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Rehabilitation Following Hip Arthroscopy

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The management of hip injuries has evolved significantly in recent years with the advancement of arthroscopic techniques. The application of minimally invasive surgical techniques has facilitated relatively rapid returns to sporting activity in both recreational and elite athletes [1]. These recent surgical advances require establishment of rehabilitation guidelines that consider the constraints of soft tissue healing while advancing patients as rapidly and safely as possible.

Although rehabilitation guidelines following hip arthroscopy continue to evolve, the overall goal remains to return the patient to a preinjury level of activity. This involves restoration of normal range of motion, gait, and strength to allow return to functional activity. In the athlete, the rehabilitation program must also focus on restoration of power, speed, and agility for optimal return to competition.

Repaired tissue must be properly protected to allow healing and to prevent excessive stress on tissue. However, prolonged immobilization is not desired because of the numerous deleterious effects, including muscle atrophy, articular cartilage degeneration, ligament strength loss, and excessive adverse collagen formation [2–9]. Rehabilitation protocols need to follow several basic principles: (1) consideration of soft tissue healing constraints, (2) control of swelling and pain to limit muscular inhibition and atrophy, (3) early range of motion (ROM), (4) limitations on weight bearing, (5) early initiation of muscle activity and neuromuscular control, (6) progressive lower extremity strengthening and proprioceptive retraining, (7) cardiovascular training, and (8) sport specific training.

We have divided postoperative hip rehabilitation protocols into four phases. Progression through each phase is based on clinical criteria and time frames as appropriate.

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PHASE I—IMMEDIATE REHABILITATION

Goals

- Protect integrity of repaired tissue
- Restore ROM within restrictions
- Diminish pain and inflammation
- Prevent muscular inhibition

Precautions

- Do not push through hip flexor pain
- Specific ROM restrictions (surgery dependent)
- Weight bearing restrictions

Criteria for Progression to Phase II

- Minimal pain with all phase I exercise
- ROM ≥75% of the uninvolved side
- Proper muscle firing patterns for initial exercises
- Do not progress to phase II until full weight bearing is allowed

Rehabilitation

The initial phase of rehabilitation is started immediately following surgery. The goals during this phase are to protect the integrity of repaired tissue, diminish pain, and inflammation, restore ROM within restrictions, and prevent muscular inhibition. During the initial phase, a brace is used to maintain motion restrictions and protect the joint for 10 days. Swelling and pain are controlled through the use of ice and nonaspirin nonsteroidal anti-inflammatory drugs.

Early ROM is initiated to restore joint motion and decrease tissue scarring in the joint. ROM is started the day of surgery using a continuous passive motion (CPM) machine, passive ROM exercises, and stationary bicycling. The CPM is typically used 8 6 to12 hours per day for 4 to 6 weeks. With early PROM, emphasis is placed on internal rotation and flexion of the hip to prevent formation of adhesions between the joint capsule and the labrum. Progressive stretching of the piriformis and iliopsoas muscles is beneficial in preventing muscle contractures. Early stretching of the posterior hip capsule is achieved through quadruped rocking (Fig. 1). Stationary bicycling with minimal resistance is done for 20 minutes daily, starting the day of surgery.

The prevention of muscular inhibition is achieved through early strength exercises that limit joint stress while providing the appropriate load through the hip and lower extremity muscles. Aquatic walking with the use of a waterproof dressing in chest deep water can be initiated postoperative day 1. Early ambulation in the pool allows patients to work on gait symmetry and low load strengthening in an unweighted environment. Isometric strengthening is initiated as early as day 1 for the gluteals, quadriceps, hamstrings, and transverse abdominals. Hip adduction and abduction isometrics, prone internal and exter-

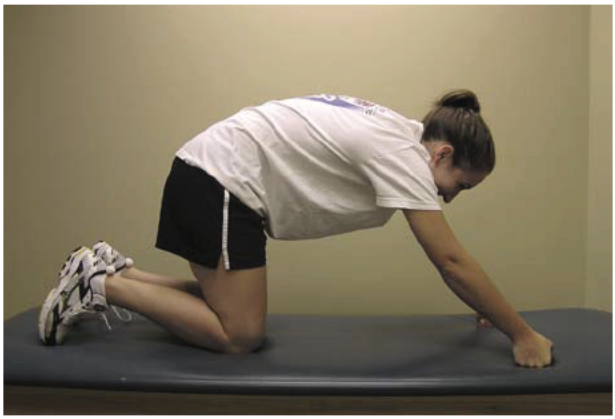

Fig. 1. Quadruped rocking.

Fig. 2. Prone internal and external rotation isometrics.

Fig. 3. Double leg bridges.

nal rotation isometrics (Fig. 2), and three-way leg raises (abduction, adduction, and hip extension) are started as early as week 2. Patients also start double leg bridges (Fig. 3), leg press with limited weight, and short lever hip flexion (Fig. 4) during the initial exercise phase. Once the goals for phase I have been met and full weight bearing is allowed, patients are progressed to the intermediate phase of rehabilitation.

Fig. 4. Short lever hip flexion.

PHASE II—INTERMEDIATE REHABILITATION

Goals

- Protect integrity of repaired tissue
- Restore full ROM
- Restore normal gait pattern
- Progressively increase muscle strength

Precautions

- No ballistic or forced stretching
- No treadmill use
- Avoid hip flexor/joint inflammation

Criteria for Progression to Phase III

- Full range of motion
- Pain free/normal gait pattern
- Hip flexion strength >60% of the uninvolved side
- Hip add, abd, ext, IR, ER strength >70% of the uninvolved side

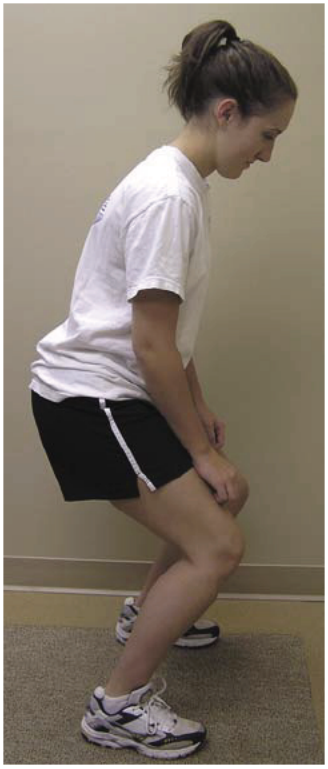

Fig. 5. Double one third knee bends.

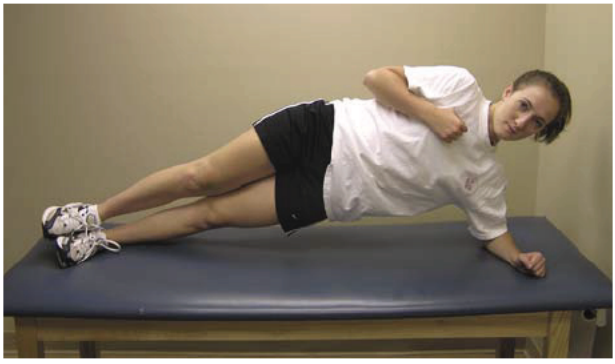

Fig. 6. Side supports.

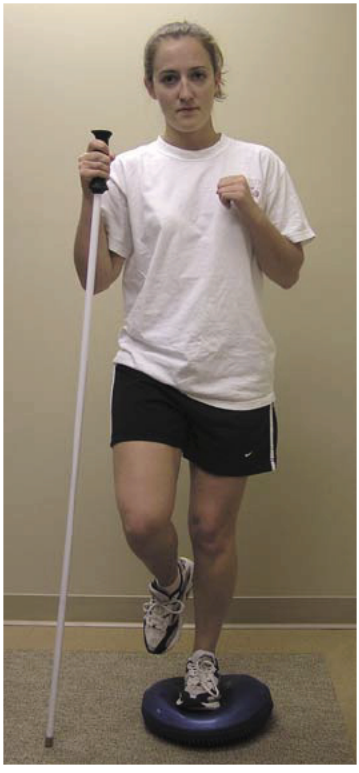

Fig. 7. Single leg stance on Dyna disc (Exertools Novato, California).

Fig. 8. Advanced bridging.

Rehabilitation

The intermediate phase of rehabilitation is typically started between 4 and 6 weeks postoperatively, dependent upon the surgical procedure and weight-bearing restrictions. The second phase of rehabilitation includes a progression of ROM/stretching, gait training, and strengthening. PROM and stretching exer-

Fig. 9. Single leg cord rotations.

Fig. 10. Sidestepping with resistance.

cises should be continued as needed to achieve full ROM. Gait training should take place both in the pool and on land as the patient is progressed off of crutches. Intermediate strength exercises include double one third knee bends (Fig. 5), side supports (Fig. 6), stationary biking with resistance, swimming with fins, single leg stance on a Dyna Disc (Exertools, Novato, California) (Fig. 7), advanced bridging (Fig. 8), single leg cord rotations (Fig. 9), Pilates skaters, sidestepping with resistance (Fig. 10), and single knee bends (Fig. 11). Cardiovascular training is achieved with the use of an elliptic machine or stairclimber during this phase. Once the goals of phase II have been met, patients are progressed to the advanced phase of rehabilitation.

PHASE III—ADVANCED

Goals

- Restoration of muscular endurance/strength
- Restoration of cardiovascular endurance
- Optimize neuromuscular control/balance/proprioception

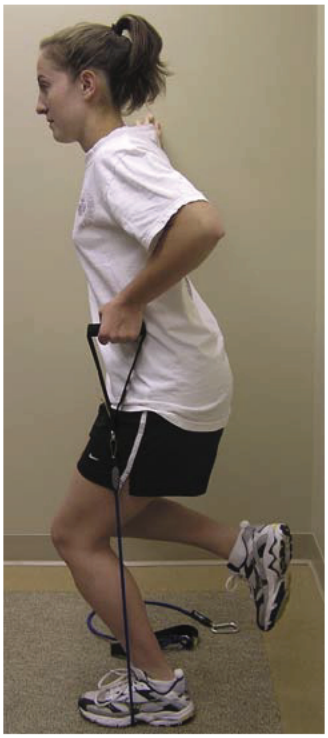

Fig. 11. Single knee bends.

Precautions

- Avoid hip flexor/joint inflammation
- No ballistic or forced stretching/strengthening
- No treadmill use
- No contact activities

Criteria for Progression to Phase IV

- Hip flexion strength >70% of the uninvolved side
- Hip add, abd, ext, IR, ER strength >80% of the uninvolved side
- Cardiovascular fitness equal to preinjury level
- Demonstration of initial agility drills with proper body mechanics

Rehabilitation

The advanced phase of rehabilitation is typically started between 6 and 8 weeks postoperatively. During this phase, patients focus on restoration of muscular strength and endurance, restoration of cardiovascular endurance, and neuromuscular control. Advanced strength and neuromuscular control exercises include lunges, water bounding and plyometrics, side to side lateral agilities

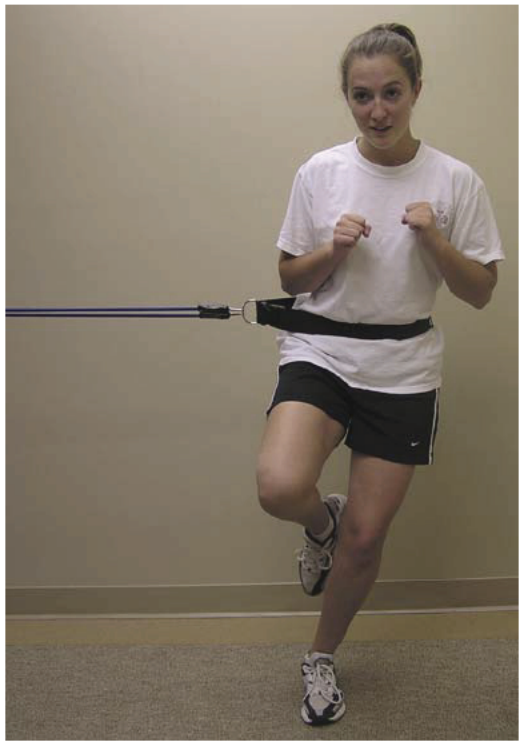

Fig. 12. Side to side lateral agilities.

(Fig. 12), forward and backward running with a cord, initiation of a running progression, and initial agility drills. Cardiovascular training should continue with progressive biking, elliptic trainer, stairclimber, and swimming. Once the goals of phase III have been met, patients are allowed to begin sport specific training.

PHASE IV—SPORT-SPECIFIC TRAINING

Criteria for Full Return to Competition

- Full pain free ROM
- Hip strength >85% of the uninvolved side
- Ability to perform sport specific drills at full speed without pain
- Completion of functional sports test

Rehabilitation

Sport-specific training is initiated between 8 and 16 weeks postoperatively. The goals of this phase are full return to competition following assessment of ROM, strength, power, and agility. Advanced agility drills and sport specific training are initiated during this phase of rehabilitation. Any deficits in ROM,

strength, balance, and proprioception are addressed during this phase as well. Contact activities should be limited until the patient is cleared for competition by the physician.

All patients should progress through the above phases of rehabilitation. Specifics of each phase are modified based upon the surgical procedure performed.

LABRAL REPAIR

Specific rehabilitation guidelines following labral repair must take into consideration the location and size of the repair. Because the majority of labral tears occurring in the North American population are located on the anterior superior region of the labrum, the following rehabilitation guidelines are specific to these repairs (Table 1) [1,10–12]. Intraoperative analysis reveals that the following ranges of motion do not stress the anterior superior labrum are; 0° to 90° flexion, 0° to 25° abduction, and 0° to 25° external rotation (Philippon MJ, personal communication, June 2005). Postoperatively, patients are instructed to limit ROM as follows: 25° of abduction for 3 weeks, gentle external rotation and extension for 3 weeks, and 90° of flexion for 10 days. Weight bearing is limited to foot-flat weight bearing (20 lbs.) for 2 weeks. A continuous passive motion machine is used for 4 weeks. Patients typically initiate phase I immediately following surgery, phase II at week 4, phase III at week 7, and phase IV at week 9.

OSTEOPLASTY

The focus of rehabilitation following osteoplasty is to avoid impingement of the hip and inflammation of the iliopsoas while restoring full ROM and strength. In cases that involve significant shaving of the femoral neck, caution must also be taken to limit impact activities that may increase risk of femoral neck fracture during the first 8 weeks (Table 2).

Following osteoplasty, flexion is limited to 90° for 10 days to protect the joint from impingement. Weight bearing is limited to foot-flat weight bearing (20 lbs.) for 4 weeks. A continuous passive motion machine is used for 4 weeks. Patients typically initiate phase I immediately following surgery, phase II at week 5, phase III at week 9, and phase IV at week 13.

MICROFRACTURE

The rehabilitation program after microfracture for treatment of chondral defects is crucial to optimal recovery after surgery [13–16]. Rehabilitation is designed to promote the ideal physical environment in which newly recruited mesenchymal stem cells from the marrow can differentiate into the appropriate articular cartilage-like cell lines [17]. The size and anatomic location of the chondral lesion will determine the specific progression of rehabilitation (Table 3) [13–16].

Postoperatively, flexion ROM is limited to 90° to protect the joint from postoperative impingement for 10 days. Passive ROM should focus on all planes of motion, progressing flexion as tolerated after 10 days. Weight bearing is

Table 1
Labra repa r

	Week											
	1	2	3	4	5	6	7	9	13	17	21	25
Phase : n t a exerc se												
Ank e pumps	•	•										
G utea , quad, HS, T-ab sometr cs	•	•										
Stat onary b k ng w th m n ma res stance	•	•	•									
Pass ve ROM (emphas ze R)	•	•	•	•								
P r form s stretch	•	•										
Pass ve sup ne h p ro (R)	•	•										
Water wa k ng	•	•										
Quadr ped rock ng		•	•									
Stand ng h p R (stoo)		•	•									
Hee s des		•	•									
H p abd/add sometr cs		•	•									
Un nvo ved knee to chest		•	•									
Prone R/ER (res sted)		•	•	•	•							
S de y ng c ams			•	•								
3-way eg ra ses (abd, add, ext)			•	•								
Water ogg ng			•	•								
Db eg br dges w/tub ng			•	•								
Knee ng h p f exer stretch			•	•								
Leg press (m ted we ght)			•	•								
Short ever h p f ex on/stra ght eg ra ses				•	•							
Phase : ntermed ate exerc ses												
Doub e 1/3 knee bends				•	•							
S de supports				•	•							

Stationary biking with resistance	•	•						
Swimming with fins	•	•						
Manual longitudinal distraction		•	•					
Manual A/P mobilizations		•	•					
Dynamic (single leg stance)		•	•					
Advanced bridging (single leg, swiss ball)		•	•					
Single leg cord rotation			•	•				
Plates skaters			•	•				
Side stepping			•	•				
Single knee bends (alternate step downs)			•	•				
Eight count/Star circumference			•	•				
Phase II: advanced exercises								
Lunges				•	•			
Water bounding/plyometrics				•	•			
Side-to-side alternate agility				•	•			
Fwd/Bkwd running with cord				•	•			
Running progression				•	•			
Initial agility drills				•	•			
Phase V: sports-specific training								
Z-Cuts					•	•	•	•	•
W-Cuts					•	•	•	•	•
Carioccas					•	•	•	•	•
Ghardeis					•	•	•	•	•
Sports-specific drills					•	•	•	•	•
Functional testing					•	•	•	•	•

Patient checklist weightbearing FFWB × 2 wk (foot flat = 20 lbs) CPM 4 wk Bledsoe brace 0°–90° × 10 d ROM limits flex, 90° × 10 d; ext, gentle × 3 wk; abd, 25° × 3 wk; ER, gentle × 3 wk; IR, no limits Modalities massage, active release technique, E-stim as needed start ing week 3 Timelines; week 1 (1–7 POD), week 2 (8–14 POD), week 3 (15–21 POD), week 4 (22–28 POD)

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Table 2
Osteop asty

	Week											
	1	2	3	4	5	6	7	9	13	17	21	25
Phase : n t a exerc se												
Ank e pumps	•	•										
G utea , quad, HS, T-ab sometr cs	•	•										
Stat onary b k ng w th m n ma res stance	•	•	•	•								
Pass ve ROM (emphas ze R)	•	•	•	•								
P r form s stretch	•	•										
Pass ve sup ne h p ro (R)	•	•										
Water wa k ng	•	•	•	•								
Quadr ped rock ng		•	•									
Stand ng h p R (stoo)		•	•									
Hee s des		•	•									
H p abd/add sometr cs		•	•									
Un nvo ved knee to chest		•	•									
Prone R/ER (res sted)		•	•	•	•							
S de y ng c ams			•	•								
3-way eg ra ses (abd, add, ext)			•	•								
Water ogg ng			•	•								
Db eg br dges w/tub ng			•	•								
Knee ng h p f exer stretch				•	•							
Leg press (m ted we ght)				•	•							
Short ever h p f ex on/stra ght eg ra ses				•	•							
Phase : ntermed ate exerc ses												
Doub e 1/3 knee bends					•	•						
S de supports					•	•						

Stat onary b k ng w th res stance	•	•	•					
Sw mm ng w th f ns	•	•	•					
Manua ong ax s d stract on	•	•	•					
Manua A/P mob zat ons	•	•	•					
Dyna-d sc (s ng e eg stance)		•	•	•				
Advanced br dg ng (s ng e eg, sw ss ba)		•	•	•				
S ng e eg cord rotat on			•	•	•			
P ates skaters			•	•	•			
S de stepp ng			•	•	•			
S ng e knee bends (atera step downs)			•	•	•			
E pt ca /Sta rc mber			•	•	•			
Phase : advanced exerc ses								
Lunges				•	•			
Water bound ng/p yometr cs				•	•			
S de-to-s de atera ag ty				•	•			
Fwd/Bkwd runn ng w th cord				•	•			
Runn ng progress on				•	•			
n t a ag ty dr s				•	•			
Phase V: sports-spec f c tra n ng								
Z-Cuts					•	•	•	•
W-Cuts					•	•	•	•
Car ocas					•	•	•	•
Gh arde 's					•	•	•	•
Sports-spec f c dr s					•	•	•	•
Funct ona test ng					•	•	•	•

Pat ent check st we ghtbear ng FFWB × 4 wk (foot f at = 20 bs) CPM 4 wk B edsoe brace 0°–90° × 10 d ROM m ts f ex, 90° × 10 d; ext, no m ts; abd, no m ts; ER, no m ts; R, no m ts Moda t es massage, act ve re ease techn que, E-st m as needed start ng week 3 T me nes; week 1 (1–7 POD), week 2 (8–14 POD), week 3 (15–21 POD), week 4 (22–28 POD)

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Table 3
M crofracture

	Week											
	1	2	3	4	5	6	7	9	13	17	21	25
Phase : n t a exerc se												
Ank e pumps	•	•										
G utea , quad, HS, T-ab sometr cs	•	•										
Stat onary b k ng w th m n ma res stance	•	•	•	•	•	•						
Pass ve ROM (emphas ze R)	•	•	•	•	•	•						
P r form s stretch	•	•										
Pass ve sup ne h p ro (R)	•	•										
Water wa k ng	•	•	•	•	•	•						
Quadr ped rock ng		•	•									
Stand ng h p R (stoo)		•	•									
Hee s des		•	•									
H p abd/add sometr cs		•	•									
Un nvo ved knee to chest		•	•									
Prone R/ER (res sted)		•	•	•	•							
S de y ng c ams			•	•	•							
3-way eg ra ses (abd, add, ext)			•	•	•	•						
Water ogg ng			•	•	•	•						
Db eg br dges w/tub ng			•	•	•	•						
Knee ng h p f exer stretch				•	•	•						
Leg press (m ted we ght)				•	•	•						
Short ever h p f ex on/stra ght eg ra ses				•	•	•						
Phase : ntermed ate exerc ses												
Doub e 1/3 knee bends							•	•				
S de supports							•	•				

Stat onary b k ng w th res stance	•	•				
Sw mm ng w th f ns	•	•				
Manua ong ax s d stract on	•	•				
Manua A/P mob zat ons	•	•				
Dyna-d sc (s ng e eg stance)	•	•				
Advanced br dg ng (s ng e eg, sw ss ba)	•	•				
S ng e eg cord rotat on	•	•	•			
P ates skaters	•	•	•			
S de stepp ng	•	•	•			
S ng e knee bends (atera step downs)	•	•	•			
E pt ca /Sta rc mber	•	•	•			
Phase : advanced exerc ses						
Lunges		•	•			
Water bound ng/p yometr cs		•	•			
S de-to-s de atera ag ty		•	•			
Fwd/Bkwd runn ng w th cord		•	•			
Runn ng progress on		•	•			
n t a ag ty dr s		•	•			
Phase V: sports-spec f c tra n ng						
Z-Cuts				•	•	•
W-Cuts				•	•	•
Car ocas				•	•	•
Gh arde 's				•	•	•
Sports-spec f c dr s				•	•	•
Funct ona test ng				•	•	•

Pat ent check st we ghtbear ng FFWB × 6 wk (foot f at = 20 bs) CPM 6 wk B edsoe brace 0°–90° × 10 d ROM m ts f ex, 90° × 10 d; ext, no m ts; Abd, no m ts; ER, no m ts; R, no m ts Moda t es massage, act ve re ease techn que, E-st m as needed start ng week 3 T me nes; week 1 (1–7 POD), week 2 (8–14 POD), week 3 (15–21 POD), week 4 (22–28 POD)

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Table 4
Capsu ar Repa r

	Week											
	1	2	3	4	5	6	7	9	13	17	21	25
Phase : n t a exerc se												
Ank e pumps	•	•										
G utea , quad, HS, T-ab sometr cs	•	•										
Stat onary b k ng w th m n ma res stance	•	•	•	•								
Pass ve ROM (emphas ze R)	•	•	•	•								
P r form s stretch	•	•										
Pass ve sup ne h p ro (R)	•	•										
Water wa k ng	•	•	•	•								
Quadr ped rock ng		•	•									
Stand ng h p R (stoo)		•	•									
Hee s des		•	•									
H p abd/add sometr cs		•	•									
Un nvo ved knee to chest		•	•									
Prone R/ER (res sted)		•	•	•	•							
S de y ng c ams			•	•								
3-way eg ra ses (abd, add, ext)			•	•								
Water ogg ng			•	•								
Db eg br dges w/tub ng			•	•								
Knee ng h p f exer stretch				•	•							
Leg press (m ted we ght)				•	•							
Short ever h p f ex on/stra ght eg ra ses				•	•							
Phase : ntermed ate exerc ses												
Doub e 1/3 knee bends					•	•						
S de supports					•	•						

Stationary biking with resistance	•	•	•					
Swimming with fins			•	•				
Manual long axis distraction			•	•				
Manual A/P mobilizations			•	•				
Dynamic (single leg stance)		•	•	•				
Advanced bridging (single leg, swiss ball)		•	•	•				
Single leg cord rotation			•	•	•			
Plates skaters			•	•	•			
Side stepping			•	•	•			
Single knee bends (alternate step downs)			•	•	•			
Eliptical/stair climber			•	•	•			
Phase III: advanced exercises								
Lunges				•	•			
Water bounding/plyometrics				•	•			
Side-to-side alternate agility				•	•			
Fwd/Bkwd running with cord				•	•			
Running progression				•	•			
Interval agility drills				•	•			
Phase V: sports-specific training								
Z-Cuts					•	•	•	•
W-Cuts					•	•	•	•
Carioccas					•	•	•	•
Ghardeis					•	•	•	•
Sports-specific drills					•	•	•	•
Functional testing					•	•	•	•

Patient checklist weightbearing FFWB × 4 wk (foot flat = 20 lbs) CPM 4 wk Bledsoe brace 0°–90° × 10 d ROM limits flex, 90° × 10 d; ext, 0° × 3 wk; abd, no limits; ER, 0° × 3 wk; PRN, no limits Modalities massage, active release technique, E-stim as needed start during week 3 Timelines; week 1 (1–7 POD), week 2 (8–14 POD), week 3 (15–21 POD), week 4 (22–28 POD)

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limited to foot-flat weight bearing (20 lbs.) for 6 to 8 weeks. A continuous passive motion machine is used for 6 to 8 weeks. Care should be taken during strengthening to avoiding compressive or sheering forces at the site of the microfracture. Impact activities should be added cautiously while the hip is monitored for swelling or pain. Patients typically initiate phase I immediately following surgery, phase II at week 7, phase III at week 9, and phase IV at week 17. All high impact activities such as running should be discussed with the physician before initiation.

CAPSULE REPAIR (PLICATION/CAPSULORRAPHY)

The focus of rehabilitation following a capsular procedure is to protect the integrity of the repair following surgery. Exercise progression must limit capsule stress throughout the rehabilitation program. Motion restrictions are determined by the location of the repair (anterior verses posterior). The majority of capsule repairs seen by the authors involve the anterior capsule. The following rehabilitation guidelines are specific to these repairs (Table 4).

Following an anterior capsule repair, extension and external rotation are limited to neutral for 3 weeks, followed by 3 weeks of gentle motion. At 4 weeks, it is felt that the cicatrix in the hip is formed and will not be subject to significant elongation [18–21]. Foot wraps are used for 3 weeks to maintain neutral hip rotation while the patient is in a supine position and not in the CPM. Flexion ROM is limited to 90° to protect the joint from impingement for 10 days. Weight bearing is limited to foot-flat weight bearing (20 lbs.) for 4 weeks. To avoid capsular stretch, neutral rotation during ambulation in emphasized. A continuous passive motion machine is used for 4 weeks. Care should be taken to avoid capsule stresses with rotational activities. Achieving a balance of joint stability and mobility is essential for successful return to competition. Patients typically initiate phase I immediately following surgery, phase II at week 5, phase III at week 9, and phase IV at week 13.

SUMMARY

Rehabilitation following hip arthroscopy has not been well understood in the past. Although surgical procedures continue to advance, athletes are already pushing the limits to return to competition as quickly as possible. As postoperative protocols evolve, it is essential to follow the basic guidelines of rehabilitation. Initially, soft tissue healing constraints must be considered while focusing on controlling swelling and pain, restoring ROM, and preventing muscle atrophy. As physiologic healing occurs, rehabilitation must address progressive lower extremity strengthening, proprioceptive retraining, and sports specific training.

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