The Effects of Active Release Technique versus Proprioceptive Neuromuscular Facilitation on Hamstring Flexibility

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A senior research project submitted in partial requirement for the degree Doctor of Chiropractic

July 20, 2007

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Abstract:
Introduction: Hamstring flexibility has been a topic of interest in numerous investigations due to its importance in athletic performance and injury prevention. The current study utilized two soft-tissue interventions, Active Release Technique (ART) and Proprioceptive Neuromuscular Facilitation (PNF) to determine their effects on increasing hamstring flexibility.
Method: Design: This project was approved by Logan College's Institutional Review Board. This project was a randomized, controlled trial (RCT) in which 30 consecutively selected, asymptomatic consenting volunteers were randomly assigned to ART, PNF or a control group. **Procedure:** The ART group received 5 treatment passes. The PNF group received 3 treatment passes. The control group received seated rest time. All groups received hamstring flexibility measures immediately post treatment/control.
Results: Pre and post hamstring extension scores for all three groups were analyzed by separate repeated measures t-tests. The ART and PNF groups had statistically significant increases ($p < .01$) in hamstring flexibility, while the control group had no change.
Conclusion: These results are similar to previous studies of ART and PNF's effects on hamstring flexibility using other soft tissue interventions and other measures of hamstring flexibility. Increasing hamstring flexibility may have the benefit of reducing athletic injuries, but continued study is needed, especially longitudinal study, to determine dose response and effect size over time.
Key Words: Proprioceptive Neurological Facilitation, Active Release Technique, Hamstrings, Knee Extension.

Introduction:

Hamstring related injuries are commonly seen by field practitioners. Due to the size, placement, and action of the hamstring, it can be contributory to a number of conditions. Problematic injuries to the hamstrings are common and can vary from minor muscle strains to complete detachment of the muscles from their insertions. Additionally, there have been recent studies that linked injuries of the lumbar spine and pelvis to the lack of hamstring flexibility(1). When tightened and shortened, the hamstrings are more prone to injury, and arguably, improving hamstring flexibility may decrease the risk of injury and also expedite recovery injury. However, there is yet to be a consensus regarding the most beneficial form of treatment available to successfully improve hamstring flexibility.

A wide variety of methods have been shown to lend therapeutic benefit in certain circumstances of hamstring-related injuries. Of the many therapeutic avenues of improving hamstring function and flexibility, this study is comparing the post-treatment effects of two well-known methods commonly used by field practitioners: Proprioceptive Neuromuscular Facilitation (PNF), and Active Release Technique (ART). This will employ a randomized controlled study to create an outcome comparison regarding the flexibility of the hamstring based upon knee extension. A population of people with decreased hamstring flexibility participated as subjects of the study.

The principle differences between these techniques, ART and PNF, rests in the amount of eccentric load placed on the muscle, and action on the muscle spindle. More specifically, ART is a type of therapeutic management system designed to treat soft tissue injuries. The practitioner places the target muscle in a shortened position, and with a specific hand contact on the muscle, the subject actively moves the structure to a fully lengthened position. This allows the contact to glide longitudinally with the soft tissue fibers, and ultimately, the lesion. The intention is to free the adhesions that have formed from scar tissue deposition within the soft tissue. On the other hand, PNF is a technique that combines passive stretching and isometric stretching in order to achieve maximum static flexibility. Current studies have shown this technique to be an effective way to increase static-passive flexibility, and that PNF is more efficacious in increasing flexibility than static or ballistics stretching (2,3). PNF usually employs a resistance against an isometric contraction followed by passively taking the muscle group through an increased range of motion (4). A variety of PNF exercises are available to the practitioner including the hold-relax technique, the hold-relax-contract technique, and the hold-relax-swing technique. PNF ultimately trains the stretch receptors in the muscle spindles to release and reduce their tone, producing a longer muscle length, and therefore, a more flexible muscle.

The primary job of the muscle spindle is to regulate the tone of the muscle fibers. When stretch is induced on a muscle, it loads the muscle eccentrically, which causes the muscle spindle to fire to protect the muscle from excess lengthening (5) Although PNF has been shown to be effective in improving flexibility, a maximal eccentric contraction upon the spindle may cause an increased, rather than decreased, tone of the muscle fibers (6). Studies have suggested that submaximal eccentric contraction of the hamstrings may be ideal for improving flexibility of muscles (7).

This study seeks to determine if ART can comparably increase flexibility of the hamstrings with respect to PNF on those with decreased hamstring flexibility. Because ART utilizes a contraction of the muscle before a maximal stretch occurs, the muscle spindle has a chance to decrease its action on the muscle. It is hypothesized that ART is at least as effective as PNF in increasing flexibility, while decreasing the risk of strain or injury.

Methods

Equipment:

A flat chiropractic table was used for measuring and treating the participants of the study. A 12-inch goniometer was utilized in order to measure the degrees of knee extension. Athletic tape was also used to secure the goniometer to the participant's leg.

Measurement:

Participants were positioned supine on the table with their hip and knee resting at the neutral position. We then used the athletic tape to secure the goniometer to the participant's leg, at the lateral epicondyle, with the arms pointing up the lateral aspect of their thigh, in midline, and the other down the midline of the fibula. The participant then was instructed to bend their hip to 90 degrees and their knee at 90 degrees. Following this the participant was then asked to actively extend their leg until resistance was met. This ensured that we were only measuring active leg extension. Once each participant extended their leg until they met resistance we then took the measurement. Each participant had measurements taken pre-treatment and post-treatment.

Subjects:

This study was approved by the Institutional Review Board of Logan College of Chiropractic. We obtained participants by asking students that were on Logan College's campus. A total of 30 participants were obtained, 10 for each of the three groups.

The inclusion criteria for this study included the following: age over 18 and an ability to read and understand the informed consent form.

The exclusion criteria included the following: report of current lower extremity injury which would contraindicate the use of ART, study modifying illness, or past/present vascular disorder, history of lumbar surgery, back pain, or disc herniation. All 30 participants met the inclusion and exclusion criteria and signed informed consent agreements. All participants were randomly assigned to each of the 3 groups, putting 10 participants in each group.

Treatment Protocol:

The first 10 participants received the ART protocol for treatment of their hamstrings. We had an ART certified individual perform the treatment for this group. Each participant was placed prone for treatment of their hamstrings. The hamstring muscle bellies were then treated with 5 treatment-passes on the tested leg. After the treatment we then re-measured.

The second group received the PNF protocol for treatment of their hamstrings. We first had the participant lay supine on the table, we took the measurement, and then the hamstrings were passively stretched until a light stretch was felt by the participant. This stretch was maintained by the investigator for seven seconds. Then, we had the participant provide a maximal isometric contraction against the resistance of the investigator, pushing the leg toward the investigator for another five seconds. The participant then rested for five seconds. This cycle was performed 3 times on each participant.

The control group, did not receive any form of treatment. After we measured their active leg extension, the participant was instructed to lay on the table for five minutes. The wait was to ensure no bias to the investigator that measured the participants post-treatment.

Results:

After the analysis of the data, we concluded that PNF revealed the greatest increase in hamstring flexibility, with a p-value of 0.000 (see table 1). PNF was followed closely by ART with a p-value of 0.012. Group 3 (control) had a p-value of 0.463.

In evaluating the measurements alone ART revealed a mean knee extension measurement of 131 degrees before treatment and 153 degrees after the treatment. PNF revealed a pre-treatment measurement of 162 degrees and 171 degrees after the treatment. The control group had the least change with the pre-treatment measurement of 164 degrees and the post-treatment measurement of 168 degrees.

Group	*n*	Pre-Mean	Post-Mean	D	df	S.D. Pre	S.D. Post	95% of CI Pre	95% of CI Post	*t*	*p*
ART	10	131	153	21	18	17.1	18.5	119.2-142.8	141.6-165.2	-2.81	0.012
PNF	10	162	171	9	18	5.29	3.21	159.3-165.1	168.0-173.8	-4.45	0.000
Control	10	164	168	4	18	13.6	10.7	155.7-171.9	159.8-176.0	.750	0.463

Table 1: Results of Data Analysis for ART, PNF, and Control groups.

Discussion:

The study showed that ART, group 1, with a p-value of 0.012 did not show as much improvement PNF, group 2, which had a p-value of 0.000. The control group, group 3, also had an increase in hamstring flexibility at the follow-up measurement, but not as significantly as ART and PNF. Therefore concluding that in this study PNF is more effective than ART in improving flexibility of the hamstring musculature.

According to previous research, PNF has been shown to be highly effective in improving the range of motion of joints (3,6,7). However, it is still unclear if submaximal eccentric contraction is actually more beneficial than if it was used with a maximal contraction. In this study, ART showed statistically significant increases in flexibility, and ART utilizes a submaximal contraction of the tissues undergoing treatment.

Conclusion:

Our research comparing ART to PNF treatment proved that both techniques showed a significant increase in hamstring flexibility after treatment. In our study we concluded that PNF was the better of the two, due to the evaluation of the p-value scores. It would still be beneficial to further investigate if submaximal contractions of ART will prove to be equally as effective as the maximal contractions of PNF.

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