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Ice Hockey Goaltender Rehabilitation, Including On-Ice Progression, After Arthroscopic Hip Surgery for Femoroacetabular Impingement

Ice hockey players are a distinct population of athletes, due to the unique demands placed on their lower body by their on-ice movements. Hip injuries are reported to be common among hockey players and are receiving increased attention in the literature.[4,27,32,33] Compared to position players, goaltenders use an entirely different set of movements, which increases the demand on their hips, especially in those who employ the "butterfly technique."[3,4] The butterfly technique is a relatively unique style of goaltending that is becoming more popular among younger players. Butterfly goalies stand with their feet apart and knees bent. When a low shot comes in on goal, butterfly-style goaltenders quickly drop to their knees, while internally rotating their hips and splaying out their lower-leg pads to cover the goal net. The combined motion of hip flexion and end-range internal rotation transfers large amounts of stress across the hip joint. This joint position has been reported to be associated with the development of overuse hip injuries.[14,22,31,32]

The stress on the hip joint in goaltenders can be further exacerbated by the presence of bony deformities. Femoroacetabular impingement (FAI) is a common hip deformity, with a reported estimated prevalence ranging from 24% to 67% in asymptomatic athletes.[13,28] First described by Ganz et al,[11] FAI has been classified into 2 types, based on the bony morphology of the acetabulum and femoral head.[2,10,34] Structural abnormality of the femur due to a bony overgrowth of the femoral neck, which causes an abutment against the acetabular rim and the chondrolabral junction, is known as the cam type. Bony abnormality of the acetabulum due to an increase in the size of the acetabular rim, effectively creating a deeper hip socket, is referred to as the pincer type. Both forms can cause damage to the acetabular chondrolabral structures as the hip

SYNOPSIS: Ice hockey goaltenders, especially those who employ the butterfly technique, are a specialized population of athletes because of the unique physical demands that the position places on their lower extremities, specifically at the hip. It is no surprise that hip injuries are a common occurrence among goalies. A review of the biomechanical literature has demonstrated that stresses on the hip while in flexion and end-range internal rotation, the position goaltenders commonly use, put the hip at risk for injury and are likely a major contributing factor to overuse hip injuries. The stress on a goaltender's hip can potentially be further intensified by the presence of bony deformities, such as cam- or pincer-type femoroacetabular impingement, which can lead to chondrolabral junction and articular cartilage injuries. There have been few published reports of goaltenders' functional outcomes following femoroacetabular impingement surgery, and, to our knowledge, no studies have yet identified the specific challenges presented in the rehabilitation of goaltenders following femoroacetabular impingement surgery. The present clinical commentary describes a 6-phase return-to-skating program developed as part of a rehabilitation protocol to aid hockey goaltenders recovering from surgery.

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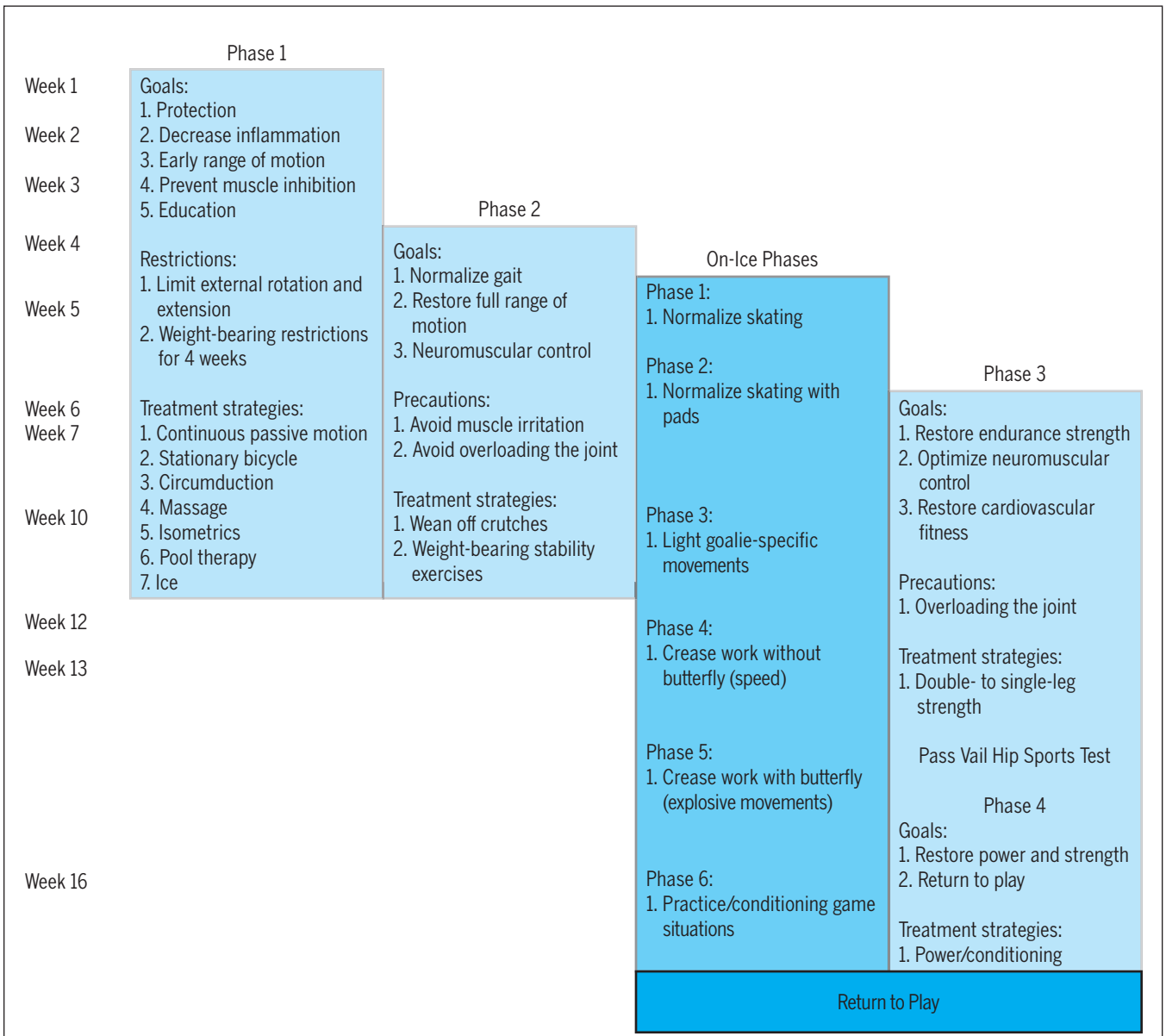

FIGURE 1. Phases and timelines for the standard rehabilitation protocol following hip arthroscopic surgery without microfracture, and the on-ice supplemental rehabilitation program designed for ice hockey goaltenders.

joint moves through the extremes of joint motion, due to repetitive bony impingement on either the acetabular labrum or the articular cartilage surfaces due to the bony incongruity.[21] Cam FAI is the most commonly diagnosed type of FAI in ice hockey goaltenders.[1]

The combination of femoral neck bony deformities with the stressful hip movements involved in the butterfly position can lead to significant injurious effects on the labrum, femoral head, and acetabulum. The combined movements of flexion and internal rotation used in the butterfly technique have been reported to increase the risk for labral impingement and hip injury in the presence of a cam-type FAI deformity.[11,16,21] Recently, there has been an increased number of both professional and National Collegiate Athletic Association hockey goaltenders who have required surgery to treat FAI, which may be due to increased recognition or incidence of this lesion.[20,21,25,27] However, rehabilitation protocols following arthroscopic FAI surgery tend to be very similar, regardless of the sport-specific demands of the individual on whom the surgery is performed.[9,11,23,30,35] As the number of arthroscopic FAI surgeries performed on goaltenders has increased, the need for a specific postoperative rehabilitation program for this population with unique

skills and demands has been recognized.

There have been few published reports of outcomes following FAI surgery in goaltenders, and, to our knowledge, no studies have yet identified the specific challenges presented in the postsurgical rehabilitation of goaltenders.[4] Rehabilitation protocols following arthroscopic hip surgeries tend to be very similar, regardless of the surgical procedure, and to include early restrictions on weight bearing and a focus on early mobility and restoring range of motion.[9,11,23,26,30,35] Hip external rotation range of motion is usually limited immediately following hip surgery to protect the anterior capsular structures. Both strengthening exercises and return-to-play activities are typically incorporated later in the rehabilitation protocol.[9,23,26] Here, we present a set of unique on-ice functional exercises designed specifically to allow for rehabilitation of ice hockey goaltenders following arthroscopic FAI hip surgery.

REHABILITATION PROGRAM

The following is a summary of the specific ice hockey goaltender hip rehabilitation functional program developed at our center and utilized since 2009. This on-ice program is divided into 6 phases, which were developed based on our experience and may be implemented during phase 2 through phase 4 of the standard 4-phase rehabilitation protocol that we use after arthroscopic hip surgery (**FIGURE 1**).[32]

Phase 1 (mobility and protection) of the standard rehabilitation protocol is time based and depends on the healing of bony and soft tissues and the length of time required to use crutches for ambulation. Following any combination of FAI-related surgical procedures, including labral repair or debridement, capsular plication, osteoplasty, or chondroplasty, patients ambulate with partial weight bearing for 4 weeks and for 6 to 8 weeks if microfracture is performed. During phase 1, hip range-of-motion exercises are emphasized within the constraints of the motion limitations determined by the surgeon during surgery to protect the healing and repaired tissues. Phase 2, stability, is intended to normalize gait and improve weight-bearing stability. Phase 3 has a greater focus on strengthening exercises, and phase 4 consists of a progressive return-to-sport program. Phases 2 through 4 are athlete dependent and therefore criterion based, taking into consideration the individual goaltender's sport-specific rehabilitation progression.

Criteria to initiate the goaltender-specific on-ice rehabilitation program, as part of the overall rehabilitation program, include pain-free ambulation and pain-free normal hip range of motion, with the exception of hip external rotation, which, if limited during phase 1, may not be normalized by the onset of the skating program. Demonstrating adequate strength of the gluteus medius and maximus, the deep hip external rotators, and the iliopsoas is also required and is assessed through the performance of a stable single-leg stance and a minimum performance of 4/5 during manual muscle tests.[18,24] The early phases of the return-to-skate program consist of simple skating drills, with an emphasis on stability. During these early phases, movements are predictable and do not incorporate motions reported to place the athlete at a higher risk of reinjury. The decision to initiate the skating program is made by the physician in conjunction with feedback from the therapist.

As in any criterion-based protocol, careful prescription and monitoring of the training load must be followed by the therapist, in conjunction with feedback from the physician as needed.[10] Similar criteria are used to start phase 3, strengthening, of the standard protocol; however, off-ice dry-land strengthening is usually initiated 1 to 2 weeks after the skating program is started to avoid a sharp increase in the rehabilitation/loading volume and to allow the hip to progressively accommodate the increase in training load. On-ice exercises are ideally performed on alternating days from dry-land strengthening exercises during the week. On-ice and/or dry-land progression should be halted if the patient begins to experience pain and/or peri-articular or intra-articular swelling.

Return-to-Skate Program Overview

There are 6 phases in the goaltender-specific on-ice postoperative hip rehabilitation program. Once initiated during phase 2 of the standard rehabilitation protocol, progression through each phase of the on-ice program is independent of the standard rehabilitation protocol (**FIGURE 1**).

Most of the on-ice exercises are common skating drills already mastered by goalies and coaches as they progress from first learning to skate to playing at the collegiate or professional level. Although not assessed with biomechanical studies, the drills are considered to be gradual progressions intended to facilitate muscle re-education and to allow for assessment of quality of movement through observations of asymmetries and compensatory motions.

Progression from one phase to the next is both time and criterion based, and includes a minimum of 4 sessions at each phase, with no associated loss of hip motion or increased hip stiffness while demonstrating good stability. Stability assessment is performed by observing for pelvic obliquity or medial collapse of the involved extremity (increased femoral adduction and/or internal rotation) while performing the movements, especially as fatigue occurs. The volume of exercises is not specific, due to the variability between different levels of players. Training intensity is measured with a single-session rate of perceived exertion (RPE), obtained utilizing the category ratio Borg scale.[29] The single-session RPE has been reported to reflect an accurate assessment of training intensity.[9,12] The Borg RPE is a valid tool to assess the athlete's perception of effort during exercise, independent of gender, age, and physical activity level.[29,32] On-ice exercises are often performed in the goal crease and in

front of the goal net. For our purposes, we utilize a standard hockey goal crease with dimensions as depicted in **FIGURE 2**.

Phase 1 (Without Pads): On-Ice Balance and Edge Control

Phase 1 is approximately 2 weeks in duration and focuses on on-ice balance and edge control. The athlete performs the exercises twice for 30 minutes each session during the first week, progressing to 3 times for 40 minutes in the second week. During the latter phase, each session is completed at an intensity of 0 to 1 on the RPE scale.[7] Phase 1 is initiated with the easier exercises from the list in the **APPENDIX** and focuses on quality, symmetry, and form, with the rest of the protocol added in the second week. No explosive movements and no equipment except skates and puck are allowed.

Phase 1 helps the goaltender to regain a normal feeling on the ice while skating and to develop improved edge control (grip on the ice with the skates). It includes the exercises listed in the **APPENDIX** (see **ONLINE VIDEO**).

Phase 2 (With Pads): Early Skating and Edge Control

Phase 2, approximately 2 weeks in duration, utilizes the same exercises listed in phase 1, but the exercises are performed with the goaltender wearing pads. It is initiated with the goaltender performing the exercises 3 times for 40 minutes during the first week, progressing to 3 times for 45 minutes in the second week. Each session is completed at an intensity of 1 to 2 on the RPE scale.[7] Phase 2 will allow the goaltender to wear bulky leg pads again and to become comfortable skating in them (**APPENDIX**).

Phase 3: Easy Butterfly, Light Crease Work, and Transitions

Phase 3 typically lasts between 2 and 3 weeks. Phase 3 is initiated with the goaltender performing the exercises listed in the **APPENDIX** 3 times per week for 45 minutes, with a session intensity of 3 to 4 on the RPE scale.[7] Phase 3 allows for a smoother transition back into butterfly position movements and introduces tighter movements in the goal crease (**APPENDIX**, **ONLINE VIDEO**).

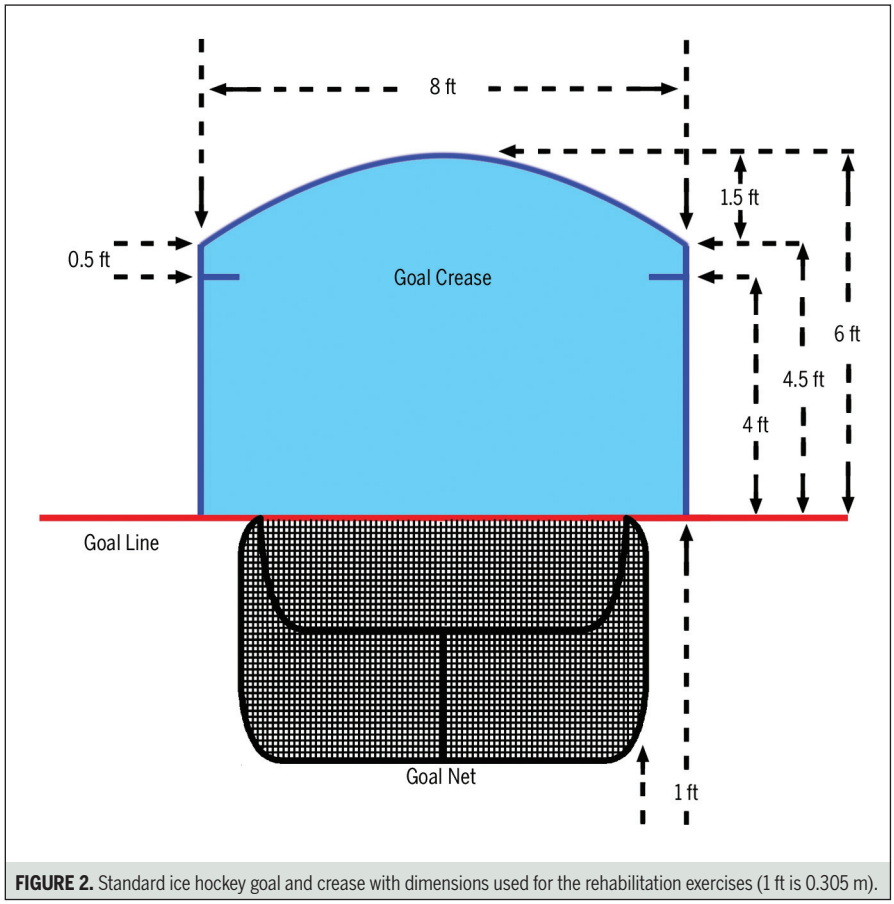

FIGURE 2. Standard ice hockey goal and crease with dimensions used for the rehabilitation exercises (1 ft is 0.305 m).

Phase 4: Crease Work (Upright Only)

Phase 4 should last between 2 and 3 weeks. The athlete performs the listed exercises 4 times per week for 45 minutes at an intensity of 5 to 6 on the RPE scale.[7] Phase 4 intensifies the crease work to improve the goaltender's movements in front of the goal (**APPENDIX**, **ONLINE VIDEO**).

Phase 5: Crease Work With Butterfly Technique

Phase 5 should last between 2 and 4 weeks. The goaltender performs the listed exercises 4 times for 45 minutes the first week, progressing to 5 times per week for 45 to 60 minutes. Phase 5 combines the tight movements in the goal crease with the butterfly technique to prepare the goaltender to return to full practice (**APPENDIX**, **ONLINE VIDEO**).

Phase 6: With Doctor Clearance, Return to Practice With Full Gear

Completion of phase 5 requires at least 4 sessions of phase 5 without experiencing pain and/or swelling, no pain with activities and drills, and passing the Vail Hip Sports Test.

The Vail Hip Sports Test is a modification of the original Vail Sport Test that has been used as a functional assessment of lower extremity strength following knee injuries and rehabilitation.[15] The Vail Hip Sports Test is composed of 4 exercises with a 20-point scoring system. The last 2 exercises were modified from the original Vail Sport Test to incorporate a rotational and deep hip flexion and extension component.[35] It is designed to challenge an athlete's ability to demonstrate adequate endurance strength;

ballistic capacity; ability to eccentrically control load (we describe this as *absorption*) in the involved lower extremity in a lateral and a rotational direction; and ability to flex and extend into a lunge position without pain, fatigue, or compensation. The 4 tests are single-knee bends, side-to-side lateral movements, diagonal side-to-side movements, and forward box lunges. The single-knee bends with cord resistance are performed for 3 minutes at a pace of 1 second down and 1 second up, without any pelvic obliquity or medial collapse of the lower extremity. One point is given for every 30 seconds that the task is successfully performed, for a total of 6 points. The lateral side-to-side movement test is performed with a resistance cord attached to the waist on the involved side. The athlete pushes off the involved side against the resistance of the cord, then returns onto the involved leg with good absorption (described as landing at approximately 30° of knee flexion and flexing down to 70° in a controlled manner). The athlete performs this movement for 100 seconds, without any of the above compensations. One point is given for each 20 seconds that the task is performed correctly and without pain, for a total of 5 points. The third test is similar to the second; however, it is performed at a 45° angle forward and at a 45° angle backward from the frontal plane. It is also performed for 100 seconds and scored the same as the previous test. The final test is a forward box lunge onto a box set at the height of the patient's knee. The test measures the ability of the hip to flex and extend without pain. It is performed for 2 minutes with cord resistance, and 1 point is scored for each 30 seconds performed without pain or compensation, for a potential total of 4 points. A score of 17 or higher is considered a passing score; however, expectations for different levels of athletes are considered (professional athletes are expected to obtain a perfect score of 20/20). The sport test is used both as a presurgery exam and as a return-to-competition test. We recommend clearance by the physician and the treating physical therapist, and passing the sport test before allowing the player to fully return to participation.

DISCUSSION

Hockey goaltenders have a unique need for increased hip motion following hip surgery, because they require on-ice movements that stress the hip within the limits of its range of motion. The movements of goalies, particularly those who employ the butterfly technique, place a large amount of stress on the soft and bony hip structures and can damage a surgically repaired hip.

Currently, there is a lack of information focused on specific rehabilitation following hip surgery in ice hockey goaltenders. Hockey goaltenders have a higher incidence of hip injuries and require specialized treatment and rehabilitation to return to a high level of play.[4] There is a need to tailor rehabilitation protocols to goaltenders to address their unique needs and the challenges they face after hip surgery. Utilizing an on-ice functional rehabilitation program as an adjunct to the standard post–arthroscopic hip surgery rehabilitation protocol helps tailor rehabilitation to address goaltenders' unique needs in a safe and efficient manner, allowing them to safely return to on-ice activities.

Frequently after hip surgery, the gluteus medius muscle becomes weakened or inhibited.[24] Rehabilitation focusing on restoring strength and endurance to the gluteus medius is very important, because this muscle is one of the strongest in the lower body and has a significant influence on proper hip, knee, and low back function.[5,6,17-19,36] Improper rehabilitation can result in persistent weakness in this important muscle and predispose the athlete to further injury.[6,17,19] However, rehabilitation that is solely focused on restoring strength to the gluteus medius has the potential to negatively affect the iliopsoas musculature, leading to hip flexor pain and/or tendinitis, which are common problems during the postoperative period following hip surgery and during rehabilitation after a hip injury.[30,35] Limiting active hip flexion for a month following surgery has been recommended to prevent hip flexor tendinitis and lingering weakness.[9,26] A recent electromyography study reported a series of safe hip rehabilitation exercises to strengthen the gluteus medius muscle following hip surgery.[35] The exercises outlined in this report avoid overactivation of the iliopsoas, which can lead to pain or tendinitis. Exercises such as stationary hip abduction (**APPENDIX**) should be utilized throughout all phases of hip rehabilitation, because these exercises activate the gluteus medius without activating the hip flexors,[35] which should minimize the risk of hip flexor postoperative irritation.

Another study[12] reported the activation levels of the pectineus and piriformis muscles during 13 different rehabilitation exercises. Exercises involving hip flexion most highly recruited the pectineus muscle, whereas only slight activation occurred with stabilization and weight-bearing exercises. Hip extension and stabilization of external rotation during abduction resulted in the greatest amount of piriformis muscle activation.[12] This study demonstrated the importance of both muscles to hip function and stability and the need to properly address their strength in rehabilitation protocols.

PEARLS AND PERILS

Pearls

1. The restoration of normal hip range of motion and muscle-firing patterns in phases 1 and 2 creates the foundation for a successful return-to-ice program.
2. It is critical to be involved in the prescription and monitoring of the training load. As training load increases, observe for symptoms such as increased pain or stiffness, which may indicate that the load is too great for the joint at that point in time.
3. Recovery between sessions is just as important as training loads.

4. Individualize the rehabilitation program to the athlete's needs. Prolonging phase duration and adjusting volume and training intensity as necessary may lead to fewer complications and better outcomes.

Perils

1. Not following hip range-of-motion and weight-bearing restrictions or rehabilitation timelines leads to stiffness, swelling, or pain that does not allow adequate muscle firing or stability during skating.
2. Hip flexor and adductor irritation is very common and difficult to treat once it occurs. Emphasis on correct muscle initiation patterns can decrease the rate of this complication.
3. Overly aggressive rehabilitation can lead to hip flexor irritation, tear of the labral repair, longstanding muscle weakness, and intra-articular adhesions.
4. A focus on returning the athlete to play as quickly as possible without completing all the necessary rehabilitation phases may lead to prolonged hip joint symptoms, such as pain and stiffness, and a decrease in patient satisfaction.

CONCLUSION

Ice hockey goaltenders are at an increased risk for hip injuries because of the stress they place on their hip joint while playing their position. Following surgery, goaltenders require increased attention and care when progressing through rehabilitation to restore their hip motion and strength to a level allowing safe return to a high level of play. The exercises described here as an on-ice functional rehabilitation program have been tailored specifically for hockey goalies to address their unique needs and strengthen the hip muscles to restore proper function and return the athlete to an elite level. ◉

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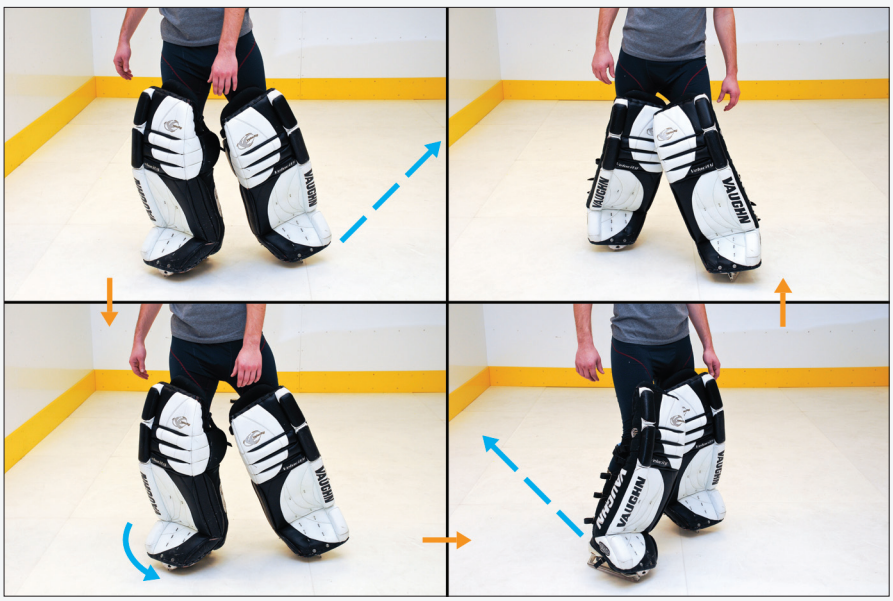
APPENDIX

RETURN-TO-SKATE PROGRAM

Phase 1 (Without Pads) and Phase 2 (With Pads)

Exercise	Description
Stationary hip abduction with the puck	Stand facing the boards in front of the bench with the upper body supported by the rail. Position a puck between the blade (sharp metal portion) of the skate and the ice. While pushing down on the puck, abduct the hip from the body in a movement parallel to the boards, and then abduct and extend the hip at approximately 30°, 45°, and 90° from the boards, performing 5 repetitions at each angle. Return to the start position between each repetition. 
Sidesteps along the boards	Stand facing the boards in front of the bench, with the upper body supported by the rail. Start at the first blue line and perform short abduction skate pushes to move the body down the ice to the center red line (approximately 30 ft [10 m]). Return to the blue line using the opposite lower extremity.

APPENDIX

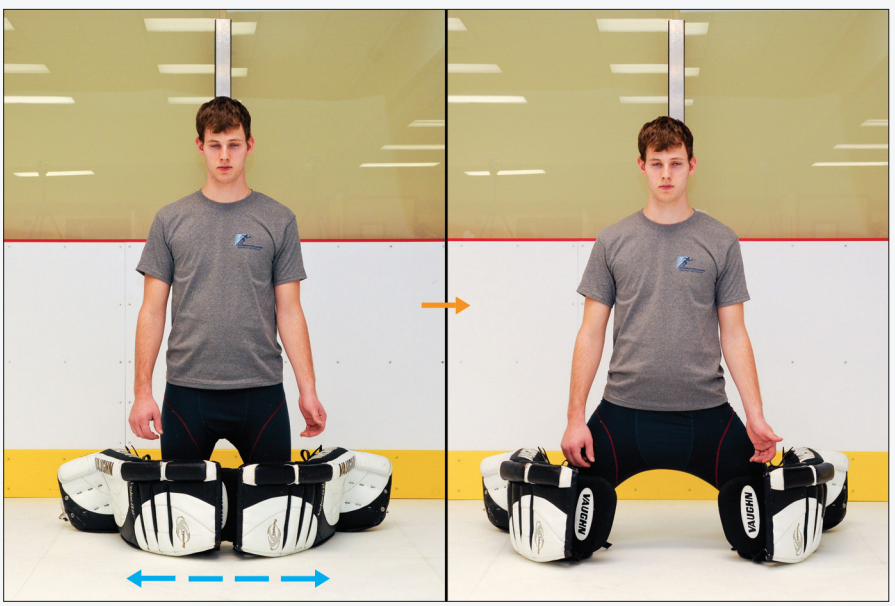
Exercise	Description
Double-leg C-cuts forward	Stand in front of the goal. Propel down the ice by abducting the left hip while also rotating it to make a C shape on the ice, then alternate to the opposite hip, finishing in front of the opposite goal.
	
Single-leg C-cuts forward	Stand in front of the goal. Propel down the ice by abducting the left hip while also rotating it to make a C shape on the ice, while the right leg provides balance and direction. Finish in front of the opposite goal and return using the right leg for propulsion and the left for balance.
Downhill skiing	Stand in front of the goal. Propel down the ice by making alternating "S" turns, keeping the legs together and weighting the outside leg of the turn and the inside edge of the skate. Finish in front of the opposite goal. Be careful not to fully extend the hip when pushing off each turn.
	
Single-leg long strides	Stand in front of the goal. Propel down the ice by performing 1 full extension and push off the right leg at a 45° angle, maintaining weight and balance on the forward leg while the right leg slides behind. As the body begins to slow down, place the back right leg at a 45° angle in the opposite direction and push off using the left leg, maintaining weight and balance on the forward outside leg while the left leg slides behind.
Inside-edge holds	Stand in front of the goal. Propel down the ice by performing 1 full-extension push-off, using the right leg to move at a 45° angle down the ice. As the body begins to slow down, turn back 180°, holding the turn on the inside edge of the outside skate. When turned completely back in the opposite direction, push off with the other leg and complete a similar motion on the left side.
Slow backward skating	Stand in front of the goal, facing the goal net, and skate slowly backward, pushing off gently with 1 leg at a time.

APPENDIX

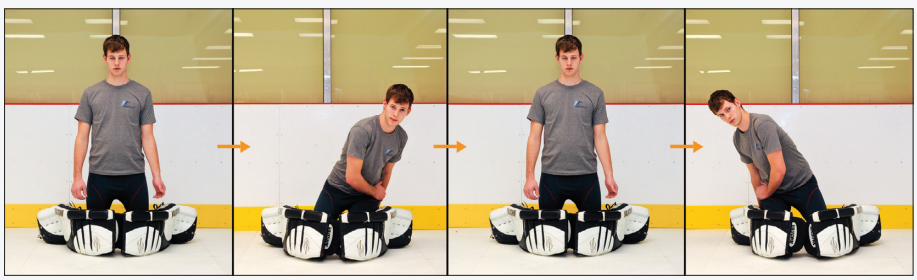
Exercise	Description
Single-leg C-cuts backward	Stand in front of the goal, facing the goal net. Propel down the ice backward, by abducting the left hip while also rotating it to make a C shape on the ice, using the right leg to provide balance and direction. Finish in front of the opposite goal and return using the right leg for propulsion and the left for balance.
Downhill skiing backward	Stand in front of the goal, facing the goal net. Propel down the ice backward by making alternating "S" turns, keeping the legs together and weighting the outside leg of the turn and the inside edge of the skate. Finish in front of the opposite goal.
C-cuts around face-off circle forward	Start on 1 side of the face-off circle (middle of the ice rink; 30-ft [9.14-m] diameter) and stand on the line. Move along the line of the circle, using single-leg C-cuts as described in the previous exercise, while keeping the inside skate on the line. Switch directions and sides with each complete circle.
Inside-edge holds backward	Stand in front of the goal, facing the goal net. Propel backward down the ice toward the first blue line (60 ft [18.28 m]). Push off using the right leg to move at a 45° angle down the ice. As the body begins to slow down, turn back 180°, holding the turn on the inside edge of the outside skate. When turned completely back in the opposite direction, push off with the other leg and complete a similar motion on the left side.

Phase 3

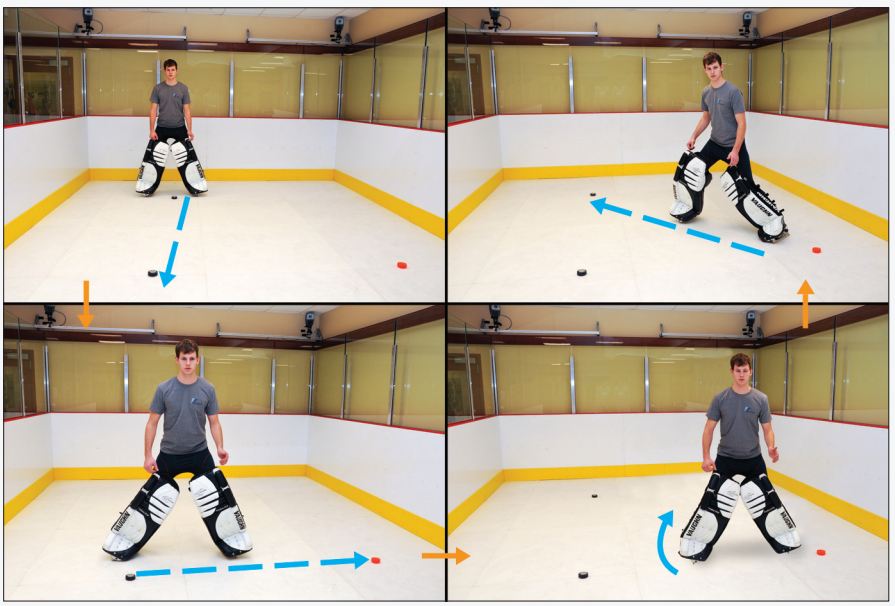
Exercise	Description
Butterfly stretches	Start in the kneeling butterfly finish position, with the pads together and the knees on the ice. Slowly abduct the thighs to create an approximately 75° angle between the legs, and then return to the start position.



APPENDIX

Exercise	Description
Butterfly sidebends	Start in the kneeling butterfly finish position with the pads together and the knees on the ice. Bend to the side at the hips and touch the elbow to the ipsilateral skate and alternate side to side.
	
Butterfly trunk rotations	Start in the kneeling butterfly finish position with the pads together and the knees on the ice. Rotate at the trunk to the right and touch the left hand to the right buttock, then rotate back to the left and touch the right hand to the left buttock. Alternate back and forth.
	
Stepping forward/backward over stick	Stand at the upright ready position in the middle of the goal crease. Position a stick on the ground parallel to the goal line. Step forward over the stick, one leg at a time, and then step backward to the original position, 1 leg at a time. Alternate starting legs each repetition.
Sidesteps over stick	Stand at the upright ready position in front of the left goal post. Position a stick on the ground on the right side, perpendicular to the goal line. Step laterally over the stick, 1 leg at a time, and then step in the opposite direction, back over the stick to the original position, 1 leg at a time.
Transitions around circle, without and with a pass	Stand on 1 edge of the face-off circle at the center line. Skate backward around the first quarter of the circle, transition to skating forward around the next half of the circle, and then transition again to skating backward for the final quarter. Add passes back and forth from the therapist or coach as the motion is mastered.
Shuffle steps around crease	Stand at the upright ready position on the left side of the goal crease on the goal line. Shuffle step with the outside leg, pushing the body around the crease to the opposite side. Return back to the starting position, shuffle stepping with the opposite leg.

APPENDIX

Exercise	Description
Puck movement	Position 3 pucks on the ice in an "L" shape, with approximately 6 ft (2 m) between the pucks. Start behind the first puck and use a double-leg C-cut to propel forward to the second puck. Push off with the outside leg to move laterally to the third puck and come to a stop. Next, push off with the opposite leg, at a 45° angle, to return to the start position and to a complete stop. Repeat the movement with the triangle facing the opposite direction to switch the legs used to push off from each side. 

Phase 4

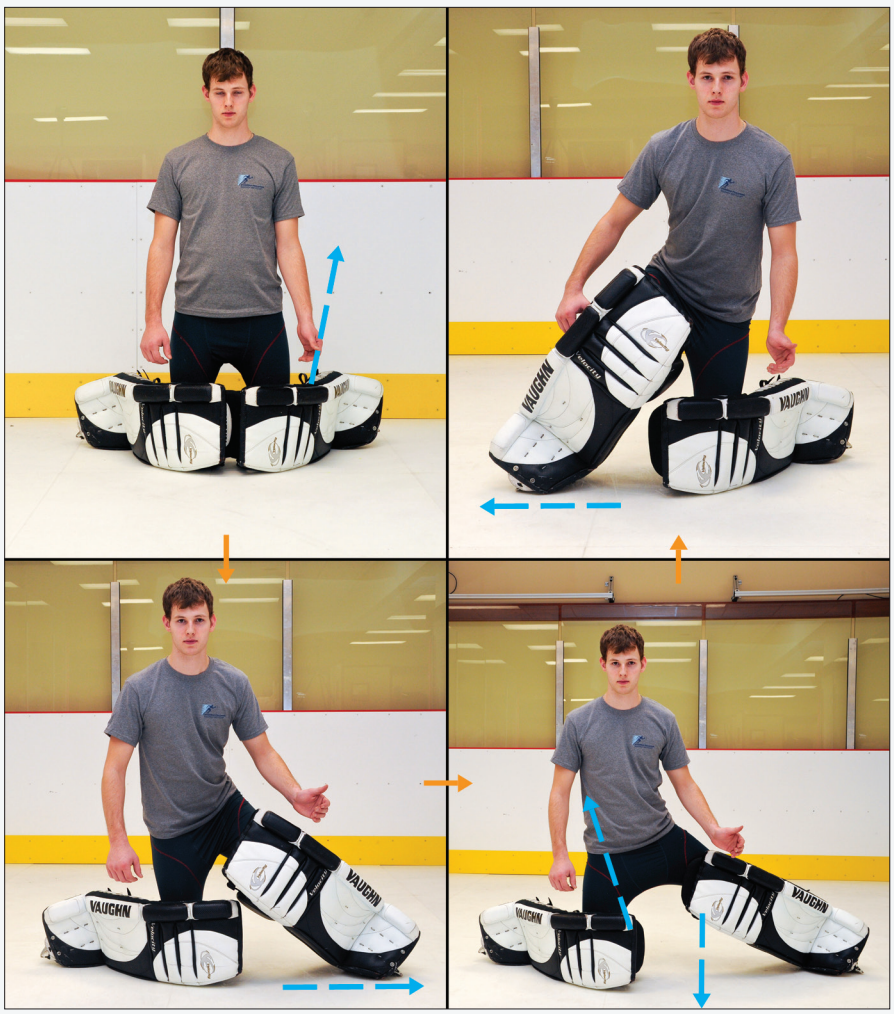
Exercise	Description
Top of crease to shuffle along crease to each post	Start on the left front edge of the crease. Shuffle step along the perimeter toward the right side of the crease, stopping a few feet short of the goal line. Shuffle step back toward the left, stopping a few feet short of the goal line, and then skate backward to the back post. Sidestep across the crease and then diagonally back to the starting position.
X box top of crease and return to top of crease	Start by standing in front of the right goal post. Push off with 1 stride at a 45° angle and stop at the left front edge of the crease. Push off again and stop at the right front edge of the crease. Finally, push off and skate backward to the left goal post and begin the movement again from the opposite side.
5-puck crease shuffle	Place 5 pucks to serve as markers 3 ft (1 m) in front of the crease in an equidistant, semicircular pattern. Start on 1 side and shuffle step along the crease, taking 1 push between each puck marker. When either edge is reached, push off backward and touch the outside skate to the goal post, and then return in the other direction.
Random 5-puck slides	Using the same puck alignment described in the 5-puck crease shuffle, start by standing in the middle of the goal. Have a trainer or coach stand in front of the goaltender with a stick and randomly point at 1 of the pucks. Use 1 stride to move toward and stop in front of the indicated puck, and then return to the edge of the goal, touching the outside skate to the goal post before returning to the middle of the goal crease. Move to the next puck selected and repeat the exercise.
Transitions around the goal net	Skate in a circular pattern around the goal using the outside leg for propulsion, while the inside leg controls balance and direction. Transition from skating backward to forward each time the front and back of the goal is crossed, respectively.

APPENDIX

Exercise	Description
X box top of crease to top of crease and to far post	Start by standing in front of the right goal post. Push off with 1 stride at a 90° angle and stop at the right front edge of the crease. Turn, push off again, and stop in front of the left goal post. Push off again at 90° and stop at the left front edge of the crease. Finally, turn and push off again and stop in front of the right goal post.
Box crease	Start by standing in front of the right goal post. Push off with 1 stride at a 90° angle and stop at the right front edge of the crease. Turn and push off again and stop at the left front edge of the crease. Push off again and stop in front of the left goal post. Start the exercise again in the opposite direction to return to the starting position in front of the right goal post to form a box.

Phase 5

Exercise	Description
Butterfly glides	Start in the down butterfly position with the knees together. Raise the right leg and push off while keeping the left leg on the ice. Glide across the ice before raising the left leg to stop and push off back to the right, this time with the right leg remaining on the ice. Alternate back and forth in 1 fluid motion.



APPENDIX

Exercise	Description
X box top of crease to top of crease butterfly and to far post butterfly slide	Start by standing in front of the right goal post. Push off with 1 stride at a 90° angle and stop at the right front edge of the crease, then drop down into a butterfly position with the knees together. Turn and push off again, while staying in the butterfly position, and stop in front of the left goal post. Stand up and push off again at a 90° angle and stop at the left front edge of the crease, before dropping into the butterfly position with the knees together. Finally, turn and push off again, stopping in front of the right goal post before returning to a standing position.
X box top of crease to top of crease with butterfly slide and to far post glide	Start by standing in front of the right goal post. Push off with 1 stride at a 90° angle and stop at the right front edge of the crease, then drop down to a butterfly position with the knees together. Push off again, while staying in the butterfly position, and stop at the left front edge of the crease. Stand up and push off again at a 90° angle and stop in front of the left goal post. Push back to the left front edge of the crease and repeat the maneuver across to the right side.
Top of crease, butterfly to T-slide, and slide to post	Start in the center of the crease in front of the goal. Drop down into the butterfly position with the knees together, bounce up, and push off the left leg to take 1 stride to the right side of the crease. Stop at the right front edge of the crease and then push backward, touching the outside skate to the right goal post. Return to the center and repeat the exercise in the opposite direction, pushing off the right leg and finishing at the left goal post. After completing both directions twice, add a butterfly slide across the crease, as one transitions from side to side, instead of returning to an upright position between sides.
Top of crease butterfly to glide, and to post	Start standing in front of the right goal post, facing the side of the rink, and push off at a 90° angle and stop at the front right edge of the crease by dropping into a butterfly position. Then, push off with the right leg to butterfly glide across the crease, stopping at the left goal post. Return to a standing position and push off to the front left side of the crease, again returning to a butterfly position. Push off with the left leg and butterfly glide across the crease to the right goal post. Return to a standing position and repeat the exercise.
Butterfly rebound directions	Stand in the front of the crease. Have a trainer or coach line up 5 pucks, about 8 inches (20 cm) apart, at the edge of either face-off circle. Have the trainer/coach lightly send pucks along the ice, alternating aiming at either side of the goal. Drop down into the butterfly to deflect the shot with the stick or blocker pad, while returning to a standing position in the middle of the crease between shots.
Dump and chase	Start standing at the left front edge of the crease. Have a trainer/coach dump a puck in behind the goal. Practice coming out of the goal and stopping the puck along the boards behind the goal net. Return the puck with a firm pass back to the trainer or coach before returning to the crease. Switch sides after 5 to 10 repetitions and work on both backhand and forehand puck clearances.