Measom G.W.** The effect of duration of stretching of the hamstring muscle group for increasing range of motion in people aged 65 years or older ,physical therapy, May 2001,81(5) ,1110-1117

17. **Webster G.**The physiology and application of muscle energy techniques. DARM RMT SMTO19-20

18. **Thampi J.** Comparison of post isometric relaxation excise and static stretching for Hamstring tightness in normal individuals' .Rajiv Gandhi University of health sciences, Bangalore. 2007.1-45

19. **Healy P.J.** Effects of post –isometric relaxation on hamstring mobility using sit –and –reach test. 2011; 22,1-14

20. **Chaitow L. et al** Muscle energy techniques 3 rd edition Elsevier, page num.8-10, 79, 82-86,110- 127,154-157.

21. **Webster G.**The physiology and application of muscle energy techniques. DARM RMT SMTO19-20

22. **Fryer G.** Muscle energy technique concepts: A need for change .Journal of osteopathic medicine. 2003;3(2):54-59.

APPENDIX

APPENDIX – I

INFORMED CONSENT LETTER

CONSENT FORM

This is to certify that I _____age _____ freely and voluntarily agreed to participate in the study _____. He/She has been explained about the procedures and the benefits and risk that would occur during the study on all the information given by me will be kept strictly confidential and used for research purpose.

PATIENTS NAME: _____

DATE: _____

SIGNATURE: _____

APPENDIX - II

ASSESSMENT

Subjective assessment

Name

Age

Gender

Occupation

Chief complaints

History of illness

Present history

Past history

Personal history

Familial history

Socio economic history

Pain Assessment

Site

Side

Onset

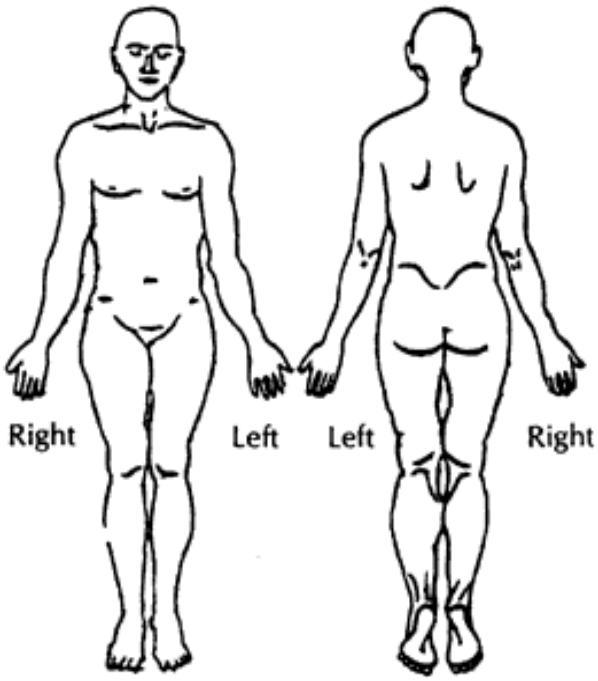
24 hour pattern

Duration of pain

Relieving factors

Visual Analogue Scale

Body Chart



On observation

Built: Ectomorphic/Mesomorphic/Endomorphic

On palpation

Tenderness

Grade I – Tenderness on palpation without grimce

Grade II – Tenderness on palpation with grimce

Grade III – Tenderness and withdraws the limb

Grade IV – Patient will not allow to palpate

Temperature

Edema

On Examination

Range of motion

	Right	Left
Active range of motion		
Passive range of motion		
Active assisted range of motion		

Muscle Girth

Manual muscle testing

Special test

Investigation

Problem list

Treatment Plan

Aim of treatment

Short term goal

Long term goal

MASTER CHARTS

MASTER CHART I

GONIOMETRY (GROUP-A) values in degrees

SUBJECTS	Pre Test	Post Test
A	**151**	**175**
B	**145**	**169**
C	**150**	**173**
D	**149**	**173**
E	**155**	**178**
F	**153**	**175**
G	**151**	**174**
H	**153**	**178**
I	**153**	**177**
J	**154**	**174**
K	**148**	**172**
L	**149**	**170**
M	**153**	**171**
N	**156**	**179**
O	**151**	**179**
P	**155**	**174**
Q	**152**	**175**
R	**149**	**173**
S	**153**	**175**
T	**149**	**173**

MASTER CHART II

GONIOMETRY (GROUP-B) values in degrees

SUBJECTS	Pre Test	Post Test
A	155	167
B	151	163
C	149	162
D	152	165
E	156	168
F	150	167
G	152	164
H	151	169
I	156	171
J	153	170
K	149	168
L	150	169
M	149	166
N	152	167
O	150	166
P	156	170
Q	152	167
R	154	168
S	151	170
T	153	166

MASTER CHART III

GONIOMETRY (GROUP-C) values in degrees

SUBJECTS	Pre Test	Post Test
A	**154**	**155**
B	**156**	**156**
C	**152**	**154**
D	**151**	**151**
E	**155**	**156**
F	**154**	**155**
G	**153**	**155**
H	**151**	**152**
I	**153**	**154**
J	**156**	**157**
K	**149**	**152**
L	**152**	**154**
M	**153**	**153**
N	**154**	**155**
O	**151**	**151**
P	**154**	**155**
Q	**152**	**152**
R	**154**	**155**
S	**149**	**150**
T	**151**	**151**