The Posterior Approach in THR: Assuring Capsular Stability

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abstract

Repair of the posterior capsule is advocated to reduce dislocation after total hip replacement (THR). To date, no predictable physical findings are reported in the literature to assess the capsular integrity and risk of hip dislocation after the posterior approach. The internal rotation test is performed at 4 to 6 weeks postoperatively with the hip and knee flexed at 90° while the patient is supine. The test is positive if a firm endpoint is felt with internal rotation of ≈15°.

Between January 2007 and January 2008, twenty-three patients who had magnetic resonance imaging (MRI) at a mean 1.8±0.7 years after posterior-approach THR were included in this study. Magnetic resonance images were reviewed by a blinded radiologist for the integrity of the posterior capsule and quadratus, the distance between the piriformis and conjoined tendon to bone, and the amount of piriformis obturator internus atrophy. Magnetic resonance imaging results in patients with positive internal rotation tests showed an intact posterior capsule and scarring of the tendons with no severe muscle atrophy. In patients with a negative internal rotation test, MRI showed incomplete healing of the tendons and severe muscle atrophy. Sensitivity and specificity of the internal rotation test for tendon/scar healing were 100% and 93%, respectively.

The internal rotation test is a simple, reproducible test that, if positive, has a high correlation with capsule/tendon healing.

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Dislocation is one of the most common and concerning complications after total hip replacement (THR), especially when using the posterior approach. Repair of the posterior soft tissue, along with the use of larger femoral heads and proper hip precautions, has reduced the dislocation rate to a range of 0% to 1.9%. The criteria to determine proper healing of the posterior capsule and short external rotator tendons have not been fully defined.

The internal rotation test is performed 6 weeks postoperatively with the hip and knee flexed at 90° while the patient is supine, and a firm endpoint is felt with internal rotation of the hip (Figure 1). The test is positive if internal rotation of ≤15° has a firm endpoint. The purpose of this study is to define proper healing of the posterior capsule and tendons and investigate the correlation between the internal rotation test and healing of the capsule/tendon.

**Materials and Methods**

Between January 2009 and January 2010, one hundred sixty-eight consecutive patients (97 women and 71 men) who underwent primary noncemented THR were prospectively followed for a minimum of 6 months. All patients received Accolade TMZF implants (Stryker Orthopaedics, Mahwah, New Jersey) through a posterior approach. The short external rotators were detached from their femoral insertion along with the capsule as a single tendon/muscle envelope and repaired through trochanteric drill holes as 1 unit with 2 separate stitches. The gap between the piriformis tendon and posterior margin of gluteus medius and minimus was also closed (Figure 2). The intraoperative combined anteversion and postoperative cup abduction angle and leg length were measured. Hip precautions were initiated postoperatively during the hospital stay and were continued for the first 6 weeks after discharge. The internal rotation test was performed 6 weeks postoperatively with the hip and knee flexed to 90°. In patients with a positive internal rotation test, all hip precautions were removed and they were allowed to return to their full activities of daily living.

Accuracy of the internal rotation test was evaluated in 23 patients who underwent magnetic resonance imaging (MRI) as a part of a separate prospective study. Magnetic resonance imaging was performed at a mean 1.8 ±0.7 years (range, 1-3 years), using a previously described protocol. All MRI studies were reviewed by a senior radiologist (H.G.P.) for capsule healing with scar formation, distance from the short external rotator tendons to the bone, and extent of muscle atrophy.

Healed capsule/tendon was defined as an intact, hypointense capsule with hypointense scar in continuity from the tendon at the muscle–tendon junction to the trochanter. Failure of repair was defined as any dehiscence or discontinuity of the posterior capsule to the trochanter, lack of scar formation, or severe atrophy of the piriformis and obturator internus muscles.

**Results**

The overall rate of positive internal rotation tests was 73% (Table 1). Mean patient age was 70.1 ±8.2 years (range, 51.8-89.6 years). Mean intraoperative combined anteversion was 40° (range, 35°-45°). Mean cup abduction angle and leg length were...
Primary Hip Replacement: What Works & for Whom?

44.2°±3.7° (range, 35.1°-51.2°) and 1±0.5 mm (range, 0-5 mm), respectively. Femoral head size was 28, 32, and 36 mm in 3%, 30%, and 67%, respectively. The internal rotation test was performed at an average of 6.0±0.9 weeks postoperatively (range, 4.3-7.9 weeks). Average follow-up was 10.1±2.1 months (range, 6.6-16.8 months). The patients with a positive internal rotation test (n=132) were allowed to return to full activities of daily living. There were no cases of dislocation in any patient at follow-up.

Of the 23 patients with an MRI, 9 had a positive and 14 had a negative internal rotation test. Magnetic resonance imaging results in the 14 patients with a negative internal rotation test showed moderate or severe muscle atrophy, lack of scar tissue formation, and incomplete healing of the tendons (Table 3). The posterior capsule was intact in 10 patients and torn in 4. In these 4 patients, mean abduction angle of the cup was 42.9±2.8° and all had large femoral heads (32 and 36 mm) (Table 4). The kappa value between internal rotation test and severe muscle atrophy was 0.65. Mean tendon-to-bone distance was 46.5±9.5 mm. The internal rotation test was strongly correlated with distance between the short external rotator tendons and the posterior capsule.
rotator tendons and the greater trochanter ($r=0.825; P<.0001$). Using the MRIs as the standard, the sensitivity and specificity of the internal rotation test based on capsule/tendon healing were 93% and 100%, respectively.

**DISCUSSION**

The incidence of posterior dislocation during the first year after THR has been reduced with the use of larger femoral heads ($\geq 32$ mm), the proper combined anteversion and coplanar test, and repair of the posterior capsule and short external rotators. The dislocation rate after the posterior approach with reattachment of the capsule/tendon unit has been reported to have reduced to a range of 0% to 0.8%.$^{4,6,7,14,15}$ Proper healing of the capsule and tendons has not been adequately defined. The literature describes the healing of the tendons to the trochanter as $<25$ mm.$^{10,14}$ We defined intact capsule and scar formation of the short external rotator tendons as static healing with scarring in continuity and functional muscle evident with minimal or no atrophy as dynamic healing of the repair. A functional tendon/scar unit would have both static and dynamic healing.

In the MRI study, all 14 patients with a negative internal rotation test had a nonhealed tendon/scar unit, either due to dehiscence of the tendon/capsule, severe muscle atrophy, or lack of scar formation. Moreover, 3 patients (21%) had an intact capsule with a functioning muscle/tendon unit. A possible explanation for increased internal rotation and a negative test in these 3 patients is hypermobility of the hip joint. In 7 patients with severe muscle atrophy and an intact capsule, the absence of dislocation could be due to resistance of the scar tissue to dislocation. In 4 patients who had dehiscence of the posterior capsule and severe muscle atrophy, we speculate that the use of large femoral heads and component positioning such as combined anteversion and cup abduction angle may play a significant role in preventing dislocation.

The internal rotation test is performed at the first postoperative visit, usually 6 weeks postoperatively. Based on MRI findings, a positive internal rotation test is indicative of proper healing of the posterior soft tissue, which includes the capsule and short external rotators, with a specificity of 100%. The high sensitivity and specificity of the internal rotation test for the healed capsule/tendon unit makes it a clinically useful test during the physical examination to demonstrate an appropriate repair and thus safely discontinue hip precautions, thereby allowing patients to return to full activities of daily living.

**REFERENCES**