Technical Note

Maximizing the Benefits of Postless Hip Arthroscopy: On-Off Traction Technique During Labral Repair to Restore the Labral Suction Seal

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Abstract: The acetabular labrum plays a key role in proper biomechanical hip function through creation or maintenance of a suction seal between the femoral head and acetabulum. The suction seal effect has been shown to provide stability within the hip, improve biomechanics, and decrease the chance for long-term development of osteoarthritis by optimizing function and force distribution within the hip. Femoral acetabular impingement syndrome damages the labrum and chondrolabral junction, thus negatively impacting the ability of the labrum to maintain native suction seal. Our technique describes the use of a postless hip arthroscopy table and the on-off traction technique throughout the labral repair, ensuring precise reduction of the labrum and restoration of the suction seal sequentially as anchors are placed.

The acetabular labrum plays a key role in maintaining normal hip function.[1] The labrum is a fibrocartilaginous rim that lies on the acetabulum and assists in creating a suction seal between the femoral head and acetabular socket. The suction seal effect created by the labrum and chondrolabral junction has been demonstrated to play an important role in normal hip biomechanics by reducing compressive load and joint friction.[2] This reduction in joint friction minimizes articular cartilage wear and thus plays a protective role in preventing the development of hip osteoarthritis. The suction seal also impacts hip stability.[3] Thus, a tear in the labrum can cause microinstability, leading to a hypermobile joint, which can contribute to further labral damage and be a pain generator.[3]

Femoral acetabular impingement is a common hip disorder caused by morphologic abnormalities of the femur, acetabulum, or both that can lead to bony collisions with soft tissue within the hip joint.[4] It has been established previously that damage to the acetabular labrum compromises labral function, resulting in an altered or inferior suction seal.[5] Labral repair and labral reconstruction aims to improve and restore intra-articular fluid pressurization of the suction seal in comparison with torn or resected labrums.[2,3] Both techniques involve suture anchors being placed in the acetabular rim adjacent to the labrum to reattach the torn labral tissue back to the acetabular rim. Recent emphasis has been placed on recreation of the suction seal in an effort to restore the anatomic function of the repaired labrum (Fig 1).

Surgeons have investigated different methods for repairing the labrum. With a recent emphasis on restoration of labral suction seal, Moreira et al.[1] described using a labral base technique that allows for adjustable eversion–inversion motion of the labrum during repair to allow for ideal placement along the chondrolabral junction. The authors noted several advantages compared with previous methods of repair, including the ability to optimally position the labrum without everting it or creating a space in between the labrum and the femur, and establishing optimal labral suction seal.[1] Another option for effective repair is using the knotless tensionable suture anchor technique that uses looped suture configuration in order to selectively tension the labrum into an anatomic position without excessive eversion of the labrum.[6-10] The authors of this technique suggest shorter operative times and the use of only 1 to 2 working portals.[7] Jackson et al.[8] compared labral base repair and

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Received September 9, 2023; accepted January 12, 2024.

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2212-6287/231303
https://doi.org/10.1016/j.eats.2024.102941

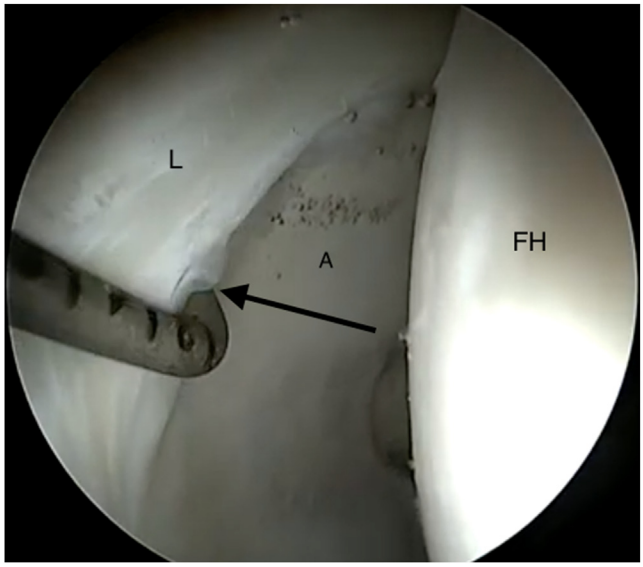

Fig 1. Diagnostic evaluation of the right hip in supine position, viewing from the anterolateral portal with a 70° arthroscope. After initial entry to the central compartment with approximately 70 lbs of traction, the labral tear (LT), femoral head (FH), and acetabular (A) cartilage are visualized, being probed (represented by the arrow) from the mid-anterior portal. Demonstrated is a labral tear with disruption of the chondrolabral junction, with evaluation of the extent of the tear in preparation for repair.

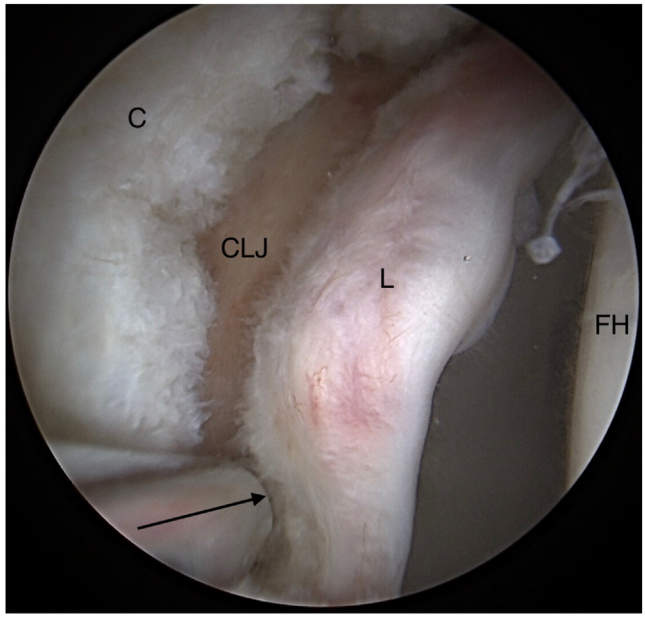

Fig 2. Global arthroscopic view of a right hip labral tear from an anterolateral portal, demonstrating its extent. After addressing central compartment pathology including pincer and subspine anatomy, and acetabular rim decortication in the area of planned resection, anchors are placed. Anchor placement is performed in a lateral-to-medial fashion adjacent to the labrum, with care taken to avoid intra-articular penetration. The arrow in the image represents placement of the first anchor. Traction can be partially released or lowered to help relax the proximal capsule and assist with angulation of the guide as needed while anchors are placed. (C, capsule; CLJ, capsulolabral junction; FH, femoral head; L, labrum.)

circumferential suture repair, noting the postoperative results were similar between the 2 operations and reported outcomes were not statistically different (Fig 2).

In this Technical Note, we describe a reproducible technique using the "on-off" traction technique and postless arthroscopy to perform anatomic labral repair and restoration of the labral suction seal, irrespective of anchor choice and labral repair suture technique.

Surgical Procedure (With Video Illustration)

The patient is placed in a supine position on the Stryker Pivot Guardian postless hip distraction table (Greenwood Village, CO) with both feet padded within traction boots (Table 1). Standard draping is performed, and portal locations are marked. Traction is applied, and access is safely established with a spinal needle via the anterolateral portal under fluoroscopic guidance, allowing initial access to the central compartment. Air arthrogram is rarely needed but performed on an as-needed basis for additional distraction. Portals are established, and an interportal capsulotomy is performed in standard fashion with 2 suspension sutures placed in the proximal leaflet for visualization purposes (Fig 3).

Standard diagnostic arthroscopy is performed, at which time labral integrity is assessed, determining the extent of repair required. A shaver is used to debride the chondrolabral junction and reactive tissue at the zone of impaction. The acetabular rim is subsequently decorticated at the area of planned repair. A distal anterolateral accessory portal is created, and in a percutaneous manner, the lateral and midbody anchors (Stryker Pivot NanoTack TT) are placed through this portal immediately adjacent to the rim on the capsular side of the labrum. In select situations in which the labrum is naturally everted or displaced out of the joint, the labrum can be mobilized and advanced, and anchors can be placed on the articular side of the labrum, again with care to prevent intra-articular penetration during anchor placement. Far anterior/medial anchors are placed via the modified anterior portal with use of a curved guide to avoid psoas tunnel penetration. The senior author favors circumferential labral fixation, although they will rely on translabral techniques when deemed appropriate or in the case of hypertrophic labra (Fig 4).

On-Off Traction Technique

At this point, both fine and gross traction are removed, reducing the femoral head into the joint, and allowing for labral reduction (Fig 5 and Video 1). With

Table 1. Clinical Pearls for Successful Postless Hip Arthroscopy Using the On-Off Traction Technique

- Proper positioning/traction abilities before prep and drape
  - Can enough traction be obtained?
  - How good is the seal upon initial traction?
  - Instruct OR staff/Rep on technique, communicate during the case
- Ensure adequate visualization
  - Patient-specific capsulotomy based on tear location
  - 2-3 suspensory sutures in capsule
  - Partial traction release to relax proximal capsule
- Precise anchor placement
  - Too close: under-reduction of the labrum, risk for intra-articular damage
  - Too far: over-reduction of the labrum and potential loss of seal
  - Easier with small anchor
- Sequential on-off traction with each anchor-tied with traction down
  - Approximate, don't strangulate
  - Tape-based sutures

NOTE. Stryker NanoTack TT demonstrated sutures demonstrated in Video 1.

OR, operating room.

traction removed, tensioning and tying are performed, depending on anchor choice, with inversion and eversion of the labrum performed either using a tensionable device (Stryker Pivot CinchLock) or knot pusher and knot manipulation in the setting of tying. Attention is focused on recreation and preservation of anatomic labrum reduction, thus restoring the labral suction seal. Traction is then re-established under direct arthroscopic visualization, confirming restoration of the seal, and the process is sequentially repeated, with improvement in the suction seal as the repair is performed and completed. After completion of the labral repair, a final check of the suction seal is performed. Finally, peripheral compartment abnormalities are addressed, and anatomic capsular closure is performed.

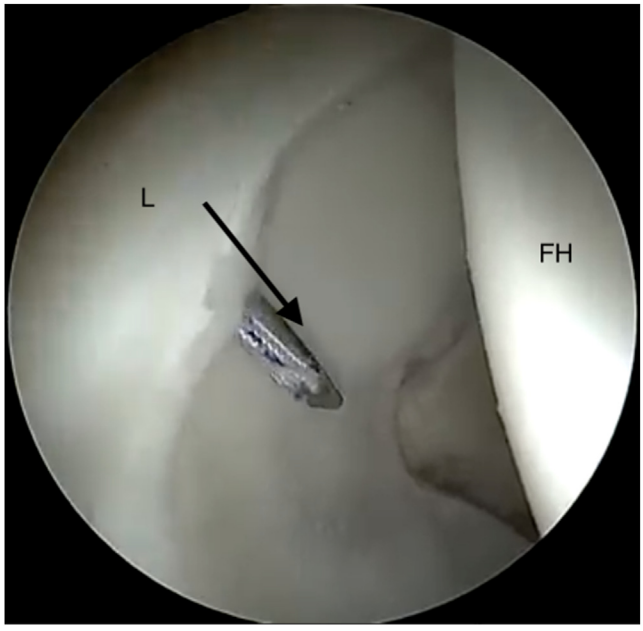

Fig 3. Viewing of a right hip labral repair from the mid anterior portal. After placement of each anchor, suture passage of the repair suture is passed through the damaged chondrolabral junction (represented by the arrow above) with the hip in traction to reduce risk for damage to the hip joint cartilage. (FH, femoral head; L, labrum.)

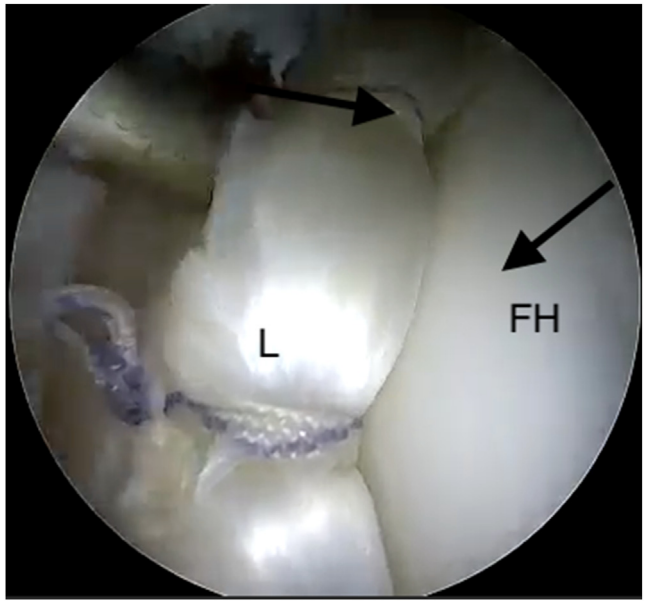

Fig 4. Viewing of a right hip labral repair after suture passage from the midanterior portal. After passage of suture per the technique chosen by the surgeon, traction is released (represented by the arrow on the right) while the arrow on the left represents tying at the anchor to ensure anatomic labral position, and restoration of the labral suction seal is achieved. The process is repeated for each anchor as the repair is progressed medially, ensuring anatomic repair and restoration of the suction seal. (FH, femoral head; L, labrum.)

Discussion

This technique using postless hip arthroscopy demonstrates benefits to coming on and off traction to restore the suction seal during a labral repair. This technique is made possible by the use of a postless table, allowing repeated on-off traction with no soft-tissue trauma, enabling evaluation of suction seal restoration during labral repair. It has been established previously that there is validity behind the importance of the suction seal, allowing the hip joint to sustain compressive and distractive loads, decreasing friction over the cartilage matrix.[2,3,11] Our technique ensures real-time evaluation of the labrum during repair, allowing for accurate recreation of the suction seal.

What separates our technique from previously described techniques is the repeated release of traction throughout labral repair. After passage of a suture and tying, traction is removed in order to compare labral position relative to the femoral head. Traction is re-

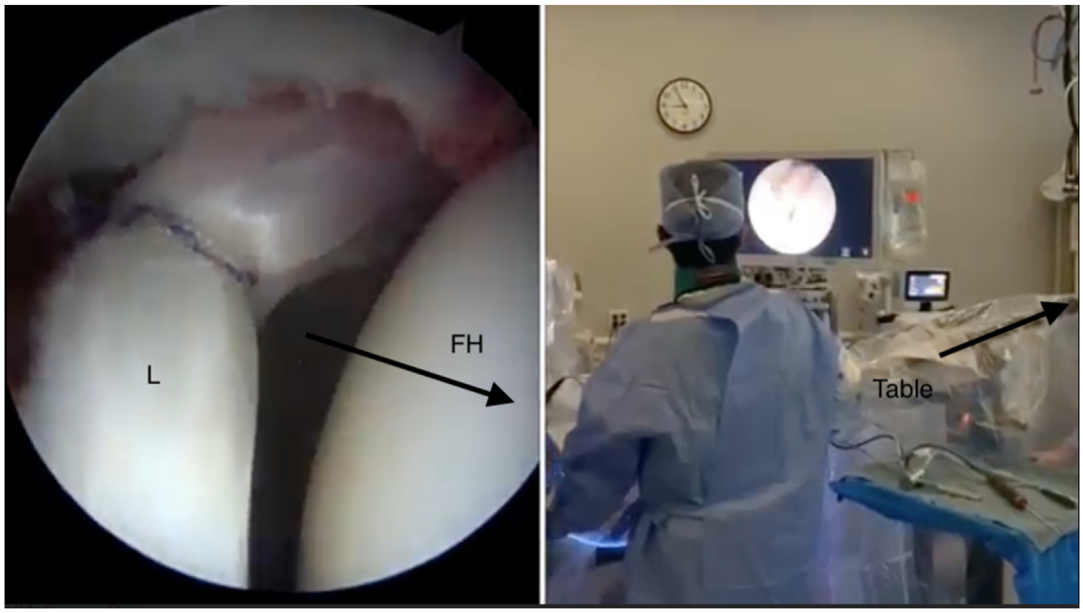

Fig 5. Intra-articular viewing from the midanterior portal and extra-articular viewing of a right hip in a supine positioning on the postless traction table while the surgical team is operating. Gross and fine traction is re-established (represented by the arrow in the photo) after tying each anchor, allowing for evaluation of the suction seal restoration. (FH, femoral head; L, labrum.)

established, and the suction seal is evaluated to ensure maximal effect from the most recent anchor that was placed, which is a unique advantage of this technique. Techniques described by Moreira et al.,[1] Suarez-Ahedo et al.,[7] and Jackson et al.[8] remained on traction throughout the process of repair. Our technique, similar to those described by Moreira et al.,[1] avoids excessive inversion or eversion and allows for anatomic recreation of the labral suction seal, regardless of anchor choice or labral suture passage technique. This allows any surgeon who is using our technique to maintain their preferred suture anchor type and passage technique. Finally, our technique calls for the use of a postless table. This table has several advantages itself, including eliminating the cited risk for perineal and pudendal nerve injuries.[12-14] Welton et al.[15] demonstrated that there weren't increased risks for nerve injury, changes in venous blood flow, or muscle tissue damage when using a postless table, establishing this as a safe method for performing this procedure.

Limitations

There are some notable disadvantages of using this technique. Access to a postless table at the surgeon's facility may be limited by cost. There are also unique learning curves to this technique, as it requires repetitive on-off traction throughout the labral repair process. This requires surgeons to be flexible with their surgical plan after the suction seal check, as additional anchors or adjustments could be required. It also requires trained support staff who know how to operate the table in collaboration with the surgeon using the on-off traction technique, and due to variability of familiarity, this can provide a unique challenge.

In conclusion, the on-off traction technique during postless hip arthroscopy is a safe, reproducible, and effective method for ensuring accurate restoration of the suction seal during labral repair, using standard hip arthroscopic approaches and operative techniques. This technique can be incorporated effectively by anyone with training in hip arthroscopy to accurately reduce the labrum and eliminate risks seen during hip arthroscopy using a post.

Disclosures

The authors report the following potential conflicts of interest or sources of funding: R.R.F. reports consulting for NewClip, outside the submitted work; and payment or honoraria for lectures, presentations, speakers bureaus, manuscript writing or educational events from Stryker (presentations for Stryker courses), outside the submitted work. All other authors (L.J.R., M.M.H.) declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper. Full ICMJE author disclosure forms are available for this article online, as supplementary material.

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