

The Iliofemoral Bounce Test: Identifying Hip Capsular Insufficiency

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Background: Insufficiency of hip capsular structures has recently gained recognition as a cause of pre-arthritis hip pain, leading to hip joint instability and progressive chondrolabral injury. An accurate evaluation of capsular integrity can help orthopedic surgeons plan capsular management prior to hip arthroscopy.

Indications: The proposed iliofemoral bounce test is meant to be applied preoperatively for identification of hip capsular integrity when microinstability is suspected or in the setting of revision hip arthroscopy.

Technique Description: After induction of general anesthesia and complete muscle relaxation, the patient is placed in a supine figure-four position by placing the foot of the pathologic hip on the contralateral knee. Two examination techniques are performed: (1) The examiner places one hand on the patient's contralateral anterior superior iliac spine and applies consecutive downward pressure in a "rocking" manner to the pelvis; (2) the examiner applies a preload and release force to the flexed knee (examined hip), with the contralateral pelvis stabilized, and observes the response of the knee to this loads.

Results: Technique 1: The expected physiologic response in a preserved joint is a "bounce" of the contralateral hip (examined hip), evidenced by an up-and-down movement of the knee in response to the rocking movement applied. This movement reflects the integrity and functionality of the hip capsule ligaments' elastic recoil forces, allowing the hip to remain in a stable state in response to destabilizing forces. In contrast, when capsular insufficiency is present, a lack of bouncing will be observed due to unrestricted external rotation of the hip to constrain the hip joint. Technique 2: In a preserved joint capsule, the knee will return to its preload position, while in capsular insufficiency, no bouncing of the knee will be observed.

Discussion/Conclusion: The iliofemoral bounce test is a novel, dynamic, and reproducible examination technique for clinicians to evaluate patient's true hip capsular integrity and for preoperative identification of the proper capsular management, either with a less invasive capsulotomy or performing a capsular closure, plication or even reconstruction, when necessary.

Keywords: hip arthroscopy; microinstability; capsular insufficiency; iliofemoral ligament; hip capsule management

VIDEO TRANSCRIPT

The purpose of this video is to describe the iliofemoral bounce test, a novel examination technique, designed by

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the senior author, for identification of hip capsular integrity when microinstability of the hip is suspected or in the setting of revision hip arthroscopy.

With the continued development of hip arthroscopy, a new potential risk for hip capsular injury following surgery has been presented. Disruption of the capsule to ensure good visibility and improved maneuverability during hip arthroscopy, without its subsequent repair or with failure of repair, has been postulated as a contributor to postoperative iatrogenic hip instability.

Awareness of primary and iatrogenic hip capsular insufficiency is vital in the setting of diagnosing patients with history of chronic hip pain but can be difficult to confirm with office examination, for this purpose we use an examination under anesthesia to confirm the presence of capsular insufficiency.

In order to illustrate the iliofemoral bounce test, we will present the case of a 25-year-old woman who presents to our office with a chronic history of pain in the right groin. Two years previous to this consultation, while enlisted in a branch of the United States military, she had undergone right hip arthroscopy, in which femoroplasty and labrum



repair were performed for symptomatic femoroacetabular impingement (FAI) with hip capsular repair at the end of the procedure. The patient had exhausted conservative treatments (activity modification, rest, intraarticular corticoid hip injections, and physical therapy) with no improvement.

During physical examination, there was soft tissue tenderness around the right hip. Increased range of motion was noted on the right hip when compared with the left. The patient experienced right groin pain with flexion, adduction, and internal rotation (FADDIR), as well as with flexion abduction and external rotation (FABER) maneuvers. Also, extortion of the foot and dial test positive were present. There was no evidence of ligamentous laxity, and physical examination was negative for Beighton criteria.

Four-view x-rays (anteroposterior pelvis, lateral and false profile views) of both hips were taken in office and demonstrate postfemoroplasty changes with Tönnis grade 1 arthritis on the right side, and a left-side cam-type femoroacetabular impingement. Radiologic measurements were as follows: anterior central-edge-angle (CEA): 30°; lateral CEA 30°; alpha angle 42° on axial view; and 38° on anteroposterior view with evidence of cam-type resection, producing a disruption of the labrum's suction seal and therefore hip microinstability.

Magnetic resonance arthrogram (MRA) demonstrates postsurgical changes at the femoral head neck junction with an apparent rupture of the anterior capsule (blue arrows) with either adhesion or surgical sutures in the interim as viewed best on the axial image with hypotrophic labrum (green arrow) and evidence of prior labral repair. Computerized tomography (CT) can be recommended along with magnetic resonance imaging (MRI) or MRA; however, in this case we did not feel that a CT was warranted based on MRI and radiographs.

In summary, this is a patient status-post right hip arthroscopy with labrum repair and over correction of femoroacetabular impingement with persistent disability associated to microinstability and secondary capsular insufficiency, resulting in discharge from the military involving hip pain.

The first therapeutic approach consisted on in-studio physical therapy. Ultimately, return to surgery was indicated, given her young age, the nature of the pathology, and the appearance of the MRI with her persistent symptoms.

The iliofemoral bounce test is a novel diagnostic technique developed by the senior author to be performed in the operating room, after induction of general anesthesia and complete muscle relaxation.

The patient is securely placed on the surgical table in a supine figure-four position by placing the ipsilateral foot of the pathologic hip on the contralateral knee, and letting the hip naturally externally rotate. The examiner stands next to the patient at the level of the pelvis, on either side of the patient, and places one or both hands on the patient's contralateral anterior superior iliac spine (ASIS).

The examiner applies consecutive downward pressure in a "rocking" manner to the pelvis, while, the other hand gently holds the knee of the examined limb.

On the right side of the screen, the examiner is performing a left-side hip examination in which we can observe the expected physiologic response in a preserved joint which is

a "bounce" of the contralateral hip. An evident up-and-down movement of the knee can be observed in response to the rocking pressure applied to the opposite ASIS. This movement reflects the integrity and functionality of the hip capsule ligaments' elastic recoil forces, allowing the hip to remain in a stable state in response to unstabilizing forces. In contrast, when capsular insufficiency is present, a lack of bouncing will be observed due to unrestricted external rotation of the hip and absence of recoil forces to constrain the hip joint.

On the left side of the screen, we can observe a positive iliofemoral bounce test without reproducing the notorious bouncing of the hip, which represents the anterior capsular ligament structures' insufficiency to limit external rotation forces, hence, its ability to stabilize the hip.

For the same purpose, a second examination technique can be performed. With the patient placed in the same figure-four position, the iliofemoral bounce test can now be evidenced by applying a preload and release force to the flexed knee (examined hip), while the contralateral ASIS is stabilized by the examiner, and observing the return of the knee to its original state.

In this video, there is evidence of a more pronounced bouncing on the left knee given an intact hip capsule compared with the capsular insufficiency evidenced on the right hip.

Another observation to consider during this examination is the distance between the lateral aspect of flexed knee and the examination table with the extremity placed in a figure-four position, indicating the degree of external rotation passively achieved and comparing both sides. An increased laxity or insufficiency of the anterior capsule will be observed by a decreased distance between the knee and the table. When the contralateral hip is unaffected, a difference can be observed during both the iliofemoral bounce test and passive external rotation.

With this anatomical hip model representation, we want to illustrate and compare the physiologic function of an intact hip capsule on joint stability vs the effect of a capsular defect after a non-repaired capsulotomy.

On the left side of the screen, we can evidence a natural return of the hip to its original position reflected by the elastic recoil forces of the intact ligaments.

While on the right side of the screen, we can observe a lack of bouncing due to unrestricted external rotation of the hip, representing capsular insufficiency.

A detailed surgical technique is beyond the discussion of this video. However, for comprehensive purposes, the following arthroscopic images are representative of intraoperative findings and surgical procedures for this patient.

We can appreciate an extensive evidence of prior surgical intervention with dense submuscular adhesions throughout the anterior hip. The hip capsule presented bruised and scarred densely to the psoas, rectus femoris muscles, and to the free edge of the labrum. The femoral head showed chondral scuffing in a linear fashion that had covered over with fibrochondral scar. The acetabular rim showed previous suture anchors with retained simple sutures and a hypotrophic labrum. A loss of the suction seal was evident when reducing the hip joint.

The adhesions were liberated within the zone of prior surgery and were meticulously separated from the bone and one another restoring the native planes to the best possible state.

Next, attention was turned toward labral augmentation given the small size of the labrum and the large loss of suction seal in the region of prior femoroplasty, suggesting cam-type resection. A tibialis anterior allograft was prepared per standard and used to augment the acetabulum rim from 10:00 to 4:00 o'clock position. The suction seal of the labrum was perfectly restored up to approximately 80° flexion, where the incongruity from the prior resection again overcame the soft tissues. The reconstruction was stable throughout a functional arc of movement.

Capsular plication sutures were placed to reapproximate and close the capsular defect. The capsulotomy was verified to be approximated and with an appropriate restoration of tension with the leg in 50° FABER.

This preoperative assessment provides an objective evaluation of patient's capsular integrity and helps the treating orthopedic surgeon mandate the proper capsular management, either with a less invasive capsulotomy, or performing a capsular closure, plication or even reconstruction, when necessary. The iliofemoral bounce test should be utilized in conjunction with a standard physical examination and radiological imaging performed routinely in the clinical setting.

The authors developed this new examination technique to be performed in the operating room after obtaining complete muscle relaxation with the anesthesia induction, in order to avoid active contraction of the hip flexors and adductor muscles causing a false-negative result.

Given that this is a novel examination technique, the lack of literature to support it is an important limitation. However, the authors cite a broad range of literature supporting the anatomic and mechanical aspects on which this technique is based. Additionally, there are no previous studies determining the inter- and intrarater reliability to determine the degree of normal vs abnormal. Importantly, the literature emphasizes on the awareness for hip capsular insufficiency and the challenges of establishing an accurate diagnosis, which is the objective of this novel technique.

The iliofemoral bounce test is a novel, dynamic, and reproducible examination technique for clinicians to identify hip capsular insufficiency and establish an accurate diagnosis when microinstability is suspected or in the setting of hip revision surgery.

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