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Investigating the relationship between internal tibial torsion and medial collateral ligament injury in patients undergoing knee arthroscopy due to tears in the posterior one third of the medial meniscus

Olcay Guler [a,*], Mehmet Isyar [a], Dilek Karataş [b], Tugrul Ormeci [c], Halis Cerci [d], Mahir Mahirogulları [a]

[a] Department of Orthopedics and Traumatology, Medipol University, Medical Faculty, Istanbul, Turkey
[b] Department of Radiology, Nisa Hospital, Istanbul, Turkey
[c] Department of Radiology, Medipol University, Medical Faculty, Istanbul, Turkey
[d] Department of Orthopedics and Traumatology, Nisa Hospital, Istanbul, Turkey

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ABSTRACT

Purpose: To evaluate the relationship between medial collateral ligament (MCL) injury and degree of internal tibial torsion in patients who had undergone arthroscopic resection due to tears in the posterior one third of the medial meniscus.
Methods: Seventy-one patients were allocated into two groups with respect to foot femur angle (FFA) and transmalleolar angle (TMA) (Group 1 31 patients with FFA < 8° and Group 2 40 patients with FFA ≥ 8°). The groups were compared in terms of valgus instability, Lysholm score, magnetic resonance view, FFA, and TMA, both before and after the operation.
Results: Lysholm scores were higher in Group 2 at both postoperative week 1 ($p < 0.001$) and month 1 ($p = 0.045$) relative to Group 1. Preoperative cartilage injury was encountered more frequently in Group 1 ($p = 0.037$) than in Group 2. MCL injury was detected more frequently in Group 1 compared to Group 2 postoperatively at week 1 ($p = 0.001$).
Conclusion: We conclude that FFA and TFA, indicators of internal tibial torsion, may serve as markers for foreseeing clinical improvement and complications following arthroscopic surgery.
Level of Evidence: level III retrospective comparative study.

1. Introduction

The knee is one of the most common sites of injury in the human body. A vast majority of knee injuries are caused by non-contact events. The most common events linked to knee and medial collateral ligament (MCL) injuries are accompanied by internal torsion of the tibia relative to the femur [1].

During torsion experiments in a previous study, internal rotation of the tibia and valgus rotation of the femur were observed during and after anterior cruciate ligament (ACL) injury. In compression experiments, the direction of tibial rotation shifted from internal rotation before failure to external rotation after failure. Moreover, ACL injuries can be created via internal tibial rotation [1].

The ACL resists internal rotation due to its orientation in the axial plane, where it attaches medially on the anterior tibial plateau and laterally in the femoral notch [2]. Owing to the posterior displacement of the femur and the medial tibial plateau induced by internal tibial rotation, the effective center of rotation is located on the medial side of the ACL. In addition, these motions occur on a coupled internal tibial and valgus rotation of the femur [3]. During these movements, the axis of rotation is placed beside the MCL due to tension in the ligament for valgus bending moments. Therefore, in addition to the ACL, the MCL has an important function in knee motion.

Tibial torsion is defined as torsion of tibia along its longitudinal axis. Deformity of the lower limb in the coronal plane has been widely investigated and found to be associated with the development of osteoarthritis (OA). However, rotational deformities of the lower limb are still a controversial subject. Some surgeons have advocated the correction of rotational deformity during total knee replacement and during treatment of complex tibial fractures [4].

Arthroscopic knee surgery is performed for various pathologies with satisfactory results. The majority of these procedures consist of meniscal resection. Adequate visualization is mandatory to achieve good results. Tightness in the medial compartment is one factor restricting sufficient visualization; the posterior horn of the medial meniscus is especially difficult. Therefore, complications can occur due to limited exposure at this location [5].

* Corresponding author at: Orthopedics and Traumatology Department, Medipol University, Medical Faculty, Atatürk Bulvarı No: 27 Unkapanı, 34083, Fatih, Istanbul, Turkey. Tel.: +90 212 444 8544; fax: +90 212 531 7555.
E-mail address: olcayguler77@gmail.com (O. Guler).

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Recognition of factors that facilitate the occurrence of complications is crucial to minimize these risks. It must be kept in mind that safe and effective arthroscopic intervention is implemented on an individualized basis with respect to an integrated evaluation of personal, radiological, and clinical data.

In this study, we assessed the relationship between MCL injury and the degree of internal tibial torsion together with clinical outcomes in patients that underwent arthroscopic resection due to tears in the posterior one third of the medial meniscus. We believe that our results contribute to a better understanding of factors prone to influence the success and likelihood of complications during arthroscopic surgery.

2. Patients and methods

2.1. Study design

This retrospective study was performed using data extracted from the medical files of 71 patients that underwent arthroscopic partial meniscectomy due to symptomatic tears in the posterior horn of the internal meniscus between 2011 and 2014 in the Orthopaedics and Traumatology Department of our Tertiary Care Center. This study was approved by the Institutional Ethics Committee and conducted in accordance with the latest version of the Helsinki Declaration.

Patients included in this study did not report any complaints, and no pathological findings were found upon physical examination of the contralateral knee preoperatively. McMurray and Apley tests were positive, and the grade of arthrosis was ≤2 according to Kellgren–Lawrence classification [6,7].

Preoperatively, valgus stress tests, as well as measurements of foot femur angles (FFAs) and transmalleolar angles (TMAs), were conducted. In accordance with report by Craft et al., magnetic resonance imaging was used for the mainstay of diagnostic imaging, with coronal sequences allowing the full assessment of the MCL complex [8]. Preoperatively, the degree of valgus instability was measured and all patients were evaluated with respect to Lysholm classification [9–11]. Postoperatively, magnetic resonance images (MRIs) were routinely obtained.

Exclusion criteria were as follows: internal meniscal repair, mechanical axis problems, ACL injury, an arthrosis score ≥3 according to Kellgren–Lawrence classification, external meniscal repair, and MRI views older than three weeks.

Patients were distributed into two groups after receiver operating characteristic (ROC) curve analysis was performed with respect to FFA and TMA. Group 1 consisted of 30 patients (11 women, 19 men) with FFA < 8°; Group 2 consisted of 41 patients (14 women, 27 men) with FFA ≥ 8°.

2.2. Outcome parameters

Patients were controlled on week 1, as well as postoperative months 1, 3, 6, and 12. The two groups were compared in terms of degree of valgus instability, Lysholm scores, MRI findings, mean FFA and TMA values, and incidence of preoperative iatrogenic cartilage injury values before and after arthroscopic surgery. The degree of valgus instability and Lysholm scores were also evaluated within each group.

The FFA is described as the angle between the axis of the foot and the axis of the femur for a patient in supine position with legs at 90° flexion (Fig. 1). Positive values indicate external rotation, whereas negative values are consistent with internal rotation. The TMA is used for clinical evaluation of tibial torsion. In the supine position, a line connecting the tips of the medial malleolus and lateral malleolus is drawn on the heel. The TMA is located between the line perpendicular to this line and another line drawn from the middle of the femur (Fig. 2).

Valgus instability is evaluated by means of abduction. In addition, a valgus stress test can be performed with the patient in the supine position on the examining table. The contralateral normal extremity must initially be examined to gain the patient's confidence and establish a baseline of normal ligamentous tightness. The knee to be examined is placed on the side of the table next to the examiner. The extremity is abducted off the side of the table and the knee is flexed at 30°. One of the examiner's hands is placed around the lateral aspect of the knee and the other hand supports the ankle. Gentle abduction or valgus stress is applied to the knee while the hand at the ankle rotates the leg slightly [12].

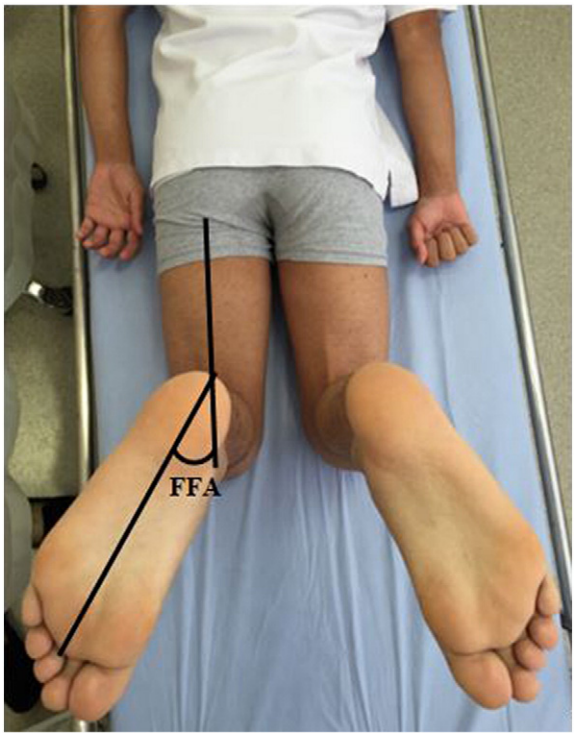

Fig. 1. Measurement of foot femur angle (FFA).

2.3. Radiological study

Conventional knee radiographs were obtained at both stance and flexion at 30°. MRI was carried out using a 1.5 T MRI device (Sigma

Fig. 2. Measurement of transmalleolar angle (TMA).