The importance of the valgus stress test in the diagnosis of posterolateral instability of the knee

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Summary

Background: The diagnosis of posterolateral instability of the knee is often based on a typical indirect mechanism of injury, a history of "giving way" and a positive dial test. Our search of the English literature revealed no mention of including the valgus stress test in the diagnostic protocol for posterolateral instability.

Hypothesis: Based on our experience, we hypothesised that a medial collateral ligament (MCL) tear will also produce a positive dial test and that a valgus stress test would provide differential diagnostic information.

Methods: The MCL's of 14 fresh cadaveric knees (7 cadavers) were cut to simulate a grade 3 tear, taking care not to damage the medial retinaculum or the posteromedial stabilisers of the knee. The amount of tibial external rotation (the dial test) was measured for each knee before and after transection of the MCL.

Results: The results of the dial test after transection of the MCL were similar to those stemming from a solitary injury to the posterolateral corner. There was a significant increase in external rotation of the knee in 30° and 90° of flexion. Moreover, external rotation in 30° was significantly greater than external rotation in 90° of knee flexion.

Conclusions: Whenever suspecting a posterolateral complex injury, one has to carefully perform a valgus stress test in 0° and 30°. Although the support of a clinical study is needed in order to make a definite conclusion, the dial test is probably not reliable in the presence of medial instability, and alternative diagnostic measures should be used.

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Introduction

Injuries of the posterolateral corner of the knee are infrequent. They can cause severe disability due to both instability and articular cartilage degeneration. The dial test (posterolateral rotation test) is the usual element of the physical examination specific to the evaluation of posterolateral instability; it was shown to provide a good assessment of the extent of posterolateral knee damage.4,5,13

The dial test was first described by Gollehan et al.4 It can be performed with the patient in a prone or supine position. The thigh is stabilised and a rotational force is applied through the foot and ankle. The examiner then looks for the extent of external rotation of the tibial tuberosity, and compares it with the contralateral healthy knee: an increase of >10° in external rotation at 30° of knee flexion compared with the contralateral side indicates a posterolateral knee injury. The test is then repeated at 90° of knee flexion. Normally, in an isolated posterolateral knee injury, there is less external rotation of the tibia at 90° than at 30°.10 Greater external rotation of the tibia at 90° is indicative of a combined posterior cruciate ligament (PCL) and posterolateral corner injury.4,5,13

During the past year, we encountered two patients who underwent posterolateral corner reconstruction and still complained of persistent instability. On physical examination, both patients had positive dial tests and valgus opening at 0° and 30° of knee flexion, consistent with grade 3 medial collateral ligament (MCL) tears. The anteroposterior stability was intact. Both patients were operated elsewhere, and we retrieved their medical records: the diagnosis of posterolateral corner injury was apparently based on a history of indirect trauma to the knee, complaints of instability and a positive dial test.

The purpose of this study was to find out whether the results of the dial test in a grade 3 MCL tear are similar to those of an injury to the posterolateral corner of the knee.

Materials and methods

Both knees of seven fresh frozen cadavers of individuals with no medical record of knee surgery or instability were studied. The stability of each knee was first verified by applying the anterior drawer test, the Lachman test and a mediolateral stress at 0° and 30° of flexion. The dial test was then performed at 30° and 90° of knee flexion. It was carried out with the cadaver lying in a supine position and the examined knee flexed over the examination table. After stabilising the thigh, one examiner maximally externally rotated the leg while the other measured the amount of external rotation of the foot using a goniometer. Each measurement was taken three times and a mean was calculated. After examining the intact knees, the deep and superficial components of the MCL were cut, taking care not to dissect the posterior oblique ligament or the medial patellar reticulum. The dial test was then performed again at 30° and 90° of knee flexion using the same method for the measurements.

Statistics

The Wilcoxon statistical test was used to analyse the results. A p value of <0.05 was considered significant.

Results

The mean values for the dial test in the intact knees at 30° and 90° of flexion were 8.35° and 8.42°, respectively. Cutting the MCL increased those values significantly (Table 1). The mean value of the dial test was 22.93° at 30° (p = 0.0001) and 19.86° at 90° (p = 0.0001). The differences between the results of the dial test at 30° and 90° of knee flexion, before and after transection of the MCL were also compared. After transecting the MCL, the external rotation of the tibia at 30° had increased by a mean value of 3.14° as compared to the external rotation at 90° (p = 0.0006).

Discussion

We carried out this study after having treated two cases of grade 3 MCL tears imitating posterolateral complex injury during the past year. Both patients described a typical mechanism of injury (indirect trauma), complaints of “giving way” and a positive
dial test, and both underwent posterolateral reconstructions. They presented to our outpatient clinic due to continuous complaints of knee instability postoperatively.

Recent reviews have considered the dial test to be almost pathognomonic for posterolateral complex injury. However, according to the results of this study, it is also positive in grade 3 MCL tears. Moreover, similar to the results of the dial test in an isolated posterolateral complex injury, the external rotation of the tibia at 90° of knee flexion was significantly less than at 30°.

Several biomechanical studies had found excessive external rotation of the tibia after transection of the MCL. However, most of them did not analyse their findings statistically and none looked at the difference in external rotation between 30° and 90° of knee flexion. Warren et al. performed a sequential transection of the MCL on cadaver knees and found an increase in tibial external rotation after transecting the long fibres. Kennedy and Fowler sectioned the deep portion of the medial collateral ligament in otherwise intact specimens. Although they noted instability, they did not record its extent. Matsumoto and Seedhom sectioned the MCL in three cadaveric knees and noted that external rotation was increased between flexion angles of 30° and 90° in two of the knees and throughout the range of flexion in the third knee. Haines et al. measured the motion limits in human cadaveric knees before and after sectioning the anterior cruciate ligament (ACL) and the MCL. According to their results, cutting the MCL increased the external rotation limit, and the increase was independent of whether the ACL was intact. Hallen and Lindahl first sectioned the superficial portion of the MCL and then its deep portion and found a significant increase in total rotation of the tibia after sectioning the superficial part in an otherwise intact specimen.

The results of our investigation are in agreement with the principle that compromise of the MCL leads to rotational instability of the tibia. A search of the English medical literature failed to uncover any mention of an MCL tear as part of the differential diagnosis of posterolateral instability, nor has it ever been recommended that a valgus stress test at 0° and 30° of knee flexion be performed after a dial test was found to be positive.

Our findings demonstrated a statistically significant increase in the results of the dial test after transecting the deep and superficial part of the MCL as well as, a significant difference between 30° and 90° of knee flexion, thus mimicking an isolated injury to the posterolateral corner. An MCL tear probably causes excessive external rotation due to anterior translation of the medial tibial plateau, whereas posterolateral corner injury causes excessive external rotation due to subluxation of the lateral tibial plateau, however, the end result regarding the dial test is the same. We recognise that the amount of tibial rotation could have been determined more accurately by measuring the intermalleolar axis; however, the purpose of this study was to re-evaluate the Dial test, which is performed by external rotation of the foot.

The advantage in a cadaveric study is the ability to create the exact injury that one wants to investigate. However, although measurements on cadaveric limbs are useful, they are somewhat different from the clinical scenario. The stability of the cadaveric knee relies on the static stabilisers where as clinically, the surrounding muscles additionally contribute a very important dynamic stability. The results of this study should be supported by a clinical study before making definite conclusions, yet, according to our results, if medial instability compatible with a grade 3 MCL tear is diagnosed, the dial test might not be reliable, and alternative diagnostic tests for posterolateral instability should be used. We recommend performing a valgus stress test at 0° and 30° whenever a posterolateral complex injury is suspected. In addition, before undertaking a reconstructive procedure, it is recommended to perform magnetic resonance imaging of the knee, which can provide valuable evidence of MCL and posterolateral corner injury.

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