RTS Guideline: Hip Labral Repair & Femoroacetabular Impingement Syndrome

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Introduction:

The hip joint is a ball and socket joint that is supported by multiple ligaments, articular cartilage, and muscles surrounding the joint and the acetabular labrum. The labrum is a triangular shaped piece of fibrocartilage that covers 170° of the acetabulum and has many different functions. These functions include shock absorption, joint lubrication, pressure distribution and aiding in stability.[1] There are many ways that this fibrocartilaginous tissue can become damaged, leading to possible osteoarthritis, interference with activities of daily living or hindering athletes from playing their sport at a competitive level. Signs and symptoms of a labral tear are: groin or anterior hip pain, hip clicking, catching and locking, sensations of hip instability, or increases in pain with activities such as sitting, sit to stand or descending stairs.[2] The risk of having a labral tear increases with repetitive microtrauma, capsular laxity/hip hypermobility, trauma to the hip joint, dysplasia, degeneration or femoroacetabular impingement (FAI).[1] Repetitive microtrauma can be from sports that involve cutting (soccer, football, baseball or basketball), repetitive hip flexion (like cycling or running), or large hip ranges of motion (ROM) such as: dance, cheerleading, hockey or gymnastics.[3,4] Patients with connective tissue disorders such as Ehlers Danlos, Legg-Calve-Perthes disease, developmental hip dysplasia or slipped capital femoral epiphysis are at higher risk of developing labral tears.[1,5] Lastly, people with FAI are at increased risk of developing labral tears. FAI is heavily influenced by structural anatomy and can be classified into three different types: cam, pincer or mixed/combined-type. Cam-type FAI is where there is an abnormal femoral head-neck junction, leading to impingement between the femur and the acetabular rim during ROM, especially flexion and internal rotation. Pincer-type FAI is where there is acetabular over-coverage, leading to impingement of the labrum during hip ROM. Lastly, mixed or combined-type FAI is where there is a combination of cam and pincer FAI, also leading to impingement of the acetabular labrum during hip ROM.[1] FAI has also been shown to lead to progressive osteoarthritis in younger populations, as it wears down the hip joint's articular cartilage, leading to further damage if not corrected surgically.[1,7,13]

Incidence of Arthroscopy for FAI/Labral Tears in Athletes:

There are several surgical techniques to correct FAI with labral tears, but this guideline will primarily focus on arthroscopic labral repairs. Hip arthroscopy for labral pathology has become a widely performed surgery in recent years. Since 2011, arthroscopic surgery for hip labral pathologies with FAI has increased by 85%, with 35% of this increase from hip labral repair specifically.[6] Generally, repairs were performed to the superior/anterior aspect of the labrum, as this is the area of the labrum most highly susceptible to tearing during repetitive motions.[1] The incidence of FAI with labral pathology is unknown in the athletic population, however, hip injuries account for 5-6% of all athletic injuries each year.[7] Of this 6%, 66% of patients who report hip pain and are diagnosed with FAI and labral pathology have the cam-type FAI.[8] Males athletes are eight times more likely to have this type of deformity than male non-athletes.[7,8] However, female athletes are twice as likely as male athletes to have FAI/labral arthroscopy performed.[6-8] Additionally, studies show that athletes who participate in their sport for 9+ years and are over the age of 16 are 4.9 times more likely to have a labral tear than those who have more limited experience in their sport or are younger in age.[8,10] This is likely due to the combination of bony morphology (FAI) and repetitive end range of hip movements over many years of participating in a sport, placing older athletes at higher risk of intra-articular hip pathology.[8]

Surgery: Success, Reasons for Failure and Complications

Hip arthroscopy in general has a high satisfaction and success rate. Studies define success as not having a secondary repair or a total hip arthroplasty performed.[11,14] One study found hip arthroscopy for FAI and labral repair to have a 94% success rate, with overall hip arthroplasty surgeries (including repair, reconstruction and debridement) having a 91.6% success rate after a 10-year period.[11] Other studies demonstrate a range in success, from 87.7-93.9%.[5,17,50] Even with a high success rate, there are still multiple factors that can lead to failure of the labral repair after the surgery is performed. One factor to consider is the size of the labrum. Studies have shown that hypertrophied labra have lower postoperative outcome scores than normal, likely due to its high correlation in patients with hip dysplasia.[12] These studies also show that labral hypoplasia can lead to failure, due to a lack of surface area for healing and the lack of the suction seal effect that is provided by a larger labrum.[12] Other risk factors to consider in repair failure are, older age of the athlete, higher BMI, longer duration of pre-operative symptoms, significant joint space narrowing following the procedure (<2mm space), additional chondral problems, or higher Tönnis grade.[13,14] Tönnis grade is indicative of degenerative changes in the hip, ranging from 0-3, with 3 being the most severe. A Tönnis grade 3 is indicative of femoral head deformity, joint space narrowing,

large cysts and avascular necrosis. Grades 0-2 are less severe and typically allow for a higher RTS rate with fewer complications.[48,49] Even if an athlete's repair doesn't fail, they may experience multiple complications immediately post-surgery that can prevent a timely return to sport (RTS) or their ability to RTS at all. Athletes can develop deep vein thrombosis (DVT) or heterotrophic ossification (HO) following surgery, which could lead to an additional surgery prior to rehabilitation.[15,16] They may experience neuropraxia due to traction or compression injuries that occur mid-surgery, but reports of these are now minor due to improved technology and surgical techniques.[16] In the long term, athletes who undergo arthroscopic surgery are at a higher risk of developing hip OA after the procedure.[9] Little is known of the rate of OA that develops early on after surgery, but after many years, radiology reports show that these athletes have higher incidence of OA than those who did not have arthroscopic surgery.[8] Additional complications that can develop during the rehabilitation process include: hip flexor or adductor tendonitis, joint edema and irritation, soft tissue imbalance, faulty movement patterns, low back pain and sacroiliac pain.[27] These complications may be due to failure of patients or therapists to follow precautions or unintentionally overloading the joint and soft tissue during transitional periods.[27]

Return to Sport Rate

Most athletes who undergo a form of surgery on any area of the body wish to know if they will be able to play their sport again and how long they will need to refrain from or modify their training. There has been a significant amount of research performed to show that the RTS rate after hip arthroscopy is high, but percentages vary depending on study and arthroscopic procedure performed. RTS percentages range anywhere from 59-93%[3,17-19,], with bilateral surgery being only 53.7%.[20] RTS is typically defined as returning to the same level of play or better after rehabilitation from an injury.[18] Athletes who are most likely to return to their sport at or above the same level prior to surgery are adolescent/young adult athletes, professional athletes and those who had shorter onset of pain prior to surgical intervention.[18] Elite or professional athletes tend to have the highest RTS rate around 93%, likely due to higher income, motivation levels and access to rehabilitation.[17,18,21] For bilateral procedures, professional athletes have the highest RTS rate, typically 100%, collegiate level athletes have the second highest around 67% and high school athletes have the lowest RTS rate around 47%.[20] The average length of time for athletes to return to sport varies depending on surgical protocol (consisting of temporal and physical criteria) and whether the sport is contact or non-contact. Studies report athletes return to sport between 5.7-7.4 months after surgery.[17,18] There is minimal data to show how long an athlete's career will be after surgery, but one report states that on average, an athlete will play about 3.2 more seasons or 3.6 more years of the sport before quitting or

retiring.[17] According to Menge et al, 87% of NFL athletes who underwent arthroscopic surgery returned to play for an average of 7.4 seasons after surgical intervention and rehabilitation.[22]

Barriers to Return to Sport

Although there is a high RTS rate for athletes who undergo labral repair, for those who do not, there are many factors that impact the decision to cease play. Some of those factors include: prolonged rehabilitation, fear of re-injury, progressive disability, potential negative impact on work, quality of rehabilitation programs, persistent hip pain and self-efficacy of returning to play.[14,18,40] Athletes who struggle with self-efficacy or lack social support during rehabilitation are far less likely to return to play. Additionally, athletes who struggle with coping strategies or in changing their expectations about their future ability to play a sport are also less likely to return to play. If an athlete cannot adapt to a lower level of play or modifications to their current level of play, they will be less likely to return to sport as well.[14] Physical therapists can help to encourage their athletes to stay positive during rehabilitation as well as educate them on the return to sport process. By providing athletes with a nurturing environment and support, the athletes will be more likely to avoid complications during recovery and be able to return to sport at the same level before surgery.

There is little data to show the effects of negative mental health on hip labral repair outcomes in the athletic population, but overall research shows that depression and anxiety have negative effects on perception of functional ability and satisfaction of surgical outcome.[14,23] Psychological readiness plays a big factor as to why athletes choose to retire from athletics following hip arthroscopic surgery. Using a psychological scale such as the Hip-Return to Sport after Injury (RSI), a newer psychological readiness questionnaire, to determine autonomy and competence of these athletes can help PTs to determine if a referral to another provider is necessary during the rehabilitation process.[42] Athletes who struggle with mental health should be counseled about rehabilitation, the toll it could take on their mental and physical health, and the potential outcomes of the surgery prior to the surgical procedure.[23]

Difficulty in Creating a Single, Comprehensive RTS Guideline

Due to differing surgical protocols and a lack of comparative studies to guide rehabilitation, there is a lack of comprehensive return to sport guidelines for postoperative hip labral repair return to sport.[24] Criteria from different protocols lead to differing temporal and physical benchmarks that athletes must reach prior to RTS.[4] Experience by both the surgical team and the physical therapists lead to varying timelines for athletes who undergo the same surgical procedure by different surgeons.[24]

Location of the labral tear also dictates which movements or activities an athlete can perform during certain phases, leading to protocol changes.[39] Additionally, pressure from coaches or trainers likely lead to athletes desiring a faster and safer RTS, as well as pressure on physical therapists to provide better and faster care for athletes.[25] This guideline will discuss the similarities and variability of different research and protocols proposed from renowned surgeons, researchers and case studies found for arthroscopic repair of the acetabular labrum with or without FAI.

Summary of Criteria to RTS

Athletes who adhere to proper rehabilitation and protocol guidelines are far more likely to RTS at a lower risk of re-injury than those who do not. Although there are varying criteria from rehabilitation protocols, many have similarities. After reviewing 10+ surgical protocols and other published research, it has been determined that temporally, athletes must be a minimum of 12 weeks post-surgery prior to participating in RTS training, with most protocols requiring a minimum of 20-24 weeks post-surgery prior to RTS training.[4,26] Additionally, athletes must meet many different physical criteria. Some examples of these include: full ROM pain free, hip strength of the involved side equal to the uninvolved side, single hop for distance, triple crossover hop for distance with at least 90% limb symmetry, Y balance test limb symmetry 80% of the uninvolved side, completion of functional sports test and ability to perform single leg squats without pain.[4,26] Depending on the surgeon and their physical therapy team, physical tests may be different, so athletes and therapists should review the protocol prior to RTS training. Physical therapists are trained in clinical decision making to deem when it is appropriate for athletes to advance to more complicated tasks, however they need to take into consideration how long it has been since surgery in order to minimize the risk of re-injuring a repaired labrum.

Post-Operative Weight Bearing and ROM Precautions

Most surgeons will have patients ambulating using foot flat weight bearing precautions or partial weight bearing (20 lbs) precautions for the first 3-6 weeks. These patients will utilize crutches for ambulation and around weeks 4-6 will begin to wean off the crutches to become weight bearing as tolerated (WBAT).[26]

In addition to weight bearing (WB) precautions, surgeons will provide a list of ROM precautions for patients to follow. These typically include: hip flexion limited to 90° for 2 weeks, gentle hip extension between neutral to 10° for 2 weeks, hip abduction <30° for 2 weeks, hip adduction <10° for 6 weeks, no limitations to internal rotation (IR) as long as it is pain free, and gentle hip external rotation (ER) <10° for 2 weeks.[26] ROM

is progressed through the phases differently based on surgical protocol, so PTs should be aware of what their specific surgeon requests. If bracing is recommended, it is prescribed by surgeons and typically worn the first 6 weeks, blocking ROM past 90° of flexion.[24,26]

Rehabilitation Through Phases

Surgeons will typically provide their patients with their recommended rehabilitation protocol post-surgery. Physical Therapists use the protocol as a tool to guide rehabilitation and communicate with surgeons periodically to maintain favorable working relationships with referring physicians. The following rehabilitation goals, interventions, exercises and criteria to move to the next phase/RTS are based upon research and a systematic review of surgical protocols. This list is not all inclusive and interventions may progress at a different rate than specific surgeons will request.

Rehabilitation: Initial Phase (1-4 weeks)[26,28]

Common goals to achieve in the initial phase of rehabilitation include: prevent hip flexor tendonitis, pain control, prevent muscular inhibition around the hip joint, protect surgically repaired tissue, proper ambulation techniques (adhering to WB precautions), restore ROM while maintaining restrictions, prevent anterior hip contractures and intra-articular adhesions, and core strengthening/isometrics for the lower extremity.[26-28] Prevention of hip flexor tendonitis is the most important precaution recommended by surgeons during the initial and intermediate phases of rehabilitation.[1,26,34] To prevent hip flexor tendonitis, active hip flexion is limited for the first 3-4 weeks post-surgery.[1,26] Adhering to WB precautions will also assist with this, as foot flat weight bearing limits activation of the hip flexors as well as contracture of anterior hip musculature.[28] Physical therapy interventions for the initial phase of rehabilitation include: PROM for circumduction, log rolling, flexion, ER/IR (with limitations), adduction and abduction, Grade 1-2 hip mobilizations for pain control, manual STM for hip, back and lower extremity muscles as needed, scar mobilization starting weeks 3-4 depending on tissue healing rate and manual long axis traction.[26] These interventions are provided to minimize adhesions formed in the hip joint, control and minimize pain, and restore ROM within limitations as quickly as possible following surgery. Additionally, PTs can provide crutch training for athletes who may have never used them before and education about weaning off of them when the surgeon gives approval for increased weight bearing through the affected extremity. Modalities used during this phase include ice/cryotherapy, electrical stimulation (E-stim) and kinesiotaping.[26,28] These modalities discourage inflammation and promote pain control during the initial phase of rehabilitation.

Exercises will vary for the athlete depending on the specific protocol and length of time after surgical intervention. Athletes should not progress to harder activities until they can perform prior exercises with ease, pain free. Examples of exercises to initiate in the PT setting include:[26,28,29]

	Goals	Exercises
Week 1	Control pain Prevent muscular inhibition Protect Repair Proper gait mechanics (adhering to WB precautions)	Ankle Pumps Glute/Quad/Hamstring isometrics Heel slides (hip flexion <90°) Transverse Abdominis Isometrics Stationary bike (seat high, no resistance) Pelvic Tilts
Week 2	Control pain Prevent muscular inhibition Protect Repair Proper gait mechanics (adhering to WB precautions) Restore ROM (within restrictions)	Continue week 1 exercises Pelvic tilts with bilateral bridging LAQ Prone psoas stretching Quadruped rocking into pain free flexion
Week 3	Control pain Prevent muscular inhibition Protect Repair Proper gait mechanics (adhering to WB precautions) Restore ROM (within restrictions)	Continue week 2 exercises Glute and piriformis stretching Hamstring and quad stretching Standing 4-way hip Aquatic therapy (IF incision is healed) Potential to start SLR if asymptomatic

Week 4	Control pain Prevent muscular inhibition Protect Repair Proper gait mechanics (adhering to WB precautions) Restore ROM (within restrictions)	Continue week 3 exercises Weight shifts Single leg stance Single leg bridges Crunches, heel taps, Russian twists Counter plank Minimal resistance on stationary bike Gentle leg press in PWB if recommended by surgeon

Before progressing to phase 2, each athlete must be able to perform the following pain free: ROM >75% of the uninvolved side, minimal pain with phase 1 exercises, hip flexion to 90°, demonstrate proper technique and activation patterns with phase 1 exercises, minimal compensation, and minimal ROM limitations with IR, add and abd.[26-28]

Rehabilitation: Intermediate Phase (5-8 weeks)[26]

Common goals to achieve in the intermediate phase of rehabilitation include: prevent hip flexor tendonitis, continue to protect the integrity of the repair, progress WB as appropriate with proper gait mechanics, restore ROM pain free, improve lower extremity strength, balance and proprioception, and progress core strengthening.[26-28] Similar to the initial phase, prevention of hip flexor tendonitis is stressed by surgeons, especially when athletes begin active hip flexion exercises.[1,26,34] Athletes may begin squatting as early as week 6, so monitoring technique and critiquing form is imperative to ensure the athlete is utilizing proper mechanics prior to progressing to more difficult activities.[34]Interventions the physical therapist can provide include: hip PROM pain free all planes, scar mobilizations, manual STM to lower extremity, hip and back musculature as needed, and grade 2-4 hip mobilizations (grade 3-4 can begin after week 6).[26,28] Similar to the initial phase, these interventions assist with pain control, mobility and regaining ROM that may still be hindering the athlete. Modalities that are recommended in this phase can include: ice/cryotherapy and E-stim.[26,28]

Similar to phase 1, athletes should not progress to more difficult activities until they can perform the prior activities with ease and pain free. Physical therapists should monitor technique during functional activities to prevent re-injury of the tissue and to optimize neuromuscular control.[34] Exercises that can be initiated in this phase include:[26,28,29]

	Goals	Exercises
Week 5	Protect integrity of repair Restore ROM (pain free) Progress WB as appropriate (ensure proper gait mechanics) Progress core strengthening	Continue week 4 exercises Increase resistance on stationary bike
Week 6	Protect integrity of repair Restore ROM (pain free) Progress WB as appropriate (ensure proper gait mechanics) Progress core strengthening	Begin forward elliptical without resistance Mini/Modified squats Swimming (no frog kicks) Side stepping w/bands Quadruped bird dogs
Week 7	Protect integrity of repair Restore ROM (pain free) Progress WB as appropriate (ensure proper gait mechanics) Progress core strengthening Improve LE strengthening, balance and proprioception	Continue week 6 exercises Wall sits w/abd band Progress core strengthening (physioball or modified plank) Kneeling hip flexor stretch Foam roll/stretch ITB and quads
Week 8	Protect integrity of repair Restore ROM (pain free) Progress WB as appropriate (ensure proper gait mechanics) Progress core strengthening Improve LE strengthening, balance and proprioception	Continue week 7 exercises Lateral step ups/downs Skaters/side steps High knee stepping Progress single leg balance activities

Before progressing to phase 3, athletes must be able to perform the following pain free: hip flexion 105° or greater, ER 20° or greater, Trendelenburg-free gait, hip flexion strength >60% uninvolved side, and add/IR/ER strength >70% uninvolved side.[26-28]

Rehabilitation: Advanced Phase (9-11 weeks)[26]

Common goals of the advanced phase of rehabilitation include: continuing to prevent hip flexor tendonitis, optimizing neuromuscular control, improving aerobic capacity, progressing ROM and strengthening, progressing balance, and initiating minimal agility training.[26-28] PTs can also use passive interventions and modalities that were stated in prior phases as they deem necessary, but the advanced and RTS phases tend to be more exercise and activity oriented.[26,28]

Exercises in the advanced phase do not differ significantly from those in the previous phase because the focus of this phase is increasing lower extremity strength, balance, and aerobic capacity to prepare for the next phase. Increasing resistance with the previous exercises is the main focus in this phase.[26-28] Exercises include:[26,28]

	Goals	Exercises
Week 9	Optimize neuromuscular control Progress ROM and strengthening (pain free) Progress balance	Continue week 8 exercises Progress closed chain exercises in balance training Progress bridging activities
Week 10	Optimize neuromuscular control Progress ROM and strengthening (pain free) Progress balance Begin improving aerobic capacity and minimal agility training	Continue week 9 exercises Incorporate bosu balance training Slow ladder drills
Week 11	Optimize neuromuscular control Progress ROM and strengthening (pain free) Progress balance Improve aerobic capacity and minimal agility training	Continue week 10 exercises SL pallof press

To move to the return to sport phase, athletes MUST be a MINIMUM of 12 weeks post-surgery AND be pain free with all strength, ROM and mobility exercises. Additionally, athletes must demonstrate hip flexion strength >70-90% uninvolved side and ER/IR strength at least 80% uninvolved side.[26,28]

Rehabilitation: RTS Phase (12+ weeks)[26]

Common goals for the RTS phase include: initiating RTS activities, restoration of cardiovascular endurance, demonstrate regained lower extremity strength, stabilization and proprioception, begin agility training, and focus on returning the athlete to competition.[26-28] Rehabilitation should focus on sport specific drills, higher level strengthening, agility training and plyometrics.[27] The athlete should be able to demonstrate good neuromuscular control with tri-planar, eccentric activities and increasing power.[27]

Exercises during this phase are progressed from prior phases and incorporate running, golf drills for golf athletes and agility. Examples of activities to progress each week include:[26,28]

	Goals	Exercises
Week 12	Restoration of cardiovascular endurance Improve strength, stabilization and proprioception Agility training Initiate RTS activities	Continue week 11 exercises Initiate return to running program (if applicable) Gentle plyometrics Advanced balance/proprioception exercises Lateral agility Golf drills (if applicable)
Week 13	Restoration of cardiovascular endurance Improve strength, stabilization and proprioception Agility training Continue with RTS activities	Continue previous exercises/advance as needed

Week 14	Restoration of cardiovascular endurance Improve strength, stabilization and proprioception Agility training Continue with RTS activities	Continue previous exercises/advance as needed
Week 15	Restoration of cardiovascular endurance Improve strength, stabilization and proprioception Agility training Continue with RTS activities	Continue previous exercises/advance as needed Z/W cuts Cariocas Outdoor cycling Sport specific drills
Week 16	Restoration of cardiovascular endurance Improve strength, stabilization and proprioception Agility training Continue with RTS activities RTS testing	Continue previous exercises/advance as needed Hill training Return to running Functional Sport tests

To return to sport at the lowest risk of re-injury, athletes should be able to perform multiple tests and reach specific criteria. These include:

- Single Hop for Distance: The goal of hop tests is to determine if an athlete has recovered enough strength, agility and power to return to sport. In this test, an athlete will hop as far forward on a single leg as possible: >90% of the non-operative extremity is considered normal.[30,51]
- Triple Hop for Distance: In this test, an athlete will hop as far forward on a single leg as possible, 3 times in a row: >90% is considered normal.[30,51]
- Triple Crossover Hop for Distance: In this test, an athlete will hop as far forward 3 times as possible, each time crossing over a line: >90% is considered normal.[30,51]
- Y Balance Test: This test was designed to assess performance during single leg balance while reaching 3 directions - anterior, posteromedial and posterolateral. This test is a portion of the Functional Movement Screen (FMS)[31] to determine if

an athlete is at risk of re-injury or ready to RTS. The athlete will stand on a single leg and reach in the 3 directions mentioned above as far as they can without losing balance with the other foot. The longest attempt or an average of three attempts made without contacting the ground with the contralateral foot is measured[31] >80% limb symmetry is required for RTS.[26,52]

- The Vail Hip Sport Test (HST) is also recommended for patients following arthroscopic hip surgery. The reliability and validity for this test has not been thoroughly evaluated, but multiple clinics and surgeons use this measure for its functional movement screens and agility tests.[27,41] The HST is a functional assessment for RTS that measures single leg knee bends, lateral agility, diagonal agility and forward box lunges.[41] Using the HST in conjunction with hop testing is recommended for RTS testing.[27]
- Sport specific drills and functional sports tests: These tests are dependent upon sport. Requirements of the sport change what each test will look like. Power, speed and agility are a few examples of tests that would be performed in these tests. Examples of these tests can include agility ladder drills, cutting drills, jumping drills (mentioned above), shuttle runs, sprints, throwing, catching, swimming, and single leg squatting activities.[32]

In order to return to sport/competition, an athlete must be 12-24 weeks post-op (most surgeons prefer 20-24 weeks), have full pain-free ROM free, demonstrate hip strength within <10% of the uninvolved side, perform a single hop, triple hop and triple crossover hop for distance with at least 90% limb symmetry, have a Y balance test symmetry index 80% of involved side, perform sport specific drills pain free and complete a functional sports test, mentioned above.[26,28]

Outcome Measures

International Hip Outcome Tool (iHOT)

The IHOT is a questionnaire that was developed for the use in assessing deficiencies in young athletes with hip disorders.[33] It has been approved for use in patients following arthroscopic labral repair and is recommended by surgeons for use to determine rehabilitation protocol efficacy.[34] The iHOT assesses areas of activities of daily living, coordination, functional mobility, gait, life participation, mental health, pain, quality of life, seating, strength and stress/coping.[33] There are two forms of this questionnaire -the iHOT-33 and the iHOT-12, with the iHOT-12 being a shortened version of the original iHOT-33. The IHOT-12 is recommended for use in the clinical setting given its ease of use.[33] This instrument is reliable and valid for patient evaluation and discharge.[35]

The Copenhagen Hip and Groin Outcome Score (HAGOS)

The HAGOS is another outcome measure that is reliable and valid for its use in patients following arthroscopic hip surgery.[34,36] This instrument includes subscales of pain, symptoms, physical function in daily living, physical function in sport and recreation, participation in physical activities, and hip and/or groin related quality of life.[26] Due to its similarity with the iHOT, clinicians should provide one of the two measures when determining rehabilitation protocol efficacy to avoid redundancy.

Hip Outcome Score- Sport Subscale (HOS-SSS)

A third outcome measure that is reliable and valid for athletes following arthroscopic hip surgery is the HOS-SSS.[33,37] The HOS is a self-report evaluation tool that has 2 sub-scales: activity of daily living and sport subscale. The sport subscale is composed of 9 items evaluating an individual's ability to perform athletic related tasks such as running a mile or swinging a golf club. Given its brevity, this instrument should be used in conjunction with another hip outcome measure to determine the results of rehabilitation post-arthroscopic surgery.[38]

Considerations for Specific Sports

Football & Hockey

Football and hockey players are at an increased risk of developing FAI and labral tears in part due to the amount of physical contact between players that puts stress on the hip joint and because of the wide range of motion of the hip that football and hockey players endure.[28,43,44,47] Both athletes are at higher risk to develop the CAM-type FAI due to deep squatting movements and impingement or labral tears due to repetitive flexion/internal rotation and push off.[43,44]Additionally, both of these sports are considered high risk for re-injury following RTS and should be rehabilitated properly to avoid re-injury.[4] PT should focus on sprint starts, running, trunk stabilization, single leg proprioceptive and agility drills and deep squatting activities.[28] Deep squatting activities can include any variation of barbell or dumbbell squats, beginning in a “catcher stance” and quickly moving to lunging or standing, mobility drills to improve the deep squatting position or “duck walks.” Football and hockey athletes should be frequently tested for hip impingement in the FADIR position to ensure hip ROM and mobility is sufficient.[28,44]

Baseball and Lacrosse

Baseball players are less frequently discussed with lower extremity injuries due to the increased prevalence of upper extremity injuries. Baseball players who utilize incorrect throwing and body mechanics are far more likely to have lower extremity injuries such as hip labral tears than those who do not.[45] Leg drive during pitching is correlated with throwing velocity and athletes who display compromised stride distance or lead leg foot placement are likely to display weakness and ROM limitations of the hip. This impairment can lead to excessive internal rotation, adduction and flexion of the hip, leading to impingement and labral tears.[45] In lacrosse, excessive hip internal rotation while shooting a lacrosse ball can lead to anterior-superior impingement of the labrum, as well as acute trauma due to colliding with other players.[45,47] Additionally, cutting and sprinting that is involved in both baseball and lacrosse, combined with FAI can lead to acetabular labral tears.[45] Understanding hip mechanics and how they produce power during pitching or throwing a lacrosse ball will help to correct body mechanics during rehabilitation to prevent re-injury.[45] PT should focus on analyzing throwing mechanics (pitching or with lacrosse stick), cutting and agility drills, sprint starts, running and single leg dynamic activities such as hopping or lunging.

Dance, Cheerleading and Gymnastics

Dance, cheerleading and gymnastics all require flexibility and more extreme ranges of motion of the hip, especially flexion and abduction. Repetitive jump landings and pivoting on a loaded femur leads to increased loading and impingement of the labrum. Since labral tears typically occur during repetitive movements, these athletes are at increased risk of this injury due to the repetitive nature of the sports.[47] These athletes should demonstrate appropriate abduction and extension strength and demonstrate the ability to perform repetitive movements into these directions. PT sessions should include high repetition for all exercises in a large range of motion to ensure the athlete can handle the demands of the sport. Analyzing mechanics for basic movements such as jumps, leaps, turns and tumbling will be important for these athletes to ensure proper form.

Running and Sprinting

The repetitive hip flexion movements runners and sprinters perform, when combined with FAI, can lead to impingement of the labrum. Running increases hip joint load more than five times the body weight, putting these athletes at higher risk of developing FAI and labral tears.[21] Runners put their hips into great ranges of flexion and adduction, leading to impingement of the hip.[46] Analyzing running mechanics and

correcting for malalignment or gait abnormalities will be most important for these athletes in addition to education about return to running and its process.[21,46] Runners and sprinters have a medium-low risk of re-injury once mechanics are analyzed and corrected.[4] PT should focus on single leg dynamic activity and plyometrics, running, sprint starts, strengthening hip abductors and lunging. A brief return to running program is mentioned in the chart below. *This is not all-inclusive and return to running should be cleared with the surgeon prior to a running progression program is initiated.*

Once an athlete is 12 weeks post-surgery, they can begin a running program. Strength and flexibility exercises should continue being performed throughout the program. Ensuring proper recovery after increased activity allows for a return to running with less probability of complications. Athletes should be performing dynamic warm ups prior to each exercise session.[53]

Phase 1: Walking Program[53]	**Phase 2: Quick Response and Plyometrics[53]**	**Phase 3: Return to Distance Running[53]**
Walk pain-free for 30 minutes at fairly aggressive pace (3.5 mph) Begin on treadmill before progressing to outdoor surface	Continue with walking program, incorporating light jogging (no hills/inclines, no speed work, focus on form, jog every other day) Level 1: - Ladders - 2-foot line jumps (forward/backward) - 2-foot dot hops - Alternating hop/hold - Alternating 1-leg hop with bounce Level 2: - Lateral shuffles - High knees - Forward/backward skips - Back pedal - Grapevine - Boxer Shuffles - Lateral skips	Athletes can begin jogging/running once they can complete phases 1-2, do not have pain with daily activities and walk without a limp Find baseline (distance athlete can run without pain and be able to run it again 48h later) Weeks 1-2 of Phase 3: Run 2-3x a week (2 runs 50-60% of baseline, 1 longer run) Weeks 3-6 of Phase 3: 3x a week (at baseline) Reassess baseline at week 5 Increase weekly volume/distance by no more than 10%/week

	Level 3: - Matrix jacks - 1-foot forward line hops - 1-foot line hops with bounce - 1-foot dot hops - Skaters	Once distance goal is reached, can begin running on hills (be cautious running downhill)

Conclusion

This guideline is not without limitations and there are many areas to develop new research on RTS guidelines for this population. Due to a lack of research about rehabilitation post-arthroscopic surgery for labral repair and FAI, some assumptions were made about specific barriers, complications and incidence of RTS in athletes. Likewise, a lot of research included other surgical procedures such as osteoplasty, chondral defects, labral reconstruction, labral debridement or osteoarthritis and this guideline was focused on labral repair and FAI without other defects. Additionally, there are few outcome measures that have proven reliability and validity with arthroscopic hip surgery specifically, making the choice of measures to use questionable and limited. Lack of agreement between surgeons on specific protocol criteria also makes it difficult to create a comprehensive guideline, as surgeons progress their patients differently based on their personal experience and the team that they have in place for rehabilitation. Areas that require further research include the effect of location and size of labral tears on recovery and RTS, how different sports and their requirements affect rehabilitation, and psychological factors of athletes who do not RTS following hip arthroscopic surgery.

Arthroscopic surgery for hip labral repair has become a widely performed surgery in recent years. More athletes are being diagnosed with FAI and labral tears every year, leading to an obvious need of proper return to sport guidelines and protocols. Literature and surgical protocols provide multiple temporal and physical criteria to return to sport while ensuring the lowest risk of re-injury for the athlete when they return to competition. These include the athlete being a minimum of 12-24 weeks post op, having pain-free equal ROM and strength between the uninvolved and involved side, and many agility and power tests. Athletes who participate in thorough rehabilitation programs and abide by surgeon recommendations have a higher probability of returning to sport with minimal complications than those who do not. Physical therapists and surgeons need to provide the appropriate psychological support for these athletes during the time of rehabilitation to allow for athletes to be in the proper mind-state to return to sport. Recognizing when an athlete is struggling with emotional

or mental aspects of returning to sport and referring the athlete to the correct provider can ensure return to sport success. Additionally, treatment sessions should be tailored to the individual athlete and focus on the movements and activities expected of them when they return to competition.

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