

The External Rotation Recurvatum Test Revisited

Reevaluation of the Sagittal Plane Tibiofemoral Relationship

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Background: Posterolateral corner injuries can be difficult to diagnose. The external rotation recurvatum test was one of the first clinical tests described to diagnose these injuries. Since its earliest description, it has been reported that a positive test result occurred with posterior translation of the proximal tibia with respect to the distal femur as the knee went into recurvatum, external rotation, and varus angulation.

Purpose: To document the sagittal plane relationship of the tibiofemoral joint in patients with posterolateral knee instability and a positive external rotation recurvatum test finding, and to determine possible injury patterns associated with this test.

Study Design: Case series; Level of evidence, 4.

Materials and Methods: In a series of 134 consecutive patients with posterolateral knee injuries, all patients demonstrating a positive external rotation recurvatum test result were identified, and bilateral hyperextension lateral radiographs were subsequently obtained to assist with preoperative planning for surgical reconstruction of their knee injuries.

Results: Of the 134 patients with posterolateral knee injuries, 10 demonstrated a positive external rotation recurvatum test finding. All 10 patients were noted to have a combined anterior cruciate ligament and posterolateral knee injury, with the proximal tibia noted to be subluxated anterior with respect to the distal femur on all hyperextension lateral knee radiographs. The percentage of patients with combined anterior cruciate ligament and posterolateral knee injuries with a positive external rotation recurvatum test result was 30%.

Conclusion: Posterolateral corner knee injuries are often difficult to diagnose, and as a result, correct interpretation of pertinent clinical knee examination findings is essential. Regarding posterolateral knee injuries, the interpretation of a positive external rotation recurvatum test result needs to be redefined to demonstrate that the tibia actually subluxates anterior to the femur, which produces an increase in genu recurvatum clinically. Moreover, the presence of a positive external rotation recurvatum test finding should alert the clinician to the presence of a probable combined posterolateral knee and anterior cruciate ligament injury.

Keywords: posterolateral knee; ACL; external rotation recurvatum; tibiofemoral subluxation

It has been well documented that posterolateral knee injuries are difficult to diagnose clinically.^{3-5,10,13,14,16,17} A variety of physical examination techniques have been described to help diagnose a posterolateral knee injury. The main clinical tests used to diagnose posterolateral knee injuries include the external rotation recurvatum, posterolateral drawer, dial at 30° and 90°, varus stress at

30°, and reverse pivot-shift tests.^{6-8,11,12,14} The external rotation recurvatum test, one of the first tests described to detect posterolateral knee injuries,¹¹ is used to detect instability with the patient's leg near extension, while the other tests are performed to demonstrate the potential abnormal tibiofemoral relationship in varying degrees of knee flexion.^{6-8,11,12,14} The external rotation recurvatum test is performed by lifting a supine patient's great toe and observing the relative amount of genu recurvatum present. The amount of relative knee hyperextension present should be compared with that in the contralateral normal knee and measured by a goniometer or heel-height differences. In addition to the increase in knee recurvatum, the literature has also reported an increase in external rotation and genu varus due to a reported increase in tibial

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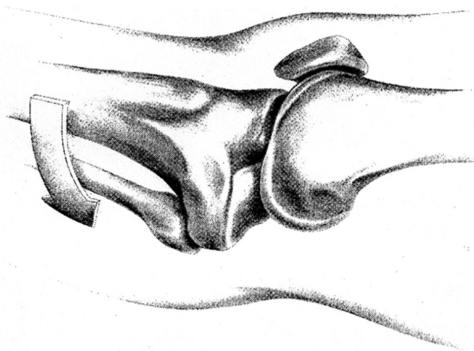


Figure 1. Original illustration of the external rotation recurvatum test. The proximal tibia was incorrectly illustrated to subluxate posterior to the distal femur (reprinted with permission from Perrin Trotter, The Hughston Foundation, Columbus, Ga).

external rotation and varus opening of the lateral compartment of the knee due to the posterolateral knee injury.^{1,2,5,10,11,15}

Literature in the mid-1980s to early 1990s further supported the use of the external rotation recurvatum test for the clinical examination of posterolateral knee injuries^{1,5,10,15} and even reported that the test was diagnostic of a posterolateral knee injury.² In 1985, Hughston and Jacobson¹⁰ noted the external rotation recurvatum test result to be positive in 83% of patients with chronic isolated posterolateral instability and 88% of patients with combined chronic anterior cruciate ligament (ACL) and posterolateral knee injuries. Passed from clinician to clinician without supporting evidence, the commonly accepted description for a positive external rotation recurvatum test finding was a posterolateral subluxation of the proximal tibia on the distal femur with apparent hyperextension and genu varus positioning of the knee joint when the great toe is lifted^{1,2,5,10,11,15} (Figure 1).

While the external rotation recurvatum test remains a useful portion of the physical examination to diagnose posterolateral knee injuries, no author has rigorously demonstrated the sagittal plane position of the femur with respect to the tibia in a positive external rotation recurvatum test finding. The main purpose of this study was to reexamine and document the sagittal plane relationship of the tibia to the femur in patients with a posterolateral knee injury and a positive external rotation recurvatum test result. In addition, we desired to determine if there was a pattern of injuries that occurs in patients with posterolateral knee injuries in the presence of a positive external rotation recurvatum test finding.

MATERIALS AND METHODS

In a series of 134 consecutive patients with grade III posterolateral knee injuries, we prospectively identified all patients who demonstrated a positive external rotation recurvatum test result. The clinical tests used to diagnose the posterolateral knee injuries in these patients included the external rotation recurvatum test, dial test at 30° and 90°, varus stress test at 30°, posterolateral drawer test, and a varus-thrust gait with ambulation, as well as increased translation on the posterior drawer and/or Lachman tests

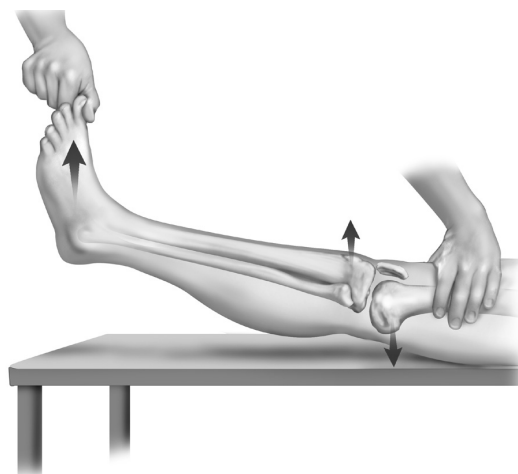


Figure 2. Sagittal plane relationship of the tibiofemoral joint with a positive external rotation recurvatum test result (lateral view, right knee). The examiner's hand should gently hold the distal thigh to prevent it from being lifted off the examining table to allow for measurement of heel height differences during this test.

(in the face of concurrent posterior and ACL tears, respectively).^{4,6,7,9,11,12,14,18} Bilateral knee supine hyperextension lateral radiographic studies were performed in all patients with a positive external rotation recurvatum test finding to assist with preoperative planning for the treatment of their posterolateral knee injuries. These hyperextension lateral knee radiographs were obtained while the external rotation recurvatum examination was performed by having the examiner hold the midthigh to the examining table with one hand and lifting the great toe off the table with the other hand (Figure 2). The radiographic findings for the affected knee were reviewed and compared with the contralateral normal knee to determine the sagittal plane relationship between the tibia and the femur. In addition, the types of associated ligament injuries were also recorded for each patient.

While we determined the presence of the external rotation recurvatum test by observing a qualitative difference in the amount of recurvatum between knees as initially described by Hughston et al,¹¹ we also gently held the midthigh to the examining table, which ensured that the heel height was not artificially inflated by the thigh being elevated off the examining table. This additional step was done to standardize the examination technique to better determine differences in heel heights between the injured and normal contralateral knee. Stabilizing the distal thigh was also used while obtaining hyperextension lateral knee radiographs to accurately determine the tibiofemoral relationship with the external rotation recurvatum test. Both clinically and radiographically, we did not observe any obvious increase in the amount of recurvatum by having the examiners gently hold the distal thigh against the examining table.

RESULTS

Out of a series of 134 patients with grade III posterolateral knee injuries, 10 patients were found to have positive

TABLE 1
Characteristics of Patients With a Positive External Rotation Recurvatum Test Result in a Series of 134 Consecutive Posterolateral Knee Injuries^a

Patient	Age	Gender	Side	Mechanism of Injury	Ligament Complex Torn	Position of Tibia With Respect to the Femur
1	22	Male	Left	Fall, blow to anteromedial knee	ACL, PLC	Anterior
2	46	Male	Left	Blow to anteromedial knee	ACL, PLC	Anterior
3	20	Male	Right	Twisting, hyperextension	ACL, PLC	Anterior
4	33	Female	Left	Slipped, fell on wet floor	ACL, PLC	Anterior
5	28	Male	Left	Stepped in hole	ACL, PLC	Anterior
6	15	Male	Right	Varus noncontact fall	ACL, PLC	Anterior
7	31	Male	Right	Varus fall, noncontact soccer	ACL, PLC	Anterior
8	39	Male	Right	Twisting, hyperextension	ACL, PLC	Anterior
9	39	Male	Right	Blow to anteromedial knee	ACL, PLC	Anterior
10	28	Male	Right	MVA, blow to anteromedial knee	ACL, PLC	Anterior

^aACL, anterior cruciate ligament; PLC, posterolateral corner; MVA, motion vehicle accident.

TABLE 2
Injury Patterns in 134 Consecutive Patients With Surgically Confirmed Isolated and Combined Posterolateral Knee Injuries^a

Injury Pattern	Number of Patients	Percentage of Total Patients
PLC	36	26.8
ACL-PLC	33	24.6
PCL-PLC	26	19.4
ACL-PCL-PLC	25	18.6
ACL-PCL-PLC-MCL	10	7.5
ACL-PLC-MCL	2	1.5
PLC-PCL-MCL	1	0.75
PLC-MCL	1	0.75

^aPLC, posterolateral corner; ACL, anterior cruciate ligament; PCL, posterior cruciate ligament; MCL, medial collateral ligament.

external rotation recurvatum test results. In all cases, a positive test finding was found in patients with combined posterolateral knee injuries and anterior cruciate tears, and all cases were confirmed at surgery (Table 1). Thirty percent of patients with combined ACL and posterolateral knee injuries also had a positive external rotation recurvatum test result (Table 2). There were no cases of a positive external rotation recurvatum test finding in patients with isolated posterolateral knee injuries or in patients with combined posterior cruciate ligament and posterolateral knee injuries in this series. Bilateral hyperextension lateral radiographs documented in all 10 patients that the tibia subluxated anterior relative to the femur in the sagittal plane in all injured knees (Figure 3) and it did not subluxate anterior on the contralateral normal knee.

DISCUSSION

In this study, for patients with both a posterolateral knee injury and a positive external rotation recurvatum test result, we found that the tibia subluxated anterior to the femur in the sagittal plane. This finding contrasts with the accepted sagittal plane tibiofemoral relationship for a positive external

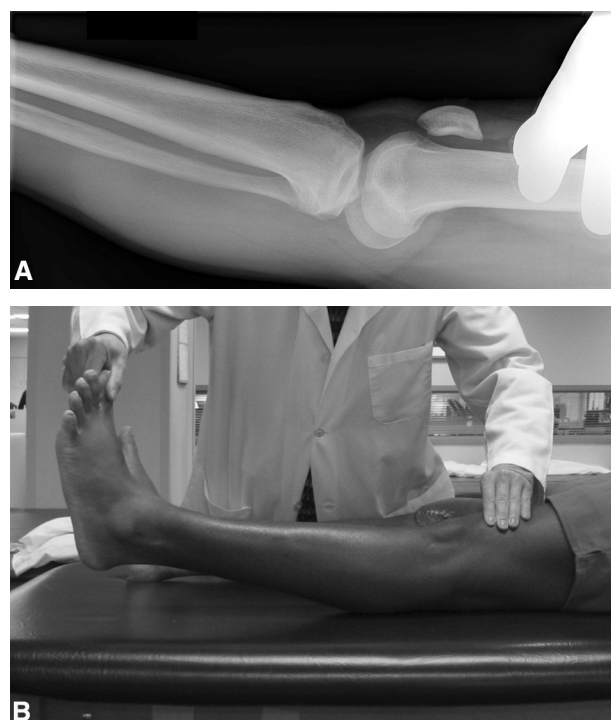


Figure 3. Radiograph (A) and clinical examination (B) of a patient with a positive external rotation recurvatum test finding.

rotation recurvatum test finding in the literature for patients with posterolateral knee injuries.^{1,2,5,10,11,15} In 1980, Hughston and Norwood¹¹ further detailed the physical examination findings of a positive external rotation recurvatum test result to diagnose posterolateral rotatory instability of the knee. They reported that a positive test finding occurred when the knee went into apparent hyperextension and genu varus.¹¹ In this instance, it was reported that the tibia was subluxated posterior to the femur in the sagittal plane.¹¹ In the past, this spatial positioning description has been the accepted understanding of the sagittal plane tibiofemoral relationship of a positive external rotation recurvatum test result in patients with posterolateral knee injuries.

Contrary to previous reports,^{10,11} we also found that a positive external rotation recurvatum test finding occurred in the presence of a combined posterolateral knee and ACL injury rather than with an isolated posterolateral corner injury. This finding makes intuitive sense when combined with our finding that the tibia subluxates anterior on the femur in the sagittal plane in a positive external rotation recurvatum test result. We originally did not predict the correlation between posterolateral knee injuries and ACL tears in patients with a positive external rotation recurvatum test result. However, this correlation makes intuitive sense when considering the anterior subluxation of the tibia in relation to the femur that is commonly seen on lateral radiographs and sagittal magnetic resonance images in patients with isolated or combined ACL tears. Therefore, the physical examination findings exhibited in patients with a positive external rotation recurvatum test result should be due to a combined ACL and posterolateral injury pattern.

For several decades, the external rotation recurvatum test has been used to assist in the diagnosis of acute and chronic posterolateral knee injuries.^{1,2,5,9-11,13-15} Besides being a complex injury by itself, most posterolateral knee injuries occur in combination with other ligament injuries.^{10,13,14} These concurrent combined injuries may mask the posterolateral knee injury from the examiner, and the initial treatment may focus on the more readily evident cruciate ligament injury rather than the concurrent posterolateral knee injury.¹⁶ Because posterolateral knee injuries may be overlooked and often occur in combination with concomitant cruciate ligament injuries, the presence of increased genu recurvatum compared with the contralateral normal knee must be carefully evaluated to understand the increased knee motion present.

Hughston et al⁹ correctly speculated that the taut ACL in extension played a key role in interpretation of a positive external rotation recurvatum test finding, and they theorized that either a lax posterolateral corner or an injury to the ACL could cause genu recurvatum. However, they also reported that posterolateral corner instability was most accurately demonstrated by a positive external rotation recurvatum test finding.⁹ As our understanding of the clinical examination findings in posterolateral knee injuries has evolved, we now know that a positive external rotation recurvatum test result is found in patients with combined ACL and posterolateral knee injuries. Furthermore, a positive external rotation recurvatum test result was not commonly found in patients with posterolateral knee injuries, as it was present in less than 10% of patients in this series of 134 patients.

Because the diagnosis of posterolateral knee injuries can be difficult, and the physical examination findings can be subtle if the examiner is not specifically looking for them, correct interpretation of the physical examination results is essential. It is on this premise that we believe a correct reinterpretation of the external rotation recurvatum test is necessary. In this study, we have demonstrated that the tibia subluxates anterior to the femur in the sagittal plane in patients with a positive external rotation recurvatum test

result. In all cases, we found that a positive external rotation recurvatum test finding occurred in patients with a combined ACL and posterolateral corner injury. Therefore, the presence of a positive external rotation recurvatum test result should alert the clinician to the presence of a possible combined ACL and posterolateral knee injury.

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