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Effect of Hold and Relax Technique on Knee Joint Position Awareness in Normal Adults

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Abstract

Effect of hold and relax technique on knee joint position awareness in normal. This study investigated whether the hold and relax technique affected knee joint position awareness. Subjects (n = 40) with non-disorder knee joint were randomly allocated into the experimental group (n = 19) and control group (n = 21). This study progressed from the direct method (hold and relax for agonist) and indirect method (hold and relax for antagonist). The hold and relax technique was repeated seven seconds for the isometric contraction and five seconds for the relaxed portion. Awareness of the knee joint position was measured at knee flexion 30°, 60°, 90° and 120° with an isokinetic dynamometer. Significant differences were seen for the mean errors for 30°, 60°, 90° and 120° knee joint position awareness. However, the means showed no significant difference. This study demonstrated that the hold and relax technique has an effect on knee joint position awareness.

Keywords: Hold and Relax, Isometric, Joint Angle, Joint Position

1. Introduction

The knee joints provide static and dynamic stability on one's weight bearing stance in daily life. Knee joint stability is important in the closed kinetic chain because most knee joint injuries affect the weight-bearing stance. Proprioception of soft tissue is important to knee joint assessment because the knee joint gains stability more from the surrounding soft tissue, such as skin, muscle, tendon, articular capsule and ligament, than it does from the structural arrangement of bone[1,2]. Information for motor control is provided by spatial action data according to visual, vestibular, somesthetic sensibility. In somesthetic sensibility, proprioception is composed of myoreceptors, tenoreceptors, joint receptors and skin receptors. These proprioceptions provide a joint's range of motion, quantity of motion, velocity and acceleration of the body segment during exercise[3]. In addition, proprioception helps to reproduce the joint angle by recognizing the joint position[4]. In particular, joint position awareness plays an important role in the maintenance of functional stability[5]. Mechanoreceptors play an important role in position awareness. Therefore, exercise that increases the mechanoreceptor's excitement is important. It came out that effect of factor on knee joint's stability is proprioception[6]. Proprioceptive neuromuscular facilitation is mostly used by enhancing proprioception. Muscle release techniques of proprioceptive neuromuscular facilitation include the contract and relax technique, hold and relax technique, or contract-relax and antagonist technique[7]. The hold and relax technique is an especially effective muscle release technique that applies maximum resistance during isometric contraction. It is used for various therapeutic purposes, such as fatigue reduction, pain reduction and promoting stability[8]. Repeated passive exercise has a positive effect on proprioception and active exercise on a partial joint has a positive effect on the sensitivity of joint position awareness[9]. In addition, static stretching[10], proprioception feedback training[11], virtual reality physical therapy[12], patella taping[13,14] and sensory exercise training[12] enhance proprioception. Muscle strength exercises also have a positive effect on proprioception[3], knee pain alleviation and functional disorder treatment[15]. Various exercise programs have been introduced to enhance knee joint position awareness, such as active exercise and passive exercise. Many proprioception enhancement studies conceived exercise programs based on composite proprioceptive neuromuscular facilitation.

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However, studies on joint position awareness with basic hold and relax techniques are still lacking. Active and passive exercises performed consistently have some disadvantages, but further study of a concretely formed method of proprioceptive neuromuscular facilitation is needed. Therefore, this study investigated how a combination of direct method (agonist hold-relax) and indirect method (antagonist hold-relax) affected mechanoreceptor excitement by assessing knee joint position awareness.

2. Methods

2.1 Subjects

The subjects of this study were healthy adults from Asan S University. None of the participants had a history of knee injury and all were free of orthopedic abnormalities. The participants were fully informed and they agreed to the aim of this study. The subjects (n = 42) were randomly split into an experimental group (n = 21) and control group (n = 21). The experimental group lost two subjects because of knee joint defect, leaving 19 people in the group. Table 1 shows the general characteristics of the experimental and control groups. The control group was assessed for knee joint position awareness without intervention while the experimental group was assessed after performing the hold and relaxes technique. This study was approved by the Institutional Review Board of the Sun moon University 2.2 Maintaining the Integrity of the Specifications

2.2 Measurement

Before measuring, the procedure was explained to the subjects. During the proprioception assessment, the subjects wore shorts to minimize superficial input and an eye patch to minimize visual compensation. Only the individual subjects and tester were present for the procedure. Isokinetic muscular strength equipment (CSMI, USA) Figure 1 was used for the knee flexion angle to minimize error. The subject was measured from a prone position and a belt was used to fix the femoral portion. To measure joint position awareness, the subjects passively flexed the knee joint from 0° to the desired angle and then remembered the angle for ten seconds. After that, they returned to the desired angle. When approaching what they perceived to be the angle, the subjects said, "Stop." This knee joint position awareness was measured for 30° Figure 2, 60° Figure 3, 90° Figure 4, and 120° Figure 5 with three repetitions. The testing order of the angles was randomly selected.

Table 1. General characteristics (n=40)

	Experimental group (n = 19)	Control group (n = 21)	χ^2 / t
Gender (male/ female)	10/9	11/10	.898
Age (years)	20.16 ± 0.90[a]	20.26 ± 1.33	–.242
Height (cm)	169.32 ± 8.45	166.32 ± 7.80	1.082
Weight (kg)	64.89 ± 13.30	62.11 ± 12.52	583

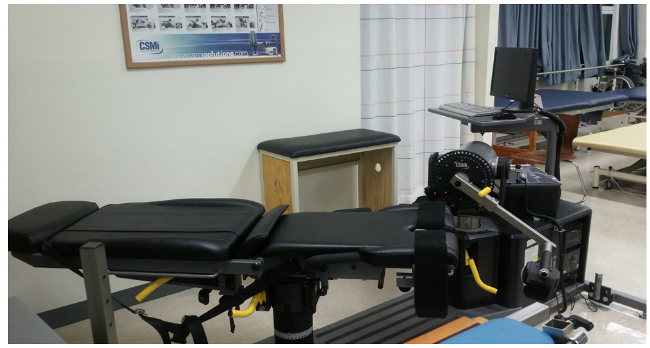

Figure 1. Isokinetic muscular strength equipment.

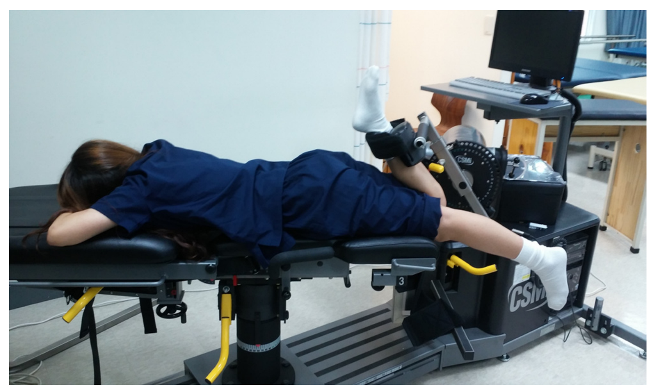

Figure 2. Knee flexion 120°.

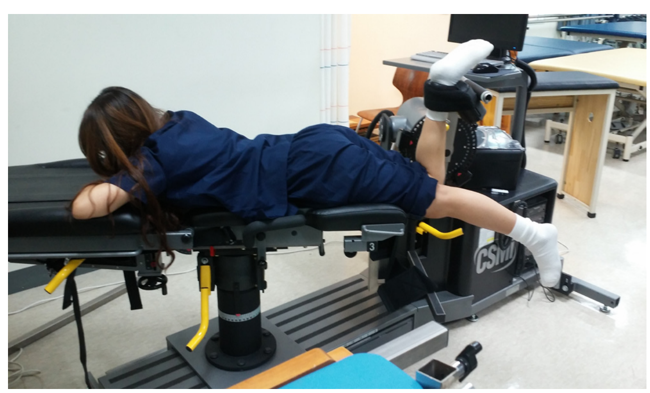

Figure 3. Knee flexion 90°.

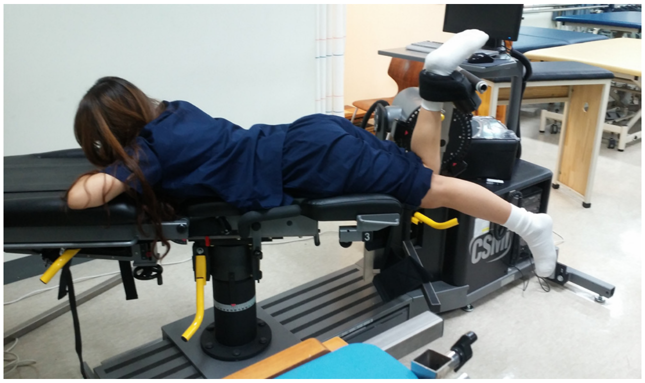

Figure 4. Knee flexion 60°.

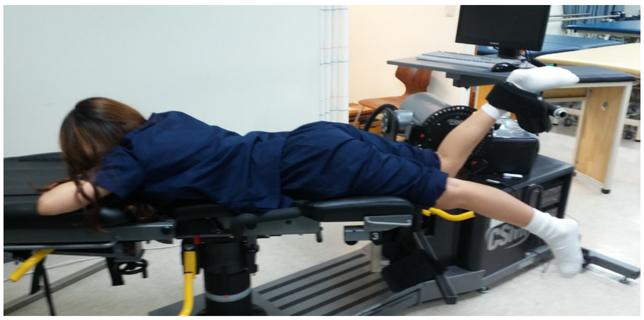

Figure 5. Knee flexion 30°.

2.3 Intervention

2.3.1 Direct Method

The direct method used resistance to the opposite side when the subjects contracted the hamstring. To maintain a hip flexion of 90°, the distal femoral part was held with one hand and the back of the ankle was held with the other hand. Then the subject was asked to bend the knee joint and maintain an isometric contraction for seven seconds with resistance to the opposite side before releasing the pose for five seconds. After being given two to three breaths to rest, the subject repeated the procedure two more times. The opposite distal femoral part and pelvis were fixed to prevent assistance during the intervention.

2.3.2 Indirect Method

The indirect method used resistance to the opposite side when the subjects contracted the quadriceps. To maintain a hip flexion of 90°, the distal femoral part was held with one hand and the front of the ankle was held with the other hand. Then the subject was asked to extend the knee joint and maintain an isometric contraction for seven seconds with resistance to the opposite side before releasing the pose for five seconds. After being given two to three breaths to rest, the procedure was repeated two more times. The opposite distal femoral part and pelvis were fixed to prevent assistance during the intervention. This study used a direct method and indirect method. To prevent confusion due to the contracted muscle and resistance being in different directions for the direct and indirect methods, a ten-second preparation time was given between methods[11].

2.4 Data Analysis

The knee flexion awareness at 30°, 60°, 90° and 120° of the experimental and control groups were compared. All collected data were analyzed with SPSS version 18.0 software (SPSS Inc., Chicago, IL, USA). The Shapiro-Wilk test was used to determine normality. The differences between the two groups were analyzed with the independent t-test. The gender ratio was analyzed with the Chi-squared test. The statistical significance level was set at p less than 0.05.

3. Discussion

This study investigated knee joint position awareness while applying the hold and relax technique with the quadriceps and hamstring. No significant difference was seen for knee joint position awareness between the hold and relax technique groups and none ($p>0.05$) Table 2. Significant differences were seen among the mean errors for 30°, 60°, 90° and 120° ($p<0.05$) Table 3. For knee flexion

Table 2. The comparison of each angle's mean error value according to intervention (n = 40)

	Experimental group (n = 19)	Control group (n = 21)	t
30°	31.25 ± 4.08[a]	30.62 ± 8.68	.78
60°	57.46 ± 5.12	59.51 ± 10.76	.45
90°	87.84 ± 3.05	90.57 ± 11.19	.31
120°	116.97 ± 4.04	117.33 ± 12.11	.90

Table 3. The comparison of each angle's mean value according to intervention (n = 40)

	Experimental group (n=19)	Control group (n = 21)	t
30°	3.39 ± 2.48[a]	7.13 ± 4.74	−3.08*
60°	4.51 ± 3.41	8.56 ± 6.26	−2.50*
90°	2.96 ± 2.23	8.38 ± 7.20	−3.14*
120°	4.47 ± 2.22	10.44 ± 6.29	−3.92*

of 30°, 60°, 90° and 120°, the hold and relax technique group's mean errors had low results. Many studies have assessed knee joint position awareness while applying static stretching technique, but the results generally showed no significant differences[16,17,18]. Moreover, intervention with static motion and superficial sensory did not enhance knee joint position awareness[1,19,20]. However, a significant effect on position awareness was seen using various warm-up exercises with active motions[21,22]. Joint position awareness is important for enhancing voluntary or involuntary motivation and facilitating the transfer of basic information, such as balance and vestibular senses, to the motor control area[18]. This information about positional awareness is provided by the mechanoreceptor[23]. To excite the mechanoreceptor, passive and active exercises are usually used in general intervention. This study demonstrated that the hold and relax technique has an effect on knee joint position awareness. Kwon and Lee[24] compared knee joint position awareness after continuous passive and active motions. The active motion group had more significant increases in knee joint awareness than did the passive motion group. This shows that active motion affects joint position awareness more than passive motion does. Heyward[25] recommended isometric contraction to agonist for seven to eight seconds, release for two to five seconds, and contraction to antagonist for seven to eight seconds and then repeat four to six times. However, contraction and release times were not uniform. Therefore, this study applied isometric contraction for seven seconds, release for five seconds with two hold and relax techniques[26]. Clinically, each muscle's contraction and release time should be determined when applying a hold and relax technique. This study investigated knee position at 30°, 60°, 90° and 120° flexion on the right side. But divided dominant side and non-dominant side and investigated knee joint position awareness after 10 weeks instability training[27]. As a result, the dominant side's joint position awareness increased but the non-dominant side's joint position awareness had no significant difference. Therefore, further studies on the non-dominant side's joint position awareness are needed. In this study, significant differences were seen for the mean errors but no significant difference was seen for the means. Grob et al.[28] intervened and measured under the identical positions. However, this study applied the hold and relax technique in the supine position and measured in the prone position. Therefore, the results possibly contained errors. In addition, Farahnaz et al.[16] applied the hold and relax technique to not only the quadriceps and hamstring, which typically involve knee flexion and extension, but also the hip adductors. They saw a significant difference in knee flexion awareness at 45°[16]. In further study, there will be significant difference in means when measuring sense of knee joint position awareness after applying the hold and relax technique to quadriceps, hamstring and hip adductors. This study's subjects were limited to healthy men and women in their twenties who had no history of knee issues. Thus, it is hard to generalize for people in different age groups or people who have experienced in knee problems. For that reason, further study is needed to investigate joint position awareness after applying active the hold and relax technique to knee joint patients.

4. Conclusion

A conclusion section is not required. Although a conclusion may review the main points of the paper, do not replicate the abstract as the conclusion. A conclusion might elaborate on the importance of the work or suggest applications and extensions.

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