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# A comparison of Passive and Active Stretching on Hamstring Flexibility

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# 슬괵근의 유연성에 대한 수동신장과 능동신장의 비교

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〈Abstract〉

**목적** : 이 연구의 목적은 수동신장과 능동신장이 단축된 슬괵근에 대한 유연성 회복에 미치는 영향을 알아보는데 있다.

**방법** : 90-90 하지직거상 검사를 통해 슬괵근의 단축이 있는 것으로 판명된 자발적 참여자를 대상으로 정적인 자세유지를 적용한 수동신장과 대퇴사두근의 근력강화 운동을 이용한 능동신장을 적용하여 슬관절의 관절운동범위의 변화를 측정하였다. 측정은 90-90 하지직거상 검사를 이용하여 신장 전, 후, 신장 후 60분이 경과한 뒤에 각각 측정하였다.

**결과** : 두 그룹 모두 신장 전, 후, 신장 후 60분이 경과한 이후의 슬관절의 관절운동범위에 유의한 향상이 있었으나, 두 그룹 간에는 유의한 차이가 없었다.

**결론** : 수동신장과 능동신장은 모두 단축된 슬괵근의 유연성 회복에 유용하게 적용될 수 있으며, 단기간의 신장 적용 후 슬괵근의 유연성 유지에도 효과적인 중재이다.

**핵심단어** : 능동신장, 수동신장, 슬괵근의 유연성

## Ⅰ. INTRODUCTION

Hamstring muscle is one of the postural muscles that is shortened caused by stress(Chaitow, 1996).

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Shortened hamstring should limit pelvic anterior tilt, throwing stress on the more lax spinal tissue(Norris, 2001).

The flexibility of the hamstring muscles is important in the prevention of injury, muscular and postural imbalance, maintenance of full range of joint movement, optimal musculoskeletal function, and enhanced performance in sports(Schuback et al, 2004). Flexibility is the ability to move a single or series of joints through an unrestricted, pain-free range of motion(Kisner and Colby, 2002).

Hamstring flexibility is very important in physical fitness and clinical practice, and many investigators have studied methods of improving hamstring flexibility. However, controversy remains concerning the method, intensity, duration, and frequency(Feland et al, 2001). Variety types of stretching(ballistic stretching, proprioceptive neuromuscular facilitation, and static stretching) have been traditionally defined in the literature in an effort to increase flexibility (Nelson and Bandy, 2004).

Recently, Winters et al(2004) studied that passive and active stretching of hip flexor muscles in subjects with limited hip extension and reported that active stretching is effective method for increasing the flexibility of tight hip flexor muscles but there was not significantly different between active and passive stretching group. Active stretching is purported to stretch the shortened muscle and simultaneously strengthen the antagonist muscle(White and Sahrmann, 1994).

According to White and Sahrmann(1994), active stretching is purposed to increase the flexibility of tight muscles while concomitantly improving function of the antagonistic muscles, moreover, improves balance of the muscle length. Winters et al(2004) reported that active stretching and passive stretching equally improve flexibility of other muscle groups is not known and in the future study, researchers should investigate whether muscle length is maintained after the stretching program is stoped.

Thus, the purpose of our study was to evaluate the relative effectiveness of passive and active hamstring stretching on ability of improvement and maintenance of hamstring flexibility, as measured by increasing range of motion at the knee joint at before stretching, after stretching, 60 minutes after stretching.

## Ⅱ. METHODS

### 1. Subjects

41 healthy volunteers(17 male, 24 female) without lower-extremity injuries or lower back pain were participated in our study. All subjects were recruited from department of physical therapy, OO college, in An-Dong. Subjects were screened for decreased ROM at knee joint and presumed hamstring shortening using 90-90 SLR test. Subjects were classified as having short hamstring if their knee joint was not full extension. Then, Subjects were divided into two

Table 1. General characteristics of subject

(N=41)

| | | Passive stretch (n=21) | Active stretch (n=20) | Total (n=41) |
|---|---|---|---|---|
| Gender(%) | male | 8(38.1) | 9(45.0) | 17(41.5) |
| | female | 13(61.9) | 11(55.0) | 24(58.5) |
| Age(years) | | 22.14±1.68 | 22.10±1.48 | 22.12±1.55 |
| Height(cm) | | 164.62±7.59 | 165.70±7.88 | 165.15±7.65 |
| Weight(kg | | 57.95±13.44 | 57.25±7.10 | 57.61±10.69 |

Mean±SD

groups(20 active stretching group, 21 passive stretching group)(Table 1).

## 2. Procedures

The Subjects were randomly assigned, instructed different stretching procedures based on their group assignment. Then, each group was performed stretching program. Effect of stretching program was measured three times, and an average value was calculated at baseline, after stretching, 60 minutes after stretching using the 90-90 SLR(Fig 1).

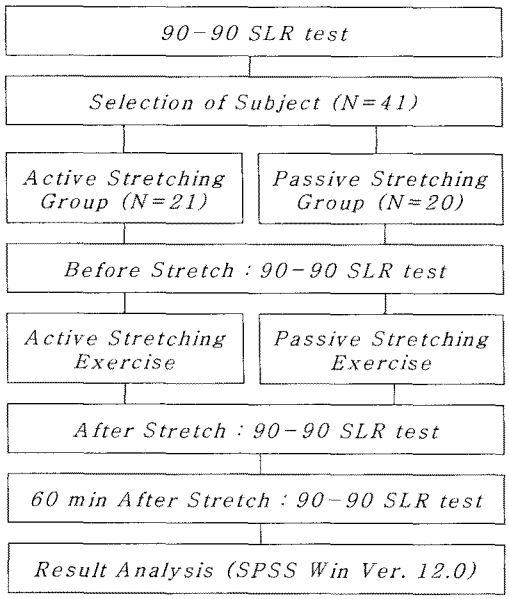


Fig. 1 Frame of study

## 3. Measurement

1) 90-90 SLR test

90-90 SLR test was applied to all subjects. Hamstring flexibility was measured using a double-armed goniometer. In our study, subjects with shortened hamstring were classified if their knee joint was not fully extension. The limb demonstrating the greatest amount of decrease ROM served as the limb of interest for study purposes. And if hamstring shortness was thought to be equal bilaterally, the side of limb of interest was chosen randomly. Hamstring flexibility was measured three times, and an average value was calculated at before, after stretching, 60 minutes after stretching.

## 4. Stretching Protocols

1) Passive stretching group

The position of passive stretching group was performed supine, on the floor, with one leg through a doorway and the other leg(the one to be stretched) propped up against the door frame. The subjects were asked to keep the knee extension. To increase the stretch, the subjects should move the buttock closer to the door frame, keeping the knee extended (Kisner and Colby, 2002). The passive stretching was held 30 seconds, 8-second rest period between repetition, and done for 10 repetitions(Fig 2).

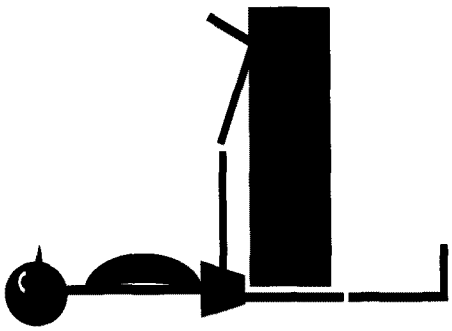

Fig. 2 Passive stretching

2) Active stretching group

The position of active stretching group was performed supine, on the floor, with one leg rest. And hip and knee of the other leg(the one to be stretched) were flexed 90 degrees. The subjects were asked to fix the thigh using both arms or towel for hold to 90 degrees hip flexion. Then, the subjects were asked to contract their quadriceps

muscles as much as possible to extend the knee. The active stretching was held 30 seconds, 30-second rest period between repetition, and done for 10 repetitions(Fig 3).

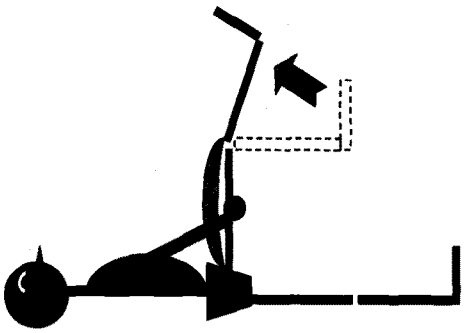

Fig. 3 Active stretching

### 5. Data Analysis

Independent t-test was used to compare before-stretching characteristics between passive and active stretching group. Paired t-test and independent t-test were used to determine whether there were significant difference between two groups using the SPSS Win Ver. 12.0 program.

The level of significance was chosen at 0.05(α=.05).

## Ⅲ. RESULTS

The Range of motion of the knee joint of before-stretching was no significant difference between passive stretching and active stretching group (P=.490)(Table 4). Thus, equal variances group was ensured between two groups. In comparison of knee flexion ROM before and after stretching, hamstring

Table 2. The improvement of hamstring flexibility in each group (N=41)

| Variable | | Before stretch | After stretch | t | p |
|---|---|---|---|---|---|
| PS group (n=21) | ROM | 157.81±7.37 | 164.48±6.63 | -5.584 | .000 |
| AS group (n=20) | ROM | 159.65±9.47 | 166.30±1.40 | -4.414 | .000 |

P<.05
PS group : Passive stretching group
AS group : Active stretching group

Table 3. The maintenance ability of hamstring flexibility in each group (N=21)

| Variable | | Before stretch | 60 min after stretch | t | p |
|---|---|---|---|---|---|
| PS group (n=21) | ROM | 157.81±7.37 | 162.71±6.17 | -4.650 | .000 |
| AS group (n=20) | ROM | 159.65±9.47 | 162.80±9.40 | -2.113 | .048 |

P<.05
PS group : Passive stretching group
AS group : Active stretching group

Table 4. The change of ROM between two groups (N=41)

| Variable | | Passive stretch (n=21) | Active stretch (n=20) | t | p |
|---|---|---|---|---|---|
| Before-stretch | ROM | 157.81±7.37 | 159.65±9.47 | -.696 | .490 |
| After-stretch | ROM | 164.48±6.63 | 166.30±10.40 | -.673 | .505 |
| 60 min after-stretch | ROM | 162.71±6.17 | 162.80±9.40 | -.034 | .973 |

P<.05

flexibility of both two groups were increased from before stretching(P<.05)(Table 2). And, in comparison of before stretching and 60 minutes after stretching, maintenance ability of hamstring flexibility of both two groups was maintained from before-stretching (P<.05)(Table 3). But, there was no significant difference between passive and active stretching group in comparison of improvement and maintenance ability of hamstring flexibility(P>.05)(Table 4).

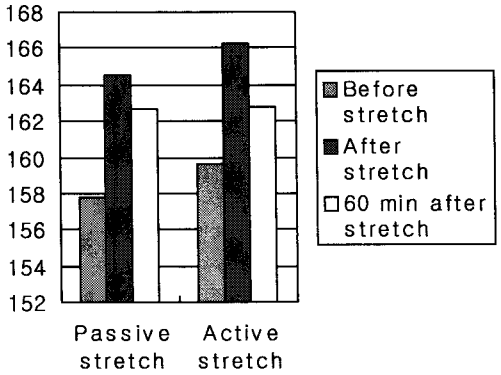


Fig. 4 The change of ROM in each groups

## Ⅳ. DISCUSSIONS

Stretching is one of the most frequently used program in the physical therapy, physical fitness, and athletic training. There was variety types of stretching, including ballistic stretching, passive stretching, static stretching, proprioceptive neuromuscular facilitation technique.

Our study was to research the relative effectiveness of passive and active hamstring stretching in increasing hamstring flexibility. Active stretching is purported to stretch the shortened muscle and simultaneously strengthen the antagonist muscle (White and Sahrmann, 1994). Sahrmann(2002) suggest that the most effective intervention is to shorten the lengthen muscle while simultaneously stretching the shortened muscle.

Winters et al(2004) documented that active or passive stretching is effective program for increasing the flexibility of the tight hip flexor and further work is necessary to determine if the 2 methods are equally effective for improving flexibility of other muscles. Thus we researched that effect of active and passive stretching on hamstring muscle at before stretching, after stretching, 60 minutes after stretching. Our results demonstrated that the two methods are equal to improve and maintain the hamstring flexibility while there is no significant difference between two methods. We thought that these result is caused by duration of active stretching, because of duration of active stretching was very short for increasing antagonist muscle strength.

In the literature, the increase in ROM, often reported after passive stretching, which may involve biomechanical and neurological effects, appear to be understood(De Deyne, 2001). Increased range of motion immediately following passive stretching can be explained by the viscoelastic behavior of muscle and short-term changes in muscle extensibility. Active stretching also places a tensile stress on the muscle being stretched, but additional increases in length are thought to be achieved through relaxation via reciprocal innervation (Kandel et al, 2000)

Decoster et al(2004) documented that standing and supine hamstring stretching are equally effect. In our study, position of ROM measurement, stretching methods were supine. And, Intensity, duration, and repetition of stretching were referred to Winters et al(2004)' study.

Our study has some limitations.

First, the subjects was selected from one college and young age.

Second, the sex distribution was not equal. Sahrmann(2002) documented that the women's hamstring is more flexible than men's.

Finally, duration of active stretching was very short for increasing antagonist muscle strength.

Future study are needed to supplement, including selection of the subject, manners(duration, frequency, intensity) of stretching program.

## V. CONCLUSIONS

The results of our study suggest that both passive and passive stretching are effective method for increasing and maintenance the flexibility of hamstring muscles after short term stretching.

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