



Banff Sport Medicine

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# Post Operative Rehabilitation Program

for  
Knee Condyle Osteochondral  
Transplant (OATS)

**September 2018**

This protocol is designed to assist you with your rehabilitation after surgery and should be followed under the direction of a physiotherapist.



**Covenant Health**  
Banff Mineral Springs

# PHASE 1: Early Post-operative Phase (1-8 weeks)

This is the initial recovery phase and it normally lasts up to 8 weeks post-operatively. In the first week you should rest and elevate your leg for a significant amount of the time.

## GOALS

1. Reduce inflammation and swelling
2. Range of Motion:  $\geq 90^\circ$  by end of 4th week post-operative  
 $0^\circ$  to  $\geq 120^\circ$  by end of 8th week post-operative
3. Full (100%) weight bearing
4. Quadriceps muscle activation

## KNEE BRACING

Patients with a knee condyle osteochondral transplant are not braced unless a concurrent osteotomy is performed. If you are placed in a brace you are permitted full Range of Motion. You do not need to take your knee out of the brace to work on the mobility and strengthening exercises.

## WEIGHT BEARING

After an osteochondral transplant surgery, it is very important to restrict weight bearing on your operative leg for a considerable amount of time. Weight bearing restriction is required to protect the graft and to allow fusion of the graft with the bone and cartilage surrounding it.

For the first 4 weeks post-operatively, you should put very limited weight through your operative leg, other than to touch your foot to the ground for balance. We call this “feather” weight bearing. Use a normal “heel-toe” pattern of heel strike, foot flat and heel off. This will reinforce a normal walking pattern and also avoid shortening of your calf muscle over time.

After 4 weeks of feather weight bearing, you can start putting 25% of your weight through your leg. Progressively increase weight bearing as tolerated using two crutches for the first 8 to 10 weeks after surgery. Increased pain or swelling in your knee may be an indication that the pace of progression is too high and should be slowed down. Continue using the normal “heel-toe pattern”. You should be able to fully weight bear, before progressing to Phase 2.

## COLD THERAPY & ELEVATION

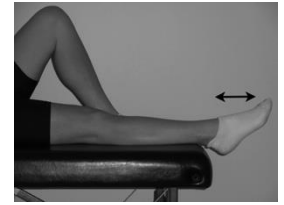
A Cold Therapy Unit or an ice pack should be applied immediately after surgery and used for at least 20 minutes every other hour while you are awake. Your operative leg should be elevated with the knee straight when applying cold therapy and/or when resting.



## EXERCISES

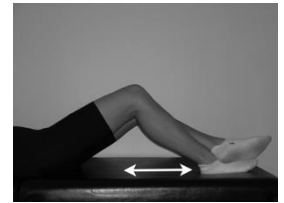
### 1. Ankle Pumps:

- The foot and ankle should be actively “pumped” up and down 10-20 times every hour.



### 2. Range of Motion:

- **Flexion:** In lying, bend your knee by sliding your heel towards your buttocks. Use your other leg to help you if needed. Flexion should only be performed within the limits of minimal discomfort. Perform up to 20 times; repeat 4 to 6 times daily.
- **Extension:** In lying, place a roll beneath your ankle to passively (allow gravity) stretch your knee into extension. Extension should only be performed within the limits of minimal discomfort. Start with 2 minutes at a time and increase as tolerated up to 5 minutes. Perform 4 to 6 times daily. It is very important in this phase to work on straightening your knee.



### 3. Strengthening:

- **Quadriceps Contraction:** In sitting with your knee straight and leg supported, tighten your thigh muscle by pushing your leg downwards. Focus on tightening the muscle and avoid lifting your leg from the hip. Perform exercise 5-10 times holding each contraction for 5 secs. Progress to 30 times holding each contraction for 5-10 secs, resting for 5 secs in between reps (repetitions). The use of EMS (Electric Muscle Stimulation) is recommended for this exercise.
- **Straight Leg Raises:** In the position shown, tighten your thigh muscle while keeping your knee straight and lift your leg up 2 inches. Perform exercise 5-10 times holding each contraction for 5 secs. Progress to 30 times holding each contraction for 5-10 secs, resting for 5 secs in between reps. The use of EMS is recommended for this exercise.



**IMPORTANT:** If you do not have full knee extension or have a significant quadriceps lag you should not perform this exercise.

- **Prone Hip Extension:** Lie on your stomach in the position shown. Lift your leg off the bench by tightening your buttock muscles and keeping your leg straight. Perform exercise 5-10 times holding each contraction for 5 secs. Progress to 15 times holding each contraction for 10-15 secs, resting for 5 secs between reps.
- **Hip Abduction:** Lie on your side with your body in a straight line from head to toe, in the position shown. Lift your upper leg off the bench by tightening your side (abductor) muscles and keeping your leg straight. Perform exercise 5-10 times holding each contraction for 5 secs. As your knee allows, gradually increase the angle at which you raise your leg while keeping your upper hip still. Progress to 30 times holding each contraction for 10-15 secs, resting for 5 secs between reps.



- **Hip Adduction:** In lying with your knees bent as shown, squeeze a soft ball or a pillow between your knees. Perform exercise 5-10 times holding each contraction for 5 secs. Progress to 30 times holding each contraction for 10-15 secs, resting for 5 secs between reps.



**IMPORTANT:** To avoid weight bearing on your operative leg you should do the Prone Hip Extension, Hip Abduction and Hip Adduction exercises with your non-operative leg in a lying position. You may choose to do these exercises with your operative leg in a standing position, while bearing full weight on your non-operative leg. The standing position exercises are outlined in Phase 2.

- **Stationary Bike Cycling:** Start cycling on a stationary bike as soon as you are able to get your foot around for a full cycle. If you are not able to make a full circle yet, start by cycling backwards. Start with 10 min 2 times daily and progressively build up cycle time. Apply no resistance during this Phase 1 of rehabilitation.

#### 4. Stretching:

- **Calf:** Sitting with your knee straight, wrap a towel around your foot and gently pull your toes and foot towards you. Hold each stretch for at least 30 secs and repeat 4 times.



**\*\* Perform all exercises 4 to 6 times per day to improve your strength and range of motion.**

**You should perform all of the exercises on both legs\*\***

#### ALSO CONSIDER:

- Other Range of Motion exercises as tolerated (heel slides on wall; passive flexion in sitting using other leg to push, gentle contract-relax knee flexion and extension).
- **Swimming pool:** The swimming pool provides an excellent setting to do controlled weight-bearing exercises (walking forwards, backwards, side steps, knee lifts, leg curls) and to train your balance. After 4-weeks when your surgeon clears you to use the pool, start in waist deep water while progressively increasing the weight on your operative leg. Over time you can move to more shallow water to increase the difficulty of the water walking.
- Hip and ankle strengthening as tolerated.
- Normalizing gait without crutches

## REQUIREMENTS FOR PROGRESSION TO PHASE 2

- ✓ Ability to activate quadriceps (specifically VMO)
- ✓ Full knee extension 0°
- ✓ Knee flexion  $\geq 120^\circ$
- ✓ Full weight bearing with normalized gait
- ✓ Pain levels managed to enable exercise progression

## PHASE 2: Muscle Strength (9-15 weeks)

This is the initial muscle strengthening phase and it normally lasts from week 9 up to week 15 post-operatively. This phase emphasizes normalized Range of Motion and progressive strengthening of the quadriceps muscles by means of double leg exercises.

### GOALS

1. Manage pain and swelling
2. Full Range of Motion: 0°- 135° (normal compared with non-operative knee) by end of 12th week
3. Able to perform a straight leg raise
4. Using stationary bike in daily exercise program
5. Increase bilateral leg strength

### KNEE BRACING

In case you have been braced because of concurrent osteotomy, the bracing will be discontinued by now.

### WEIGHT BEARING

Before proceeding to this phase, you should be able to fully weight bear using a normalized gait. In general this will be achieved in week 9 to 10 at the latest. While doing the Double Leg strengthening exercises, focus will be on dividing your weight equally between your non-operative leg and operative leg.

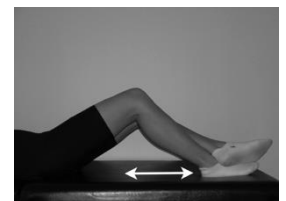
### COLD THERAPY & ELEVATION

Manage your swelling by continuing to use cold therapy and elevation, especially after exercise or physiotherapy sessions.

### EXERCISES:

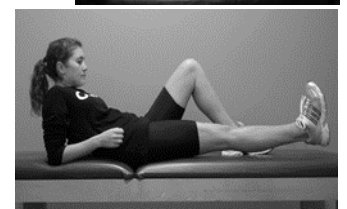
#### 1. Range of Motion:

- Progress to full flexion using active, active-assisted and passive exercises. No forced flexion. Add prone hangs, active-assisted and passive range of motion if full extension has not been achieved.



#### 2. Strengthening:

- **Straight Leg Raises:** In the position shown, tighten your thigh muscle while keeping your knee straight and lift your leg up 2 inches. Continuation of Phase 1 SLR exercise. Perform exercise 30 times holding each contraction for 5-10 secs, resting for 5 secs in between reps. The use of EMS is recommended for this exercise.



- **Double Leg Squats:** Slowly squat with equal weight on each leg. Bend your knees from 0° to a maximum of 90° of flexion, making sure your knees do not move beyond your toes. Start with one set of 10 reps, holding each squat for 5 secs and increase the number of reps as your strength increases, up to 30 reps x 15 secs hold. EMS is recommended for this exercise with the 'contraction' time at least double the 'rest' time.



- **Double Leg Calf Raises:** Start with feet shoulder width apart and toes pointed straight ahead, and raise up onto your toes with equal weight on each leg. Start with one set of 10 reps, holding each raise for 5 secs. Increase the number of reps up to 30 with 5 sec holds. Start by using support at a wall or table and progress to no support as able.



- **Gluteals: (bridges)** In lying with your knees bent and your arms by your sides, squeeze your buttocks and lift up to create a bridge. Keep equal weight on each leg and straight alignment from your shoulders to your knees. Be careful not to push down on your neck or shoulders – use your buttocks to do the work. Start with one set of 10 reps, holding each lift for 5 secs. Increase the number of reps as your strength increases. Once you can complete 20 reps holding for 10 secs each, change to single leg bridges.



- **Hamstrings:** In sitting place a resistance band around your ankle and also have it attached to a chair or table leg in front of you as shown. Slowly bend your knee backwards pulling against the resistance band using the muscles under your thigh. Start with 1 set of 10 reps and increase to 3 sets of 15 reps.



- **Hip Extension, Hip Abduction:** Continuation of Phase 1 Hip exercises. Perform exercise 30 times holding each contraction for 10-15 secs, resting for 5 secs between reps.



- **Planks:** Place the forearms on the ground with the elbows aligned below the shoulders, and arms parallel to the body at about shoulder-width distance. Engage your core and glute muscles and lift the hips up off the ground. Start with one set of 10, holding each lift for 15 secs. Increase the holding time as your strength increases.



- **Dead Bugs:** Lie flat on your back with your hands extended above you toward the ceiling. Bend your knees in a 90-degree angle and raise your thighs until they are perpendicular to the floor. Now deeply exhale and engage your abs to bring your ribcage down and flatten you back onto the floor. Slowly lower the right arm and the left leg down to the floor simultaneously. Lower them down until just before the lower back starts to arch off the ground. On your way down exhale. Then slowly return to the starting position while inhaling. Alternate sides. Start with one set of 10, holding each lift for 5 secs. Increase the number of reps as your strength increases.



### 3. Proprioception:

- **Double Leg Squats on an unstable surface:** (thick carpet → foam block → camping mattress → pillow → BOSU)

### 4. Cardio:

- **Stationary bike cycling:** progress build up cycle time up to 30 min. *You may start to apply some gentle resistance in Phase 2; slowly increase resistance as your strength improves.*

### 5. Stretching:

- **Calf:** Standing at a wall in the positions shown. Lean forward until you feel a stretch in your calf. Hold each stretch for at least 30 seconds and repeat 4 times. Do exercise with back leg straight and again with back leg slightly bent.



- **Hamstring Stretch:** In lying, place a towel or belt around your foot and bring your leg up until a stretch is felt at the back of the thigh. Hold each stretch for at least 30 seconds and repeat 4 times.



**\*\* Perform all exercises at least once per day, 4-5 days per week, including cardio and resistance training, to improve your strength and range of motion.**

**You should perform all of the exercises on both legs\*\***

### ALSO CONSIDER:

- Double leg wall squats (with/without ball squeeze)
- Double leg squats with ball squeeze
- You are allowed to swim (all strokes) as long as it is not painful.
- Abdominal and core strengthening (i.e. curl-ups, obliques, isometric holds, transversus abdominis, and Pilates)

## REQUIREMENTS FOR PROGRESSION TO PHASE 3

- ✓ Full range of motion (compared with non-operative knee)
- ✓ Good control and alignment during double leg squats on an unstable surface

## PHASE 3: Muscle Strength & Control and Core Stability (16 weeks – 6 months)

This phase is the advanced muscle strengthening and control phase and it normally lasts from 16 weeks to 6 months post-operatively. This phase focuses on improving muscle bulk, muscle control, balance and proprioception along with core strengthening.

### GOALS

1. Increase quadriceps, hamstrings, gluteal and core strength using advanced exercises
2. Improve proprioception and balance
3. Aerobic activity for 20-30 minutes per day, 3-4 times per week
4. Avoid impact

### NON-IMPACT

During the first year post-surgery, any impact on the operative knee should be avoided. Light-impact should not even be considered before passing the 1<sup>st</sup> year. Both this third phase, as well as the next phase, are non-impact phases.

In this phase there will be a gradual shift from doing mainly Double Leg stance exercises to Single Leg stance exercises.

### COLD THERAPY & ELEVATION

Manage your swelling by continuing to use cold therapy and elevation, especially after exercise or physiotherapy sessions.

### EXERCISES

#### 1. Range of Motion:

- Continue active assisted and passive range of motion exercises to ensure full range of motion.

#### 2. Strengthening:

- **Step-ups:** Do graduated heights, starting at 4" and increasing to 8". Stand in front of a stair or stepping stool and place one foot on the step in front of you. Rise up onto the step by shifting all of your weight onto this leg and tighten your quadriceps muscles. Put all of your weight through this leg and do not step up onto the step with your other leg. Start with one set of 10 reps, holding at the top of the step-up for 5 secs. Increase the number of reps as your strength increases, up to 20 reps with 15 secs holds on each leg. EMS is recommended for this exercise with the 'contraction' time at least double the 'rest' time.





- **Step-downs:** Do graduated heights, starting at 4" and increasing to 8". Start with one leg standing on the step and slowly bend your knee to lower your other leg to lightly touch floor. Keep all of your weight through the leg that is on the step. Start with one set of 10 reps, holding at the bottom of the step-down for 5 secs. Increase the number of reps as your strength increases, up to 20 reps with 15 secs holds on each leg. EMS is recommended for this exercise with the 'contraction' time at least double the 'rest' time.



- **Single Leg Squats:** Standing on one leg, slowly squat bending your knee from 0° to a maximum of 90°, making sure your knee does not move beyond your toes. Start with one set of 10 reps, holding each squat for 5 secs and increase the number of reps as your strength increases, up to 30 reps x15 secs holds on each leg.



- **Squats with rubber band:** Stand with legs shoulder width apart with a resistance band around your thighs just above your knees. Slowly squat with equal weight on each leg. Bend your knees from 0° to a maximum of 90° of flexion, making sure your knees do not move beyond your toes. The rubber band will push your knees into internal rotation (inwards), so make sure the patella (knee cap) is aligned with the second toe the whole time. Start with one set of 10 reps, holding each squat for 5 secs and increase the number of reps as your strength increases, up to 30 reps x 15 secs hold. EMS is recommended for this exercise with the 'contraction' time at least double the 'rest' time.



- **Single Leg Calf Raises:** Start on one leg with toes pointed straight ahead, and raise up onto your toes. Start with one set of 10 reps, holding each raise for 5 secs. Increase the number of reps up to 20 with 5 sec holds on each leg. Start by using support at a wall or table and progress to no support as able.



- **Lunges:** Standing with feet as pictured, squat down to lunge as shown. Control the descent ensuring your knee that is forward does not move beyond your toes. Start with 1 set of 10, holding each lunge for 5 secs. Increase the number of reps as your strength increases, up to 3 sets of 10 on each leg.



- **Gluteals: (single leg bridges)** In lying with your knees bent and your arms by your sides, squeeze your buttocks and lift up to create a bridge. Straighten one knee and hold that leg in the air. Keep straight alignment from your shoulders to your knees. Be careful not to push down on your neck or shoulders – use your buttocks to do the work. Start with one set of 10, holding each lift for 5 secs. Increase the number of reps as your strength increases, building up to 15 reps with 10 sec holds for each leg.



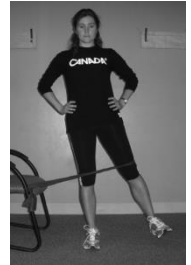
- **Hamstrings:** Lying on your stomach, place a resistance band around your ankle and also have it attached to an anchor point as shown. Slowly bend your knee against the resistance of the band pulling your foot towards your buttock. Start with 1 set of 10 reps and increase to 3 sets of 15 reps.



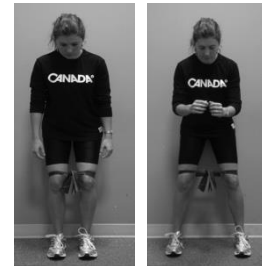
- **Hip Extension:** Stand with legs shoulder-width apart with a resistance band around one of your thighs just above your knee as shown. Extend your leg to place slight tension on the resistance band. Slowly move the leg backwards against the resistance of the band using the muscles in your buttock and the back of your thigh. Start with 1 set of 10 reps and increase to 3 sets of 15 reps.



- **Hip Abduction:** In the position shown, with a resistance band around your outside thigh just above your knee, lift your leg to place slight tension on the band. Move this leg sideways slowly against the resistance of the band using the muscles in your buttock and your hip. Start with 1 set of 10 reps and increase to 3 sets of 15 reps.



- **Hip Abduction (additional):** In standing with legs hip width apart and feet pointing forwards, tie a resistance band around your thighs as shown. Take a sideways step against the resistance of the band and then step back to the starting position with your other leg. Start with 10 steps to the left and right, and increase to 3 sets of 15 steps to the left and right.



- **Combination: Hip extension + external rotation + abduction:** In standing with legs hip width apart and feet straight forwards, tie a resistance band around your thighs as shown. Move your leg outwards and backwards in a **45-degree** angle with your toes slightly pointing out. Keep your pelvis square and still, so you don't compensate with your back muscles. Engage your "back pocket muscles" as you perform the movement. Start with one set of 10, holding each movement for 5 secs. Increase the number of reps as your strength increases.



- **Single leg dead lift with pole:** Stand on your non-operated leg first and hold the pole behind your back to keep it in a neutral position. Keep the supporting knee still. Flex forward from the hips, allowing the opposite hip to extend while keeping the spine neutral and the hips facing forward. The foot that goes up should be pointed down to help prevent hip rotation. Hinge forward through the hips only as far as you are able to maintain a neutral spine, keeping the shoulders and hips parallel to the floor.



- **Reverse bridge:** Place your palms, with fingers spread wide, on the floor slightly behind and outside your hips in a sitting position. Press into your palms, and lift your hips and torso toward the ceiling, trying to keep a straight line from head to knees, which will be bent at 90 degrees. Hold for 10 seconds and slowly lower the hips back down. Start with one set of 10. Increase the number of reps as your strength increases, up to 20 reps with 15 sec hold.



- **Side Planks:** Lie on one side with the legs stacked on top of one another then prop the body up on the hand or elbow while keeping the feet stacked. Start with one set of 10 repetitions on each side, holding each lift for 15 secs. Increase the holding time as your strength increases.



### 3. Proprioception:

- **Single leg stance (eyes open → eyes closed)**
- **Single leg stance on an unstable surface (thick carpet → foam block → camping mattress → pillow)**
- **Single leg squats on trampoline:** Standing on one leg, slowly squat bending your knee from 0° to a maximum of 90°, making sure your knee does not move beyond your toes. Start with one set of 10 reps, holding each squat for 5 secs and increase the number of reps as your strength increases, up to 20 reps x 15 sec holds for each leg.



- **Single leg stance with ball toss:** Standing on one leg on a BOSU or other unstable surface (i.e. foam), toss and catch a light ball against a wall. Start with 2 sets of 10 tosses on each leg and increase as strength and balance improve.



### 4. Cardio:

- Stationary bike cycling with resistance.
- If you have good balance you can commence outdoor cycling on a smooth, flat surface.
- Maintain or improve aerobic fitness by doing a 30-minute workout, at least 3 to 4 times a week. Ideas include aquatics, swimming, hiking, cycling, elliptical trainer and straight line skating. Impact on the knee should be avoided at all times.

**\*\* Perform all exercises at least once per day, 4-5 days per week, including cardio and resistance training, to improve your strength and range of motion.**

**You should perform all of the exercises on both legs\*\***

#### **ALSO CONSIDER:**

- Gait pattern exercises using an agility ladder (forward/backward/side to side)
- Hamstring curls in supine lying with a physio ball;
- Other core exercise ideas include bridging with legs on physio ball, bridging with back on physio ball, sit ups on physio ball, side sit ups on physio ball, “dead bug” on a BOSU and Pilates core exercises.
- Hip adduction: bridging with ball squeeze
- Stretching – stretch after exercising (quadriceps, hamstrings, calves, hip flexors)

#### **REQUIREMENTS FOR PROGRESSION TO PHASE 4**

- ✓ **Single leg squat with good motor control on an unstable surface to 70° flexion**
- ✓ **Ability to demonstrate good core control and posture in single leg stance activities**
- ✓ **Evidence of improvement in strength (hamstrings, hip abductors, hip extensors, hip rotators)**

## PHASE 4: Strength, Agility and Return to Function (6-12 months)

This phase begins as early as 6 months post-operatively and may last up to 12 months postoperative. This phase focuses on maximizing strength, increasing agility and return to function.

### GOAL

1. Maximize quadriceps, hamstrings, hip and core strength with functional exercises
2. Increase agility
3. Able to perform all daily life activities
4. Commence sport activities limited to aquatics, swimming, hiking, outdoor cycling, x-country skiing
5. Avoid impact

### NON-IMPACT

It is very important that during the first year after surgery, any impact on the operative knee should be avoided. Even light-impact should not be considered before completing the 1<sup>st</sup> year of rehabilitation. Similar to the third phase, this fourth phase is a non-impact phase.

In this phase there will be a focus on functional exercises that will enable you to return to function, performing all activities of daily life. Sport activities are limited to activities such as aquatics, swimming, hiking, biking, skating and X-country skiing and should only be commenced with approval from your surgeon.

### COLD THERAPY & ELEVATION

Manage your swelling by continuing to use cold therapy and elevation, especially after exercise or physiotherapy sessions.

### EXERCISES

1. **Strengthening: progressive strengthening program ensuring all muscle groups are included using functional exercises. Weight training should be limited to half the body weight.**
  - Quadriceps (stair descent)
  - Hamstrings (reverse lunge)
  - Hips (side shuttles with resistance band)
  - Calves (heel raises on unstable surface)
2. **Proprioception:**
  - **Squats on a BOSU:** Slowly squat with equal weight on each leg. Bend your knees from 0° to a maximum of 90° of flexion, making sure your knees do not move beyond your toes. Start with one set of 10 reps, holding each squat for 5 secs. Increase the number of reps as your strength increases, up to 20 reps x 15 sec holds on each leg. Progress to single-leg squats starting with 10 reps x 5 sec holds, increasing to 20 reps x 15 sec holds on each leg.



- **Lunges on a BOSU:** Step forward or back and lunge as shown. Control the descent ensuring your knee that is forward does not move beyond your toes. Start with 1 set of 10 reps, holding each lunge for 5 secs. Increase the number of reps as your strength increases up to 3 sets of 10 on each leg.



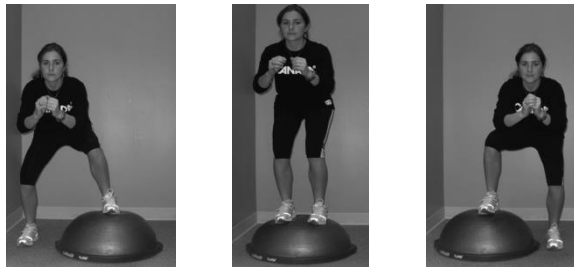
### 3. Dynamic Core:

- **Mountain climber:** Assume a press up position so your hands are directly under your chest at shoulder width apart with straight arms. Your body should form a straight line from your shoulders to your ankles. Lift your right foot off the floor and slowly raise your knee as close to your chest as you can. Return to the starting position and repeat with your left leg. Start with 1 set of 10. Increase the number of reps as your strength increases up to 3 sets of 15.
- **Ups and downs:** Assume a press up position so your hands are directly under your chest at shoulder width apart with straight arms. Your body should form a straight line from your shoulders to your ankles. Lift your left hand off the ground and then place your left forearm on the ground where your hand just was. Do the same with your right arm. Now pick your right forearm off the ground and put your palm back on the ground. Follow again with your left arm. This completes one repetition. Start with 1 set of 10. Increase the number of reps as your strength increases up to 3 sets of 10.



### 4. Agility: Patient must be able to perform a very well controlled single leg squat before commencing plyometric exercises.

- **Side to side steps on the BOSU:** Perform quick steps in both directions over BOSU. Start with 1 set of 10 steps in both directions and progress to 3 sets of 15 steps in both directions as your strength increases.



### 5. Cardio:

- Maintain or improve aerobic fitness by doing a 60-minute workout, at least 3 to 4 times a week. Ideas include aquatics, swimming, hiking, outdoor cycling, elliptical trainer, and straight line skating.
- Cross-country skiing on even, flat surfaces may be commenced around 6 months post-operative only with approval from your surgeon.

**\*\* Perform all exercises once per day to improve your strength and range of motion.**

**You should perform all of the exercises on both legs\***

## REQUIREMENTS AT THE END OF PHASE 4

- ✓ Able to perform agility exercises with good motor and core control
- ✓ Good strength and improved endurance of bilateral lower extremities
- ✓ Improved aerobic endurance
- ✓ Return to function, ability to perform all daily activities

## 1 YEAR POST-SURGERY ADVICE

### ***\*\*Limit impact activities\*\****

An osteochondral transplant is a relatively fragile joint sparing procedure where the goal of the surgery is to prevent bone deterioration. It is therefore recommended that impact activities be limited indefinitely. Trial of light jogging if tolerated will be acceptable after a year. However more impact activities in your life increases the chance of the collapse of the bone graft.

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