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# Role of the Acetabular Labrum and the Iliofemoral Ligament in Hip Stability : An In Vitro Biplane Fluoroscopy Study

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# Role of the Acetabular Labrum and the Iliofemoral Ligament in Hip Stability

## An In Vitro Biplane Fluoroscopy Study

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**Background**: Recent biomechanical reports have described the function of the acetabular labrum and iliofemoral ligament in providing hip stability, but the relative stability provided by each structure has not been well described.

**Hypothesis**: Both the iliofemoral ligament and acetabular labrum are important for hip stability by limiting external rotation and anterior translation, with increased stability provided by the iliofemoral ligament compared with the acetabular labrum.

**Study Design**: Controlled laboratory study.

**Methods**: Fifteen fresh-frozen male cadaveric hips were utilized for this study. Each specimen was selectively skeletonized down to the hip capsule. Four tantalum beads were embedded into each femur and pelvis to accurately measure hip translations and rotations using biplane fluoroscopy while either a standardized 5 N·m external or internal rotation torque was applied. The hips were tested in 4 hip flexion angles (10° of extension, neutral, and 10° and 40° of flexion) in the intact state and then by sectioning and later repairing the acetabular labrum and iliofemoral ligament in a randomized order.

**Results**: External rotation significantly increased from the intact condition (41.5° ± 7.4°) to the sectioned iliofemoral ligament condition (54.4° ± 6.6°) and both-sectioned condition (61.5° ± 5.7°; $P < .01$), but there was no significant increase in external rotation when the labrum alone was sectioned (45.6° ± 5.9°). The intact and fully repaired conditions were not significantly different. External rotation and internal rotation significantly decreased when the hip flexion angle decreased from 40° of flexion to 10° of extension ($P < .01$) regardless of sectioned condition. Anterior translation varied significantly across sectioned conditions but not across flexion angles ($P < .001$). The ligament-sectioned (1.4 ± 0.5 mm), both-sectioned (2.2 ± 0.2 mm), and labrum-repaired (1.1 ± 0.2 mm) conditions all resulted in significantly greater anterior translation than the intact condition (−0.4 ± 0.1 mm) ($P < .001$).

**Conclusion**: The iliofemoral ligament had a significant role in limiting external rotation and anterior translation of the femur, while the acetabular labrum provided a secondary stabilizing role for these motions.

**Clinical Relevance**: These results suggest that, if injured, both the acetabular labrum and iliofemoral ligament should be surgically repaired to restore native hip rotation and translation. In addition, a careful repair of an arthroscopic capsulotomy should be performed to avoid increased external hip rotation and anterior translation after arthroscopy.

**Keywords:** iliofemoral ligament; acetabular labrum; hip stability; capsulotomy; hip biomechanics

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Hip instability has gained interest in recent years as a cause of pain and disability in the athletic population. The healthy human hip is an inherently stable joint primarily because of the bony congruence between the femoral head and acetabulum. However, the unique soft tissue anatomy surrounding the hip joint is also important in maintaining hip stability, particularly in the presence of hip injury or lesions. The iliofemoral ligament is the strongest of the 3 capsular ligaments and functions to restrict extension and external rotation of the hip.[13,16,18] Additionally, the acetabular labrum is a fibrocartilage ring that attaches to the near-circular outer rim of the acetabulum and limits femoral head translation by deepening the hip socket and maintaining negative intra-articular pressure.[8,11,12]

Athletes who participate in sports causing repetitive twisting and pivoting of the hip frequently suffer from a combination of anterior labral tears, elongation of the iliofemoral ligament, and hip microinstability.[1,9] Loads as high as 5 times body weight have been reported in the hip during running, with potentially greater loads present during more dynamic movements.[7,26] Additionally,

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increasing numbers of athletes who suffer from hip pain have bony conflict associated with femoroacetabular impingement (FAI).[20,24] This only adds complexity to the understanding of the development of instability. It is possible that the repetitive rotational and translational forces at the hip that result from routinely twisting and pivoting the lower extremities, in conjunction with abnormal bony anatomy, initially lead to anterior labral tears and subsequent greater anterior translations of the femoral head.[8] This could also eventually cause chronic iliofemoral ligament elongation. Conversely, these twisting motions might result in initial stretching of the iliofemoral ligament, leading to increased tensile forces and possible tears of the anterior labrum. Although there have not been any studies that have quantified in vivo hip biomechanics postoperatively that would allow a more comprehensive assessment of these procedures, it has been reported that repair of a torn acetabular labrum yields improved patient outcomes compared with debridement alone.[10,22] The improved patient outcomes with these techniques are theorized to be a result of restoration of hip stability provided by the repaired labrum and/or capsule.[20] However, the individual contributions of these structures to maintain hip joint stability are not known. While most surgeons would advocate performing either an anterior capsulotomy or a capsulectomy at the initiation of hip arthroscopy cases to allow for improved visualization and mobility, the effects of capsular and iliofemoral ligament sectioning on hip biomechanics are not well known, especially in cases that involve labral repair.[17,27]

The purpose of our study was to use biplane fluoroscopy to determine the relative contributions of the acetabular labrum and iliofemoral ligament in maintaining hip joint stability as measured by external rotation, internal rotation, and anterior translation of the femur relative to the center of the acetabulum. We hypothesized that each of these structures are vital for hip stability by limiting external rotation and anterior translation, with increased stability provided by the iliofemoral ligament compared to the acetabular labrum. Moreover, we hypothesized that once sectioned, these structures could be surgically repaired to restore native hip translation and rotation.

## MATERIALS AND METHODS

### Specimen Testing Protocol

Eight fresh-frozen pelvis specimens (16 hips) were obtained from male cadaveric donors (average age, 60.4 years; range, 53-68 years). Specimens were screened with CT scans to rule out any evidence of bony lesions, including inflammatory arthritis or osteoarthritis, previous surgery, or abnormal bony morphologic characteristics including FAI. One hip was excluded because of labral injury, leaving a total of 15 hips. All musculature and soft tissues were then removed from the pelves, leaving the hip capsular ligaments and the labrum intact. The hips were then examined clinically for range of motion, crepitus, or any other sign of occult bony abnormalities. To accurately measure translations and rotations of the femur relative to the center of the acetabulum using biplane fluoroscopy, 8 tantalum microbeads with a diameter of 1.6 mm (Wennbergs Finmek AB, Gunnilse, Sweden) were injected into bony landmarks in each hip through an 18-gauge needle. Four beads were spaced evenly throughout each hemipelvis and 4 were placed in each proximal femur (Figure 1). The pelvis of each specimen was securely mounted in a custom hip rig to allow for positioning of the hip in the biplane fluoroscopy system. The femoral shaft was then centered and fixed in a clear cylinder that was fixed to a pulley to allow for application of 5 N·m internal and external rotation torques (Figure 2). The testing apparatus was designed to recreate the clinical examination of the log-roll test.[19] This test is performed with the patient lying prone with the legs straight and relaxed. The examiner grasps the heel and uses the foot to gently rotate the leg internally and externally to test for hip ligament laxity. Pilot testing demonstrated that 5 N·m of torque was sufficient to recreate a typical internal/external full range of

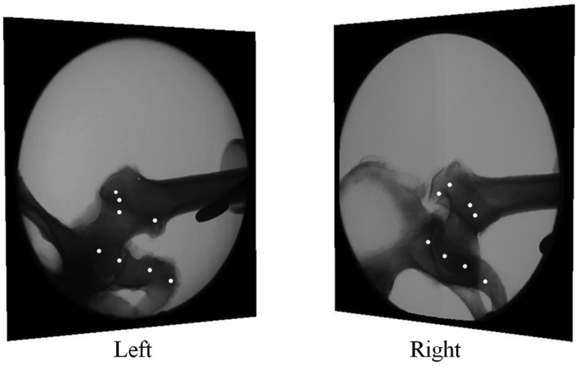

**Figure 1.** Left and right radiographic images from the biplane fluoroscopy system with the position of the embedded tantalum beads in the pelvis and femur highlighted in white.

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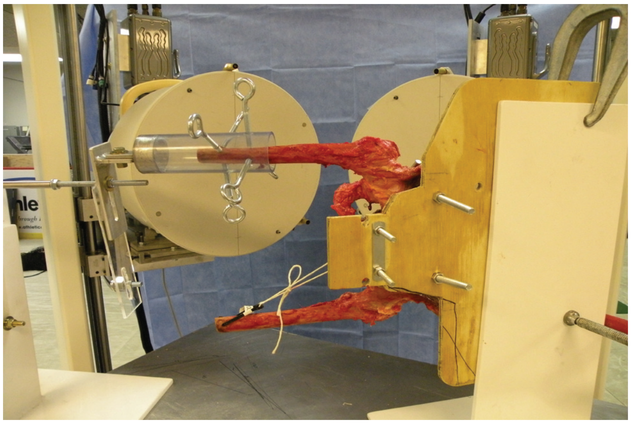

**Figure 2.** Custom testing hip apparatus with the support stand, gripping cylinder, and biplane fluoroscopy image intensifiers. The specimen connected to the testing apparatus is orientated for the right hip to be analyzed.

motion without producing contact between the greater trochanter and ischium at peak external rotation.

The hips were tested in each of the following states: intact, sectioning of either the iliofemoral ligament or the labrum (randomly assigned), sectioning of both the iliofemoral ligament and labrum, repair of either the iliofemoral ligament or the labrum (randomly assigned), and repair of both. The order of labral and iliofemoral ligament sections and repairs were randomized to minimize order bias. Iliofemoral ligament sectioning was performed parallel to the acetabular rim, 1 cm distal to the edge of the acetabulum, through the entire medial and lateral arms of the ligament similar to the level of a capsulotomy performed during hip arthroscopy.[22,24] There was no additional resection of the capsular ligaments after the sectioning. Labral tears were created by sharply incising the labrum off the acetabular rim from the 12-o'clock to the 3-o'clock position on right hips and the corresponding anterior-superior location on left hips, which correlated with the most common reported location of labral tears.[3,24] In conditions where the randomized order dictated a labral sectioning before sectioning of the iliofemoral ligament, a 5-mm longitudinal incision was made in the anterior capsule to section the labrum, and this tissue was reapproximated with a nonabsorbable No. 0 suture after the labral sectioning. The labrum was later anatomically repaired using 2 suture anchors. Iliofemoral ligament repairs were performed with interrupted nonabsorbable No. 0 sutures, with care taken to reapproximate the ligament and not overconstrain it. For each sectioned condition, the hips were tested in the following positions: 10° of extension, neutral, 10° of flexion, and 40° of flexion to assess the hip throughout its flexion/extension range of motion. External and internal rotation torques of 5 N·m were applied and femoral head rotations and translations were measured using biplane fluoroscopy technology. To test the reliability of the testing apparatus and analysis, the condition in which both the iliofemoral ligament and labrum were sectioned was repeated at each joint angle after a 30-minute time interval. Hip rotations were compared between the 2 repeated conditions.

## Biplane Fluoroscopy System

The biplane fluoroscopy system was composed of 2 commercially available BV Pulsera c-arms with 30-cm image intensifiers (Philips Medical Systems, Best, The Netherlands). Images were recorded with 2 coupled, high-speed, high-resolution (1024 × 1024) digital cameras (Phantom V5.1, Vision Research, Wayne, New Jersey) interfaced with the image intensifiers of the fluoroscopy systems using a custom interface. Image distortion was corrected for and the biplane fluoroscopy system was calibrated using standard techniques as previously described.[4,14,29] For each position and condition, 20 images were recorded and averaged for optimal image quality.

## Data Analysis

For each hip, data analysis consisted of 5 steps: (1) 3-dimensional bone geometry reconstruction of the femur and pelvis from CT data, (2) anatomic coordinate system assignment and transformation using the reconstructed bones, (3) bead location determination in the biplane fluoroscopy data, (4) determination between the bead configuration and hip anatomic coordinate systems, and (5) post-processing to extract the parameters of interest. The 3-dimensional geometries of the femur and pelvis were extracted from the CT data using commercial software (Mimics, Materialize Inc, Ann Arbor, Michigan). Determination of the bone position and orientation and bead locations from the biplane fluoroscopy data were performed using model-based RSA (roentgen stereophotogrammetric analysis) (Medis Specials, Leiden, The Netherlands) according to previously described techniques.[4,14] Custom software written in MATLAB (Mathworks, Natick, Massachusetts) was used to assign anatomic coordinate systems to the bones and to transform the position and orientation of the bead configuration to the hip anatomic coordinate system.[31]

The beads were automatically detected for each image, and the locations of the beads were determined by finding the intersections of the radiographic beams originating from the focus positions of the x-ray generators and extending to the centers of the detected beads in the imaging planes. Figure 3 shows the reconstructed position and orientation of the femur and pelvis as well as the digitized beads with their projections in the biplane fluoroscopic images.

## Statistical Analysis

A 2-way repeated-measures analysis of variance (ANOVA) with independent factors of hip flexion angle (10° of extension, neutral, 10° of flexion, and 40° of flexion) and sectioned condition (intact, tear of either the iliofemoral ligament or the labrum, tear of both iliofemoral ligament and labrum, repair of either the iliofemoral ligament or the labrum, and repair of both) was applied to the degree of external rotation, internal rotation, and 3-dimensional translations. Adjusted Bonferroni/Dunn post hoc analyses were applied when significant differences were found.

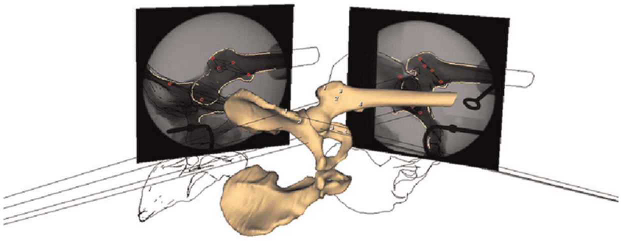

**Figure 3.** An image of the reconstructed pelvis and left femur. Contours of bony landmarks were detected on each radiograph and detected contours were optimally matched with the projected contours from the imported bone geometries.

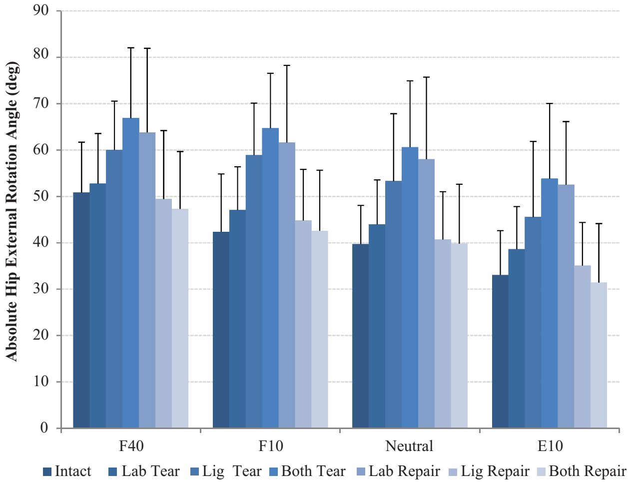

**Figure 4.** Hip external rotation angle after the application of 5 N·m of external rotation torque for each of the sectioned conditions at the 4 hip flexion angles tested.

The level of significance was set to $P < .05$. A pilot study was conducted on 5 hips to maximize testing conditions prior to the initiation of this study. A power analysis of the rotation and translation data collected in the pilot study revealed that a minimum of 14 hips would be necessary to detect significant differences using the statistical analysis described here with a beta of .8 and an alpha of .05.

## RESULTS

Results of the 2-way repeated-measures ANOVA demonstrated that significant differences were present as a result of the sectioned conditions and hip flexion angle independently. However, no interaction relationship was found to exist between sectioned conditions and hip flexion angle. Post hoc analysis of the sectioned conditions revealed that external rotation significantly increased by 12.9° ± 5.2° after sectioning of the iliofemoral ligament alone (54.4° ± 6.6°) when compared with the intact condition (41.5° ± 7.4°) across all flexion angles ($P < .0001$). However, the labral-sectioned condition alone (45.6° ± 5.8°) resulted in no significant increase in external rotation relative to the intact condition (41.5° ± 7.4°). External rotation significantly increased by 7.1° ± 5.9° from the iliofemoral ligament–alone sectioned condition (54.4° ± 6.6°) to when both the labrum and iliofemoral ligament were sectioned in the both-sectioned condition (61.5° ± 5.7°) ($P < .05$). Additionally, the both-sectioned condition (61.5° ± 5.7°) resulted in significantly greater external rotation when compared with the intact condition (41.5° ± 7.4°) ($P < .0001$) (Figure 4).

There was no significant difference in external rotation when only the labrum was repaired (59.0° ± 4.9°) compared with the both-sectioned condition (61.5° ± 5.7°). When only the iliofemoral ligament was repaired (42.5° ± 6.1°) compared with the both-sectioned condition (61.5° ± 5.7°), a significant decrease in external rotation of 19.0° was found ($P < .0001$). Additionally, no significant difference was observed between the intact (41.5° ± 7.4°) and both-repaired conditions (40.3° ± 6.7°) across all flexion angles (Figure 4). Post hoc analysis of the effect of hip flexion angle demonstrated that the average amount of external rotation across all sectioned conditions significantly decreased by an average of 4.8° ± 1.5° for each angle tested as hip flexion decreased from 40° of flexion to 10° of extension ($P < .0001$) (Figure 5A).

Anterior-posterior translations significantly varied across sectioned conditions but not across hip flexion angles. The both-sectioned condition resulted in a significant increase of 2.6 ± 0.2 mm of anterior translation when compared with the intact condition ($P < .001$) and a significant increase of 0.8 ± 0.4 mm when compared with the sectioned iliofemoral ligament–alone condition ($P < .01$). A sectioned iliofemoral ligament alone resulted in significantly greater anterior translation of the femur relative to the center of the acetabulum (1.4 ± 0.5 mm) when compared with both the intact condition (−0.4 ± 0.1 mm) and the labrum sectioned alone (−0.5 ± 0.3 mm) ($P < .001$). A repaired labrum alone (1.1 ± 0.2 mm) demonstrated significantly greater anterior translation when compared with the intact condition (−0.4 ± 0.1 mm) ($P < .01$); however, there was a significant reduction in anterior translation with a labral repair alone (1.1 ± 0.2 mm) compared with the both-sectioned condition (2.2 ± 0.2 mm) ($P < .01$). Additionally, there was no difference in anterior translation between the intact condition (−0.4 ± 0.1 mm) and a repaired iliofemoral ligament (0.8 ± 0.3 mm). Finally, no differences were observed between the intact (−0.4 ± 0.1 mm) and both-repaired conditions (−0.4 ± 0.2 mm) (Figure 5B).

After the application of a 5 N·m internal rotation torque, internal rotation significantly increased as the hip flexion angle increased for all the sectioned conditions ($P < .001$). There was a 4.9° increase in internal rotation from 10° of hip extension (18.4° ± 1.3° ) to 40° of hip flexion (23.3° ± 1.3°) across all sectioned conditions ($P < .001$). Hip sectioned condition demonstrated no significant effect on internal rotation angle (Table 1).

The reliability test showed that the largest difference between the both-sectioned condition and the repeated

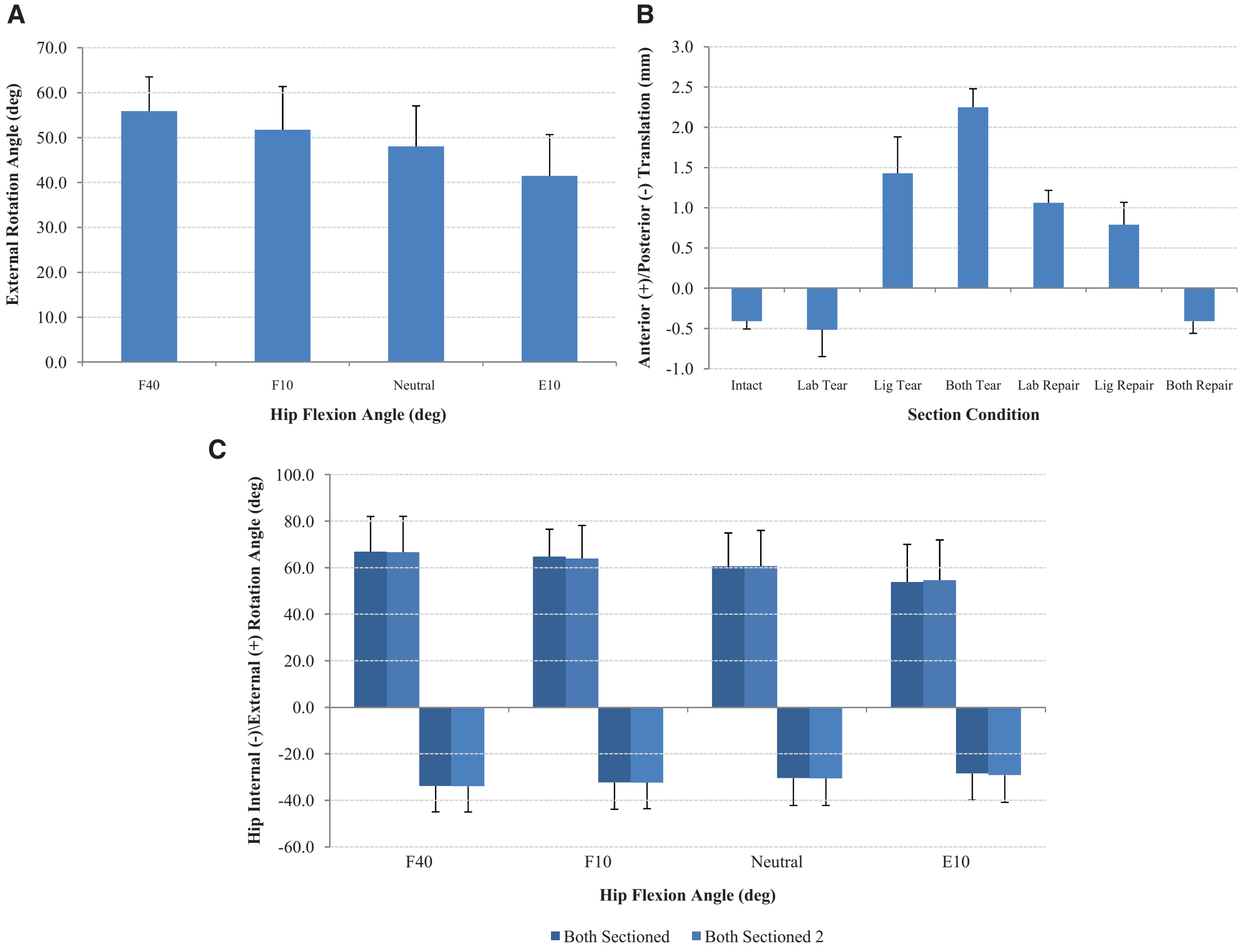

**Figure 5.** A, external rotation averaged across all sectioned conditions after the application of 5 N·m of external rotation torque for each hip flexion angle tested. B, anterior (+)/posterior (−) translation after the application of 5 N·m of external rotation torque for each sectioned condition averaged across all of the 4 flexion angles tested. C, reliability of the testing apparatus test with hip internal rotation (−) and external rotation (+) angle for the repeated both-tear condition at each hip flexion angle tested.

TABLE 1
Average Internal Rotation Angle in Degrees (±1 Standard Deviation) for Each Sectioned Condition at 4 Hip Flexion Angles[a]

| | Intact | Lab Cut | Lig Cut | Both Cut | Lab Repair | Lig Repair | Both Repair |
|---|---|---|---|---|---|---|---|
| F40 | 31.5 (10.1) | 30.8 (8.6) | 35.6 (12.9) | 33.9 (11.1) | 32.0 (10.4) | 35.4 (11.5) | 34.0 (10.6) |
| F10 | 30.2 (11.1) | 30.0 (8.5) | 33.2 (13.6) | 32.3 (11.5) | 31.0 (10.7) | 34.6 (12.2) | 33.0 (11.2) |
| Neutral | 27.8 (11.4) | 28.6 (8.9) | 31.5 (13.2) | 30.5 (11.8) | 30.6 (11.7) | 32.9 (12.0) | 30.9 (11.7) |
| E10 | 26.3 (10.6) | 26.4 (8.7) | 28.5 (14.1) | 28.4 (11.3) | 27.9 (10.7) | 30.3 (11.8) | 29.0 (10.4) |

[a] Intact, the skeletonized hip tested before any other alterations; Lab Cut, only the acetabular labrum sectioned; Lig Cut, only the iliofemoral ligament sectioned; Both Cut, both the acetabular labrum and iliofemoral ligament sectioned; Lab Repair, only the acetabular labrum repaired; Lig Repair, only the iliofemoral ligament repaired; Both Repair, both the acetabular labrum and iliofemoral ligament repaired; F40, the hip positioned in 40° of hip flexion; F10, hip positioned in 10° of hip flexion; Neutral, hip positioned in neutral (0° of flexion); E10, hip positioned in 10° of hip extension.

both-sectioned condition was 0.8° in external rotation and 0.7° in internal rotation. There were no significant differences when the both-sectioned condition was repeated in internal rotation and in external rotation at any of the flexion angles, validating our testing apparatus for these testing conditions (Figure 5C).

## DISCUSSION

We confirmed our hypothesis and found that sectioning of the iliofemoral ligament alone resulted in significantly increased femoral head external rotation and anterior translation when an external rotation torque was applied in all flexion angles compared to the intact state. However, the acetabular labrum exhibited a significant role as a secondary stabilizer as evidenced by the significant increases in external rotation and anterior translation that we observed when the labrum was sectioned after the iliofemoral ligament had already been sectioned. Repair of both the iliofemoral ligament and the labrum provided significantly decreased translation and external rotation compared with a labral repair alone. Additionally, we found that the presence of a sectioned labrum alone did not result in a significant increase in femoral head external rotation and anterior translation compared to the intact state. Repair of the labrum with the iliofemoral ligament sectioned did not significantly restore native hip rotation, but was able to significantly reduce anterior translation. Finally, we found that neither the acetabular labrum nor iliofemoral ligament significantly affected internal rotation.

The hip capsule is shaped like a thick sleeve with 3 distinct thickenings that form the capsular ligaments. The iliofemoral ligament lies anteriorly and fans out in an inverted Y shape, originating at the lower portion of the anterior inferior iliac spine and inserting along the intertrochanteric line of the femur. The iliofemoral ligament is the strongest of the hip capsular ligaments, demonstrating the greatest stiffness and force to failure of the 3 capsular ligaments.[15,16] The iliofemoral ligament is reported to resist hip extension and external rotation and prevent anterior translation of the femoral head when the hip is in neutral to extended positions.[18] Insufficiency of this ligament can reportedly lead to subtle instability and possibly lead to hip pain. While there have not been any in vivo investigations of hip instability, recent studies describing capsular plication or shrinkage to treat iliofemoral ligament deficiency have reported improved patient outcomes with restoration of anterior support.[21,22] Our results would indicate that the iliofemoral ligament is vital to limit excessive amounts of external rotation and anterior translation of the femur.

During hip arthroscopy, an anterior capsulotomy is typically performed at the beginning of the procedure with the goal of increasing the maneuverability of instruments and visualization of the joint. In most cases, the incision starts 1 cm from the acetabular rim and continues parallel to the labrum, connecting both portals[23,25]; however there are other techniques that exist to perform this incision and subsequent closure.[28] Each of these techniques could result in varied effects on hip joint stability. Although currently many believe that a capsulotomy is a crucial component of any hip arthroscopic procedure, there is no consensus in the literature regarding how the hip capsule should be treated at the end of the arthroscopic procedure.

To our knowledge, only 2 studies have attempted to quantify the role of the soft tissues of the hip in maintaining hip stability. Crawford et al[6] used motion analysis to quantify the role of the acetabular labrum in hip stability. They reported that with the hip in 30° of flexion and a 20 N·m external rotation torque, there was a 7.1° ± 2.4° increase in external rotation after venting of the capsule and sectioning of the labrum. Additionally, they reported that the femoral head translated 0.05 ± 0.28 mm posteriorly for the same condition.[6] The increased amount of external rotation they reported is much greater than the 2.0° ± 4.1° that we observed for the same-sectioned condition with the hip in 40° of flexion and with less external rotation torque applied. They also reported translations that were more than an order of magnitude less than the 0.8 ± 0.8 mm of posterior translation that we observed when the labrum was sectioned. These differences may be explained by differences that exist in the methodology between motion analysis and biplane fluoroscopy. Additionally, Crawford et al[6] applied a constant 100-lb axial load during each testing state that may have contributed to the differences present in the 2 studies.

Martin et al[18] assessed the role of the capsular ligaments in internal and external rotation, which included sectioning of the iliofemoral ligament but did not address the role of the acetabular labrum. Despite the fact that their study did not consistently load the hip in internal and external rotation, but instead manually moved the hip through its rotational range of motion, they reported a similar average increase in external rotation of 16.6° after sectioning of the iliofemoral ligament across all hip flexion angles. However, they also concluded that the iliofemoral ligament had dual control of external rotation in flexion and both internal and external rotation in extension.[18] This is contrary to our findings, where the iliofemoral ligament did not have a significant role in limiting internal rotation. With our findings, and given the anatomy and attachment sites of the iliofemoral ligament, it is difficult to conclude that it has a primary role in limiting internal rotation.

While our results demonstrated only slight increases in external rotation and anterior translation after a labral tear, recent studies have demonstrated the negative effects of labral injury.[1,6,11,13,24,27] A recent study reported that labrum venting and tears led to increased translation of the femoral head and significantly less force required for distraction in cadaveric hips.[6] Another recent study reported considerable tensile strain in the anterior part of the labrum with external rotation and abduction maneuvers, which may explain the incidence of anterior labral tears in athletes who participate in twisting and pivoting sports.[8] However, an increasing amount of patients with hip pain are presenting with a combination of FAI, hip dysplasia, hip instability, and acetabular labral tears.[20] Previous reports demonstrated that more than 90% of patients with labral tears have underlying bony abnormalities.[30] We believe that adequately treating each individual condition is essential for good clinical outcomes after surgical intervention. Our data demonstrate that the labrum is an important secondary stabilizer of the hip. Incomplete restoration of hip translation and rotation will be achieved by labral repair alone when the iliofemoral ligament is damaged or surgically incised. In light of these findings, we recommend a capsular repair after an arthroscopic hip capsulotomy to fully restore native hip translation and rotation.

We recognize certain limitations of this study. We did not apply compression to the cadaver specimens during testing. This study was meant to reproduce the relative stability provided by the labrum and the iliofemoral ligament during internal and external rotation as measured during a clinical examination with the patient lying supine. Our study also included only male specimens. Our early pilot investigations utilizing female specimens demonstrated that some females have increased hip laxity compared with males. When these female specimens were skeletonized, 5 N·m of external rotation torque resulted in contact between the greater trochanter and ischium. Additionally, it has been reported that the ligamentum teres provides an important role in hip stability,[2,5] but this was not tested in this study because it is not involved in the hip capsulotomy. The differences in translation detected in this study were small and it is difficult to determine whether these increases in motion are clinically significant to hip stability. This study did not address whether increased rotation and/or translation of the hip results in increased risk of retearing the labrum or clinical pain. Further studies are recommended to address these issues.

In conclusion, we found that the acetabular labrum had a secondary role in hip stabilization and is most effective at limiting external rotation and anterior translation when paired with an intact or repaired iliofemoral ligament. These findings have important clinical implications. They demonstrate that if both the acetabular labrum and iliofemoral ligament are torn, they should be surgically repaired to restore native hip translation and rotation. These results also suggest that a careful repair of an arthroscopic capsulotomy is important to maintain hip translation and rotation and avoid increased external hip rotation after arthroscopy.

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