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Effects of tibial rotation on Ober's test and patellar tracking

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ABSTRACT

Background: The purpose of this study was to investigate the effects of tibial position on ITB flexibility and patellar position.
Methods: A total of 31 asymptomatic subjects (21 males, 10 females) were recruited for this investigation. Adduction angle was measured by Ober's test, and PCD was measured by ultrasonography in three different tibial rotation conditions: N, IR, and ER.
Results: Repeated measures ANOVA revealed a significant difference in adduction angle and PCD among three different tibial positions ($P < 0.05$). Adduction angle was significantly greater in the N tibial position than in ER ($P < 0.05$). The PCD was significantly greater in N position than in IR ($P < 0.05$). However, the PCD was significantly smaller in IR compared with the N position ($P < 0.05$).
Conclusions: These findings support that tibial rotation influences the flexibility of ITB and patellar positions. Therefore, excessive tibial rotation can cause inappropriate patellar positions that eventually lead to knee injury. Therapists should consider tibial rotation when measuring adduction angles because tibial rotation can change Ober's test results and contribute to the consistency of ITB length measurements.
Level of evidence: Level IV.

1. Introduction

The iliotibial band (ITB), located at the lateral aspect of the thigh, is a lateral stabilizer of the knee [1]. Anatomically, the ITB originates from the ilium, gluteus medius fascia, and tensor fasciae lata. Distally, the ITB is separated into two components: the iliopatellar band and iliotibial track. The iliopatellar band is attached to the lateral retinaculum of the patella, while the iliotibial track is attached to the lateral tubercle of the tibia (Gerdy's tubercle) [2]. Thus, with increased ITB tension, the patella tends to be pulled laterally [3–5], and the tibia rotates externally [4,6].

Various clinical methods have been used to measure ITB flexibility. Ober's test is frequently used to indirectly quantify ITB flexibility [7], with good intratester and intertester reliability (intraclass correlation coefficient, ICC 0.94 and 0.73, respectively) [8]. The test starts from an abducted and extended hip position with 90° knee flexion. The examiner stands behind the subject and lowers the leg with adduction. When ITB length is normal, the leg drops to the adducted hip position. However, when a person lacks ITB flexibility, the leg remains abducted [9].

Tightness or lack of ITB flexibility is considered a cause of knee injury [10,11] and anterior knee pain (AKP) [12]. Increased tension in the ITB causes AKP due to its potential influence on patellar motion [10,13]. A tight ITB can lead to a laterally located patella and an abnormal patellar tracking pattern through the femoral trochlear groove, causing lateral shifting during knee flexion and extension. This lateral patellar motion could increase the load on the lateral patellar facet and the lateral femoral condyle area [14]. According to Winslow et al. [15] ballet dancers are at higher risk of exacerbated patellofemoral pain secondary to decreased ITB flexibility and lateral patellar displacement. This is caused by repeatedly performed ballet routines, such as demi-plies, in tibial external rotation and knee flexion positions. However, the potentially harmful influence of tibial rotation on the patellar position has been overlooked.

Patellar position has been measured using tape measure, ultrasonography, computerized tomography (CT), and magnetic resonance imaging (MRI) [3,13,16]. However, the reliability and validity of the tape measure method have been questioned [17–19]. While CT and MRI have been acknowledged as reliable measurement tools, they are expensive and time-consuming methods. Ultrasonography has been recognized as a cost-effective and non-invasive measurement to replace MRI and CT. Herrington et al. [20] suggested a new method of measuring patella-condyle distance (PCD) using ultrasonography. Strong correlation and good intratester reliability were observed for PCDs measured with ultrasonography and the amount of patellar tracking measured by MRI [21].

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