Figure-of-Four Pivot Shift Test
A Technical Note

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Abstract

The pivot shift test is a cornerstone in the clinical diagnosis of anterior cruciate ligament (ACL) deficiency. It can be difficult to perform in overweight patients or in those with long or bulky legs. We present an alternative method to perform the pivot shift test that recalls the judo technique of figure-of-four knee lock and eases the examination of the patient with anterior cruciate ligament deficiency. This modality of execution also makes the surgeon able to perform varus-valgus tests with small changes in hand positions. The surgeon, embracing with one arm the tibia of the affected limb, grasps with this hand the wrist of his free arm opposite to the affected limb. Then the surgeon hooks onto the posterior surface of the leg with his free hand. In this way, the surgeon can exert a moment on the limb of the patient, and can apply combined internal rotation, flexion, and valgus stress to perform the pivot shift test or simply varus or valgus force to perform the varus-valgus tests.

Clinical examination is the cornerstone of orthopaedic diagnosis, and should be performed before any imaging procedure. In anterior cruciate ligament (ACL) insufficiency, patients suffer from instability and report a “giving way” of the knee, with a sensation of the knee slipping, particularly during vigorous activity or sport. Orthopaedic surgeons can clinically reproduce this symptom when performing the pivot shift test, first described by Galway and colleagues in 1972, as reported here from a subsequent publication. Several investigators had previously recognized the abnormality following an ACL tear, and a variety of terms had been used to describe it, although the pivot shift remains the term most commonly used in the scientific literature. The test is normally performed by grasping the calcaneus of the affected limb with one hand, rotating the limb internally, applying a valgus stress on the lateral aspect of the proximal tibia with the other hand, and at the same time flexing the knee. It is easy to perform on slender patients but more difficult with obese or tall patients whose limbs may be difficult to handle correctly and comfortably.

We present a new method to perform the pivot shift test that recalls the figure-of-four, or ashi-hishigi (knee lock), of judo, which easily allows the surgeon to perform the pivot shift test and varus-valgus stress test on those patients whose weight, height, or leg length may make the classic method more difficult. This technique has evolved from the figure-of-four modified Lachman test and taught in the examination of the knee component of the original Sports Medicine Course at the London Hospital Medical College, the precursor of the current Centre of Sports and Exercise Medicine (CSEM).

Technique

We have named this technique the “figure-of-four pivot shift test,” as the position of the hands and “locking” of the knee is the same as in a figure-of-four knee lock in Judo. The patient lies supine on the examination couch. The examiner stands on the side of the patient to be examined. To test the right knee, the examiner puts the right foot of the patient into his or her right axilla, and with the free right hand grasps his own left forearm just below the elbow (Figs. 1 and 2). The patient’s right hip
is abducted 20°. With the forearm supinated, the palm of the left hand reaches the lateral aspect of the upper one-third of the patient’s right leg, with the right thumb behind the head of the fibula. At this point, the right foot is gently internally rotated by side flexion of the surgeon’s trunk, the left thumb imposes a posterior-to-anterior force, a valgus stress is imparted to the leg by slightly twisting the body toward the patient, and the knee is gently flexed. The knee is observed, and it is then ascertained whether the pivot shift phenomenon occurs. To perform a valgus stress test, the hands do not change position; the internal rotation of the leg is released so that the leg lies in neutral, the knee is flexed to 20°, and a valgus stress is imposed (Fig. 3). To perform a varus stress test the left hand goes over the top of the upper one-third of the patient’s right leg so that the tips of the fingers reach the medial head of the gastrocnemius; the internal rotation of the leg is released so that the leg lies in neutral, the knee is flexed to 20°, and a varus stress is imposed (Fig. 4).

Discussion

This method of performing the pivot shift test and varus-valgus stress test can be an option when the surgeon examines obese or tall patients. The pivot shift test mimics the combined abnormal amounts of laxity, both in combined rotational testing and translation of the tibia relative to the femur in the ACL-deficient knee. The pivot shift and Lachman tests are two clinical tests commonly used to formulate a diagnosis of ACL insufficiency on clinical grounds. The Lachman test is widely used to evaluate knee laxity after ACL rupture and the success of ACL reconstruction. The sensitivity of the Lachman test for acute and chronic ACL tears has been reported to be 94% to 98% and does not vary if the test is performed under anesthesia or not. In patients with an acute or chronic lesion, whether under anesthesia or not, the specificity of the pivot shift test has been reported to be 97% to 100%, although the sensitivity without anesthesia can be relatively low in both chronic and acute ACL tears. However, Kaplan and coworkers7 demonstrated a
significant correlation between the grade of pivot shift test and patients’ return to physical activity, as confirmed by Kocher and associates. They also reported in a study of 202 patients a correlation between the grade of the pivot shift test and relief of symptoms and patient satisfaction.

Different examination techniques have been described over the years. In 1980, Galway and MacIntosh described the lateral pivot shift as placing the left hand over the fibular head while internally rotating the leg with the right hand and applying strong valgus force with the left hand.

Slocum and Larson performed the test with the patient lying on the left side with the left hip and knee flexed and rotating the pelvis posteriorly until the weight of the leg bears on the right heel, allowing that valgus force would be provided by gravity. Hughston and colleagues performed the test by internally rotating the leg with the right hand and applying valgus stress with the left hand to the proximal tibia. They named this maneuver the “jerk test.” A number of investigators have described other alternative ways to perform the pivot shift test. In all these methods for the right knee, for example, the examiner’s right hand controls rotation, and the left hand controls flexion, extension, and varus and valgus load. In some patients, it can be difficult to properly handle the leg with one hand. In our method, the examiner controls internal rotation, flexion, extension, and varus and valgus load in a different manner. Given the configuration of the hand in the figure-of-four, the leg is not sustained by one hand only, allowing the examiner to use his trunk and lower-limb muscles, if needed, to perform the test. This enables the examiner to perform the pivot shift test in overweight patients or in those with long or bulky legs – the major innovation of this method.

Petermann and coworkers studied the effect of hip position and lower leg rotation in relation to the pivot shift test. The pivot shift phenomenon was more readily triggered in patients with isolated insufficiency of the ACL when the hip was abducted and externally rotated at the same time. In our technique, the pivot shift test is performed with the hip abducted exerting an internal rotation force on the lower leg as the foot is strongly held in the axilla of the surgeon, so that he is able to control the limb in all the planes.

Another advantage of our technique is that it allows one to perform the pivot shift test and the varus-valgus stresses with minimal changes to position of the hands, imposing a strong controlled force to the knee.

We acknowledge that this report is a technical note, and that no objective of comparison between this new test and the classical pivot shift method in terms of data are presented. We plan to evaluate this technique on a suitable population of ACL deficient patients before and after preoperative anaesthesia by different surgeons, comparing it with the classical pivot shift test.

**Disclosure Statement**

None of the authors have a financial or proprietary interest in the subject matter or materials discussed, including, but not limited to, employment, consultancies, stock ownership, honoraria, and paid expert testimony.

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