

The Effects of Post-Isometric Relaxation Protocol for Hamstring Tightness on Sit and Reach Scores

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Submitted: 10/16/12

Abstract

Post-isometric relaxation (PIR) is a soft tissue stretching technique used by many health care professionals to lengthen both acute and chronic short muscles. PIR is commonly used on patients with low back pain to lengthen short hamstring muscles that can contribute to their low back pain. The purpose of this study was to test the effectiveness of post-isometric relaxation on participants with measurable hamstring restrictions. This study utilized both a control and a treatment group to measure the effectiveness of PIR stretching. The both groups were given an initial sit and reach test before having hamstring tightness measured with a goniometer. Those participants who were found to have restricted hamstring flexion were treated with PIR and finally all participants were given a final sit and reach test. The results showed a significant increase between the pre and post PIR sit and reach scores. The study found that PIR was an effective treatment to increase hamstring flexibility.

Introduction

The hamstrings are a group of three muscles consisting of the biceps femoris, semitendinosus, and semimembranosus. The origin of the hamstring group is the ischial tuberosity and the linea aspera of the femur. The biceps femoris insertion is located at the fibular head and lateral tibial condyle. The semitendinosus inserts at the pes anserine of the tibia. The semimembranosus inserts at the medial condyle of the tibia. The collective actions of the hamstring

group include hip extension and knee flexion. Antagonistic musculature to the hamstrings is the quadriceps group which flexes the hip and extends the knee.

Hamstring strain injuries comprise a large percentage of acute musculoskeletal injuries incurred during sporting activities at the high school, collegiate, and professional levels. Hamstring flexibility, weakness, and fatigue are all modifiable risk factors associated with hamstring strain⁴. Hamstring strain remains a primary concern for rehabilitation professionals as they result in a debilitating injury characterized by acute loss of functional performance, prolonged periods of recovery, and resultant increased incidence of recurrence⁵. Improved flexibility has long been considered a major component of preventive treatment of musculotendinous strain¹. Increasing hamstring flexibility can play an important role in preventing lower extremity overuse injuries².

No consensus exists between professionals on how to establish hamstring flexibility. The standard protocol for hamstring lengthening is typically based on provider specialty or preference². Post-isometric relaxation technique relaxes tone in muscles that demonstrate hypertonicity. The technique requires the practitioner to engage the barrier of muscle resistance followed by an isometric contraction provided by the subject involved. The isometric contraction is held for 6 to 10 seconds. The release phase requires the subject to relax completely followed by the practitioner engaging the new muscle barrier. This procedure can be repeated up to four times to lengthen the involved muscle³.

Materials and Methods

Forty seven participants between the ages of 20-40 were included in this study. Informed consent was obtained after a thorough explanation of the study. Participants were included if they were asymptomatic, between the ages of 18-40 years old, and students at Logan College of Chiropractic. They were excluded if they had any previous or current vascular conditions, a previous surgery to the hip, knee, or lumbosacral region, were currently pregnant, have a lower extremity sprain/strain, or have a CNS disorder/conditions as demonstrated in a general health status questionnaire. Study approval was provided by the Logan College of Chiropractic institutional review board.

All subjects were first instructed on how to perform a proper sit and reach test utilizing a sit and reach box. Next, the participant performed a sit and reach maneuver and a baseline score was recorded. Subjects then had their hip flexion measured by an investigator with a goniometer. Hip flexion was measured with the participant supine with assistance from an investigator to assist in keeping the participants knee in extension. Measurements were taken at the point when the patient's ipsilateral anterior superior iliac spine (ASIS) moved posterior. If the participant's hip flexion was less than 80 degrees they received PIR for the hamstrings. If the participant's hip flexion was greater than 80 degrees they waited the same duration PIR protocol would take to complete. The participants then finally performed a final sit and reach test.

The tested hypothesis was that participants with hamstring restrictions that received PIR would have statistically significant increases in sit and reach scores when compared with those participants that did not receive treatment.

Results

Data on PRE and POST PIR measurements were taken on 47 subjects (34 Male, 13 Female). Of these 47 subjects 7 were found to have no hamstring restrictions. Overall the PIR significantly increased {1.41 (1.18, 1.65), $p < .001$ } (see Table1). The paired responses of the subjects are shown in the scatter plot in Figure1.

Comparing the 7 normals to the 40 abnormal (Table2), the SLR was significantly higher (87.3 vs 59.2, $p < .001$), additionally those classified as normal had less CHANGE in the pre/post measurements (.9 vs 1.5, $p = .047$)

There were no significant differences by gender (Table3).

Paired t-tests were used to compare the pre/post differences and a p-value of .05 was considered statistically significant. All analysis was performed with SAS 9.3 (Cary, NC)

Table1: Paired t-test pre vs post PIR

| PIR DATA | | | | |
|----------|------------|-------------|-------------------|-----------------------|
| | | | | |
| | Pre | Post | Paired Difference | Paired t-test P-value |
| PIR | 8.47 ± 4.0 | 9.88 ± 3.76 | 1.41 (1.18, 1.65) | <.0001 |

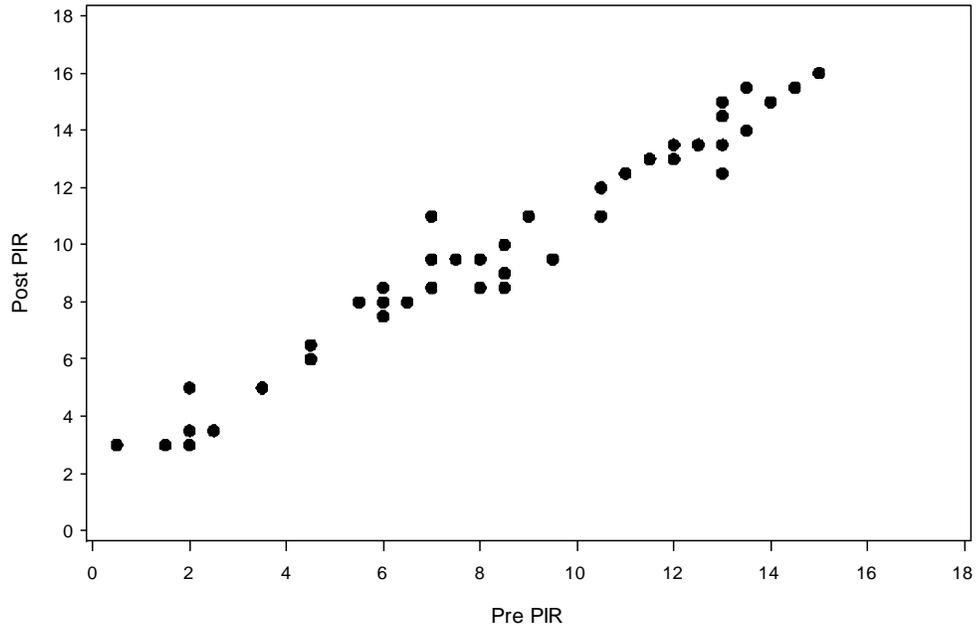
Table2: Normal vs Not-Normal

| | NORMAL | | P- Value |
|---|------------|-------------|-------------|
| | 1 n = 7 | 0 n = 40 | |
| SLR | 87.3 ± 2.8 | 59.2 ± 13.4 | < 0.001 |
| Post- Pre | 0.9 ± 0.6 | 1.5 ± 0.8 | 0.047 |
| Continuous variables compared using linear trend test. Categorical variables compared using Mantel- Haenszel trend test. | | | |

Table3: Male vs. Female

| | Sex of Patient | | P- Value |
|---|----------------|-------------|-------------|
| | F n = 13 | M n = 34 | |
| SLR | 61.0 ± 17.0 | 64.2 ± 15.8 | 0.542 |
| Post- Pre | 1.5 ± 0.7 | 1.4 ± 0.8 | 0.661 |
| Continuous variables compared using linear trend test. Categorical variables compared using Mantel- Haenszel trend test. | | | |

Figure1: Pre and Post PIR Scatterplot



Discussion

This study looked at PIR's effects on lengthening hamstrings in 47 asymptomatic patients. Interestingly, 39 out of the 40 patients who received PIR showed increases in sit and reach scores after treatment. Forty out of forty-seven participants showed a hamstring restriction, which demonstrates a large number of restricted hamstrings in the general asymptomatic population. If participants were to have hamstring injuries with adhesions it is possible that they would receive additional benefits from muscle lengthening using post-isometric relaxation. An additional interesting observation was that the control group, which showed no

hamstring restrictions, was only composed of females. Research has shown that females generally have greater hamstring flexibility than males⁶.

To improve this project it would be suggested to blind all participants of their sit and reach scores. It was observed that individuals were competing against themselves to achieve a higher sit and reach score on their second testing. Though participants were not showed their scores they were able to look at the scoring system marked on the sit and reach box and remember how far they reached. Additionally the sit and reach box was only marked at one half inch intervals and more accurate data could have been obtained with centimeter measurements. Requiring all participants to wear shorts during the study would reduce external patient restrictions. Examiners overheard participants complain that pants restricted their scores.

Conclusion

The results suggest that a single treatment of PIR significantly increases hamstring flexibility in the asymptomatic population. This is important because hamstring flexibility is a modifiable risk factor for hamstring strain⁴. Future studies should work to find a larger number of participants so that a larger control group can be studied.

References

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