Rehabilitation After Arthroscopic Repair of Intra-Articular Disorders of the Hip in a Professional Football Athlete

Marc J. Philippon, Jesse C. Christensen, and Michael S. Wahoff

Objective: To report the 4-phase rehabilitation progression of a professional athlete who underwent arthroscopic intra-articular repair of the hip after injury during the 2006–07 season. Design: Case study; level of evidence, 4. Main Outcome Measures: Objective values were obtained by standard goniometric measurements, hand-held dynamometer, dynamic sports testing, and clinical testing for intra-articular pathology. Results: This case report illustrates improvements in hip mobility, muscle-force output, elimination of clinical signs of intra-articular involvement, and ability to perform high-level sport-specific training at 9 wk postsurgery. At 16 wk postsurgery, the patient was able to return to full preparation for sport for the following season. Conclusion: After the 4-phase rehabilitation program, the patient demonstrated improvement in all areas of high-level function after an arthroscopic intra-articular repair of the hip. The preoperative management to return to sport is outlined, with clinical outcomes and criteria for return to competition. Keywords: case report, hip arthroscopy, return to sport.

The prevalence of intra-articular disorders of the hip in elite-level athletes is becoming more apparent with advancements in clinical and diagnostic testing, especially with respect to acetabular labral tears.1–7 Research has been conducted on specific clinical signs1,8–12 and diagnostic imaging3,4,13,14 to confirm labral involvement. Labral lesions have been found to decrease the stability of the joint, which increases force transmission through the articular cartilage, leading to premature osteoarthritis.15–17

Labral tears can be associated with femoral-acetabular impingement (FAI), trauma, capsular laxity, dysplasia, and degeneration.18,19 FAI results in compression of the anterior superior labrum between the rim of the acetabulum and the anterior femoral neck.19,20 Two particular types of FAI have been described in the literature, illustrating morphological formations of osseous prominence on the femur (cam) and/or acetabulum (pincer).21–24 The presence of FAI with sport

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activities with repetitive pivoting or flexion has been documented to increase risk of acetabular labral tears.\textsuperscript{25,26} Traumatic intra-articular tears have been reported to occur as a result of subluxations or dislocations, direct hip contact, and sudden twisting or pivoting motion.\textsuperscript{10,18}

Clinically, a variety of symptoms of labral tears have been documented.\textsuperscript{12,27} Many patients complain of mechanical symptoms such as catching, painful clicking, locking, groin pain, dynamic instability, and restricted range of motion (ROM).\textsuperscript{12,28} Vigilant clinical and radiographic testing is necessary to differentiate these symptoms between intra- and extra-articular pathology. Presence of impingement with associated labral and/or chondral pathology warrants surgical intervention to repair these lesions.\textsuperscript{8,18–20,24} Advancements in arthroscopic surgical repair of these lesions have been shown to maintain the function of the hip joint and decrease the development of premature arthrosis.\textsuperscript{15–17,24}

With recent developments in arthroscopic repair, demands to incorporate appropriate rehabilitation principles into practice have become extremely important. Although appropriate evidence supporting rehabilitation for this pathology has been shown adequate attention,\textsuperscript{18,19,24,29–32} few articles address the specifics of a systematic approach to the rehabilitation of a high-level athlete after an arthroscopic intra-articular repair of the hip.\textsuperscript{30–32} With a successful rehabilitation program, a reported 93\% of professional athletes returned to an elite level of competition after FAI decompression with associated labral and/or chondral pathology.\textsuperscript{18} The purposes of this case report are to describe the 4-phase rehabilitation progression, report the clinical outcomes measured, and outline return-to-sport criteria used to treat a National Football League athlete after arthroscopic intra-articular repair of the hip.

**Case Description**

A 25-year-old wide receiver (6’ 3”, 208 lb) sustained a traumatic collision that resulted in a right-sided posterior hip subluxation during the second game of the 2006–07 season. Initial imaging ordered by the team physician showed positive radiographic findings for femoral-head fracture and inconclusive magnetic resonance imaging (MRI) findings for labral pathology. The injury was treated conservatively for 12 months with minimal reduction in symptoms by the team physical therapist with a diagnosis of hip-flexor strain and fracture, which eventually developed into avascular necrosis of the femoral head. After failing with conservative care and being unable to return to his previous level, the patient consulted the senior author (MJP), and a second MRI confirmed a diagnosis of an acetabular labral tear. The patient’s chief complaints were debilitating hip pain with associated locking, catching, popping, restricted active ROM, and inability to perform at the professional level. In addition, the patient complained of sharp-achy pain that persisted in various areas of origin (Table 1). Past medical history included a chronic left hamstring strain and osteitis pubis that had been problematic for 1 prior season with moderate relief with rehabilitation.

The patient consulted the senior author in October 2007, when further diagnostic assessment demonstrated a shallow dysplastic right acetabulum with a center-edge angle of 17° and a cam-impingement lesion with an alpha angle of
69°. Literature has supported that a center-edge angle of less than 20° and an alpha angle greater than 55° are abnormal.33,34 In addition, the osseous cam lesion at the femoral head–neck junction was found with an anterolateral labral detachment. There was minimal reactive right hip effusion, focal synovitis, and scarring along the ligamentum teres. Bone edema at the pubic symphysis and parasymphyseal region was also present.

This athlete’s presurgical inability to perform at the professional level can be hypothesized to be a result of an osseous prominence on the femoral head–neck junction and a shallow dysplastic right acetabulum with a high-energy mechanism of injury. These physical characteristics, in addition to the traumatic collision, could predispose any athlete to pathological intra- and extra-articular involvement.

After a discussion with the senior author, the patient was scheduled for surgery the subsequent day. Based on radiographic and MRI findings, a comprehensive physical therapy examination was ordered.

### Preoperative Examination

A battery of special clinical tests (Appendix 1) was conducted to elicit symptoms relative to intra-articular pathology (Table 2). Passive ROM (PROM) was performed using a universal dual-arm goniometer for all cardinal-plane mobility of the hip, which has shown high reliability for assessing hip PROM (Figure 1).35

A handheld dynamometer (HHD; Microfet 2 Load Cell Dynamometer, Hoggan Health Industries, Draper, UT, USA) was used in this case with a standard strain-gauge transducer to objectively document force output. Kendall36 protocols were used for all test positioning and procedures. Multiple studies have demonstrated good to excellent reliability with HHD in relation to hip testing.37–41 Scott et al39 concluded that intraclass correlation coefficients for HHD testing were .81, .67, and .74 for flexors, abductors, and extensors, respectively.

The HHD tests included 3 isometric trials taken from each muscle group. The isometric force-output measurements were taken bilaterally from 8 different hip-muscle actions to establish purposeful measures of overall force output (Figure 2).
Our objective was to obtain maximum force output within limits in which pain was not reported.

The patient also underwent a functional return-to-sport test to provide a baseline of muscle-endurance performance. This test is a sport-cord agility test (Figure 3) designed to gauge an athlete’s ability to participate in training. The test consists of 3 minutes of cord-resisted single-knee bends to 70° of knee flexion and cord-resisted lateral agility, diagonal agility, and forward box lunge. The ability to land in a soft, controlled manner and flex to 70° of knee flexion without pain or compensation is assessed during the agility tests, and there should be no pain or pinch in the hip with the lunges. One point is given for every 30 seconds of single-knee bend performed for a maximum of 6 points, 1 point is given for every 20 seconds during agility tests for a maximum of 5 points, and 1 point is given for every 30 seconds of lunges for a maximum of 4 points. If the patient is unable to score at least 1 point during the single-knee bends the test is discontinued because all 4

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<td>Dial (log roll)</td>
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<td>FABER</td>
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Figure 1 — Preoperative passive hip range of motion. Abbreviations: Flex, flexion; Abd, abduction; Add, adduction; IR, internal rotation; ER, external rotation.
tests rely on the ability to perform single-knee-bend movements. During preoperative testing, the patient was unable to tolerate more than 20 seconds on the first task (single-knee bends) of the sports test because of pain in the hip and compensation. The patient failed the sports test and was issued a score of 0 out of 20 (17 out of 20 to pass) because of continued pain and an inability to show proper biomechanics. Currently, nothing in the literature supports the validity or reliability of this test, but clinically we have found it useful to support return to sport.

On initial physical therapy examination, the patient demonstrated an unusual case of increased PROM and nearly symmetrical muscle-force output of the affected hip (Figures 1 and 2). The typical clinical presentation of loss of internal rotation and pain with flexion, adduction, and internal rotation has been reported as indicating labral pathology. The patient’s findings were consistent with literature that has shown that individuals with persistent hip pain for more than 4 weeks, clinical provocative labral-involvement signs, and MRI findings of a labral tear are appropriate candidates for hip arthroscopy. After evaluation, it was determined that the patient was a good candidate for surgical intervention for intra-articular hip pathology.

**Operative Intervention**

A right hip arthroscopy with debridement and repair of the torn labrum was performed. The patient was placed in the supine position, and 2 standard arthroscopic portals (anterior and anterolateral) were used to evaluate all pertinent structures. Surgical intervention included preparing bony bed on the acetabular rim to support labral repair, osteoplasty of the femoral neck for treatment of the cam lesion, chondroplasty of the acetabular rim, debridement of the torn ligamentous teres, synovectomy, capsular plication for redundant capsule, and removal of loose chondral fragments. Overall, the patient tolerated the operation extremely well without complication and was able to initiate postoperative rehabilitation less than 12 hours after surgery.
Figure 3 — Functional return-to-sport test to provide a baseline of muscle-endurance performance. (a) Single-knee bends with sport cord. (b) Lateral agility with sport cord. (c) Diagonal lateral agility with sport cord. (d) Forward box lunge with sport cord.
Postoperative Rehabilitation

**Phase I: Mobility and Protection.** The preliminary treatment for an arthroscopic acetabular labral repair is to protect the repaired tissue while initiating early but restricted PROM. The patient was seen twice a day for 10 days under the supervision of the senior physical therapist and author before returning to the team for continued rehabilitation. After the athlete’s return to the team, weekly communication was maintained via phone conversation to monitor rehabilitation progression. Precautions in phase I consist of adherence to foot-flat (20 lb) weight bearing precaution to protect the femoral neck after the osteoplasty, ROM limits of external rotation and extension to protect the capsule plication, and hip-flexion ROM restrictions to help mitigate pain.

The initial phase of rehabilitation emphasized hip circumduction, flexion, and internal-rotation PROM secondary to potential adhesion formation within the joint capsule. Other important goals during phase I of treatment are to reduce the amount of acute inflammation and pain. In addition, isometric exercises were implemented to mitigate muscle inhibition and atrophy. Early activation of the gluteal, hamstring, quadriceps, deep rotators, and transverse abdominal muscles is emphasized to facilitate synergistic muscle activation and core musculature.

PROM exercises began 4 hours after surgery to prevent immobilization while promoting tissue healing and neuromuscular reeducation. A continuous-passive-motion machine was set at 0° to 90° of hip flexion for 2 weeks postsurgery (4 hours each day), along with use of a stationary bike at zero resistance for 20 minutes. Cryotherapy was strongly encouraged and was applied for 20 minutes 5 or 6 times per day. A continued PROM regimen was implemented 24 hours postsurgery as described in Appendix 2.

The patient was allowed 20 lb of flat-foot weight bearing, which was calculated with a calibrated medical scale and recommended for 2 weeks’ duration. For the first 10 days postsurgery, the athlete wore specialized foot pumps to alleviate the risk of deep-vein thrombosis and foot boots to limit hip external rotation when supine. A functional hip brace was used for 10 days postsurgery to protect the hip from excessive hip flexion and limit abduction and extension movement. Patient was advised to spend 2 or more hours per day in a prone position to prevent hip-flexor contracture secondary to the flexion PROM required postoperatively.20

The criteria to advance to phase II consist of minimal pain with all phase I exercises and more than 75% ROM relative to the uninvolved lower extremity.31

**Phase II: Stabilization.** The intermediate phase of rehabilitation began at weeks 2 to 3 postsurgery, with core-stabilization exercises and progressive resistive exercise in addition to continued PROM and gait training. Precautions in phase II were no ballistic stretching, no conditioning on a treadmill, and avoidance of adductor and flexor tendinitis. Balance training and neuromuscular reeducation were initiated to promote proper gait mechanics.

At this point, hip-flexion motion was progressed at the patient’s tolerance with no restrictions. External rotation was still restricted to 0° for an additional week to prevent stress to the plication closure of the capsular repair. Continued advancement to full PROM, restoring a functional gait pattern, and core stabilization were key elements in phase II.
Arthroscopic Hip Repair in a Football Athlete

The criteria to progress to phase III were full PROM, normal gait mechanics without limitations, normal muscle-activation patterns, more than 60% hip-flexor strength relative to the contralateral lower extremity, and more than 70% adduction, abduction, extension, internal-rotation, and external-rotation strength of the hip in comparison with the uninvolved limb.\textsuperscript{31}

**Phase III: Strengthening.** The advanced phase of rehabilitation was initiated during week 6 postsurgery, with emphasis on muscle-endurance strength and cardiovascular conditioning. Advanced cord-resisted agility and single-leg-bend activities were started to prepare the patient for the functional return-to-sport test. Gradual progression with no specific precautions was emphasized in phase III, while contact activities were restricted until weeks 16 to 20. The criteria to begin phase IV consisted of passing the return-to-sport test.

**Phase IV: Return to Sport.** The sport-specific phase was implemented at week 12, with the athlete’s integration into team practice in preparation for competitive return to high-level sport. The purpose of this phase is full return to competition without limitations in elite sport function, other than restrictions on full-contact training.

The athlete’s return to prior professional-level training depended on approval from the senior author and passing the functional return-to-sport test. At week 16, the senior author cleared the patient to return to full-contact training without restrictions in preparation for the 2007–08 season.

**Outcomes**

On follow-up examination at 9 weeks, clinical signs of impingement were negative (Table 2) and the patient reported no mechanical symptoms with rehabilitation training. The patient did present with mild asymptomatic bilateral hip-flexor tightness (positive Kendall test), which was clinically hypothesized to be caused by hip-flexor overuse during rehabilitation.

In addition, preoperative and postoperative comparison values of force output via HHD also showed improvement. Postoperatively, the patient demonstrated an increase in force output of 89% hip external-rotation, 83% hip-abduction, 80% hip-adduction, 65% hip-flexion, 57% hip internal-rotation, and 23% hip-extension strength compared with preoperative measurements. Hamstring force output also showed a tremendous gain (356%), which was likely a result of both diminished pain and muscle hypertrophy. A decrease in force output of 0.6% on hip abduction with external rotation was noted (Figures 4 and 5).

Measurements of PROM showed a slight increase, with a $13^\circ$ improvement in both hip flexion and adduction at follow-up. A $4^\circ$ improvement was observed in hip abduction, whereas no change was found with hip internal and external rotation (Figure 6). At follow-up, PROM comparison between hips (Figure 7) indicated symmetry in hip abduction and adduction, whereas there was a minimal difference in internal rotation ($10^\circ$), hip flexion ($5^\circ$), and external rotation ($5^\circ$). There was also a 10-cm improvement in the FABER distance test relative to preoperative and postoperative testing (Table 2). The FABER distance test is defined as a measure of the distance from the lateral femoral epicondyle to the
A positive test is confirmed if asymmetry is found between hips. In addition, one noticeable deficit in our patient was bilateral hip-flexor tightness (positive Kendall test).

Improved muscle endurance and functional technique were also verified with the functional return-to-sport test. This test is used to evaluate an athlete’s performance when the athlete is fatigued, assess an athlete’s ability to accept load through the hip with agility-specific exercises, and provide an objective clearance protocol for athletes. Unpublished data have been collected to support correlations between passing this test and high subjective reports of overall function.\textsuperscript{47}
Preoperatively, the patient was issued a score of 0 out of 20 on the sport test because of his inability to perform the test secondary to hip pain and poor biomechanical performance. At follow-up testing, he scored 20 out of 20 without any sign of pain while using excellent technique and minimal verbal cuing.

A subjective report of restrictions in function was evaluated, with the patient reporting hip-flexor tightness and gluteal weakness in the involved hip leading to an inability to accelerate with sprinting at his preinjury level. At follow-up, the patient reported no pain or discomfort with the left hamstring or pubic cleft with rehabilitation or training. The patient’s follow-up measurements were reevaluated during postoperative week 9, whereas most patients are reassessed at week 12. The senior author’s decision to evaluate and release the athlete to higher level sport-specific training earlier than expected was based on the athlete’s ability to successfully complete the return-to-sport test and demonstrate no clinical signs of
intra-articular pathology. The athlete was not fully released to return to training until postoperative week 12 and was not cleared for full competition without restrictions until postoperative week 16.

**Discussion**

The purpose of this case report was, first, to report the clinical outcomes achieved for this high-level athlete. Before surgical intervention, the patient demonstrated 5 out of 7 clinical signs of hip pathology (Table 2). The patient also displayed a dramatic decrease in force output before surgical and rehabilitation interventions (Figure 4). In addition, he was unable to successfully complete a closed-kinetic-chain sport test because of significant pain and discomfort.

After successful surgical intervention and a 4-phase rehabilitation program, the patient reported no complaints of instability or impingement. On examination, no symptoms of labral pathology could be elicited with clinical testing. No pain or discomfort was reported with high-level rehabilitation training, and the patient demonstrated considerable improvements in overall function as demonstrated by his ability to successfully pass the return-to-sport test.

The 4-phase rehabilitation program was outlined secondary to the lack of literature to support the progression from postoperative status to return to competition in the athletic population. Initially, acute postoperative principles should be followed with importance placed on controlling swelling and pain, restoring PROM, and preventing muscle atrophy. Stabilization with neuromuscular retraining should then be emphasized, followed by strengthening and finally sport-specific training.

The return-to-sport criteria for this athlete after arthroscopic intra-articular repairs of the hip were based on a 3-tier program. Clinically, the patient’s ability to return to competition was dictated by successfully completing the sport test, demonstrating improvement in all clinical outcome measures, and final approval by the senior author.

Although the athlete met all criteria to return to competition and was completely capable of competing at the professional level, because of unrelated hip problems he was placed on the reserve list for the duration of the 2006–07 season. He confirmed and reported improvements in overall hip mobility, muscle strength, pain reduction, and high-level function with sport-specific activities. Although one cannot conclude that there is a cause-and-effect relation with a case report, the clinical outcomes reported are relevant in nature and supported in the existing literature in respect to postoperative management of arthroscopic intra-articular hip repairs.

**Conclusion**

This case report highlighted the multifactorial progression of rehabilitation with a professional athlete undergoing arthroscopic intra-articular repair of the hip. A sequenced illustration of preoperative management to return to sport was outlined, with clinical outcomes and criteria for return to competition. A 4-phase rehabilitation progression was employed to provide the most optimal environment
for healing and prevent any possible irritation or disruption to the repaired labrum. Continued research is needed to establish more concrete evidence in postoperative management to provide clinicians with guidelines to improve patient outcomes.

Acknowledgments

The authors recognize the patient who participated in the case report and the Steadman-Hawkins Research Foundation; without their cooperation this project would not have been possible.

References


### Appendix 1: Examination Procedures for Intra-Articular Hip Pathology

- **Kendall Test:** The subject is supine with both knees bent over the edge of the exam table. The subject is instructed to hold the non-testing knee against the chest. A positive test is confirmed when the test knee demonstrates less than 90° of knee flexion while the contralateral knee is flexed to the chest.8
- **Anterior Impingement Test:** The subject is supine with the examiner passively positioning the hip into 80° to 90° of flexion and maximum internal rotation and adduction. A positive test is confirmed with pain at end-range motions.9
- **Posterior Impingement Test:** The subject is in the Kendall testing position with the examiner passively internally and externally rotating the hip. A positive test is confirmed with a report of pain with passive mobility testing.
• *Abduction Impingement Test:* The subject is supine with the examiner passively moving the hip into maximum abduction. A positive test is confirmed with a report of pain on the lateral aspect of the hip.

• *Ober Test:* The subject is side lying with the examiner passively abducting and extending the test hip. The examiner slowly lowers the upper limb to the examination table. A positive test is confirmed if the subject’s upper limb is unable to fall to the table.\(^8\)

• *Dial (Log Roll):* The subject is supine with the hip in neutral flexion/extension and abduction/adduction. The examiner passively rolls the hip into full internal and external rotation. A positive test is confirmed with asymmetrical range of motion, pain, or clicking.\(^9\)

• *FABER Test:* The subject is supine with the examiner passively positioning the hip into flexion, abduction, and external rotation. A positive test is confirmed with asymmetrical hip range of motion. The distance from the lateral femoral epicondyle to the exam table is measured.\(^8\)
## Appendix 2: Revised Protocol for Arthroscopic Hip Rehabilitation

### Marc Philippon MD

**Procedure:** Labral Repair, Osteoplasty, RimTrimming, Acetabular and Femoral Chondroplasty, Iliofemoral Plication, Lig. Teres Thermal Debridement, Synovectomy

### Patient Checklist:

**Weightbearing:**
- FFWB for 2 wks
  - Flat Foot = 20 lb
- CPM:
  - 2 wks: 4 hr/day
- Lie on Stomach:
  - 2 or more hours
- Rotational Boots:
  - Limits external rotation when lying on back: 15 days
- Bledsoe Brace:
  - 0°-90°: 10 days

### Phase I: Mobility and Protection

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### Phase II: Stabilization

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<td><strong>O.</strong> Sidelying Glute Med Progression</td>
<td>3x wk</td>
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<td><strong>P.</strong> Planks</td>
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<td><strong>Q.</strong> Pilates Reformer if avail.</td>
<td>3x wk</td>
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### Walking and Standing Stability

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<td>Leg Press (limited weight)</td>
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<td>V.</td>
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<td>Outdoor Biking (or Resisted Biking)</td>
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<td>Z-1</td>
<td>Running progression: 20 (4 walk:1 run)</td>
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<td>Running progression: 30 (3 walk:2 run)</td>
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<td>Z-3</td>
<td>Running progression: 30 (2 walk:3 run)</td>
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<td>Z-4</td>
<td>Running progression: 30 (1 walk:4 run)</td>
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<td>Z-5</td>
<td>Running: 10 min / initial speed</td>
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<td>Double 1/3 knee bends-tuck squats</td>
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**ROM Limitations:**
- **Flexion:**
  - 0° to 90°: 10 days
- **Extension:**
  - To 0° by wk 1
  - 0° + after day 15
- **External Rotation:**
  - 0° (none): 15 days
- **Internal Rotation:**
  - No limits
- **Abduction:**
  - 0° to 45°: 15 days

**Phases:**
- **Phase III: Strengthening**
- **Phase IV: Return to Sport**

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Howard Head Sports Medicine
Therapist: Michael Wahoff PT