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Immediate Effect of TFL Stretching in Weight Bearing Versus Non-Weight Bearing

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Abstract

Purpose : The purpose of this paper is to compare the immediate effects of tensor fascia latae (TFL) stretching with weight bearing (standing position) or non-weight bearing (side-lying position).

Methods : The study was conducted on 30 adults (12 men, 18 women) in their 20s. Modified Thomas's test was conducted to find out if the TFL muscle has a tightness for current study. This study randomly divided the subjects into two groups and set the standing stretching group (n=15) or the side-lying stretching group (n=15). Both groups applied self-stretching under the therapist's supervision. TFL stretching in each positions was performed 30 seconds per set, 3 times, and 30 seconds per set could rest. The Ober test were conducted to investigate the effect of TFL stretching in each positions.

Results : For the Ober test measurements within each group, both groups significantly increased after intervention compared to before ($p<.05$). There was no significant difference between the groups ($p>.05$).

Conclusion : TFL stretching in standing position and side-lying position increased the range of motion of the TFL muscle. Therefore, if it is difficult to apply TFL stretching in standing position (weight bearing) due to pain or other reasons, it will be able to TFL stretching in side-lying position (non-weight bearing).

Key Words: non weight bearing, Ober test, stretching, tensor fascia latae, weight bearing

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Ⅰ. Introduction

Tensor fascia latae (TFL) muscle starts with anterior superior iliac spine and is connected to the iliotibial band (ITB) to attach to the lateral condyle of the tibia (Reese & Bandy, 2003). TFL muscle and ITB are located on the lateral portion of the femur and are particularly well-used during sports with muscle shortening (Gose & Schweizer, 1989). TFL muscles are prone to fatigue and shortening because they perform various functions in the hip joints, and when shortened, they often develop clinical symptoms such as the iliotibial band syndrome (ITBS) or the patellofemoral syndrome (Paré et al., 1981; Reese & Bandy, 2003). It is also connected to the ITB to engage in the function of the hip and knee joints and is restricted to the movement of the knee and in the rotation of the legs when the TFL muscle has shortened (Kasunich, 2003). On the biomechanics aspect, even when walking, the TFL and the ITB work together to influence the movement of hip and knee joints. During the swing phase, the TFL and the ITB are located at the front of the greater trochanter, acting as the axis of the hip flexion and extension, and in the stance phase (push-off phase), the ITB primarily acts as the back of the greater trochanter, thus working extension of the hip joint. Furthermore, the knee joint acts to maintain the knee flexion well when walking (Gose & Schweizer, 1989). Therefore, shortening the TFL and ITB can pose problems in the behavior of walking and running.

TFL stretching is mainly used in clinicians to alleviate clinical symptoms due to TFL shortening (Fredericson et al., 2000). The TFL stretching method is mostly applied with self-stretching techniques, in which the subject performs the stretching independently under the therapist's supervised instruction, which allows the application of TFL muscle in various postures, such as standing, side-lying and prone position (Arumugam & Govindharaj, 2018). The self-stretching technique in standing position is mainly applied to ordinary people who have shortened the length of the TFL muscle (Arumugam & Govindharaj, 2018; Fredericson et al., 2002). However, the TFL muscle stretching in standing position is difficult to apply to subjects who have unstable knee joint or have lower extremity's pain with the weight bearing.

In a non-weight bearing position, the TFL stretching is applied to pain or instability in the lower extremity. In previous studies, both weight bearing and non-weight bearing groups increased the ankle dorsiflexion passive range of motion (ROM) when applying stretching with weight bearing and non-weight bearing to the gastrocnemius muscle (Dinh et al., 2011). The results create a question of whether weight bearing stretching makes different result compared with non-weight bearing stretching or not. However, so far, studies are very limited to distinguish between weight bearing stretching and non-weight bearing stretching for TFL muscles. For example, in previous studies, the effects of TFL stretching in standing position and side-lying position were conducted respectively (Arumugam & Govindharaj, 2018; Fredericson et al., 2002; Kasunich, 2003), but studies of the effects of the comparison of the TFL muscle stretching in standing position and side-lying position were infrequent. Therefore, this study compared the immediate effects of TFL stretching in standing position (weight bearing) and side-lying position (non-weight bearing).

Ⅱ. Methods

1. Subjects

The present study was conducted on 30 adults (12 men, 18 women) in their 20s. The study participants were chosen to have no experience of serious leg injury and had a tightness of the TFL muscle. Modified Thomas's test was conducted to find out if the TFL muscle has a tightness. The therapist instructed the subjects to do prone position and hold one-side of their knee that was not involved this study, and another side of their leg lay on the treatment table until the ischial tuberosity was met. The therapist then

applied the hip extension by lightly pressing the far side of the thighs to be measured. When passive hip adduction was applied in this position after thigh were lowered to the horizontal, persons who did not reach 15~20 ° were selected as the subjects (Tunnell, 1998)(Fig 1-A). Prior to this study, all the subjects were informed of the purpose and method of the study and were given a voluntary signature on the consent form.

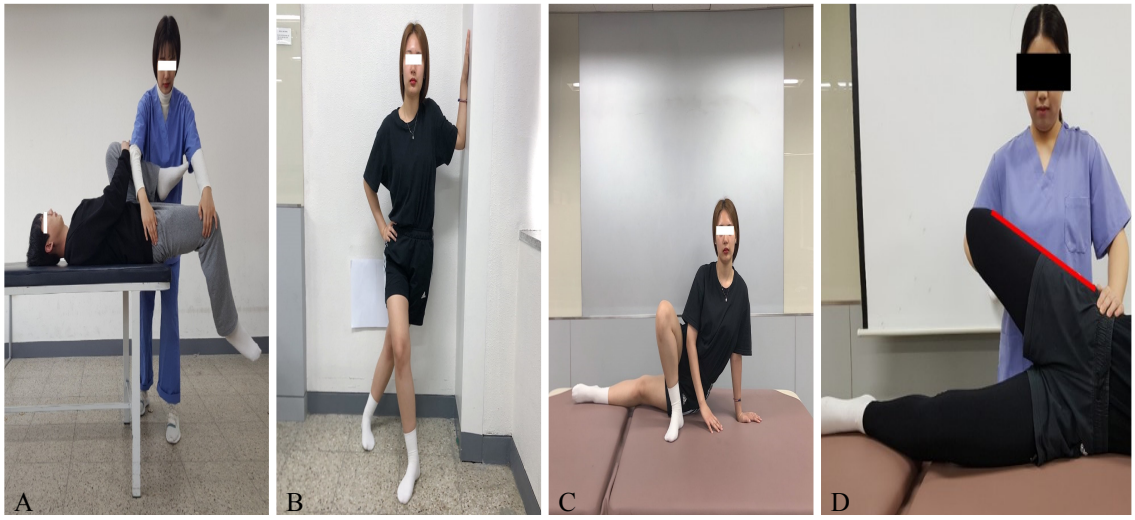

Fig. 1. Measurement and intervention of TFL muscle, A: TFL muscle tightness test, B: TFL stretching in standing position, C: TFL stretching in side-lying position, D: Measurement of TFL lengthening (Ober test)

2. Procedures

To find out the effect of weight bearing stretching and non-weight bearing stretching on TFL muscle, we randomly divided the subjects into two groups; TFL standing stretching group (n=15), and TFL side-lying stretching group (n=15). Table 1 shows the general characteristics of subjects in current study. In the TFL standing stretching group, the hip joint of the wall-side direction was performed with extension, external rotation and adduction and the hands on the wall pressed against the wall for a stable posture. Keep all the soles of your feet in contact with the floor (Fig 1-B). The TFL side-lying stretching group lay sideways so that the legs applying the stretching face the floor, and did it extension and external rotation of the legs, then flexing the hip and knee joints of the other leg (the non-stretching leg), and then placing them in front of the other knee(the stretching leg). The lower leg was

Table 1. General characteristic of subjects

	Standing stretching group	Side-lying stretching group
Gender (male/female)	6/9	6/9
Age (year)	19.7±1.4[a]	20.2±1.3
Height (㎝)	168.1±9.9	166.7±9.6
Weight (㎏)	65.9±15.6	63.7±15.2

[a]M±SD

applied by touching the floor with both hands facing forward for stretching (Fig 1-C). Both groups applied self-stretching under the physical therapist's supervision. TFL stretching in each positions was performed 30 seconds per set, 3 times, and 30 seconds per set could rest.

3. Instrumentation

This study conducted an Ober test to find out the effects of TFL stretching according to weight bearing of the subjects (Reese & Bandy, 2003; Willett et al., 2016). For the Ober test, the subjects performed side-lying position, and the therapist stood behind the patients. After bending the knee joint, the therapist held subject's pelvis with one hand, and made it extension and external rotation of the hip joint, and then performed the hip adduction. In neutral position (0 °), the hip adduction angle is related to the length of the TFL muscle (Kendall et al., 2005). Hip adduction was performed to the point where stiffness was felt by the therapist or the downward tilt of the pelvis was displayed (Fig 1-D). At this point, the angle was measured at the point where the greater trochanter and the lateral epicondyle of the femur are met. The Ober test was conducted twice, and the average value was used as data. To measure the hip ROM, a plastic roller and a phone application Clinometer (Clinometer, Plaincode™, Germany) were used.

4. Statistical analysis

Statistical analysis of this study used SPSS version 25.0 (SPSS Inc., Chicago IL, USA), and the values of each data represent the Mean±SD. In order to compare the differences between the standing stretching group and the side-lying stretching group, an independent t-test was performed, and paired t-test was conducted to identify the effects of intervention before and after each group. The statistical significance level α was set at .05.

Ⅲ. Results

In this study, we identified the immediate effects of TFL stretching in standing position and side-lying position in the persons with TFL tights. For the Ober test measurements within each group, both groups (standing and side-lying stretching groups) significantly increased after intervention compared to before ($p<.05$)(Fig 2). While both groups significantly increased after the intervention compared to before the intervention, the TFL side-lying stretching group were shown to be higher in the significant p-value. The ROM value in TFL side-lying stretching group increased more than in TFL standing stretching group, but there was no significant difference between the groups ($p>.05$)(Table 2).

Table 2. Measurement value of Ober test (ROM of hip adduction) (unit: °)

	Standing stretching	Side-lying stretching	t	*p*
Pre	8.62±5.20	7.08±3.88	0.921	.365
Post	10.9±5.24	11.20±4.31	-0.169	.867
t	-3.769	-8.063		
p	.002	.000		

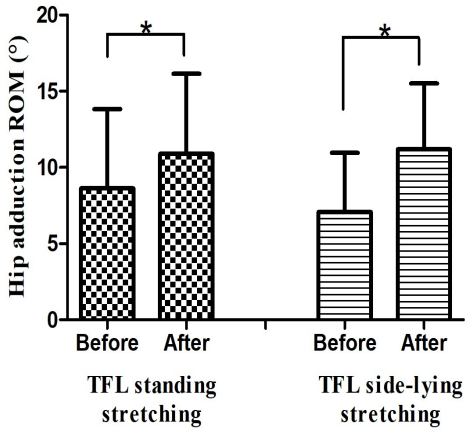

Fig. 2. Hip adduction ROM in TFL standing stretching group and TFL side-lying stretching group

Ⅳ. Discussion

This study conducted an Ober test to find out the immediate effect of the TFL stretching, whether weight bearing (standing stretching position) or not (side-lying stretching position), and TFL stretching of both positions increased TFL ROM after the intervention. Authors think that this study is considered to have clinical meaning. This is because, first, this intervention was easy to apply immediately in clinical practice and in everyday life. For example, the Ober test is not only relatively comfortable to apply but also highly reliable or TFL muscle testing. As a result, the most commonly Ober test have used a method for measuring the TFL and ITB lengthening (Gajdosik et al., 1992; Reese & Bandy, 2003). Second, this technique can reduce ITBS. This is because in this study, ROMs were increased after both standing and side-lying stretching positions. An article demonstrated that TFL stretching may reduce low back and sacroiliac pain that seemed to originate from a dysfunctional ITB (Kasunich, 2003), and the stretching with conservative management could make subjects with return to sport at 8 weeks and a 91.7 % cure rate with return to sports at 6 months after injury (Beals & Flanigan, 2013). Authors think the results for this study are significant because researchers said that adults who have exercised often experience ITBS, and that the ratio is up to 15 % for women and 7 percent for men (Falvey et al., 2010; Segal et al., 2007).

In the present study, there was no significant difference in the TFL stretching effect according to posture. This is an interesting result that is very different from the effect than we expected (Bae et al., 2017; Kim, 2019). We explain the reasons for the result with the following sentences. First, it can be inferred that the TFL muscles were applied as tight targets but were not necessarily in a condition that causes pain. For example, a prior study found that the pain of hip joint was not related to the TFL, sartorius, and the rectus femoris muscle size (Emery et al., 2019). Considering these points, as mentioned in this study's introduction, it was not possible to apply the TFL stretch effectively when subjects feel pain in the knee and ankle in the standing position. Therefore, the authors think that the subjects from this study had a shortening of TFL muscles but felt little or no pain. Second, we think there was no difference because the study participants were in their 20s. Bae et al. (2017) article showed that TFL muscle shortening may have caused pain in the waist or pelvic region, since the average age in the study was in their 40s. On the other hand, the subjects of this study were in their 20s, so there was a shortening of the TFL, but other tissues around them would have supplemented it. In other words, muscle volume, ligaments and smooth blood circulation would have complemented the tightness of the TFL, which in turn would have produced similar results between the two groups as they did not reach for experiencing ITBS. This also be a limitation of this study. Thus, further studies should show more direct results based on posture not only in the shortening of the TFL but also in the presence of pain when selecting the subjects. However, this study is considered to have clinical meaning. First, this article shows that the subjects who have unstable knee joint and have lower extremity' pain have another option to apply TFL muscle stretching. From the results of this study, TFL stretching showed effects in the both positions (standing and side-lyin

g) to muscle length. Therefore, if it is difficult to TFL stretching due to lower extremity's instability in standing position, it will be able to TFL stretching in side-lying position. Second, there is a few TFL stretching papers comparing, standing and side-lying positions. Third, using only one plastic ruler and a mobile phone application used to measure the angle of hip joint adduction for conducting the study. We think more people will have suggested a way to apply this intervention for a TFL stretching method.

Ⅴ. Conclusion

TFL stretching in standing position and side-lying position increased the ROM of the TFL muscle. Therefore, if it is difficult to apply TFL stretching in standing position (weight bearing) due to pain or other reasons, it will be able to TFL stretching in side-lying position (non-weight bearing). We suggest the training of Ober test by the physical therapist to the public so that they can easily see the effect of TFL stretching at home.

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