

Immediate Comparative Effect of Post-Isometric Relaxation and Reciprocal Inhibition Techniques on Hamstring Flexibility in Patients with Hamstring Tightness

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ABSTRACT

Background: Hamstring are essential for posture stabilization, pelvis control activities like walking and running .Tight hamstrings can lead to functional impairments, postural issues and low back pain. Muscle energy techniques (MET) using controlled isometric or isotonic contractions are effective in reducing muscle tightness ,improving flexibility and enhancing range of motion .These techniques leverage post isometric relaxation (PIR) and reciprocal inhibition (RI) to promote muscle relaxation. **Objective:** This study aims to investigate the effect of post isometric relaxation and reciprocal inhibition techniques on hamstring flexibility. **Methods:** This will be quasi experimental control trial in which convenient sampling will be done from Government institutes of Faisalabad after meeting inclusion and exclusion criteria. Forty individuals with hamstring tightness will be assigned into two groups: Group A and Group B. Group A will receive post isometric relaxation technique (one session 3 repetitions) and group B will receive reciprocal inhibition technique (one session 3 repetitions). **Results:**Post isometric relaxation showed

significant pain reduction ($Z = -3.694$, $p < .001$, $d = 2.82$) and strong improvements in knee extension ($d = -1.75$) and hamstring flexibility ($d = 1.63$). Reciprocal inhibition also led to notable pain relief ($Z = -2.645$, $p = .008$, $d = 2.17$) with moderate gains in flexibility and knee extension. **Conclusion:** Both PIR and RI effectively reduced pain and improved flexibility, with PIR showing superior short-term benefits in enhancing function among females with hamstring tightness.

Keywords: Post-isometric relaxation, Reciprocal inhibition, immediate effect

Introduction

Hamstring tightness stands as a frequent musculoskeletal issue which produces postural problems and reduction in flexibility and brings about both back pain and movement restrictions including walking and running. MET has proven itself as an effective therapy for enhancing muscle flexibility and function. The muscle energy technique MET was originally developed by Fred Mitchell Sr before Fred Mitchell Jr improved it. MET as a method where practitioners use patient-initiated muscle contractions to fight resistance for promoting both relaxation and stretching of muscles (1). The two variations of MET include Post-Isometric Relaxation (PIR) and Reciprocal Inhibition (RI) that use different neurophysiological principles to facilitate muscle lengthening and enhance joint mobility. (2). High forces result from eccentric and concentric functioning of hamstrings which equally stabilizes posture base and controls pelvic movement. Significant problems with low back pain together with daily activities, posture and hamstring muscle tightness often develop. Reciprocal inhibition and post-isometric relaxation form the targets for various MET variations including isometric and isotonic contractions. Research lacks sufficient evidence to establish which MET variation leads to the best results for hamstring function even though they are commonly employed in practice (3). The support of healthy posture and correct lower limb movements depends heavily on our capability to move our hamstrings well because it decreases the risks for injuries. The diminished flexibility of hamstrings results in pelvic alignment changes while reducing athletic performance while

increasing muscle strains. Rehabilitation professionals have adopted Muscle Energy Techniques (MET) as a popular approach to enhance flexibility by engaging patients in an active manner. The approach of Reciprocal Inhibition controls the opposing muscle movement during agonist muscle contractions while Post-Isometric Relaxation concentrates on post-contraction muscle extension. An effective therapy requires complete comprehension of how different treatment methods operate. The investigation aims to assess the quick results of PIR and RI protocols on hamstring flexibility within tight individuals.(4).

There are two main types of muscle energy techniques (MET) commonly used as Post- isometric relaxation and reciprocal inhibition to decrease muscle tension thereby improving flexibility and joint mobility. A subject uses PIR to contract the target muscle group by holding it steady while maintaining low resistance. During the relaxation phase the muscle receives gentle lengthening until reaching its new resting measure which helps normalize tone while easing muscle tension. The antagonist muscle contraction through RI enables the agonist muscle relaxation of the tight muscles to occur. Stretching operations become more easily performed because of this method. Physiotherapy and rehabilitation professionals employ these stretching approaches to heal patients by improving their movement abilities and fixing their muscle discrepancies as well as enhancing their recovery times. The methods employ body functions through neuromuscular reactions and represent a safe treatment with control measures (5). The mechanism of Relaxation Post-Isometric (PIR) lets the body utilize autogenic inhibition since an isometric contraction of one muscle leads its neighboring muscles to relax. During this procedure the operator performs an isometric muscle contraction with minimum resistance after doing a muscle stretch. Next the therapist releases the muscle before performing a gentle stretch on it. Through PIR therapists make it possible for patients to achieve more motion range while also reducing muscle tension. In Reciprocal Inhibition muscle contraction of antagonists to prevent agonist muscle function. Through its mechanism RI allows the agonist muscle to

relax and stretch itself thus increasing joint flexibility (6).

Materials and Methodology

This study was conducted to see the immediate comparative effect of post isometric relaxation technique and reciprocal inhibition technique on hamstring tightness. This study was a quasi experimental design with a sample size of 40 participants of hamstring tightness. Data was selected through convenient sampling from physical therapy department of government college university Faisalabad. The study duration was 4 months. This timeframe was chosen to allow necessary procedural consistency.

Eligible participants included were females aged 20-30 years and having knee flexion angle of 15 degrees or more on AKET and their willingness. Exclusion criteria comprised of patients with any low back pathology and with any recent history of fracture or surgery of lower back. It also included patients with knee joint pain or hyper mobility. Patients with any neurological disorder were also excluded from the study. The last exclusion criteria was patients with any history of recent hamstring injury.

Written informed consent was taken from every participant and their confidentiality was maintained throughout the study procedure. Numeric pain rating scale, Goniometer, Hamstring flexibility scale and Active knee extension test were used for pre and post-assessment. Forty participants were allocated to two groups, twenty in each group. Active Knee Extension Test was used mainly to check pre and post hamstring tightness. A restriction in knee extension while performing this test tells that the hamstrings may be stiff or tight. Procedure:

1. **Position of Patient:** The patient rests supine and the hip is flexed to 90 degrees (knee also flexed at 90 degrees).
2. **Active Knee Extension:** The patient is requested to actively lengthen the muscle by extending knee as much as she can while maintaining the hip at 90 degrees.
3. **Measurement:** The examiner evaluates the degree of knee extension attained.

Interpretation:

- **Normal:** Normal ranges for AKE are usually within 15 degrees of full extension.
- **Tight Hamstrings:** There will be hamstring tightness if the knee cannot be extended within 15 degrees of full extension.

The interventions we used were PIR and RI. **Group A** received post isometric relaxation technique (one session 3 repetitions). To perform isometric relaxation technique, patient was placed in a relaxed seated or lying position. The individual slowly contracted the hamstring muscle with the joint still. This was accomplished by pressing the heel down into the floor or against a fixed surface. For about **5 to 10 seconds this contraction was held**. After maintaining the contraction, person loosened the hamstring muscle gently and allowed it to come back to its resting state on instruction. This phase remained for about 10-15 seconds then the knee joint was straightened and a stretch was applied for 30 seconds. **Group B** received reciprocal inhibition technique (one session 3 repetitions). For reciprocal inhibition technique, the participant lied supine on a comfortable treatment table. The patient by himself/herself contracted his quadriceps musculature, by causing extension at the leg. The patient maintained this contraction for about 5-10 seconds. When the contraction is finished, the therapist slowly and passively stretched the **hamstrings** by extending the leg of patient at the hip and/or the knee. This caused the hamstrings to de-stress due to reciprocal inhibition. Data was analysed using SPSS version 21.

Results

Statistical testing using Wilcoxon signed-rank test showed that post isometric relaxation led to significant improvements. Pain scores dropped for most, with a Z-value of -3.694 and p-value of less than .001. Similar trends were found in knee extension and hamstring flexibility as well, both reaching strong significance levels. The reciprocal inhibition group also showed meaningful results with slightly less magnitude, but still statistically significant. Pain scores reduced with $Z = -2.645$ and $p = .008$. Knee extension and hamstring improvements followed suit with significant Z-values.

Effect size analysis confirmed these findings. In post isometric relaxation, Cohen's

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d for pain reduction was very large at 2.824, with knee extension also showing a large negative effect size ($d = -1.749$), meaning great improvement. Hamstring flexibility improved with $d = 1.63$. For reciprocal inhibition, pain reduction had an effect size of 2.173, while knee extension and hamstring showed medium to large changes with $d = -1.142$ and 0.767 respectively. These figures suggested that while both methods were effective, post isometric relaxation seemed to brought slightly greater changes overall.

Knee Extension Pre-Intervention Crosstab

(Active Extension Intervention)	Knee Angle -	Post Pre-Relaxation (n=20)	IsometricReciprocal Inhibition (n=20)	Total (n=40)	Chi- (X^2)	Squared f	p- ue	valSpea r	Spea rma n
15°-25°		0 (0.0%)	1 (5.0%)	1 (2.5 %)					
26°-35°		2 (10.0%)	4 (20.0%)	6 (15.0 %)					
36°-45°		8 (40.0%)	7 (35.0%)	15 (37.5%)					
Greater than 45°		10 (50.0%)	8 (40.0%)	18 (45.0%)					
Total		20 (100.0%)	20 (100.0%)	40 (100. %)	1.956	3	0.5 82	-0.15 9	0.32 6

Knee Extension Post-Intervention Crosstab

(Active Extension Intervention)	Knee Angle -	Post Post-Relaxation (n=20)	IsometricReciprocal Inhibition (n=20)	Total (n=40)	Chi- Square (X^2)	d f p- ue	valSpea n r	Spea rma n
15°-25°		3 (15.0%)	6 (30.0%)	9				

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			(22.5 %)					
26°-35°	13 (65.0%)	5 (25.0%)	18 (45.0%)					
36°-45°	3 (15.0%)	6 (30.0%)	9 (22.5 %)					
Greater than 45°	1 (5.0%)	3 (15.0%)	4 (10.0 %)					
Total	20 (100.0%)	20 (100.0%)	40 (100. 0%)	6.556	3	0.0	0.09	0.57
					87	2	2	

Discussion

The superior results in the post-isometric relaxation (PIR) group may stem from its direct engagement of reciprocal inhibition via isometric hamstring contractions, stimulating Golgi tendon organs to induce post-contraction relaxation and enhance stretch efficacy (Patel et al., 2023). Unlike reciprocal inhibition (RI), which relies on indirect spinal reflex inhibition of the hamstrings via quadriceps activation, PIR's targeted contraction-relaxation sequence promotes deeper neuromuscular relaxation and connective tissue adaptation (Shankarbai, 2014). PIR's pain-reducing effects likely arise from improved circulation, reduced ischemia, and enhanced proprioceptive feedback, dampening nociception. While RI might show comparable long-term effects, PIR's acute benefits in flexibility, range of motion, and pain relief were more pronounced in this short-term study (Aleem et al., 2022). The immediacy of PIR's neurophysiological mechanisms—combining mechanical loading, viscoelastic elongation, and tone modulation—positions it as a superior intervention for rapid functional gains.

Conclusion

Both PIR and RI techniques were effective in reducing pain and enhancing flexibility, but PIR demonstrated superior short-term effects in improving functional outcomes among females with hamstring tightness. These techniques can be easily incorporated into rehabilitation settings to optimize lower limb performance and reduce injury risk.

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