



# Rehabilitation Guide

## *Anterior Cruciate Ligament Reconstruction*

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Sports Medicine



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# Rehabilitation Guide

## *Anterior Cruciate Ligament Reconstruction*

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# General Information

## Before Your Surgery

Before your surgery you will have appointments in two clinics: Sports Rehabilitation and Sports Medicine. In most cases these appointments will be scheduled sequentially on the same day. The appointments with your physical therapist and your surgeon will occur at the UW Health Sports Medicine Center. You may also need to be seen in the Anesthesia Screening Clinic at University of Wisconsin Hospital and Clinics. This will be determined by the physician assistant during your appointment at the Sports Medicine Clinic.

### Sports Rehabilitation appointment

During this appointment you will:

- be fitted with a postoperative knee brace if indicated based on your surgery
- be fitted with and given instructions in proper use of crutches (if you don't already have some)
- be issued and instructed in the use of a postoperative cooling unit
- review your immediate postoperative exercises
- have a KT-1000 test to measure the laxity in your knee
- set up additional postoperative appointments, approximately two times a week for 2-3 weeks

### Sports Medicine Clinic appointment

During this appointment a pre-surgical physical and an examination of your knee will be performed. You will also have an opportunity to discuss the surgery with your physician. You will also be given prescriptions for pain medication (Tylenol #3, Percocet) and anti-inflammatory/pain medication (Toradol). You will need to fill these prescriptions prior to surgery. The Percocet prescription will expire if it is not filled within two weeks of issuance. Staff will inform you when you should stop eating and drinking prior to surgery.

### Anesthesia Screening Clinic appointment

You may be asked to see the Anesthesia Screening Clinic if you have certain illnesses or past problems with anesthesia. Any questions that you may have about the anesthesia will also be addressed.

## Day Before and Day Of Surgery

1. Do not eat or drink after 12:00 a.m. on the day of your surgery.
2. Scrub your leg with the Hibiclens the night before and the morning of your surgery.
3. Call the outpatient surgery clinic at (608) 263-8804 if they have not called you by 3:00 p.m. the day before surgery.
4. Report to F6/2, the Outpatient Surgery Center, at the time given to you.

Remember to bring the following items to the hospital for your surgery:

- crutches
- postoperative knee brace
- postoperative cooling unit
- shorts
- comfortable and secure walking shoes

## Incision and Drain Care

The use of a drain will be determined by your surgeon. If you have a small drain in your knee, your nurse will show you how to empty the drain and measure the drainage before you go home. If the reservoir becomes full, it can easily be emptied from the side opening. Measure the amount of drainage in the morning, or sooner if the reservoir is full. It is usual to have a decrease in the amount of drainage. It is normal to see some clot formation in the tubing. Do not shower while the drain is in your knee.

Keep your dressings dry. A wet dressing is a prime site for bacterial growth. If you shower, you must use a secure plastic wrap to keep your knee dry. If your dressing has visible drainage, your physical therapist may change the dressing before your two-week follow up with the doctor.

Watch for signs of infection which include fever greater than 100° F, chills, redness at the incision, increased knee pain not associated with activity, or cloudy, pus-like drainage from your incision.

## Day After Surgery

- Most patients are seen the day after surgery to begin their post-operative rehabilitation, your surgeon will determine this. If you have a small drain in your knee it will be removed prior to your rehabilitation/physical therapy appointment. During this appointment your physical therapist or athletic trainer will help you begin the phase one exercises and also make sure you are walking and moving about safely. It is usually helpful to take your pain medication prior to the removal of the drain and start of the rehabilitation.
- You should begin the exercises prescribed for you on the first day after your surgery. These exercises were explained to you by your physical therapist or athletic trainer at your pre-surgical appointment.
- You should weight bear as tolerated on your surgical leg, using crutches to assist you in walking. Your surgeon will determine if you also need to use a brace post-operatively. Putting the foot on the floor with some pressure will reduce your risk of falling.
- When you are not using your cooling unit, you should remove the polar pad, without removing the dressings underneath the pad, to allow the dressings to air out. This will prevent condensation from forming on those dressings. Do this a couple times each day after surgery.

## Swelling Control

During the first 24-48 hours after surgery, you may run your cooling unit continually. For days 2-7, you should use the cooling unit 4-6 times per day for about 45 minutes each time. The frequency of icing after the first 7 days will depend on how well your swelling is controlled. More swelling will require more icing. When you are not using the cooling unit, you should remove the pad over the knee. The pad should be removed for at least eight hours per day. This will prevent condensation from forming underneath the pad. If you have a reconstruction using a hamstring graft, you may find it helpful for pain relief to alternate the position of the polar pad between the front of your knee and the posterior medial (back inside) aspect of your knee where the incision is located. Be sure to have ample ice at home.

Elevation and compression will also help to decrease swelling. While icing, you should try to elevate your knee above your heart. When you are not icing, an ACE® wrap may be used for compression. The ACE® wrap should always be more snug below the knee and less snug above the knee, to push the fluid towards the heart and not towards the foot.

## White Compression Stocking

You may stop wearing the white compression stocking on your non-operative leg after 24-48 hours. This compression stocking helps prevent a blood clot from forming in your leg. Once you are walking frequently you will no longer need the stocking. If you develop lower leg swelling, tenderness, and/or redness, please contact the Sports Medicine Clinic or the Sports Rehabilitation Clinic.

## Brace

Your surgeon will determine if it is necessary for you to wear a brace after surgery. This will depend on the time of year, other injuries in addition to the ACL tear and type of procedure you have done. If your meniscus is repaired you will have a brace that keeps your knee locked while weight bearing for the first few weeks, but you will be able to unlock the brace or remove it for range of motion exercises that are non-weight bearing. Your surgeon and physical therapist or athletic trainer will determine when you can begin to remove the brace.

## **Return to Work**

Returning to work will vary for each person. Even if you have a desk job, you will want to be off work for 7-10 days. If you do not have a desk job, your return to work will be related to how well you are able to control the swelling and protect the knee from potentially dangerous movements.

## **Rehabilitation**

You will be working with a physical therapist or an athletic trainer who will determine the frequency of appointments needed, based primarily on your progress. The recovery of strength, balance and movement control will occur over 4-8 months. Your compliance with your rehab program will be the main determinant in the return of your strength, balance and movement control.

Return to certain activities and sports will depend on how stressful the activity is on your knee as well as strength, balance, and movement control. Return to high demand

sports such as basketball and soccer is approximately six months. Ultimately your return to certain activities and full return to sports is not based on a specific time frame but instead on your demonstrated ability to do sport related movements safely. This is a function of your strength, balance, power, mobility, landing mechanics, endurance and mental readiness. Your physician and rehab team (physical therapist and/or athletic trainer) will decide when you are able to safely return to sports without restrictions based on various performance tests.

## **Driving**

You may return to driving when you feel comfortable and when you have adequate reaction time. It is in your best interest not to drive (unless it is the left knee and you are driving an automatic transmission) until your brace is unlocked. Also remember, it is unsafe to drive while taking narcotic pain medication (for example, Percocet or Codeine).

# Special Precautions

Certain procedures may require slight modifications to the normal ACL post-operative restrictions. Please see the list of procedures and associated precautions:

## **Meniscal repair**

Patients of Drs. Graf, Dunn, Baer and Keene should not perform any weight bearing with knee flexion (bending) for four weeks. This requires the patient to wear the brace locked while walking for four weeks. This protects the meniscal repair sutures and anchors. You are allowed to work on flexion range of motion in non-weight bearing positions. While performing these exercises, be cautious to avoid a pinching type discomfort or pain in the back of the knee.

Patients of Dr. Scerpella do not have any precautions for range of motion or weight bearing when a meniscal repair is performed with an ACL reconstruction.

The above precautions are the “standard” precautions for each surgeon's usual procedure, but these precautions may change based on location or size of meniscus tear, time of year or patient's weight.

## **Allograft (cadaver) ACL graft**

With an allograft, it is important to realize that pain is not a sufficient guide for activity. Often with this procedure you will have less pain, but the graft still requires significant time for healing. Follow your physical therapist's or athletic trainer's instructions carefully. Also, patients should not do more than 10-15 minutes of biking per day to avoid repetitive stress as the graft is healing.

## **ACL reconstruction in the skeletally immature patient (“over the top” procedure)**

Patients should not perform any weight bearing with knee flexion (bending) for six weeks. This requires the patient to wear the brace locked while walking for six weeks, although when the brace is locked they can put weight on it. They may work on gentle flexion in non-weightbearing positions. The patient will not be starting Phase 2 of the rehabilitation guide until six to eight weeks after surgery and subsequently all timeframes should be adjusted by an additional six weeks.

## **Microfracture**

Patients need to modify the normal weight bearing progression to protect the healing fibrocartilage matrix. During the first two weeks, patients should be non-weight bearing (no weight placed on the involved leg), and during weeks three and four they should be touchdown weight bearing (20-30 lbs.). At the start of week five, they can slowly begin to put more weight on the involved leg with the goal of achieving full weight bearing by six weeks, post-operatively. During this time, the brace may be unlocked if the patient has good leg control.

## **OATS procedure (allograft or autograft)**

Patients need to modify the normal weight bearing progression to protect the healing cartilage plug(s). During the first three weeks patients should be non-weight bearing (no weight placed on the involved leg), and during weeks four through six they should be touchdown weight bearing (20-30 lbs.). At the start of week seven, they can slowly begin to put more weight on the involved leg with the goal of achieving full weight bearing by seven to eight weeks, post-operatively. During the first six weeks the brace should be locked in extension (straight).

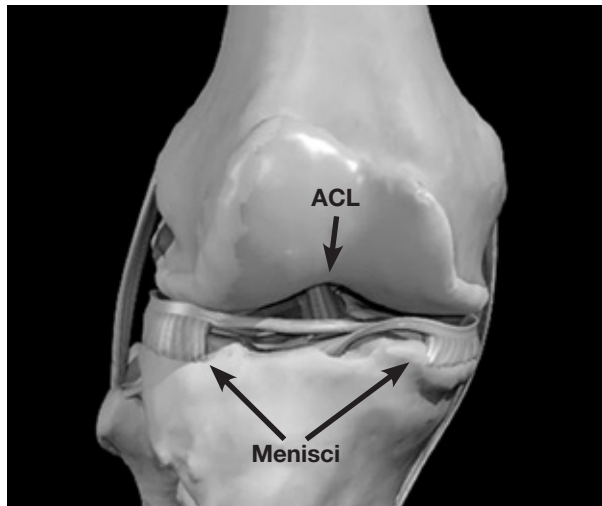
## **Medial Collateral Ligament (MCL) Injury**

If a patient has a concomitant MCL injury they may be braced longer after ACL surgery. If the MCL is not operated on but still healing this may protect it more, if the MCL is repaired it will protect the repair until healed.

# Understanding the Anterior Cruciate Ligament

## Anatomy

The knee joint is composed of the femur (thigh bone), tibia (shinbone), and the patella (knee cap). The knee joint is primarily a hinge joint, but it does allow a slight amount of rotation during bending and straightening movements. Sitting between the tibia and femur are two pads of cartilage called the medial meniscus and lateral meniscus (collectively termed “menisci”). The menisci act as shock absorbers between the femur and the tibia that protect the joint surfaces. The shape of the menisci increases the concavity of the tibial surface, which enhances the stability of the knee joint (Figure 1).



*Figure 1. View of the front of the knee with the patella removed*

A ligament is a bundle of connective tissue that connects one bone to another bone. The anterior cruciate ligament (ACL) is one of the four major ligaments in the knee that connect the tibia to the femur. The ACL is located in the center of the knee along with the posterior cruciate ligament (PCL). The ACL's primary function is to prevent the tibia from shifting forward under the femur and to control the amount of rotation in the knee joint. Embedded in the ACL are nerve endings and mechanoreceptors, called proprioceptors, that send signals to the brain and central nervous system about the joint position of the knee. When these nerve endings are

stimulated, the central nervous system activates muscles around the knee to bring the joint into a more stable position. Thus, the overall function of the ACL gives the knee joint stability during movement.

## Mechanisms of Injury

There are two typical mechanisms of injury that lead to a torn ACL. The primary mechanism is a shearing of the ACL when a sudden shifting occurs between the tibia and the femur. This can occur when a person is running and attempts to rapidly slow down and change direction at the same time, or attempts to turn quickly after the foot has been planted.

The second mechanism is hyperextension of the knee causing failure of the ligament from excessive stretching. Hyperextension can occur as a result of landing from a jump with the knee extended or by sustaining a blow to the front of an extended knee.

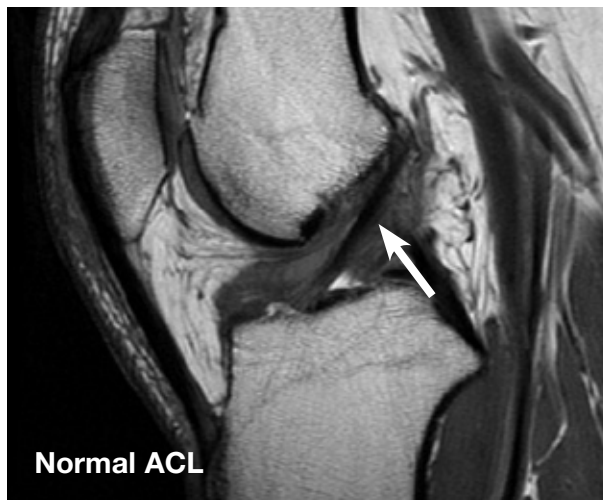
## Diagnosis

The diagnosis of a torn ACL is often suspected from the description of the injury and immediate after effects. In addition to describing a mechanism listed above, 85% of patients will feel a pop at the time of injury and most will have significant swelling within two to three hours of injury. Almost all athletes will have to stop playing because of the injury. Specific clinical exam tests and the use of a KT 1000 can be used to determine if the knee is loose (laxity) which may indicate a torn ACL. An MRI provides an image of the ligaments of the knee and determine if the ACL is torn (Figure 2). Often times an MRI is used to determine the presence of other injuries, such as meniscal tears, chondral lesions or other ligament injuries, whether or not the ACL is torn.

## Consequences of Injury

If the ACL is torn, the stability of the knee joint is compromised. This may lead to episodes of knee instability or giving way, particularly during activities that require jumping or changing directions quickly. Repeated episodes of knee instability increase the risk for injury to the menisci and may lead to premature degeneration of the joint surfaces.





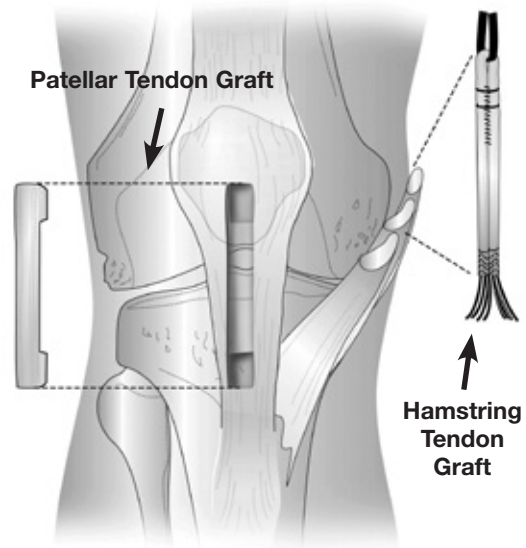
*Figure 2: MRI images of the ligaments of the knee*

## Treatment Options for a Torn ACL

Surgery is not always indicated for, nor desired by everyone who tears his or her ACL. In some cases it is possible to do well by following a rehabilitation program and avoiding activities that require cutting and/or pivoting movements.

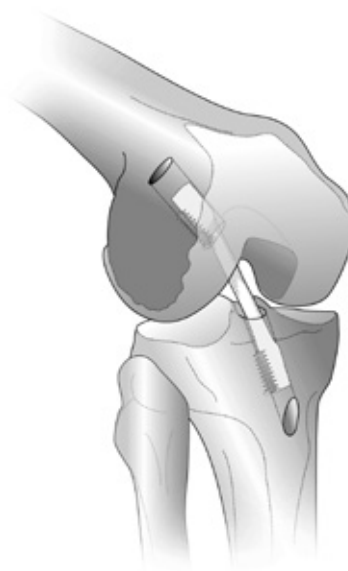
If surgery is chosen, the patient should undergo a preoperative physical therapy exercise program to regain normal knee range of motion, decrease pain and swelling and strengthen the musculature around the knee. This may last three to six weeks, but will allow the postoperative course to progress faster.

Surgical reconstruction involves replacing the torn ACL with a graft. The most common grafts used are the patellar tendon graft, the hamstring tendon graft and an allograft (cadaver).



*Figure 3: Donor sites for patellar tendon and hamstring tendon grafts*

## Patellar Tendon Graft



*Figure 4: Example of a bone-patellar tendon-bone graft using two interference screws*

The patellar tendon graft is usually taken from the knee that has the torn ACL, although occasionally the patellar tendon of the uninjured knee may be utilized. In this procedure, the central third of the patellar tendon is removed along with a bone plug at each end of the tendon.

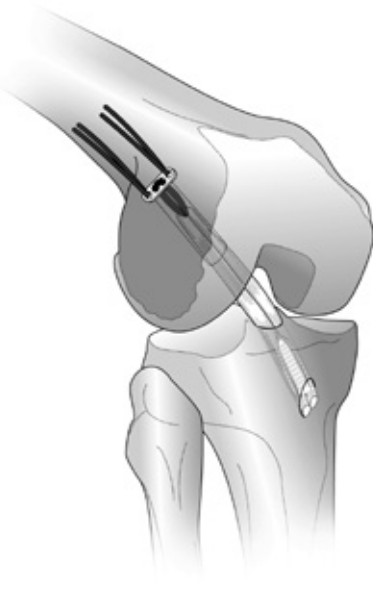
One bone plug is taken from the patella and the other is harvested from the tibia (Figure 3). Tunnels are drilled in the femur and the tibia near the normal attachment sites for the ACL.

The patellar tendon graft is then threaded through the tunnels so that it is placed where the original ACL was located. The bone plugs of the graft are then anchored with screws into the femur and tibia.

The disadvantage of the patellar tendon graft is that patients occasionally have problems with anterior knee pain or patellar tendonitis because of the location from which the tendon graft was taken.

Removing the central third of the patellar tendon often causes more immediate post-operative stiffness than using a hamstring graft. This may require more initial work with range of motion exercises.

## Hamstring Tendon Graft



*Figure 5: Example of a hamstring tendon graft using an endobutton on the femoral side and a interfix screw on the tibial side.*

The hamstring graft is a relatively newer graft than the patellar graft, but evidence supports that it is a good option. Recent studies have shown success rates and return to sport times to be similar to those of patellar tendon grafts.

The hamstring tendon graft is also usually taken from the knee that has the torn ACL. A strip of tendon is taken from two muscles, the semitendinosus and gracilis. These two muscles are located on the back of the knee on the inner (medial) side. The two tendons are then put together to make one graft. This graft does not have attached bone. Tunnels are drilled in the femur and the tibia at the normal attachment sites for the ACL. The hamstring graft is then threaded through the tunnels so that it is placed in the location of the original ACL. The graft is anchored in the tibia and femur with either screws or buttons (Figure 5). Another advantage of the hamstring graft procedure is that there is usually less postoperative pain and tendonitis.

## Quadriceps Tendon Graft

A quad tendon graft is usually taken from the knee that has the torn ACL. A strip of tendon is taken from above the knee cap, including a small piece of the knee cap as well. This bone creates a bone plug for fixation with an interference screw in the tibial tunnel and the tendon is placed in the femoral tunnel with soft tissue fixation techniques. The advantages of this graft are that a thick and adequate graft can be easily harvested and may create less donor site symptoms and less quadriceps inhibition than the patellar tendon graft.

## Allograft

An allograft is tissue used from a cadaver. This could be a bone-patellar tendon-bone graft (Figure 4) or a soft tissue graft (hamstrings, Achilles). The potential advantages of an allograft include less chance of patellofemoral symptoms, shorter operative time, availability of larger grafts, smaller scars on your skin and the possibility for multiple ligament reconstructions.<sup>3</sup> Possible disadvantages include increased cost, sub-optimal healing leading to a potential graft rupture, disease transmission and immune reactions. These cases have been reported, but are extremely rare.

*The UW Health Sports Medicine physicians use all of the grafts described above to best meet the needs of their patients. It is important to discuss with your surgeon which graft choice is best for your individual situation.*

## Rehabilitation

Post-operative rehabilitation is essential in optimizing your function and return to sport after an ACL reconstruction.<sup>6</sup> Frequently during an ACL reconstruction, other injuries or pathologies are addressed during surgery. These additional procedures require special post-operative precautions. (see page 5). The process of returning to physical and athletic activities is not based on time, it is based on the individual's ability to achieve certain milestones or criteria. The time needed to do this will vary from individual to individual.

Post-operative rehabilitation begins the day after surgery. The four phases of post-operative rehabilitation are described in detail in this booklet. Your compliance with this program will have a direct effect on your function and return to sport.<sup>4,6</sup>

During the first phase of rehabilitation, the goals are to increase your range of motion and strength, and return to walking without crutches. There is evidence that pain and swelling can hinder or inhibit your ability to generate muscular force in your leg, especially your quadriceps.<sup>7</sup> Thus, it is important to minimize swelling and pain to help restore your strength – your ability to get stronger is limited if your knee is swollen. You can decrease swelling by elevating your knee above your heart, icing your knee with the cooling unit, using compression wraps on your leg and avoiding too much activity the first few weeks after surgery. In addition to your prescribed medications, the points listed above will also help to minimize your pain. Scar tissue massage/mobilization and patellar mobilizations may also be used to help decrease pain.<sup>1</sup>

As pain and swelling decrease, you will begin more specific strength training exercises in Phase 2. During this phase it is still important to monitor the return of any pain or swelling. Phase 2 will also focus on restoring your strength and proprioception. There is evidence to show that strength deficits have a direct effect on functional outcomes and return to sport.<sup>4,6</sup> Proprioception is a sensory modality that provides internal feedback solely on the status of the body's position, movement and alignment.<sup>2,5</sup> Various balance exercises will be used to help improve and recover your proprioception. These exercises also help to regain strength.<sup>2</sup> In subsequent phases when jumping, cutting

and pivoting are emphasized, it is essential that the body is in correct alignment.

One primary goal of Phase 3 is to eliminate strength differences between both legs. You will be doing strenuous strength training exercises three to four times a week. Often times it may be necessary to do more sets and repetitions on the surgical leg than the non-surgical leg to eliminate the difference. You must also be careful not to compensate or “overuse” the non-surgical leg while doing your strengthening exercises, as this will have the reverse effect on the difference. During this phase your physical therapist or athletic trainer will also begin to introduce running, agility and impact (jumping) exercises.

Phase 4 of rehabilitation is termed “athletic enhancement”. This is the phase where you will work on sport-specific movement drills.<sup>5</sup> Although you will perform some exercises and movements from earlier phases, you will be working on doing these activities at higher speeds until you progress to game speed. Conditioning drills for muscular endurance and cardiovascular conditioning are included in this phase. Being released to return to sport is a collaborative decision between your surgeon and physical therapist or athletic trainer. They will use a series of tests to help determine your readiness for sport, including a computerized strength test (Biodex), a series of hopping tests, a shuttle run and a balance test.

The chance of re-tearing your ACL after surgery is 5-15%.<sup>8</sup> There is actually a greater chance of tearing your other ACL, the risk being 10-22%.<sup>8</sup> The reason for the greater risk on the other side is not entirely known. It may be due to your anatomy, compensation for your surgical knee or genetic risk factors. Some of these risk factors cannot be modified, but there are measures you can take to reduce the overall risk of another ACL tear. Research has shown that continuing proprioceptive exercises and continuing to train your landing mechanics and deceleration will reduce your risk of ACL injury. Your physical therapist or athletic trainer will give you recommendations and guidelines to continue these exercises after you are discharged from therapy. UW Health Sports Rehabilitation also offers individual and group training programs for injury prevention.

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# UW Health Sports Rehabilitation: Progressive ACL Testing for Return to Sport

Patients will be seen in coordination with their physician follow-up visits. Follow-ups are scheduled immediately prior to physician visits. These visits are generally scheduled at 2, 3, 4 and 6 months post ACL reconstruction. All visits will be scheduled for 60 minutes and will consist of a progression of testing beginning with a basic knee assessment and measurements (height, weight, limb length, etc.). The following tests will be performed and progression to the next test on the list is dependant on level of limb symmetry index (involved limb/uninvolved limb x100) and therapist's assessment of the quality of movement—i.e. the alignment and balance during landing.

## Joint Assessment

- Limb length – measured at 1st testing visit
- Height and weight
- Range of Motion
- KT-1000 testing (performed at all follow-up visits)

## Strength Testing

- Y-Balance Test
- Single-leg Press Test
- Isokinetic Strength Testing
  - o 60°/sec
    - Quadriceps peak torque
    - Hamstring peak torque
  - o 240°/sec
    - Quadriceps total work
    - Hamstring total work

## Jump / Landing Mechanics

- Double-leg Jump/Landing Symmetry (Force plate test)
- Landing Mechanics (LESS test)

## Performance Testing

- Vertical Hop
- Vertical 4 Hop
- Horizontal Hop
- Horizontal Cross-over Hop
- Repeated Hop for fatigue

## Psychological Testing

- Psychological readiness to return to sports scale
- TSK-11

## Notes:

- Appropriate clinical decision making needs to be employed by the physical therapist or athletic trainer to make sure the individual patient is ready for each test since some patients may need to delay their testing. Patients should be encouraged to test as hard as they feel is safe.
- For all testing it is important that the patient controls the landing positions. Failure to hold a landing position with control is deemed a failed attempt and must be repeated. Control for this purpose is defined as at least a full second of single-leg balance after landing.

## Return to Sport

Return to sport is collaboratively determined by the surgeon, sports rehabilitation staff and athlete. Return to sport includes return to selected drills, partial participation and full unrestricted participation. (see the *Participation Continuum* on the following page) The above tests will help determine when it is safe for you to return to sport. It is important to realize that return to sport is not based on a specific timeline; it is based on the individual athlete's ability to meet physical performance criteria, mental readiness, age, sport and the position you play.

*(continued)*

## **Participation Continuum:**

1. Movement Patterns
  - a. Sprinting
  - b. Shuffle
  - c. Carioca
  - d. Zig-zag cutting
  - e. Shuttle change of direction
2. Closed Drills – sport-specific drills without opposition in a controlled speed environment
3. 1 on 1 Drills (no-contact) – sport-specific drills/ activities where the athlete is expected to react to his/ her opponent without compensation
4. 1 on 1 Drills – full speed 1 on 1 drills with game necessary contact
5. Team Scrimmage (no-contact) – patients are asked to wear a different colored jersey to indicate there contact restrictions during team scrimmaging when appropriate
6. Team Scrimmage – full scrimmaging
7. Restricted Play – progressing time and situational play as appropriate.
8. Full return to play

# Phase 1

## *Acute Management/Early Motion and Basic Movement Retraining*

This phase begins immediately after surgery and continues for 2-4 weeks, depending on your progress. To promote proper healing it is important not to progress too rapidly.

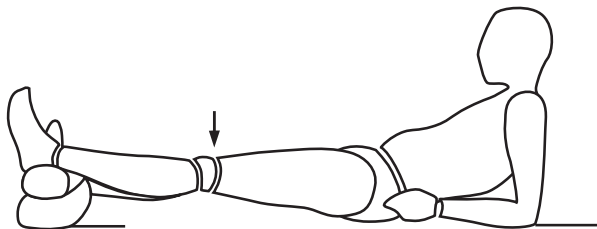
### Goals

1. Achieve full active knee extension equal to the uninvolved side
2. Eliminate swelling
3. Restore the ability to control the leg while weight bearing
4. Achieve at least 125° of knee flexion
5. Be able to lift the leg in all directions without assistance
6. Normalize walking pattern with the assistance of crutches and/or brace

### A. Range of Motion (ROM) Exercises

#### Extension on a bolster (below)

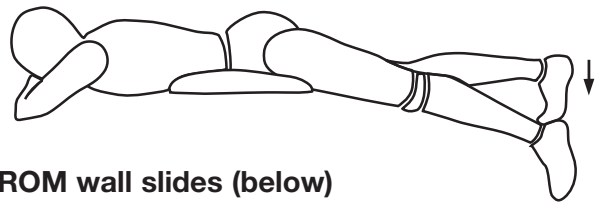
While sitting or lying down with the brace off, support your heel on a towel roll. Now let your knee straighten as much as possible. To increase the stretch you may activate your quadriceps muscle or apply some pressure (your hands or weight) on the thigh, but not over the knee cap. You should feel some stretching and mild discomfort behind the knee. **Hold this stretch for 1-5 minutes, rest for 30-60 seconds, repeat 3-5 times consecutively, and perform 3-5 sessions per day.**



#### Prone hangs (below)

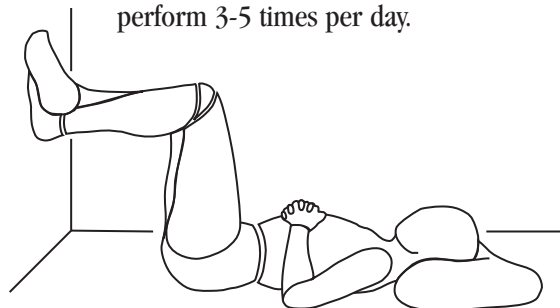
Lie on your stomach with your brace off and your knees and lower legs hanging off the bed or table. Try to keep your hips down on the table. You may place a small weight on your ankle or use the other foot to apply some downward pressure onto the heel to increase the stretch. You should feel some stretching and mild discomfort in the back of the knee. **Hold this for 1-5 minutes, rest for 30-60 seconds, repeat 3-5 times consecutively, and perform 3-5 sessions per day. This exercise should not be done if your surgery was performed with a hamstring graft.**

*NOTE: You may do either exercise 1 or 2 but it is not necessary to do both unless you were specifically instructed to do so.*



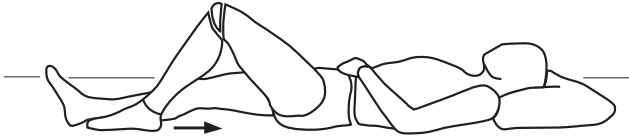
#### ROM wall slides (below)

Lie on your back with your involved foot up on the wall, with your brace off. Slowly slide the foot down the wall as far as possible. You may use your other foot to push the involved foot farther down the wall. At this point it is normal to feel pressure in the front of the knee. **Hold this for 5-10 seconds,** Then push into the wall and slide the foot back up until the knee is flexed approximately 90°. Now push into the wall for 10 seconds, such that you are performing an isometric leg press. Now slide foot up until the knee is fully extended. **Repeat 15-25 times, and perform 3-5 times per day.**



### Heel slides with assist (below)

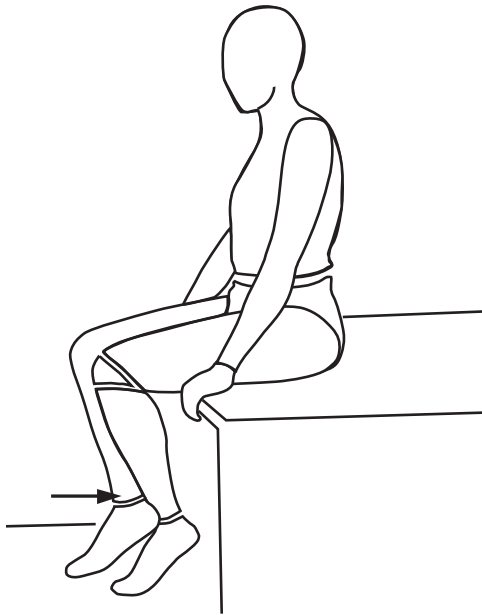
Lie on your back with your brace off and slowly slide your foot toward your hips, as far as possible. You may use your other foot to push for greater motion. At this point it is normal to feel pressure in the front of the knee. **Hold this for 5-10 seconds**, Now slide the foot back until the knee is fully extended. **Repeat 15-25 times, and perform 3-5 times per day.**



### Seated knee flexion (below)

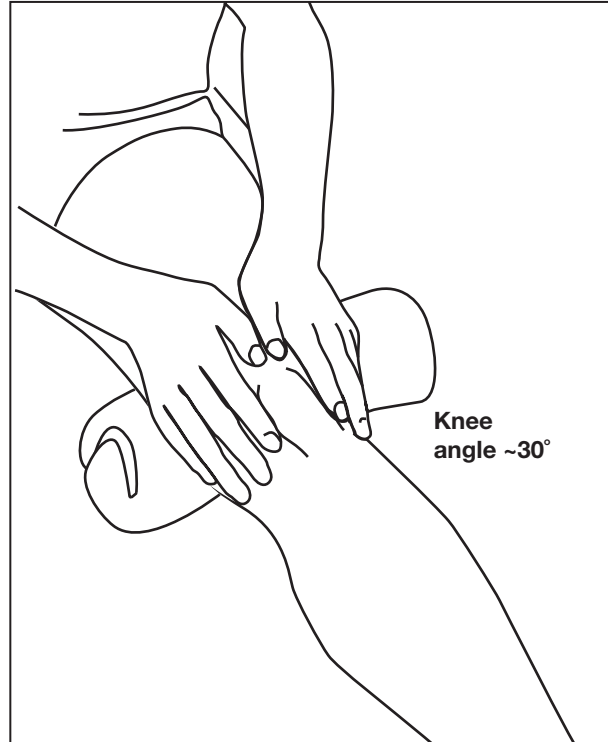
Sit with your leg off the edge of a table or chair. Your brace should be off. Allow the knee to bend as far as possible. At first you may need to use the opposite leg to help slowly lower the foot. Then use the uninvolved foot to apply a little overpressure over the foot, trying to bend it further. At this point it is normal to feel pressure in the front of the knee. **Hold this for 5-10 seconds, Repeat 10-20 times, and perform 3-5 times a day.**

*NOTE: It is necessary to do exercises to increase knee flexion. The previous three exercises all work on increasing knee flexion. If there is one that works better for you, you may do that exercise more often and spend less time on the other flexion exercises. They should be done with your brace off.*



### Patellar mobilizations (below)

With your fingers, palpate the edge of your patella (knee cap). Then gently glide the patella in four directions; up, down, to the inside and to the outside. Try not to tip or tilt the patella, but slide it. **Hold for 2 seconds at the end of the glide.** This will prevent scar tissue from forming around the patella. **Glide in each direction for 1 minute, and perform 3-5 times per day.**



*Place a towel under knee so knee is flexed approximately 30°.*



## B. Muscle Activation

### Quad sets

With the knee fully extended, contract your quadriceps muscle as much as possible and **hold for 5-10 seconds**, then **relax for 5 seconds**, Repeat for **2-3 minutes**.

### Straight leg raises

Once you can achieve a good quad set you can attempt to lift the leg up 12 to 16 inches while maintaining full knee extension. This should be held for 5-10 seconds, and repeated 10-15 times. Your physical therapist or athletic trainer will determine if you should do this with the brace on or off.

*NOTE: If the patient is having difficulty with quadriceps activation using the above exercises it may be helpful to try some short arc quad or full arc quad movements to assist in the re-activation. Electrical stimulation may also be helpful in this phase.*

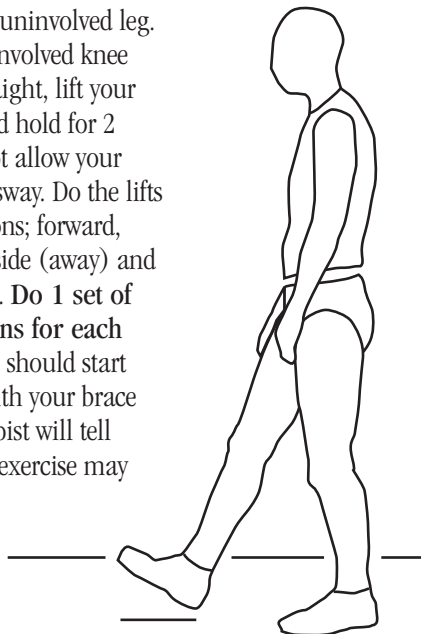
### Hamstring sets

Sit on the floor. With your knee slightly bent, push your heel into the floor. You should feel your hamstrings contracting on the backside of your thigh. **Hold for 5-10 seconds**, then **relax for 5 seconds**. Repeat for **2-3 minutes**.

*NOTE: This exercise should not be done if your surgery was performed with a hamstring graft.*

### Standing leg lifts

Stand on your uninvolved leg. Keeping your involved knee completely straight, lift your leg forward and hold for 2 seconds. Do not allow your upper body to sway. Do the lifts in four directions; forward, backward, outside (away) and inside (across). **Do 1 set of 5-10 repetitions for each direction**. You should start this exercise with your brace on. Your therapist will tell you when this exercise may



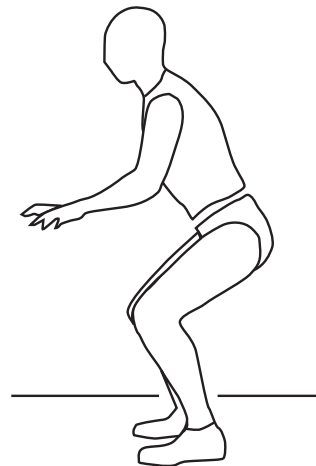
be done with the brace off and when you may begin doing this exercise standing on your surgical leg.

### Weight shifting

Stand with your feet shoulder width apart and knees slightly bent. Shift your weight from one foot to the other. **Hold for 5-10 seconds**. This can also be done with one foot in front of the other, shifting your weight forward and backward from one foot to the other, holding for 5-10 seconds. **Continue these various weight shifting patterns for 2-3 minutes**. You should start this exercise with your brace on and your therapist will tell you when it is okay to remove the brace.

### Double leg mini squats

Stand with your feet shoulder width apart. Perform a mini squat by bending your knees and flexing your hips. A good squat alignment will have the chest over the knees and the knees over the feet, with the weight evenly distributed over the feet. **Do 1-3 sets of 10-15 repetitions**. You should start this exercise with your brace on and your therapist will tell you when it is okay to remove the brace.



### **Squat with Bounce/Lateral Shift/Sagittal Shift**

Assume a proper squat position with your shoulders aligned vertically over your knees and hips pushed back behind your heels. This is the base position for the following exercise progressions:

#### **Bounce**

Maintain your weight distribution over the entire foot or slightly toward the ball of the foot. Using a quick and controlled motion, bounce into your hips as if sitting back into a high chair. This motion should be no greater than about 6". Focus on maintaining your weight distribution and not allowing your knees to thrust forward.

#### **Lateral Shift**

From the squat position, shift your weight side to side quickly with control. As you shift, be sure to shift both your hips and shoulders at the same time. Avoid letting your knees rotate inward as you shift into each side. This exercise can be made more difficult by slightly widening your stance and/or shifting more quickly.

#### **Sagittal Shift**

Shift your weight forward onto your toes (heels just raise off the ground), then back into your heels (should be able to wiggle your toes). This movement is performed by using a whole body forward/backward weight shift. The angles of your knees, hips and trunk should not change.

#### **Double leg toe raises**

Stand with your feet shoulder width apart and knees fully extended. Rise up onto your toes. Hold this position for 2 seconds and then return. **Do 1-3 sets of 10-15 repetitions.** You should start this exercise with your brace on and your therapist will tell you when it is okay to remove the brace.

## **C. Core Body Training**

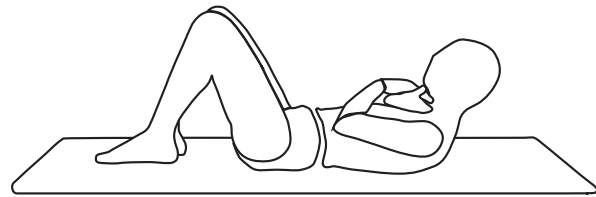
Maintaining good core body strength enhances performance of physical activities and reduction of injuries. Your abdominal muscles, low back muscles and pelvic stabilizing muscles are considered your core. Strong abdominals are important in every motion. The trunk and torso transfer and stabilize all forces generated by the upper and the lower body musculature. Your core is the foundation in activities of daily living and in athletic movements.

#### **Abdominal isometrics**

Lying on your back or standing, tighten the abdominal muscles by drawing your stomach in. Do not hold your breath. Do not attempt to flex your trunk. **Hold for 10 seconds, repeat 1-3 sets of 10-15 repetitions.**

### **Crunches (below)**

Lie on your back with the knees bent and feet flat on the floor. Tighten abdominals by pressing the small of your back against the floor. Hold abdominals in as you slowly curl upper back, shoulders, and head 6-12 inches away from the floor, one segment at a time towards your center, or core. You should feel the movement being initiated at your abdominals, not at your head. Hold this position for a few seconds. Return slowly to the floor and repeat. Hold your hands at your sides, across your chest, or clasp your hands behind your head to support the weight of your head.



### **Reverse crunches (below)**

Lie on your back with the knees bent and lift your feet a few inches off the floor. Tighten your abdominals by pressing the small of your back against the floor. Hold abdominals in as you slowly curl your lower back and hips 4-6 inches off the floor and towards your center, one segment at a time. Hold this position for a few seconds. Return slowly to the floor and repeat. Hold your hands at your sides.



### **Diagonal crunches**

Lie on your back with your right knee bent and foot flat on the floor. Bend the left knee and rest the outside aspect of the left ankle on the right knee to form a figure four cross. Clasp your hands behind your neck. Tighten abdominals by pressing the small of your back against the floor. Keeping your left shoulder and left elbow on the floor, rotate your body and bring your right elbow towards your left knee. Return slowly to the floor and repeat. Switch legs to work on rotating towards the right.

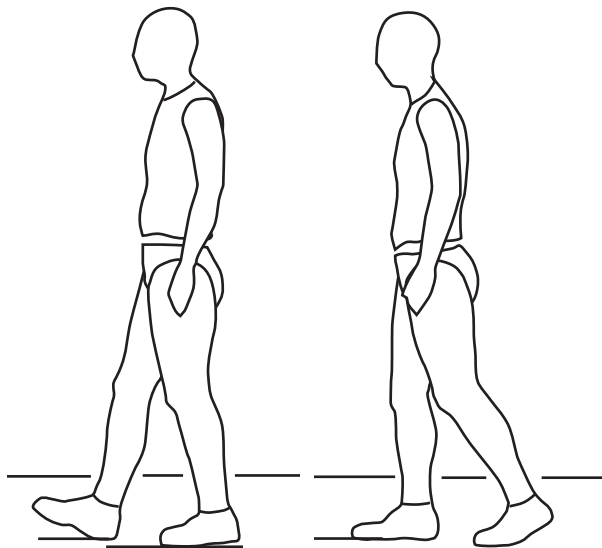
## Back extension

Lie on your stomach. Place your hands at your side or clasp behind your lower back. Lift your chest 6-12 inches off the floor and towards your center. Return slowly to the floor and repeat.

## D. Ambulation

### Diagonal weight shifting (below)

Place your involved foot in front of the uninvolved foot, maintaining shoulder width distance between them. Start with all of your weight on the uninvolved foot. The involved leg should start in front of the other with only the heel contacting the ground. As you shift your weight towards the front foot, gradually let the entire foot come into contact with the ground and slightly flex the knee. Hold for 5 seconds and then return to the starting position. Do 2-3 sets of 15-20 repetitions.



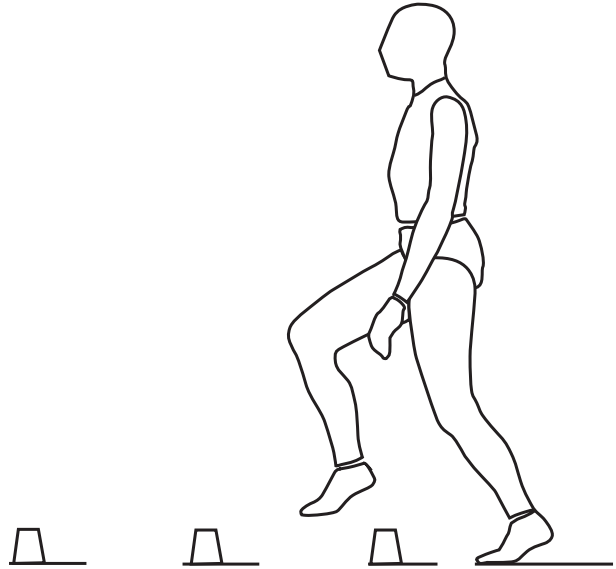
### Backward stepping

Walk backward, focusing on raising your leg and avoid swinging your legs out to the side. Try to lift the toes off the ground before the heel when stepping off. Do 2-3 sets, walking 50-75 feet for each set.

## Step-overs (below)

Place a series of books or paper cups in a row, about one step length apart. The books or objects should stack up so that they are at least ankle height. Now walk forward and backward, bending the knee to step over the objects. Do 2-4 sets, walking continuously for 30-45 seconds.

The following criteria are a guideline for determining when it is safe for you to discontinue using the crutches and brace:



### 1. Discontinuation of crutches (1-7 days)

- Normal gait with brace on

### 2. Unlocking the brace (3-14 days)

- Good quad set
- Within two degrees of full knee extension
- Able to stand on surgical leg with good alignment and control, without brace, for at least five seconds
- Able to perform a double leg mini-squat, with equal weight bearing, through 30 degrees of knee motion

### 3. Removal of the brace (1-4 weeks)

- Normalized gait (walk without a limp)
- Able to stand on surgical leg with good alignment and control without the brace for at least 10 seconds
- No apprehension when walking without the brace
- Initially, go without the brace in safe environments (avoiding icy conditions, uneven terrain and crowds)

## Phase 2

### *Basic Strength and Proprioception*

This phase begins 2-6 weeks after surgery. It will usually take 3-5 weeks to achieve the goals in this phase.

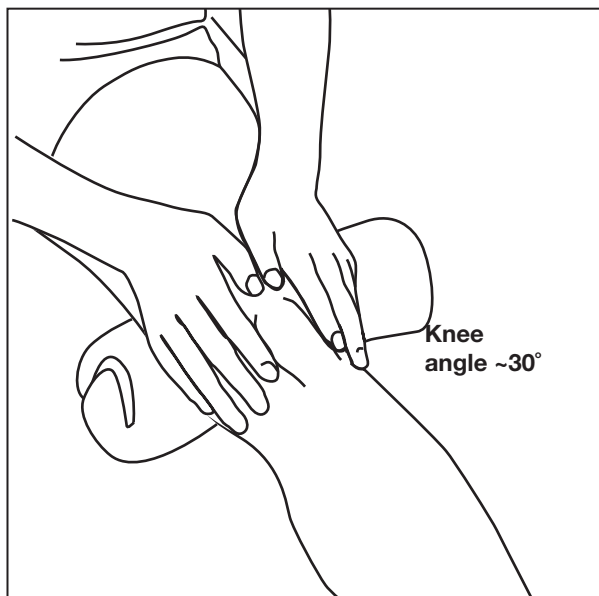
#### Goals

1. Restore proper body alignment and control with basic movements, such as walking without assistance, squats, stationary lunges and single-leg balance
2. Build lower extremity and core body strength
3. Develop increased proprioception, starting with stationary postures and then progressing to movements
4. Achieve active range of motion equal to the uninvolved knee

#### A. Range of Motion Exercises

##### Patellar mobilizations (below)

With your fingers, palpate the edge of your patella. Then gently glide the patella in four directions; up, down, to the inside and to the outside. Try not to tip or tilt the patella, but slide it. **Hold for 2 seconds at the end of the glide.** This will prevent scar tissue from forming around the patella. **Glide in each direction for 1 minute, 3 times per day.**



*Place a towel under knee so knee is flexed approximately 30°.*

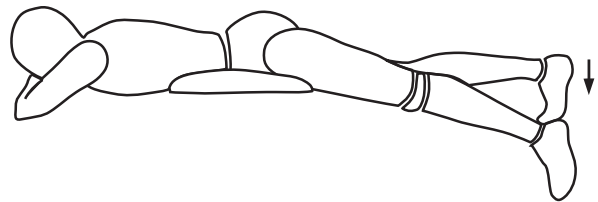
##### Stationary bike

Adjust the seat height so that you feel a gentle stretch with the knee bent at the pedal's highest point.

**Bike 5-10 minutes with minimal to no resistance. Patients should be cautious to avoid too much biking in Phase 2 as it may place too much repetitive stress on the graft.**

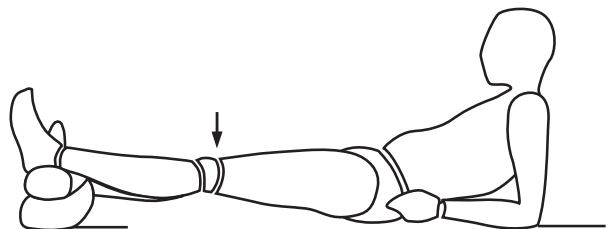
##### Prone hangs (below)

Lie on your stomach with the lower half of each leg hanging off the bed. **Hold this stretch position for 30-60 seconds, repeating 3-4 times.** You may use the uninvolved leg to apply a downward force on the heel of the involved leg. This will force the knee into more extension.



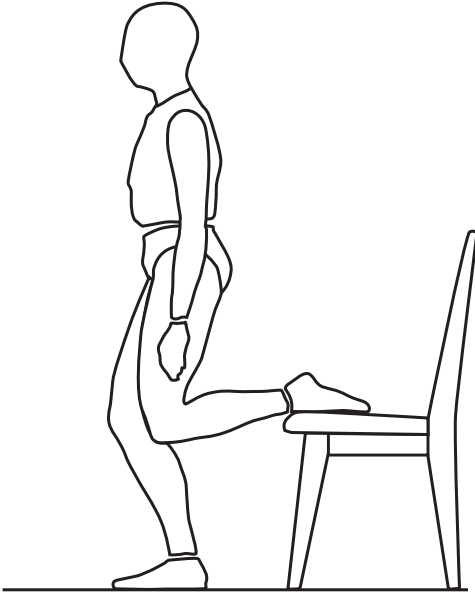
##### Extension on a bolster (below)

Place heel on a towel roll and let the knee sag downward. **Maintain this position for 30-60 seconds, repeating 3-4 times.** You may place a sandbag weight over thigh to help apply additional pressure if needed.



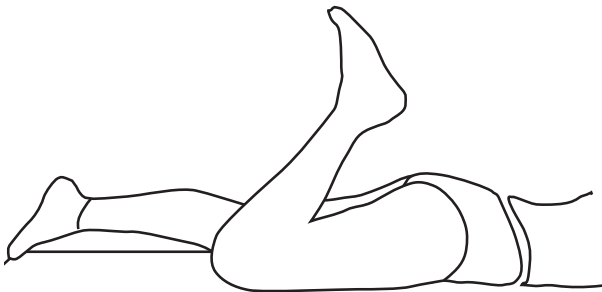
### Standing knee flexion (below)

Standing with your back to a chair, place the top of the involved foot/toes up onto chair. Then slowly squat down on the uninvolved leg to bring the involved knee into a flexed position. **Hold 20-30 seconds, repeat 3 times.**



### Prone knee flexion (below)

Lie prone (on stomach), contract your abdominal muscles to prevent the low back from arching and bring the heel of your surgical leg towards your gluts. **Hold 20-30 seconds and repeat 3-4 times.** Use your other leg or hand to provide the bending pressure.



### Lower extremity flexibility

In addition to knee range of motion, promote lower extremity flexibility by beginning a static stretching program for the following muscle groups:

- Hamstrings
- Iliotibial (IT) Band
- Gastrocnemius/Soleus (calf)
- Hip Flexors/Quadriceps

### B. Gait Drills

These drills should be done with slow controlled movement:

1. Forward high knee walk
2. Backward high knee walk
3. Forward high knee hurdler walk with hip circles
4. Backward high knee hurdler walk with hip circles
5. Side step in mini squat position
6. Forward zig zag skater's step with pause
7. Backward zig zag skater's step with pause

## C. Functional Strengthening

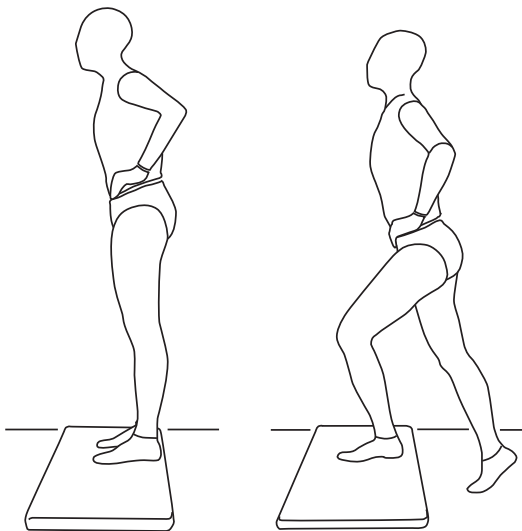
### Squat (below)

Stand with your feet approximately hip width apart or a little wider. Point your toes forward or slightly out to the side. Lower your hips until your thighs are almost parallel to the floor. If you lose balance before your thighs are parallel to the floor, you may return to standing at any time. Keep your knees aligned over your first and second toes. Distribute your body weight over your entire foot or towards the balls of your feet. Be sure to bend at the hips when bending the knees. Return to standing.



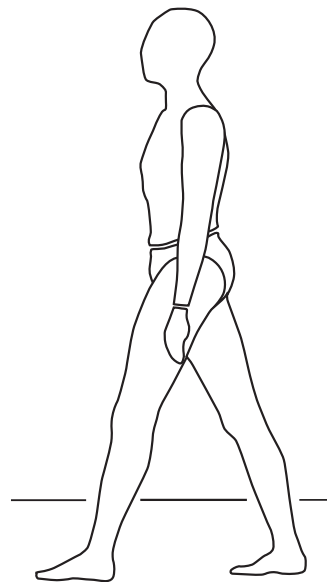
### Step back (below)

Stand with both feet on a step. Reach back with one foot and slowly lower your body until your foot taps the floor behind you. Return to standing. Repeat with the other foot. The further you reach back, the more challenging this exercise becomes.



### Partial lunge (below)

Step forward to 3/4 of your full stride. This is the starting position. Distribute your body weight so that 75% or more of your body weight is on the lead leg. Lower your body until your front thigh is almost parallel to the floor. If you lose balance before your thighs are parallel to the floor, you may return to standing at any time. Keep your front knee aligned over the first and second toes. Your trail leg can be bent at the knee comfortably or remain straight depending on your chosen stride length. The trail foot should also rise up onto the toes. Use your lead leg to push yourself up to the starting position. Your physical therapist or athletic trainer may progress this to a walking partial lunge.



## D. Balance

In Phase 2 the focus will be on the development of balance and proprioception. Exercises that challenge different planes of balance will be emphasized, including:

1. Single leg toe raises
2. Single leg balance with reaches, involving arms and legs

Exercise \_\_\_\_\_

Repetitions \_\_\_\_\_ Hold time \_\_\_\_\_

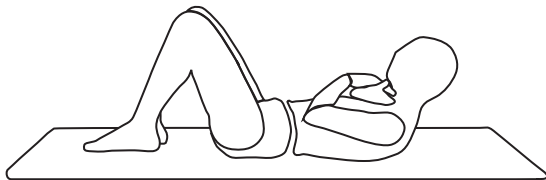
3. Single leg balance, eyes closed
4. Single leg leaning towers
5. Single leg balance with various head, arm, trunk and leg positions to challenge balance

Individual instructions:

## E. Core Body

### Crunches (below)

Lie on your back with the knees bent and feet flat on the floor. Tighten abdominals by pressing the small of your back against the floor. Hold abdominals in as you slowly curl upper back, shoulders, and head 6-12 inches away from the floor, one segment at a time towards your center, or core. You should feel the movement being initiated at your abdominals, not at your head. Hold this position for a few seconds. Return slowly to the floor and repeat. Hold your hands at your sides, across your chest, or, clasp your hands behind your head to support the weight of your head.



### Reverse crunches (below)

Lie on your back with the knees bent and lift your feet a few inches off the floor. Tighten abdominals by pressing the small of your back against the floor. Hold abdominals in as you slowly curl your lower back and hips 4-6 inches off the floor and towards your center, one segment at a time. Hold this position for a few seconds. Return slowly to the floor and repeat. Hold your hands at your sides.



### Diagonal crunches

Lie on your back with your right knee bent and foot flat on the floor. Bend the left knee and rest the outside aspect of the left ankle on the right knee to form a figure four cross. Clasp your hands behind your neck. Tighten abdominals by pressing the small of your back against the floor. Keeping your left shoulder and left elbow on the floor, rotate your body and bring your right elbow towards your left knee. Return slowly to the floor and repeat. Switch legs to work on rotating towards the right.

### Back extension

Lie on your stomach. Place your hands at your side or clasp behind your lower back. Lift your chest 6-12 inches off the floor and towards your center. Return slowly to the floor and repeat.

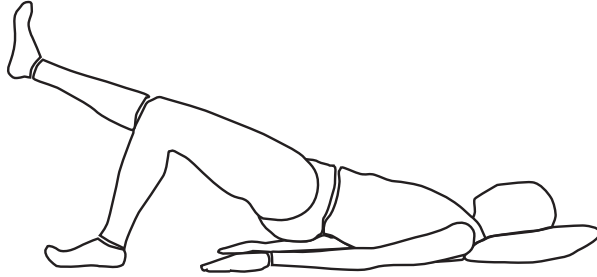
### Bridge (below)

Lie on your back with your knees bent and feet flat on the floor. Your arms should be on the floor at your side. Tighten your abdominals and buttocks as you lift your hips off the floor high enough to form a straight line from your shoulders to your knees. Do not arch your back. Return slowly to the floor and repeat.



### **One legged bridge (below)**

Perform a bridge. Straighten one leg out while still maintaining good posture and a straight line from your shoulders to the knee and foot. Hold for approximately 10 seconds. Return slowly and repeat with the opposite leg.



### **Cardiovascular conditioning**

Alternate the modes of cardiovascular exercise. (For example, Stairmaster for 10 minutes, stationary bike for 10 minutes, UBE (upper body ergometry) for 5 minutes). Your goal is to use this variety to create a cardiovascular demand without causing anterior knee pain.

### **Upper body strength**

Each patient will have an individualized program. The demands of your sport or work requirements will guide the design of this component.



# Phase 3

## *Dynamic Neuromotor Strength, Endurance and Coordination*

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This phase can be initiated when the goals of phase 2 are met. On average this will begin 6-8 weeks after surgery.

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### Goals

1. Increase the strength of the involved leg. You should be doing strenuous pain-free strengthening at least 3 times per week. Consider doing more sets and repetitions on the involved side to eliminate side-to-side strength differences. Be very cautious not to overuse your non-surgical leg, as this will increase the side-to-side difference. Progress from single plane strengthening and functional exercises to multi-plane strengthening and functional exercises (before progressing the patient should be able to demonstrate good alignment and control with each component of the multi-plane exercise). This is a prerequisite for future progression to cutting and pivoting activities.
2. Develop eccentric neuromuscular control to allow acceptance of impact activities without increasing symptoms (before initiating impact activities the patient should not have any swelling, have full knee extension, be able to balance on one leg for 10 seconds and be able to perform a single leg squat to approximately 45-60° of knee flexion with good posture and control).
3. Develop dynamic flexibility to allow for proper alignment during activities of increasing speed.
4. Full range of motion is expected.

### A. Range of Motion

If full range of motion has not been achieved by this phase, your physical therapist or athletic trainer may want to consider additional measures such as modalities or manual therapy to assist in regaining range of motion.

- Continue with extension on bolster or prone hangs
- Continue with flexion exercises such as stationary bike and prone flexion
- Continue with static flexibility exercises

### B. Dynamic Agility Drills

Begin with small strides at low velocity, gradually progressing the velocity and then stride length as your movement control improves.

1. Forward skip
2. Backward skip
3. Side skip
4. Side shuffle with trail leg push off
5. Carioca or grapevine with short quick strides
6. Carioca with increasing backward hip rotation with longer strides
7. Three step and stop
8. Back pedal accelerations
9. Fast feet in place
10. Tall-fall-run

## C. Functional Strengthening

*NOTE: Most of the recommended strengthening exercises are closed chain with a component of stability and control. If a patient is having trouble re-gaining quadriceps strength it is acceptable to provide that patient with some open chain quadriceps strengthening exercises. Caution should be taken to monitor any associated anterior knee pain with these exercises.*

### Squat with knee lift

Start with your feet together. Squat to a comfortable level that you can maintain for at least 10 seconds. Shift your body weight to one leg and raise the opposite knee without compromising your posture. Hold 5-10 seconds, Lower your knee and switch legs.

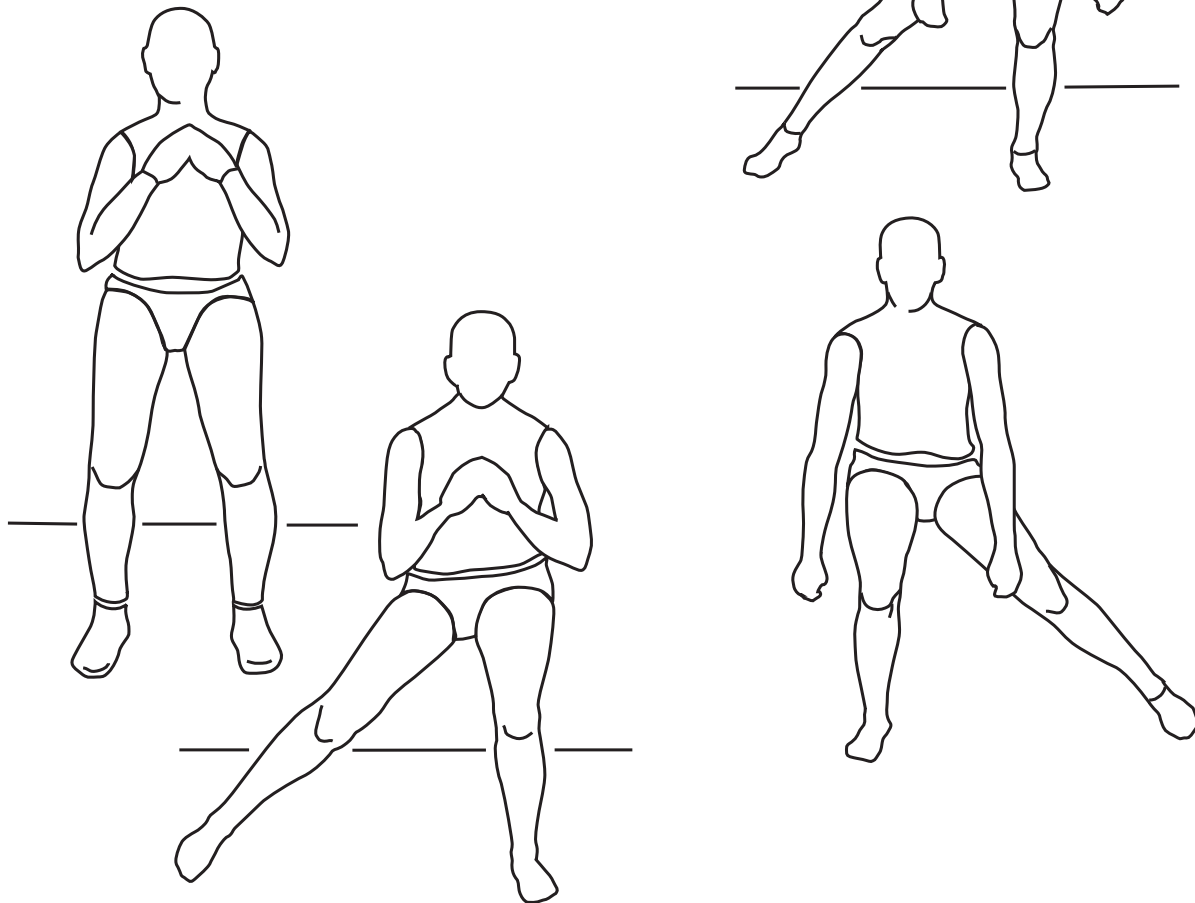
### Squat and reach (below)

Squat to a comfortable level that you can maintain for at least 10 seconds. Shift your body weight to one leg. Reach

laterally (to the outside) with the opposite leg until your hip is fully extended. Return to a squat. Do not allow any transfer of weight from the stance leg to the reaching leg until the desired numbers of repetitions are completed. Switch legs.

### Squat and alternating reach (below)

Perform as the squat and reach exercise but alternate legs with every repetition. Maintain the distance between your hips and the floor as you alternate legs as quickly as possible.



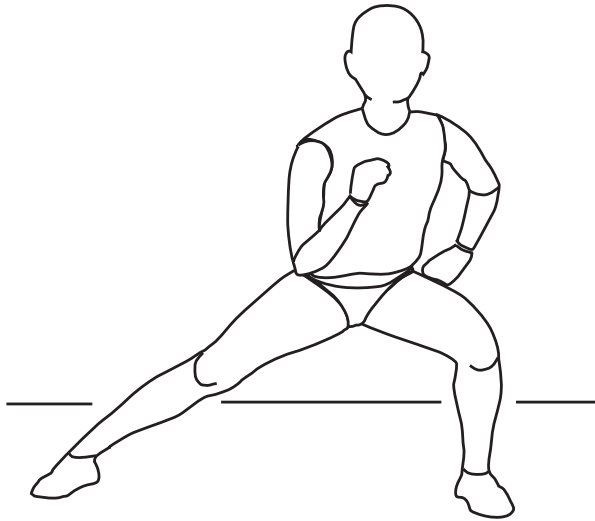
*Dumbbells or medicine balls can be added to progress the amount of resistance with these exercises.*

### Reverse lunge

Start from a standing position with your feet together. Step backwards into a lunge, then return to standing. Your center of gravity should be forward and above your front knee.

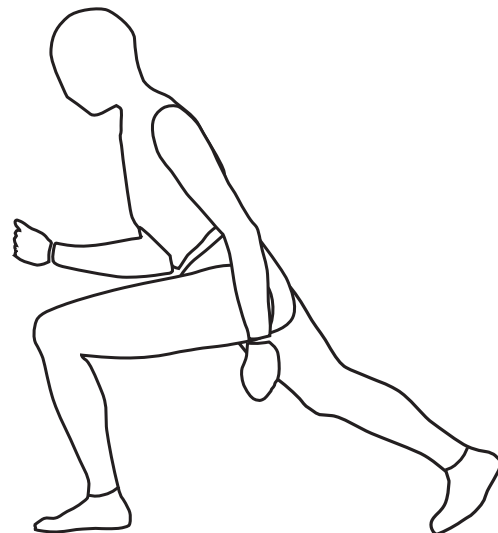
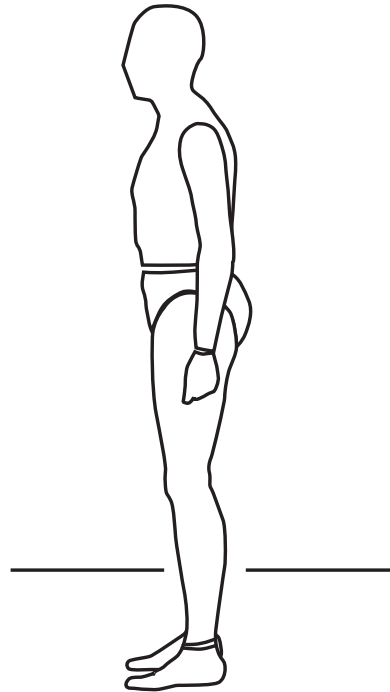
### Lateral lunge walk (below)

Start from a standing position with your feet together. Step sideways into a lunge with 80-85% of your weight on the lead leg (knee over the foot) with the trail leg relatively straight. Push up with the lead leg to return to standing. Be careful not to bounce off the toes of the trail leg. Repeat with the other leg.



### Forward lunge walk (below)

Start from a standing position with your feet together. Step forward into a lunge. Try to get 80-85% of your weight on to the forward leg, with the knee over the foot. The trail leg should be relatively straight and come up on to the toes. Then push off and up with the forward leg to bring body up and knee straight. Repeat with the other leg.



*Dumbbells or medicine balls can be added to progress the amount of resistance with these exercises.*

## D. Landing and Takeoff Drills

### Step offs

Step off a 6-10 inch high box. Try to land on both feet simultaneously. Absorb the shock of the landing by coming into a squat position upon landing. When you are able to perform this consistently, correctly and without symptoms, your physical therapist or athletic trainer will progress you to single leg landings.

### Bounce jumps

Stand with equal weight on both feet. Now perform the first portion of a shallow jump. Your toes may not leave the ground initially. Repeat this to produce a light bouncing action. When you are able to perform this consistently, correctly and without symptoms, your physical therapist or athletic trainer will progress you to single leg bouncing.

### Leap and land

Stand on one leg, then using opposite arm and leg action, push off that leg to become slightly airborne. Land softly by bending the knee and hip as your other foot contacts the ground. Pause and hold your balance in this partial squat position for 2-3 seconds.

### Jump stops

Perform three forward jumps, with both legs, then stop. Maintain good balance in a squat position for 3-4 seconds upon stopping. Repeat this sequence 10-20 times. When you are able to perform this consistently, correctly and without symptoms, your physical therapist or athletic trainer will progress you to single leg hopping.

## E. Balance

In Phase 3, balance exercises will challenge postural control and duration. The goal of these exercises is to make balance an unconscious phenomenon. By using tasks that require hand-eye coordination and concentration, your cognitive awareness of body position is diminished. Some examples of these exercises are listed.

1. Balance board activities
2. Soccer ball drills balancing on injured leg
3. Stick handling with a hockey stick and ball
4. Football passes while balancing on injured leg
5. Tennis racket swings while balancing on injured leg
6. Swim strokes
7. Volleyball bumps or sets while balancing on injured leg
8. Basketball ball handling drills in single leg stance position
9. Walk and hold stance on single leg
10. Windmills
11. Single leg balance with your eyes closed
12. Single leg balance while standing on a towel roll

Complete the above exercises highlighted by your physical therapist or athletic trainer.

Duration \_\_\_\_\_ Repetitions \_\_\_\_\_

## F. Core Body

The core functions to bend, stretch, twist and stabilize your body. The anatomical terms for these functions are flexion, extension, rotation and stabilization, respectively.

### Iso abs (stabilization)

Lie face down. Lift your upper body and hips off the floor into a push up position. You can support your upper body weight either on your elbows or your hands. Stabilize and hold this position for approximately 30 seconds.



### Chopping (flexion and extension)

You will need a ball and a solid wall. With your back facing the wall, stand approximately 1-2 feet away (the further you stand away from the wall, the greater the challenge). Straddle your feet so they are approximately shoulder width apart. Hold the ball in both hands and raise it to tap the wall overhead behind you. Then lower it down and bring the ball between your knees to tap the wall behind you at knee height. Repeat.

### V-Sit and stretch (flexion and extension)

While seated on the floor, form a “V” with your body by bending at the hips and knees. Raise your feet 4-6 inches off the floor. Widen the “V” by stretching at the hips and knees while maintaining a distance of 4-6 inches from your feet to the floor. Return and repeat.

### Russian twist (rotation)

Begin in the same starting position as the chopping exercise. Slightly bend one knee and twist in the opposite direction of that knee to tap the ball on the wall behind you. Return and repeat in the opposite direction. The speed of the twist will vary depending on your sport.

### V-Sit and twist (rotation)

Begin in the same starting position as the V-sit. Twist your body and reach to touch the floor on the other side of the opposite hip. Return and repeat in the opposite direction.



### Diagonals (combines flexion and extension movements with rotation)

Stand with your feet close together and your back to a wall. Put both hands together. Now touch both hands to the wall as high as possible above the right shoulder then bring them across your body and touch the wall to the outside of the left hip. Use your abdominal muscles to control the movement. Repeat this diagonal pattern 12-15 times, then do the opposite diagonal which will be from the left shoulder to the right hip. Do two sets of each diagonal pattern. The progression for this exercise is to hold a weight between your hands.

### Cardiovascular conditioning

Continue cross training, but begin to design your program more toward the type of cardiovascular requirements you will need for your sport (i.e., intervals vs. moderate intensity, moderate duration vs. low intensity, long duration). During this phase you should be working hard to get in shape, or improve your muscular and cardiovascular work capacity to allow for more intense rehabilitation exercises in Phase 4.

### Upper body strength

Continue on individualized program as determined by your rehabilitation provider.

# Phase 4

## *Athletic Enhancement and Return to Activity*

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This phase can be initiated when the goals of Phase 3 are met. This phase will usually begin 12-16 weeks after surgery.

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### Goals

1. Progress from double leg impact control to single leg impact control (this should not be initiated before 8 weeks post-op, a KT1000 measurement and completing the double leg progression).
2. Develop proper technique and appropriate neuromuscular control with start and stop movements and change of direction movements. This includes cutting and pivoting (this should not be initiated before 8 weeks post-op, a KT1000 measurement and completing the double leg progression).
3. Eliminate apprehension that may exist with complex movements related to sports.

### A. Dynamic Warm Up

These drills are designed to enhance athletic performance by preparing your body for the demands of your sport. This warm-up will help with increasing core body temperature, mental alertness, elasticity of the muscular system and activation of your neuro-muscular system. It may take from 5-15 minutes to perform. The following exercises are similar to the agility drills in Phase 3, but now you will begin to increase the size and speed of movement:

1. Forward skip
2. Backward skip
3. Side skip
4. Side shuffle with arm swings
5. Carioca or grapevine with short quick strides
6. Carioca with increasing backward hip rotation with longer strides
7. 3 step and stop
8. Back pedal accelerations
9. Fast feet in place
10. Tall-fall-run

### B. Multi-planar Landing Control and Neuromuscular Reaction

#### Jump rotations

Perform a squat jump, while in the air turn 90°, then land on a box and hold the landing. Attempt to increase the duration of balance and control during the landing.

Sets \_\_\_\_\_ Repetitions \_\_\_\_\_

#### Fast feet and lunge

Do fast feet choppers in place for 3-4 seconds, then lunge forward. From the lunge position return to the upright fast feet sequence. Continue this cycle, alternating the lunge leg.

- a. Forward
- b. Lateral
- c. Multi-angle

Sets \_\_\_\_\_ Repetitions \_\_\_\_\_

#### Multi-planar leap and land

Stand on one leg, then using opposite arm and leg action push off that leg to become slightly airborne. Land softly by bending the knee and hip as your other foot contacts the ground. Pause and hold your balance in this partial squat position for 2-3 seconds.

- a. Forward
- b. Lateral
- c. Diagonal
- d. 90 degree rotation

Sets \_\_\_\_\_ Repetitions \_\_\_\_\_

#### Stop and go

Jog forward a few paces and stop softly on one foot, hold this landing for 1-2 seconds. Continue this sequence in multiple directions.

## **Hopping (Single foot takeoff–single foot land)**

Use opposite arm and leg action. Land softly by initiating contact at the ball of the foot and as the heel comes to the ground the knee and hip should flex (bend). Attempt to increase the duration of balance and control (not letting the knee go in towards midline) during the landing.

- a. 4 hop for height
- b. 4 hop for forward distance
- c. 10 yard speed hop

## **Power bounds**

This high intensity exercise is basically a progression of the forward hop and requires cycling of your legs during the flight phase of the hop. You should increase your distance with each bound.

## **Agility ladder**

Progress various drills to promote dynamic balance and agility from the least provocative plane of movement (usually sagittal) to the most stressful plane of movement (usually transverse). You can simulate an agility ladder using a tape pattern on the floor. Your physical therapist or athletic trainer will provide you with a handout of drills specifically designed for you.

## **Cutting and pivoting drills**

As outlined by your physical therapist or athletic trainer, these drills encourage equal weight distribution between the surgical and nonsurgical legs. You should start at a low velocity and progress to higher velocity as your movement control increases and your apprehension decreases.

## **C. Functional Movements and Strengthening**

### **Forward lunge walk with rotation**

Start from a standing position with your feet together and hands holding a small weight overhead. Step forward into a lunge and bring the weight over forward leg to touch the ground. As you stand to lunge forward to the other leg, the weight should travel in a smooth arc overhead.

Sets \_\_\_\_\_ Repetitions \_\_\_\_\_

### **One legged squat**

This exercise is performed in a similar manner as the squat, but is performed with only leg at a time. Attention to postural alignment is very important.

Sets \_\_\_\_\_ Repetitions \_\_\_\_\_

### **Single leg deadlift**

Stand on one leg with the knee straight but not hyper-extended while holding a weight or medicine ball. Reach toward the floor with the weight by flexing at the hip but keeping the knee and back straight. Raise back up to a standing position by extending the hip.

Sets \_\_\_\_\_ Repetitions \_\_\_\_\_

### **Lunge clock**

This exercise utilizes the lunge at multiple angles. To perform this exercise, imagine yourself standing in the center of a clock. Now, lunge out to each number on the face of the clock, coming back to the center each time.

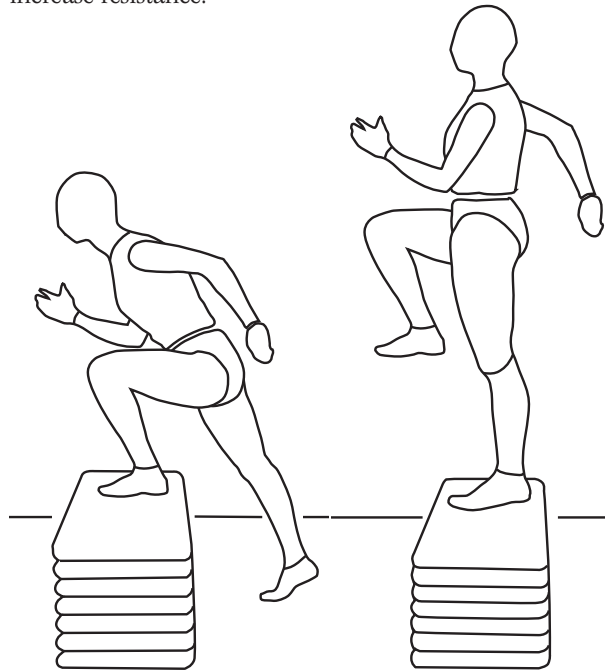
Sets \_\_\_\_\_ Repetitions \_\_\_\_\_

### **Lateral lunge walk**

Start from a standing position with your feet together holding a medicine ball overhead. Step sideways into a lunge with 80-85% of your weight on the lead leg (knee over the foot) and the trail leg should be relatively straight. As you go in to the lunge position you should bring the medicine ball down, just in front of the knee. Then push up with the lead leg to return to standing. The ball should be pushed overhead while the lead leg is extending (straightening).

### Power step up (below)

Start with left foot flat on top of a stable chair, a weight bench or stacked aerobic steppers. With a majority of your weight maintained through the left foot, explode quickly upward by straightening left knee and left hip ending up only on left leg. At the same time, the left arm will punch upwards with elbow bent at 90 degrees and the right knee will end up in a high knee march position. Repeat on opposite side also. Hold dumbbells in your hands to increase resistance.



## D. Advanced Core Training

Core muscles are important as they provide stabilization to your body and assist in transfer of power from lower to upper body and vice versa during sport.

1. Prone body bridge
2. Body bridge left
3. Body bridge right
4. Supine body bridge

Progress these exercises by adding extremity motion and eventually adding resistance through dumbbells/light resistance.



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## Phase 5

### *Sports Performance and Injury Prevention*

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At this point your physical therapist or athletic trainer will provide you with specific exercises based on your sport and specific needs. These exercises are important for enhancing sports performance and preventing future injuries.

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## General Information

1. Welcome to Performance Spectrum! Classes meet two times per week.

Phase I	Mon, Wed 4:00–4:30 p.m.
Phase II	Mon, Wed 4:30–5:00 p.m.
Phase III	Tues, Thur 4:00–5:00 p.m.

2. Due to special events or holidays, the Performance Spectrum program may be closed during usual class hours. These events and dates will be posted in advance.
3. Regular Performance Spectrum class attendance is important for proper progression of your rehabilitation program. If you cannot attend a class, please call (608) 263-4765 to cancel.
4. Prior to beginning Performance Spectrum, each athlete will need to schedule an orientation. The purpose of the orientation is to evaluate the athlete and determine the appropriate phase of participation. The athlete will go through a series of exercises designed to assess the athlete's functional ability (strength, endurance, mechanics, etc.). The orientation fee is a non-refundable \$30 which is due at the time of the orientation. To schedule the orientation, call (608) 263-4765.
5. Performance Spectrum is a fee for service program. The monthly fee will be due at the beginning of each month. The monthly fee is \$120 per month for phase I and II, and \$176 per month for phase III. This fee is pro-rated at the start based on the number of session available your first month. You will be responsible for the entire monthly fee at the beginning of the next month.
6. Appropriate exercise wear is required. We recommend cross trainers or shoes with good lateral support vs. running shoes. Please do not wear wet or muddy shoes in the aerobics room. Floors that are wet or dusty are hazardous for the type of activities performed in Performance Spectrum class.
7. You will need to warm up and stretch independently before class starts. The stretching area in the fitness center is reserved for patients and members to use for the purpose of stretching only. Please do not use it as a waiting area. When you are finished with your warm up and stretch, please move to the aerobics room.

## Description

UW Health Performance Spectrum is a lower extremity, group rehabilitation program that integrates philosophies of sports training with philosophies of functional rehabilitation. The program is designed to provide athletes an opportunity to work on functional conditioning and sport specific drills that prepare them to return to sport activities. We can better return athletes to their full motor potential by rehabilitating the injuries, retraining the kinetics, or movements, of their required sports skills and provide the necessary tools to attain higher levels of fitness, strength, flexibility, movement and sports skill. Athletes in this program participate with others who have experienced similar injuries, and therefore, receive the camaraderie and motivation needed to successfully achieve performance goals. The class is primarily designed for patients who have had ACL reconstruction but is beneficial for all lower extremity injuries. Evidence has shown that return to sport rehabilitation and sports performance training have similarities. Therefore this program is also available to non-injured athletes. There are three phases of progression in the program: basic, intermediate.

### **Phase I: Return to basic fundamental movement:**

The key to bridging the gap between rehabilitation and sports application is to return to basic fundamental movement skills. This begins with postural awareness exercises, balance activities, proprioceptive challenges, coordination activities and basic functional strengthening drills. These activities are used as building blocks for more advanced and complex sports movements. Lack of these skills may result in a deficit in movement pattern and movement response. Athletes in this phase of rehabilitation must have already addressed the physiological responses of pain, swelling, range of motion and basic strength during the early phases of healing.

### **Phase II: Restore biomotor patterns (intermediate)**

As the athletes relearn to control their strength and coordination, they then need to apply their coordination to simple biomotor tasks such as running, jumping, hopping, skipping, leaping, catching, etc. before advanced athletic movements can be achieved. Activities in Phase II progressively become more complex by adding components of speed, impact, change of center of gravity components and by combining more than one movement and more than one direction or plane of movement. They will also continue to work to rebuild their strength.

### **Phase III: Retrain and recondition to return to sports (advanced)**

In phase III, athletes will demonstrate that they are efficient with simple biomechanical locomotor and non-locomotor patterns. The rehabilitation now will be more specialized to return to individual sport by retraining in agility, plyometrics, speed, strength and power exercises. Phase III is longer than phase I or II. This is to allow for appropriate conditioning, intensity, and movement complexity to meet each individual's needs to return to their desired sport(s). After completion of phase III, athletes are prepared to resume full sports participation at pre-injury level or beyond.

### **Core body**

Underlying the three phases of Performance Spectrum is core strength. There is a relative comparison to overall athletic performance and reduction of injuries to maintaining good core strengthening and mobility in our athletes. The trunk and torso transfer and stabilize all forces generated by the upper and lower body musculature. Each participant in the program is instructed on an individualized core body program that includes exercises for trunk flexion, extension, rotation and stabilization. Core body drills are always performed as part of a five to ten minute cool down after each class session. All three phases of the rehabilitation program integrate a program of core body training.

## **Fitness**

By incorporating components of general athletic fitness, athletes can maximize the gains made in rehabilitation. More importantly, each participant works with others who have similar needs to emphasize functional strengthening, agility and sports specific training. To make this class work, individual time and effort is required. Below is a list of some very important aspects of general athletic fitness. Athletes will be instructed on activities for each component and will become independent with these activities. Participants are encouraged to pair up with a classmate as a good motivational tool.

### **Warm-up, cool-down**

Warming up before each workout and cooling down afterwards are very important aspects of total fitness. A proper warm-up period allows the heart to gradually accelerate into the training zone, preparing the body for more strenuous activity. Warm-up consists of 5-10 minutes of gradually progressive exertion on the stationary bike or stair master, followed by a dynamic warm up outlined by the performance spectrum staff or your physical therapist/athletic trainer. This component helps to prepare the neuromuscular system for the demands of class activities.

### **Flexibility**

Normal musculoskeletal function requires that an adequate range of motion be maintained in all joints. Stretching exercises are important for developing and maintaining these motions. Stretching not only prepares the body for activities but also helps in preventing unnecessary injuries. Stretches are generally performed right after warm-up and again at the end of the workout.

### **Cardiovascular conditioning**

General athletic fitness is the base on which sport-specific athletic fitness and skills are built. Each sport demands a certain level of aerobic or anaerobic endurance. To begin developing cardio-respiratory endurance, a conditioning program is initiated at the beginning of the program.

### **Core body**

Strong core body musculature is important in every athletic motion. The trunk and torso transfer and stabilize all forces generated by the upper and lower body musculature. Strong abdominals also help support the lower back, which is a common site for athletic injury.

## Patient Profile

Name \_\_\_\_\_

Street Address \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_

Work Phone \_\_\_\_\_ Home Phone \_\_\_\_\_

Date \_\_\_\_\_ Age \_\_\_\_\_

### What is included in your current exercise program?

Stretching

Strengthening (include frequencies and volume (sets x reps) of each exercise) \_\_\_\_\_

Cardiovascular conditioning (include frequencies and duration) \_\_\_\_\_

Where do you perform your exercise program? \_\_\_\_\_

What activities tend to irritate your injury? \_\_\_\_\_

Do you perform regular recreational physical activities?  Yes  No

If not, what is the major obstacle?  time  motivation  lack of facility  other \_\_\_\_\_

What is your rehabilitation goal?

return to sports  return to work  physical demands with activities of daily living

What is your profession? \_\_\_\_\_

Would you describe your lifestyle as:  sedentary  fairly active  moderately active  highly active?

What sport(s) do you participate in? \_\_\_\_\_

What position(s) do you play? \_\_\_\_\_

T-shirt size (circle one) M L XL XXL

### This section will be completed by the Sports Rehabilitation staff

Start date \_\_\_\_\_ Orientation date \_\_\_\_\_

Phase: I II III (circle one)

Registered in Performance Spectrum Binder  Yes  No