

Comparison between Immediate Effects of Post Isometric Relaxation and Reciprocal Inhibition Techniques on Hamstring Flexibility in Patients with Hamstring Tightness: An Experimental Study

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Abstract

Aim: There are studies comparing the effects of post isometric relaxation technique & reciprocal inhibition technique on hamstring muscle flexibility but to the best of our knowledge there is hardly any study that has reported comparative immediate effect of these two techniques. Thus the aim of our study was to evaluate the immediate effect of these two techniques on hamstring muscle flexibility.

Method: The research design used was Comparative Experimental study design. Total 46 participants were screened and those meeting the inclusion criteria (n=40) were included in the study. The participants were randomly divided into two groups- group A - post isometric relaxation and Group B - reciprocal inhibition of 20 each. Pre and immediate post intervention scores were measured in terms of AKET

Findings: Inter group comparison (student's unpaired t test) showed that there was no statistically significant difference between the two groups in terms of AKET. The comparison of pre and post intervention values of the outcome measure in both the groups showed a statistically significant difference.

Conclusion: It can be concluded from the present study that both post isometric relaxation technique & reciprocal inhibition technique have an immediate effect on reducing hamstring muscle tightness. From the mean difference values it is visible that PIR (13.20) is slightly more effective than RI (5.45) although statistically significant difference is not seen.

Keywords: *Post isometric relaxation, Reciprocal inhibition, Immediate effect.*

Introduction

Hamstrings are important muscles of the human body. They contribute to posture stabilization of the body as also to the control of the pelvis region. Hamstring muscles possess the ability to generate high forces rapidly through their eccentric and concentric contractions. A hamstring muscle's length can be changed up to one third as a result of either eccentric or concentric contraction. Usually hamstring muscle is subject to high forces in closed and open kinetic chain activities.¹ Hamstring tightness not only hampers the activities of daily living like running, walking etc. but also causes postural issues and low back pain. Thus

treating the hamstrings and relieving the tightness is of utmost importance. Many interventions are available to treat hamstring tightness like passive and active stretches, positional release technique, active release technique, muscle energy techniques etc. Multiple studies have shown the immediate and prolonged effectiveness of Muscle energy techniques in Hamstring tightness²⁻⁴

Devised by an osteopathic physician, Fred Mitchell, Sr, and polished by Fred Mitchell, Jr Muscle energy technique has been used for the treatment in various aspects. Muscle energy technique involves voluntary contraction of target muscles against a counterforce provided by operator, in a precisely controlled direction.

MET is useful in reducing pain, stretching tight muscles, decreasing muscle tone, improving local circulation, strengthening weak musculature and mobilizing joint restrictions.⁶

Different variations of MET are used in daily practice such as Isometric contraction using antagonist or agonist (with or without stretching), isotonic (concentric or eccentric) contraction, slow eccentric isotonic contraction and isokinetic variation (combined isotonic and isometric contractions) depending on the need.⁷ A common explanation proposes that a voluntary agonist muscle contraction, prior to stretching of the muscle, has the effect of reducing reflexive components of that contraction thus causing relaxation, increased muscle length and range of motion of the joint that is in other words causing post isometric relaxation.⁷ The second is reciprocal inhibition (RI) mechanism which states that when a muscle contracts isometrically, its antagonist is inhibited, and there is reduced tone immediately after this. Thus the isometric contraction involves two neurological components: Postisometric relaxation (PIR) will follow contraction of the agonist, as a result of Golgi tendon organ mediation and Reciprocal inhibition (RI) which affects the antagonist, as a result of spindle mediation. So, once the stretching has actually commenced, biomechanical effects seen as low intensity force is applied to lengthen the tissues and 'creep' stage begins.⁸ However, there is limited documented evidence to find out which technique is the best MET technique on Hamstring function. Thus this study was conducted to find out which of the two widely used MET techniques has a better immediate effect on hamstring muscle function.

Methodology

Study design: A Comparative Experimental study

Sampling method: Simple random sampling

Sample size: Total 40

- **Group A:** 20 subjects received MET (PIR) treatment
- **Group B:** 20 subjects received MET (RI) treatment

Study setting: DattaMeghe College of Physiotherapy, Nagpur

Study duration: 2 months

Inclusion Criteria:

- Patients with knee flexion angle of 15 degrees or more on AKET
- Gender: Male and female both
- Patients willing to participate in the study
- Age group: 25-60 years.

Exclusion Criteria:

- Patients with any low back pathology.
- Patients with history of any recent fracture or surgery of lower limb
- Patients with of knee joint pain or hypermobility
- Patients with any neurological disorder.
- Patients with history of recent hamstring injury

Material Used: Plinth, Stabilising belt, Universal goniometer, Stop watch

Outcome measure – For measuring the hamstring flexibility, the active knee extension test was used in both the groups.

Active knee extension test (AKET) – The patient lies in supine lying with hip flexed to 90 degrees. The patient is asked to perform active knee extension movement and stop when he/she feels strong resistance to the movement. The range of motion of knee joint is measured with the help of goniometer at this end range.

Procedure – The study was carried out at the DattaMeghe College of Physiotherapy, Wanadongri, Nagpur. Ethical approval was obtained from Institutional Ethical Committee & an informed consent was obtained from the participants. Total 46 patients were assessed for the study. Inclusion and exclusion criteria were applied and 6 patients were excluded from the study. The study was conducted on 40 patients fulfilling the inclusion criteria. The participants were randomly divided into two groups by computer generated randomized table into groups of 20 each. Group A received post isometric relaxation technique and Group B received reciprocal inhibition technique. The pre and the immediate post reading of AKET were measured.

Group A – MET (PIR) for Hamstrings tightness:
The contralateral leg may be either flexed or may lie

straight on the plinth. The affected leg was flexed at both the hip and knee joints, and then slowly straightened by the therapist until the restriction barrier was identified. The limb was moved a little away from the restriction barrier and the isometric contraction against resistance was introduced. The patients were asked to resist the movement with no more than 25% of strength. The contraction was held for 7-10 seconds followed by complete relaxation of the limb. On exhalation, the knee joint was straightened (extended) towards its new barrier and through that barrier a stretch was applied and maintained for 30 seconds. 3 repetitions of this process were done.⁷

Group B – MET (RI) For Hamstrings tightness:

The supine patient was asked to fully flex the hip and knee on the affected side. The affected leg was then slowly straightened by the therapist until the restriction barrier was identified. The calf of the affected leg was then placed on the practitioner’s shoulder that stands facing the head of the table on the side of the affected leg. Then the patient was asked to attempt to straighten the lower leg utilizing the antagonists to hamstrings, employing approximately 20 percent of the strength of the quadriceps. This was resisted by the practitioner for 5 to 7 seconds. Appropriate breathing instruction were given. On exhalation, the knee joint was straightened (extended) towards its new barrier and through that

barrier a stretch was applied and maintained for 30 seconds. 3 repetitions of this process were done.⁷

Results

MYSTAT 12 software was used in this study. The outcome measure used was Active knee extension test (AKET). Descriptive statistics such as mean and standard deviations were calculated to describe all the variables. The paired t-test and the unpaired t-test were used to confirm differences between pre- and post-intervention. The statistical analysis was conducted at 95% confidence level, and p<0.05 was considered statistically significant.

The gender ratio was 12:8 (12 females and 8 males) in Group A – MET PIR group and 10:10 (10 females and 10 males) in Group B – MET RI group. The difference in the mean age of both the groups was statistically not significant (Table 1)

Comparison of the pre and post intervention values (student’s paired t test) of the outcome measure showed that there was statistically significant difference in AKET values in both the groups (Table 2 and table 3). Inter group comparison (student’s unpaired t test) showed that there was no statistically significant difference between the two groups in terms of AKET (Table 4).

Table 1: Baseline demographic data of both the groups

Group	Group A	Group B	t value	p value	Inference
Age (Years)	39.05±13.91	35.65±13.26	0.76	0.45	Not Significant
Gender ratio (M:F)	8:12	10:10			

Table 2: Mean and SD scores of Group A (Paired t test)

Group A - MET PIR group				
			Paired t test	
	Pre intervention	Post intervention	Mean Difference	p value
AKET	143.10 ± 18.15	156.30 ± 15.54	13.20	0.000

Table 3: Mean and SD scores of Group B (Paired t test)

Group B - MET RI group				
			Paired t test	
	Pre intervention	Post intervention	Mean Difference	p value
AKET	146.75 ± 15.02	152.20 ± 14.68	5.45	0.000

Table 4: Result of post-intervention values of both the groups (Unpaired t test)

	Group A	Group B	Unpaired t test	
	Post intervention	Post intervention	p value	Inference
AKET	156.30 ± 15.54	152.20 ± 14.68	0.39	Not Significant

Discussion

A study done by Bandy et al concluded that the optimal duration for an effective stretch as duration of 30 seconds.¹⁰ In both PIR and RI techniques stretch is maintained for this duration thus leading to increased muscle length with a combined effect of creep and plastic changes occurring in the connective tissue.^{5,11} Various studies have shown a positive effect of post isometric relaxation technique on hamstring muscle flexibility.^{1,12} A study done by Sambandham et al showed an immediate positive effect of MET on hamstring tightness which upholds the result of our study.¹³

Similarly a study conducted in 2018 by Desai Sonali et al showed considerable improvement in AKET ranges on application of MET on hamstring muscles which supports our study.⁴ Ivan et al has stated MET as an effective manipulative technique. MET is said to inhibit the motor activity from the muscle spindles or the Golgi tendon organs.¹⁴ The technique of post isometric relaxation leads to reduction of the muscle tone. The afferent nerve impulses entering the dorsal route associate with the inhibitory motor neuron, stopping the efferent motor neuron impulse discharge. This prevents further contraction and decreases the muscle tone resulting in relaxation of the agonist muscle.¹⁵ In this period lengthening becomes easier as a result of reduced tone. Similar reasons have been discussed by Kuchera et al in their study.¹⁶ In addition Shellock F G et al explained that the inhibitory golgi tendon reflex is said to be activated during isometric contraction of muscles leading to reflex relaxation of the muscle.¹⁷ A pilot study done by Azizi M et al concluded that post isometric relaxation technique can be used to increase the flexibility of hamstring muscle. Visco-elastic changes in muscles or increased tolerance threshold toward stretch are thought to be some of the several possible mechanisms of immediate effectiveness of MET.¹⁸ Furthermore Lederman also explained the viscoelastic changes of the connective tissue to be responsible for the increased flexibility. Thus it can be stated that any reduction in hamstring stiffness after application of

MET can be resulted from the viscoelastic changes in musculotendinous unit. In addition Fryer et al in their study have explained that the reasons of increased flexibility after MET may be the result of biomechanical or neuro-physiological changes or increased stretch tolerance.⁵

In the present study we found that there was significant improvement in RI group as well. The amount of literature available on effect and mechanism of working of RI is not as much available. A comparative study of PIR and RI techniques on flexibility of hamstring muscles done by Agrawal S also showed similar results which is in accordance with our study.²⁰ The nerve impulses discharged from muscle spindles exciting the agonist muscles' afferent nerve fibers synapse with their excitatory motor neuron in the spinal cord. Simultaneously there occurs inhibition of the motor neuron of the antagonist muscle leading to prevention of its contraction, thus resulting in antagonist relaxation¹⁵

A study done by Nasiri et al concluded that both PIR and RI techniques are equally effective in increasing the flexibility of hamstring muscle which correlates with our study. Moreover it has been proposed that by virtue of an isometric contraction of antagonist muscle, a muscle can be inhibited prior to stretching.⁷

Conclusion

It can be concluded from the present study that both post isometric relaxation technique & reciprocal inhibition technique have an immediate effect on reducing hamstring muscle tightness. From the mean difference values it is visible that PIR (13.20) is slightly more effective than RI (5.45) although statistically significant difference is not seen.

Ethical Clearance: Taken from institutional ethics committee.

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Conflict of Interest: Nil.

References

1. Adkitte R et al. Effect of muscle energy technique on flexibility of hamstring muscle in Indian national football players. *Saudi J Sports Med* 2016;16:28-31
2. Cheraladhan S. et al. Immediate Effect of Muscle Energy Technique and Eccentric Training on Hamstring Tightness of Healthy Female volunteers—A Comparative Study. *Ijccr*. 2011; 3(9): 122-126.
3. Sonali Desai et al. Comparative Study on the effectiveness of Muscle Energy Technique Versus Static Passive Stretching on Hamstring Tightness in Healthy Young Individuals. *International Journal of Current Advanced Research*. 2018; 07(6): 13639-13643.
4. Freyer G. et al. Muscle energy concepts: a need for change. *J Osteopathic Medicine*. 2000; 3: 54-59
5. Tejal R, Hetal M. Comparison between Post Isometric Relaxation and Reciprocal Inhibition Techniques of Muscle Energy Techniques on Respiratory Function Patients with Chronic Obstructive Airway Disease *International Journal of Current Research*. 2018; 10(11): 75505-75527.
6. Chaitow L. *Muscle Energy Techniques*, 3rd ed: Churchill Livingstone; Edinburg, 2006
7. Taylor DC, Dalton JD Jr, Seaber AV, Garrett WE Jr. Viscoelastic properties of muscle-tendon units. The biomechanical effects of stretching. *Am J Sports Med*. 1990;18(3):300-309.
8. Phil Page. clinical commentary current concepts in muscle stretching for exercise and rehabilitation. *The International Journal of Sports Physical Therapy*. 2012; 7(1): 109.
9. Bandy WD, Irion JM, Briggler M. The effect of time and frequency of static stretching on flexibility of the hamstring muscles. *Phys Ther* 1997;77:1090-6.
10. Ross A Clark. Hamstring injuries: Risk assessment and injury prevention. *Ann Acad. Med. Singapore*. 2008; 37: 341-346.
11. Wassim M et al. Efficacy of Muscle Energy Technique on hamstring muscles flexibility in normal Indian collegiate males. *Calicut Medical Journal* 2009; (7): e4 : 1-4
12. Ivan Z. Anatomy, physiology and biomechanics of hamstring injury in football and effective strength and flexibility exercises for its prevention. *Journal of Human Sport Exerc* 2012;7:S208-17
13. Kuchera WA, Kuchera ML. *Osteopathic Principles in Practice*. 2nd ed revised. Kirksville, Missouri: KCOM Press;1992.
14. Shellock FG, Prentice WE. Warming-Up and Stretching for Improved Physical Performance and Prevention of Sports-Related Injuries. *Sports Medicine*. 1985;2(4); 267-278.
15. Azizi M et al. The Pilot Study of the Immediate Effect of Muscle Energy Technique on Flexibility and Stiffness in Healthy Young Females. *Journal of Modern Rehabilitation*. 2018; 12(3):195- 200.
16. Lederman E. *Fundamentals of manual medicine*. In: Neumann HD, editor. *Introduction to Manual Medicine*. Berlin: Springer; 1997.
17. Agrawal S. Comparison between post isometric relaxation and reciprocal inhibition manuevers on hamstring flexibility in young healthy adults: randomized clinical trial. *Int J Med Res Health Sci*. 2016;5(1):33-37
18. Nasiri M, Asghar A. et al The effect of four different stretching techniques on flexibility of hamstring muscles group in 18-28 years old boy students' of Zahedan university of medical sciences. *Middle-East Journal of Scientific Research* 8 (2): 416-423, 2011.