RigidFix Femoral Fixation: A Test for Detecting Inaccurate Cross Pin Positioning

Stergios G. Papastergiou, M.D., Ph.D., Nikolaos E. Koukoulias, M.D., Ph.D., Theofilos Dimitriadis, M.D., Georgios Pappis, M.D., and Constantinos A. Parisis, M.D., Ph.D.

Abstract: The RigidFix Cross Pin System (DePuy Mitek, Raynham, MA) is a popular technique for femoral fixation of graft in ACL reconstruction. In some cases, though, cross pins miss the femoral tunnel resulting in inadequate proximal graft fixation. We present a simple test to detect the incorrect placement of cross pins. The pinholes are drilled through the guide frame, leaving 2 sleeves for cross pins insertion. The manufacturer’s recommendations, at this stage, are to reinsert the femoral tunnel guidewire, remove the guide frame, and insert the graft without verifying accurate pinhole positioning. We reinsert the femoral tunnel guidewire without removing the guide frame, and a second guidewire is introduced through each of the sleeves in turn. In case of appropriate pinhole placement, the 2 guidewires will meet in the cannulated rod of the guide frame and the surgeon will have the metal-to-metal feeling. If the pinhole misses the femoral tunnel, the 2 guidewires will not meet and the surgeon will not have the metal-to-metal feeling. In our practice, 9 cases of inaccurate pinhole placement were detected with this test and verified by direct vision of the femoral tunnel with the arthroscope. We find this test simple, reliable, and not time consuming. Key Words: RigidFix—Anterior cruciate ligament reconstruction—Cross pin—Graft fixation.

Nowadays, the use of cross pins is a universally accepted method in anterior cruciate ligament (ACL) reconstruction for femoral fixation of hamstring grafts, with excellent biomechanical properties.1-4 The RigidFix Cross Pin System (DePuy Mitek, Raynham, MA) is such a device that uses 2 parallel pins across the graft and femoral tunnel. The tacks are composed of polylactic acid, and they are fully absorbed in the human body by hydrolysis.

We have used this femoral fixation system in 450 ACL reconstructions with a hamstrings graft between March 2002 and December 2005. In 10 cases, the pinholes missed the femoral tunnel, raising concerns regarding adequate graft fixation. The senior author made up a simple test to identify the incorrect placement of pins.

TECHNIQUE

The femoral tunnel is prepared, as usual, according to the manufacturer’s recommendations. After obtaining proper positioning of the femoral tunnel, a guidewire is drilled through the notch and out the lateral femoral cortex. Subsequently, the femoral tunnel is drilled to a 30-mm depth with the drill that corresponds in diameter to that of the graft. The surgeon can use either the transtibial or medial portal technique.
The next step prepares the pinholes. The appropriate cannulated rod is attached to the RigidFix guide frame and then inserted to the femoral tunnel. The extra-articular portion of the frame lies on the lateral side of the operative knee. The guidewire is then removed to allow drilling of the pinholes. The RigidFix sleeves are placed over the interlocking trocar and then drilled through the hole of the guide frame to the lateral femoral condyle creating the pinholes. At this stage, the manufacturer’s recommendations are to reinsert the guidewire, remove the frame, and insert the graft.\textsuperscript{5,6}

In some cases, though, pinholes miss the femoral tunnel (Fig 1). As a result, accurate placement should be verified. After the pinholes are drilled and the sleeves are in place, a second guidewire is introduced through each of the sleeves in turn. The femoral tunnel guidewire is reinserted in the femoral tunnel without removing the guide frame (Fig 2). In case of appropriate pinhole placement, the 2 guidewires will meet in the cannulated rod of the frame and the surgeon will have the metal-to-metal feeling (negative test). In that case, we remove the guide frame, and we proceed to graft passage after arthroscopic confirmation of correct pinhole position (double check). If the pinhole misses the femoral tunnel, the 2 guidewires will not meet and the surgeon will not have the metal-to-metal feeling (positive test). In that case, we do not remove the guide frame, and the pinholes are redrilled at a slightly different angle. The test is then reapplied, and we proceed as described earlier until the test is negative.
tive and accurate pinhole positioning has been achieved.

**DISCUSSION**

The first time in our practice that the cross pins missed the femoral tunnel, we had not checked the pinholes before the insertion of the graft, and the graft was retracted out of the femoral tunnel during graft tensioning. In that case, an interference screw was used to fix the graft proximally. Since then, we always confirm the accurate positioning of pinholes before graft fixation by using the test we described.

We have detected 9 more cases of incorrect pinhole placement in 450 ACL reconstructions with hamstring grafts using the RigidFix Cross Pin System. The test was positive in all 9 cases, and the inaccurate pinhole placement was verified by direct vision of the femoral tunnel with the arthroscope. In the rest of the cases, the test was negative and also confirmed with the arthroscope. As a result, no false-positive or false-negative cases were obtained, and the sensitivity and specificity of the test are 100%.

Femoral fixation of quadrupled hamstring tendon or bone–patellar tendon–bone grafts is a key element to a durable ACL reconstruction. Correct pinhole placement should be verified to make sure that cross pins anchor the graft efficiently.

Accurate pinhole position in the femoral tunnel can be suspected when fluid outflow is obtained through sleeves, which means communication of the sleeves and pinholes with the, distended with fluid, joint through the femoral tunnel. However, this is not a reliable sign because not a centered pinhole position (Fig 1) in the femoral tunnel has the same result (fluid outflow). Chandratreya and Aldridge have reported on this problem and proposed direct vision of the pinholes with the arthroscope inserted through the tibial tunnel into the femoral tunnel.

Our test is simple, reliable, and not time consuming in inaccurate pinhole positioning detection because we simply introduce a second guidewire through the sleeves before the guide-frame removal. Furthermore, the test helps the surgeon to save some time in cases of incorrect pinhole placement because he/she avoids a step of the procedure. The guide frame is still in place, and therefore the surgeon does not have to remove it, detect the wrong pinhole position with the arthroscope, and reapply the guide frame for new pinholes drilling.

In our experience, the test is not only useful in inaccurate pinhole positioning detection but also in the correct placement verification. Nevertheless, in our current clinical practice, we always confirm correct pinhole placement with the arthroscope (double check), and we only use the test for inaccurate positioning detection.

**REFERENCES**