



Original Article

Immediate effect of stretching and ultrasound on hamstring flexibility and proprioception

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Abstract. [Purpose] This research explored the positive effects of self-myofascial release on hamstring muscular flexibility and proprioception and investigated the effectiveness of the stretch combined with therapeutic ultrasound. [Subjects and Methods] This study included 30 healthy university students with no history of pain in the Achilles tendon or hamstring within the recent 6 months. Each participant completed two experiments. In the first experiment (MS), they completed self-myofascial stretching using a foam roller for 7 days. In the second experiment (MSU), the same participants performed the self-myofascial stretching after the 15-minute application of ultrasound. This study involved a pre- and post-test on hamstring muscle flexibility and hip joint proprioception. [Results] The use of self-myofascial stretching in the MS experiment had a significant effect on hamstring muscle flexibility and hip joint proprioception. However, the addition of ultrasound in the MSU experiment had no additive effect. [Conclusion] Self-myofascial stretching immediately increased hamstring muscle flexibility and improved hip joint proprioception, but the addition of pre-stretch ultrasound provided no further benefit.

Key words: Self-myofascial release, Ultrasound, Flexibility

(This article was submitted Jan. 19, 2016, and was accepted Mar. 12, 2016)

INTRODUCTION

Kumar¹⁾ claimed that people have difficulty using the hamstrings, muscles that are prone to shortening. Ayala²⁾ argued that the hamstrings play a significant role in effective walking and running, and that short hamstrings have often been observed in people, especially athletes. In addition, extended hamstring muscle contraction prevents complete extension and reduces flexibility. As stated by Kim³⁾, stretching is one of the most popular methods to increase muscular flexibility; thus, self-myofascial release with a foam roller has gradually become preferred to improve muscular flexibility, particularly since it is a low-cost intervention. Faulkner⁴⁾ also asserted that self-myofascial stretching improves one's sense of physical awareness and joint sensitivity, and improves the function of the proprioceptors, which function in balance and motor skills. They added that this muscular release enhances balance and muscular strength.

Muscular flexibility of the hamstrings can be examined using the sit and reach test, passive toe touch test, and straight leg raise (SLR test). The sit and reach test is highly reliable; thus, it is used as a valid testing method^{5, 6)}. Ultrasound delivers heat deep into the muscles, resulting in better flexibility of the collagen fibers and muscles^{7, 8)}. The therapeutic effects of ultrasound include relaxed joint contracture, better adhesion, and reduced joint stiffness, pain, and muscular rigidity^{7, 9)}. However, Magalhães¹⁰⁾ argued that ultrasound has no therapeutic effects on muscular flexibility.

Therefore, this study explored the positive effects of self-myofascial release on hamstring muscular flexibility and proprioception and investigated the comparative effectiveness of the stretch combined with therapeutic ultrasound.

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Table 1. Comparison of hamstring flexibility and hip joint proprioception before versus after the MS and MSU interventions

| | | Before | After | Differences |
|-----|---------------|--------------|---------------|--------------|
| MS | SRT (cm) | 7.42 ± 10.21 | 10.92 ± 9.84* | 9.58 ± 10.12 |
| | JPS (degrees) | 3.57 ± 2.49 | 1.41 ± 1.30* | 0.40 ± 1.02 |
| MSU | SRT (cm) | 5.42 ± 11.33 | 10.67 ± 9.73* | 9.36 ± 10.48 |
| | JPS (degrees) | 7.45 ± 4.28 | 1.37 ± 2.12* | 0.79 ± 1.82 |

MS: self-myofascial stretching; MSU: self-myofascial stretching with ultrasound; SRT: sit and reach test; JPS: joint position sense (* $p < 0.05$, mean ± SD)

SUBJECTS AND METHODS

This study involved 30 university students (mean age, 21.8 ± 0.81 years; 1:1 male:female ratio; mean height, 167.6 ± 8.49 cm; mean weight, 62.5 ± 8.13 kg) with no history of pain in the Achilles tendon or hamstrings within the most recent 6 months. Written informed consent was obtained from each subject. This study was approved by the Ethics Committee of the Kaya University (Kaya IRB-78).

The subjects participated in two experiments. In the first experiment (MS), they performed self-myofascial stretching using a foam roller daily for 1 week. In the second experiment (MSU), the same participants performed the self-myofascial stretching after the 15-minute application of ultrasound. Ultrasound therapy was applied to the biceps femoris, semitendinosus, and semimembranosus muscles for 5 minutes each (frequency, 1 Hz; strength, 3 W/cm^2 ; velocity: 2 cm/sec). This study included pre- and post-tests of hamstring muscle flexibility and hip joint proprioception.

The self-myofascial stretch consisted of three steps. First, participants sat with their legs straight out. Next, they put a foam roller under their hamstrings. Last, they moved the roller back and forth under their hamstrings. This study used the sit and reach test to evaluate hamstring flexibility, while dual inclinometers were used to test hip joint proprioception. A paired t-test was used to test differences between the pre- and post-test results, while an independent t-test was used to test differences between the two experiments.

RESULTS

The use of self-myofascial stretching in the MS experiment had a significant effect on hamstring flexibility and hip joint proprioception. However, the addition of ultrasound to self-myofascial stretching in the MSU experiment had no additive effect (Table 1).

DISCUSSION

As suggested by Sherer¹¹, self-myofascial stretching had a significant effect on increased hamstring flexibility and improving hip joint proprioception. Longo¹² also investigated the muscle and tendon stiffness after stretching with feet lifted 20 degrees toward the shin, that is, in dorsi-flexion, using an electromyogram and an ultrasound. As shown in the aforementioned research, this study also presented the same result that self-myofascial stretching using a foam roller immediately increased hamstring flexibility and enhanced hip joint proprioception.

However, the results of this study showed that the use of therapeutic ultrasound for 15 minutes prior to the self-myofascial stretching had no additional effect on hamstring flexibility or hip joint proprioception. Therapeutic ultrasound delivers heat to the soft tissues, which helps increase blood circulation and induce relaxation. As suggested by Kondo¹³, the application of heat on leg contractures in mice did not increase muscular flexibility. However, further research should be performed since Lounsberry¹⁴ presented the contradictory result that therapeutic ultrasound treatment applied to the hamstrings can increase muscular flexibility.

The current study concluded that self-myofascial stretching immediately increased hamstring flexibility and improved hip joint proprioception but that the addition of therapeutic ultrasound offered no further benefit.

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