

Anterior Cruciate Ligament Reconstruction Preoperative Instructions

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WITHIN A FEW WEEKS BEFORE SURGERY

Dr. Sanders will see you in the office. He will do a preoperative history and physical examination and complete the necessary paperwork. He will write preoperative hospital orders and schedule an appointment with the pre-operative test center. You will have an opportunity to speak with anesthesia and physical therapy. It is recommended that you utilize a stationary cycle to maintain your knee range of motion and improve the overall function of the knee prior to surgery.

SEVERAL DAYS PRIOR TO SURGERY

Wash the knee several times a day to get it as clean as you can. This decreases the risk of infection. **Be careful not to get any scratches, cuts, sunburn, poison ivy, etc.** The skin has to be in very good shape to prevent problems. You do not need to shave.

THE DAY BEFORE SURGERY

Please be in touch with Dr. Sander's office to confirm the exact time that you should report to the hospital for surgery. **You can have nothing to eat or drink after midnight on the day before surgery.** It is very important to have a completely empty stomach prior to surgery for anesthesia safety reasons. If you have to take medication, you can do so with a sip of water early in the morning prior to surgery (but later tell the anesthesiologist you have done so).

DAY OF SURGERY

Report directly to the hospital two hours prior to surgery.

SURGERY

The operation to replace the torn **anterior cruciate ligament** will be done arthroscopically. A small incision will be made on the inner side of the knee to take the graft from the middle of the patellar tendon together with a small piece of bone from the bottom of the knee cap to the upper part of the leg bone (mid-third patellar tendon graft, bone-tendon-bone). The incision leaves a small area of numbness on the outer side of the upper leg. Most of this numbness clears but it takes a year or two and is not usually bothersome. In certain circumstances, the graft is a hamstring tendon or a donor graft from a cadaver (allograft).

AFTER SURGERY

Prior to surgery, a **continuous passive motion (CPM) machine** will be delivered to your home. This is a small apparatus that sits on the bed onto which your knee rests. The CPM very slowly bends and straightens out the knee. Once you get used to the machine, it actually hurts much less and your rehabilitation is much quicker if you use a CPM.

You will be able to adjust the CPM with a **hand-controlled unit**. The most important part of using the CPM in your postoperative rehabilitation is **to get the knee out straight (extension)**. The machine is set to **pause for five seconds in extension** to allow you to stretch the knee fully. How much flexion (bending) you gain is not as important; how quickly the machine moves also is not important. For the first several days, just allow the machine to bend the knee as much as is comfortable and gradually work on gaining more flexion as the week progresses. After four days, try to have the CPM at 90 degrees of flexion. **The most important aspect is to get the knee out straight.**

You will be able to **adjust the speed**: at night have the machine move as slowly as possible and you will be able to sleep better. During the day, you can speed up the machine and also gain more flexion.

You will be given a **prescription** for pain medication to take home with you. In addition to this medication, you should take one aspirin a day to help prevent blood clots (phlebitis) for 10 days. The pain medication has a tendency to make you constipated. Let us know if this is a problem.

The **dressing** should be changed the day following surgery and can be removed at two days. The wound is sealed with steri-strips (small pieces of tape on the skin). You **can shower** on the second day following surgery, but be careful standing in the shower so that you **do not fall**. It is better to have a small stool to be able to sit on. However, you can get the leg wet and wash it. **Do not submerge the knee under water in a bath, hot tub, or swimming pool.**

You should wear the white stockings for one week after surgery to help control swelling in the lower leg. **If you develop calf pain or excessive swelling in the leg, call Dr. Sanders.**

The **cryocuff** is a blue wrap that is put on the knee to keep it cold. You can use this as often as you want to cool down the knee to reduce swelling and pain. Check your skin every time that you remove the wrap to make sure that it is intact.

For one week following surgery, it is best to be in the CPM for approximately 10 hours a day. You can get up whenever you want to but it is best to get up more frequently for short periods of time. If you are out of the CPM for a long period of time, the knee tends to become stiff and painful. This is not really a problem, but it takes a while to get the knee loosened up again and moving in the CPM. Thus, getting up more frequently for short periods of time is better than being out for a long period of time.

ACL Rehabilitation Protocol

Phase I: 0-2 weeks after surgery

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This protocol is a guideline for your **rehabilitation after anterior cruciate reconstruction**. You may vary in your ability to do these exercises and to progress from one phase to the other. Please call the doctor if you are having a problem with your knee or if you need clarification of these instructions.

PHASE I: 0 - 2 weeks after surgery

You will go home with a **knee brace, crutches, cryocuff cold therapy unit and a CPM machine**.

GOALS:

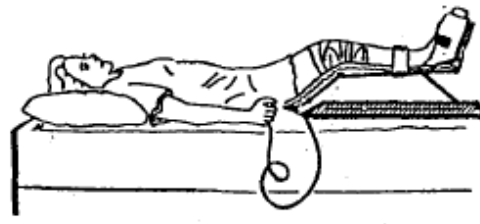
1. Protect the reconstruction - avoid falling
2. Ensure wound healing
3. Attain and maintain full knee extension
4. Gain knee flexion (knee bending) to 90 degrees
5. Decrease knee and leg swelling
6. Promote quadriceps muscle strength
7. Avoid blood pooling in the leg veins

ACTIVITIES

1. CONTINUOUS PASSIVE MOTION (CPM)

Use the CPM machine at home as much as possible.

You should use the machine at least 10 hours per day. You may move the machine to a sofa, the floor or onto a bed **as you change positions and locations**. You should use the machine at night while sleeping; slow down the machine at night to facilitate sleeping.



Extension (knee straight) on the machine should be set at **minus five degrees** at all times to help your knee extend. **It is very important that you straighten the knee completely!** The machine should be programmed to include an extension pause of 5 seconds (in other words, when the knee is straightened out, it pauses in the straight position to allow you to stretch it out straight).

This flexion setting will start at around 30 - 40 degrees and should be gradually increased to at least 90 degrees as you can tolerate more bending of your knee. After 5 to 7 days of CPM, if you have attained greater than 100 degrees of flexion (bend), you can discontinue CPM and begin stationary cycling with the approval of the doctor or his physical therapist.

2. BRACE/CRUTCHES

Your knee brace is set to allow your knee to bend and straighten. Use it when walking. Put as much weight on your operated leg as possible when walking. You should use the crutches in the beginning, but can discontinue the crutches when you have confidence in the knee to support you. In some cases, crutches and restricted weight bearing may be necessary for longer periods. The doctor or physical therapist will give special instructions in these cases.

3. CRYOCUFF (COLD APPLICATION)

If you are experiencing pain, swelling, or discomfort, we suggest icing for 15-20 minutes with at least a 60-minute break in between. Use your cryocuff or place ice in a zip lock bag and/or in a towel and apply to the injured area. Never place ice directly on the skin.

4. WOUNDCARE

Remove your bandage on the second morning after surgery but leave the small pieces of white tape (steri-strips) across the incision. You can wrap an elastic bandage (ace) around the knee at other times to control swelling. You may now shower and get your incision wet, but **do not** soak the incision in a bathtub or Jacuzzi until the stitches have been removed.

5. ASPIRIN / ELASTIC STOCKINGS

Take an aspirin each morning, wear an elastic stocking (TED) below the knee, and do at least 10 ankle pump exercises each hour to help prevent phlebitis (blood clots in the veins).

6. FREE / MACHINE WEIGHTS

Upper Body/Trunk Only

We suggest that you do not use any lower extremity free or machine weights. If you are doing free or machine weights for the upper body and trunk, we suggest a very light resistance of 3 sets of 15-20 repetitions. Do not place yourself in a compromising position with your recently operated knee.

EXERCISE PROGRAM

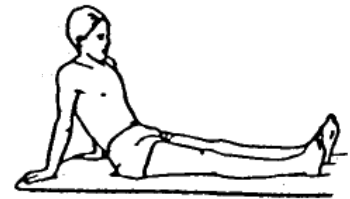
RANGE OF MOTION EXERCISES (brace off)

Days per Week: 7

Times per Day: 3-4

Quadriceps setting	1-2 sets of 15-20 reps
Heel prop	5 minutes
Heel slides with towel assist	1 set of 5 to 15 minutes
Sitting heel slides	1 to 2 sets of 15 to 20 reps
Straight leg raises	1-2 sets of 15-20 reps
Patellar mobilization	1 set for 1 to 3 minutes
Hip abduction	3 sets of 10 reps
Ankle pumps	1 set of 2 to 3 minutes
Prone hang	5 minutes

Quadriceps setting - to maintain muscle tone in the thigh muscles and (extend) straighten the knee. Lie on your back or sit with the knee extended fully straight as in the figure. Tighten (contract) and hold the front thigh muscle (quadriceps) making the knee flat and straight. If done correctly, the kneecap will slide slightly upward toward the thigh muscle. The tightening action of the quadriceps muscles should make your knee straighten and be pushed flat against the bed or floor. Hold 5 seconds for each contraction. Do 20 repetitions three times a day and also try to do any time your knee is out of CPM.

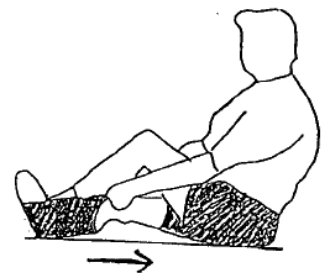


Patellar Mobilization to prevent scar tissue from binding the kneecap. With the knee fully straightened, grasp the edges of your kneecap between your thumb and index finger. Move the kneecap side to side and up and down.



Heel Slides to gain knee flexion.

While sitting or lying on your back, actively slide your heel backward to bend the knee. Keep bending the knee until you feel a stretch in the front of the knee. Hold this bent position for five seconds and then slowly relieve the stretch and straighten the knee. While the knee is straight, you may repeat the quadriceps setting exercise. Continue this exercise until you can fully bend your knee equal to the unoperated side. Also, as you start to gain flexion, you can assist your efforts to gain flexion by assisting the heel slide with a towel. See illustration. Repeat 20 times, three times a day.



Sitting Heel Slides - to regain the bend (flexion of the knee).

When sitting in a chair, slide the heel backward as if trying to get the foot underneath the chair (figure 5). Hold 5 seconds and slowly relieve the stretch by sliding the foot forward. You can help with the opposite foot if necessary.



Heel prop - to straighten (extend) the knee.

Lie on your back with a rolled up towel under your heel or sit in a chair with the heel on a stool as shown. Let the knee relax into extension (straight). If the knee will not straighten fully, you can place a weight (2 to 5 pounds) on the thigh, just above the kneecap. Try to hold this position for **5 minutes, three times a day. While maintaining this extended position, practice quadriceps setting.**

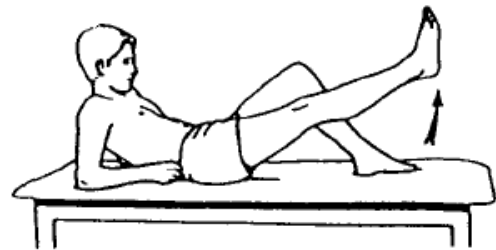
Prone hang - to straighten (extend) the knee.

Lie face down across your bed so that the kneecap is just off the edge of the mattress. Let your leg drop down toward the floor so that your knee straightens fully. If the knee will not fully extend, then attach a weight around the ankle to help pull the leg down. Use an amount of weight as described above for the heel prop exercise. Try to hold this position for **5 minutes, three times a day.**



Straight Leg Lift - **The quality of the muscle contraction in this exercise is what counts the most, not just the ability to lift the leg!**

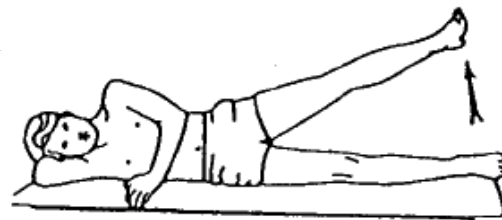
1. Tighten the quadriceps (quadriceps setting) as much as you can, push the back of the knee against the floor.
2. Tighten this muscle **harder!**
3. Lift your heel 4 to 6 inches off the floor
4. Tighten the quadriceps **harder again.**
5. Lower your leg and heel back to the floor. Keep the quadriceps as tight as possible.
6. Tighten this muscle **harder again.**
7. Relax and repeat



If the knee bends when you attempt to lift the limb off of the bed, do not do this exercise. Keep trying to do the quadriceps setting exercise until you can lift the limb without letting the knee bend.

Hip Abduction

Lie on your unoperated side. Keep the knees fully extended. Raise the operated limb upward to a 45 degree angle as illustrated. Hold one second, then lower slowly.



Ankle Pumps - to stimulate circulation in the leg. Move your foot in an up and down motion 30- 40 times a minute.



OFFICE VISIT

Please return to see your surgeon approximately **seven to fourteen ten days** after your surgery. At this time, your sutures will be removed and your progress will be checked. You will see the physical therapist for exercise instruction. You will discontinue CPM at this time.

START PHYSICAL THERAPY

- You can start formal physical therapy about 3 to 5 days after the operation.
- We ask that your physical therapist follow our written protocol.
- If your PT has questions, please ask them to call us to discuss them.

ACL Rehabilitation Protocol

Phase II: 2-6 weeks after surgery

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Goals

1. Protect the reconstruction, avoid falling
2. Ensure wound healing
3. Maintain full knee extension (straighten knee fully)
4. Begin quadriceps muscle strengthening
5. Attain knee flexion of 120 degrees or more
6. Decrease knee and leg swelling
7. Normal gait without crutches

ACTIVITIES

1. Cryocuff

Use the cryocuff or ice bags to decrease swelling for 20 minutes three times a day after each exercise session.

2. Brace / Crutches

In cases where the patellar tendon autograft is used, you can begin placing all of your weight on the operated leg when you walk unless otherwise instructed by your surgeon. Discontinue using your crutches when you are comfortable doing so. Continue using your brace when walking outside of the home until you are confident that you can walk safely without the brace. Within one or two weeks, you can usually discontinue use of the crutches if you have good control of the leg and are sure that you will not fall or get injured. Concentrate walking normally, in a heel-strike to toe-off pattern, without a limp. Occasionally (every one or two hours) practice standing on your operated leg, with your knee fully straight, for 10 to 20 seconds.

In cases where hamstring autograft or allograft is used, you will be advised to put partial weight (50%) on your leg with crutches and brace for the first 6 weeks after surgery.

3. Swelling

Continue using the elastic stockings (TED) for the lower leg and wrapping the knee with an elastic bandage (ACE) to control swelling.

4. Exercise Program

Stationary Bicycle

Days per week: 5-7

Times per day: 1-2

Utilize a stationary bicycle to move the knee joint and increase knee flexion. If you cannot pedal all the way around, then keep the foot of your operated leg on the pedal, and pedal back and forth until your knee will bend far enough to allow a full cycle. Most people are able to achieve a full cycle revolution backwards first, followed by forward. You may ride the cycle with no resistance for up to 10-15 minutes, 1 to 2 times a day. Set the seat height so that when you are sitting on the bicycle seat, your knee is fully extended with the heel resting on the pedal in the fully bottom position. You should then actually ride the bicycle with your forefoot resting on the pedal.



Water Workout (optional)

Days per week: 3

Times per day: 1

Aqua-jogger exercise or

20-30 minutes

Flutter-kick swimming

20-30 minutes

Range of Motion and Strengthening Exercises(brace off)

Days per Week: 5-7

Times per Day: 1-2

Quadriceps setting	1-2 sets of 1 5-20 reps
Heel prop	5 minutes
Prone hang	5 minutes
Heel slides with towel assist	1 set of 5 to 15 minutes
Standing hamstring curl	3 sets of 10 reps
Standing toe-raises	3 sets of 10 reps
Hip abduction	3 sets of 10 reps
1/3 knee bends	3 sets 15 reps
Wall slides	3 sets of 15 reps

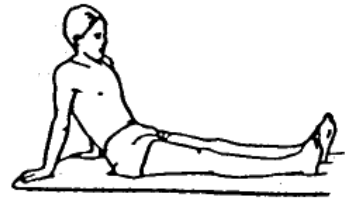
Patellar Mobilization to prevent scar tissue from binding the kneecap. finger. Move the kneecap side to side and up and down. With the knee fully straightened, grasp the edges of your kneecap between your thumb and index finger. Move the kneecap side to side and up and down.



Heel Slides to gain knee flexion. While sitting or lying on your back, actively slide your heel backward to bend the knee. Keep bending the knee until you feel a stretch in the front of the knee. Hold this bent position for five seconds and then slowly relieve the stretch and straighten the knee. While the knee is straight, you may repeat the quadriceps setting exercise. Continue this exercise until you can fully bend your knee equal to the unoperated side. Also, as you start to gain flexion, you can assist your efforts to gain flexion by assisting the heel slide with a towel. See illustration. Repeat 20 times, three times a day.



Quadriceps setting - to maintain muscle tone in the thigh muscles and (extend) straighten the knee. Lie on your back or sit with the knee extended fully straight as in the figure. Tighten (contract) and hold the front thigh muscle (quadriceps) making the knee flat and straight. If done correctly, the kneecap will slide slightly upward toward the thigh muscle. The tightening action of the quadriceps muscles should make your knee straighten and be pushed flat against the bed or floor. Hold 5 seconds for each contraction. Do 20 repetitions at least three times a day.



Heel prop - to straighten (extend) the knee.

Lie on your back with a rolled up towel under your heel or sit in a chair with the heel on a stool as shown. Let the knee relax into extension (straight). If the knee will not straighten fully, you can place a weight (2 to 5 pounds) on the thigh, just above the kneecap. Try to hold this position for 5 minutes, three times a day. While maintaining this extended position, practice quadriceps setting.



Prone hang - to straighten (extend) the knee.

Lie face down across your bed so that the kneecap is just off the edge of the mattress. Let your leg drop down toward the floor so that your knee straightens fully.

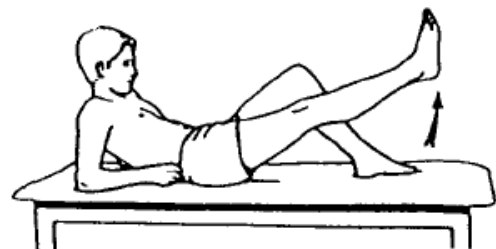


If the knee will not fully extend, then attach a weight around the ankle to help pull the leg down. Use an amount of weight as described above for the heel prop exercise.

Try to hold this position for 5 minutes, three times a day.

Straight Leg Lift - The quality of the muscle contraction in this exercise is what counts the most, not just the ability to lift the leg!

1. Tighten the quadriceps (quadriceps setting) as much as you can, push the back of the knee against the floor.
2. Tighten this muscle **harder!**
3. Lift your heel 4 to 6 inches off the floor
4. Tighten the quadriceps **harder again.**
5. Lower your leg and heel back to the floor. Keep the quadriceps as tight as possible.
6. Tighten this muscle **harder again.**
7. Relax and repeat.



If the knee bends when you attempt to lift the limb off of the bed, **do not** do this exercise. Keep trying to do the quadriceps setting exercise until you can lift the limb without letting the knee bend.

Standing Hamstring Curl

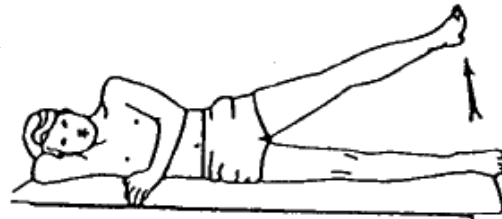
Stand facing the wall, using the wall for balance and support. While standing on the unoperated limb, bend the knee of the operated side and raise the heel toward the buttock. Hold this flexed position for one second. Slowly lower the foot back to the floor. Keep the thighs aligned as illustrated. -



Standing Toe Raises

Stand facing a wall, hands on the wall for support and balance.

Keep the knees extended fully. Tighten the quadriceps to hold the knee fully straight. Raise up on 'tip-toes' while maintaining the knees in full extension. Hold for one second, then lower slowly to the starting position.



Hip Abduction

Lie on your unoperated side. Keep the knees fully extended. Raise the operated limb upward to a 45 degree angle as illustrated. Hold one second, then lower slowly.

1/3 Knee bends

Stand facing a table or desk with the feet about 1 foot apart. Lean forward at the hips and bend the knees as if starting to sit down. Lower the hips about 5 or 6 inches, pause 1 to 2 seconds and return to the full upright position.



Wall Slides

Stand upright with your back and buttocks touching a wall. Place the feet about 12 inches apart and about 8 inches from the wall. Slowly lower your hips by bending the knees and slide down the wall until the knees are flexed about 45 degrees (illustration). Pause five seconds and then slowly slide back up to the upright starting position. Do 3 sets of 10 to 15 repetitions.



OPTIONAL ADDITIONAL EXERCISES -

You can start the Leg Press and Hamstring curl machine during this phase under supervision of a physical therapist if you have achieved the following goals:

- Full passive knee extension
- Full extension while quadriceps setting
- Flexion of 125 degrees
- Minimal swelling

OFFICE VISIT

Please return to see Dr. Sanders approximately **six weeks** after your surgery.

ACL Rehabilitation Protocol

Phase III: 6-12 weeks after surgery

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Goals:

1. Protect the reconstruction; avoid falling.
2. Maintain full knee extension.
3. Attain full knee flexion.
4. Walk with a normal heel-toe gait with no limp.
5. Muscle strength and conditioning improvements.

1. Brace

The brace is discontinued after you see your surgeon at your 6 week post-operative office visit. Concentrate on walking with a heel-toe gait without a limp. In some cases, use of the brace will continue if the knee requires a longer period of protection.

2. Cryocuff/Ice

Continue to use the cryocuff for 20 minutes after each workout.

3. Exercises

Range of motion and Strengthening Exercises

Days per week: 3 Times per day: 1

Quadriceps setting	1-2 sets of 15-20 reps
Heel prop	5 minutes
Prone hang	5 minutes
Heel slides with towel assist	1 set of 5 to 15 minutes
Straight leg raises	3 sets of 10 reps
Standing hamstring curl	3 sets of 10 reps
Standing toe-raises- single leg	3 sets of 10 reps
Hip abduction	3 sets of 10 reps
Squat to chair	3 sets of 15 reps
Wall slides	3 sets of 15 reps
Single leg strengthening progression	see timeline

Stretching Exercises

Days per week: 5-7 Times per day: 1-2

Hamstring stretch	3-5 reps holding 15 to 30 seconds
Quadriceps stretch	3-5 reps holding 15 to 30 seconds
Calf Stretch	3-5 reps holding 15 to 30 seconds

Cycling

Days per week: 3-4

Times per day: 1

Stationary or outdoor (mountain or road bikes)	30-45 minutes
(Stay on flat terrain and remain on seat)	Progressive moderate resistance
Indoors- Brace off	
Outdoors- Brace ON	

Water Workout

Days per week: 2

Times per day: 1

Same as Phase 2

Optional Additional Weight Training

Days per week: 2-3

Times per day: 1

The following exercises may be added to your exercise program about 8 weeks after surgery:

Seated Leg Press	3 sets
Hamstring Curl	3 sets

Additional Activities

Days per week: 1-2

Times per day: 1

Walking	20-30 minutes
Rowing	20-30 minutes
Cross Country Ski Machine	20-30 minutes

Hamstring Stretch

Perform this stretch in the position illustrated at the right. Bend slowly forward at the hips, keeping the knee fully extended until you feel gentle stretch in the back of your thigh and knee. Hold the stretch for 15 to 20 seconds and repeat 3 to 5 times.

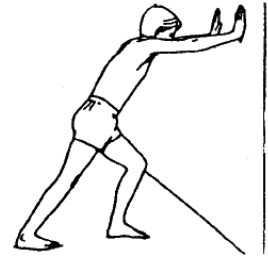


Quadriceps Stretch

This stretch is performed in the position illustrated at the right. Lean gently backward as if bringing you heel toward the buttock. When a stretch is felt in the front of the thigh and knee, hold 15 to 20 seconds for 3 to 5 repetitions.

Calf/Achilles Stretch

In the position illustrated, keep the heel flat on the floor and the knee fully extended. Lean forward at the hips with the arms supporting your weight. When you feel a gentle stretch in the back of your calf and knee, hold for 15 to 20 seconds, 3 to 5 repetitions.



Straight Leg Lift and Hip Abduction lift

Add 1 lb. per week to reach 5 lbs.

Squat to Chair

In the chair squat exercise, you lower your buttocks toward the chair until your buttocks touch the chair. Do not sit or rest at the chair, but instead immediately and slowly return to the standing and starting position. Remember to keep your head over your feet and bend at the waist as you descend. After the first week, you may hold dumbbells while performing this exercise. Start with **3** to 5 pounds each hand. You may add 2 to **3** pounds per week until you reach 10 pounds in each hand.



Wall slide

Continue the wall slide exercise from phase 2, progress to using dumbbells for resistance as described for the chair squat.

Single-Leg Strengthening Progression

At this time, it is important to begin the development of single-leg strength. Begin to follow the "Progression for Single Leg Strengthening after ACL Reconstruction" included in this packet if you are able to do the exercises without pain. The instructions estimate a time period of 10 to 12 weeks for you to progress through the whole program. This time line will vary for different people and knees, depending upon the presence of other knee problems.

Please follow this program as written, step-by-step. When applicable, please ask your physical therapist to follow this progression as outlined. The progress of your strengthening will be evaluated using these particular drills and the timeline in the progression.

Standing Hamstring Curls

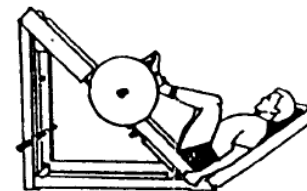
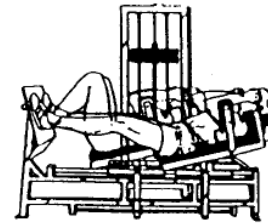
Add 1 lb. Per week to reach 5 lbs

Not necessary if using the hamstring curl machine at the gym.



Seated Leg Press

Use an amount of weight that feels easy enough to perform 20 repetitions as the starting weight for this exercise. Use this weight for the first week before raising the weight. The weight may be increased by about 5 pounds every 7 to 10 days thereafter, as long as you can perform 20 repetitions per set for **3** sets. In this exercise, avoid letting the knees **snap** or drop suddenly into extension when reaching the fully straightened position. Avoid starting the exercise with the knees excessively bent. Do not bend the knee so far that your calves and back of thighs touch. Adjust the seat position to limit the excursion of the machine.



Resisted Hamstring Curls

If you have access to a hamstring curl machine (illustration), you may start using it. As with the leg press, start with a reasonable weight and use that weight for the first week. You may increase the weight by 3 to 5 pounds every 10 days as long as you can perform 3 sets of 20 repetitions slowly, with good form. If you do not have access to a hamstring machine, continue doing the standing hamstring curl adding an ankle weight for resistance. Start with 3 to 5 pounds and add 1 pound per week until you build to 10 pounds for 3 sets of 15 repetitions.



Additional Weight Training

Hip Abductor/Adductor machine

Roman Chair

Calf Raise Machine

Phase 3 Exercise Program Summary:

Frequency: **3** times a week

Sets and repetitions: 3 sets of 10-15 repetitions

Exercises:

- Leg Press
- Hamstring Curl
- Wall Slides
- Roman Chair
- Chair Squat
- Calf Raises or Calf Raise machine
- Hip Abductor/Adductor machine
- Single leg strengthening progression
- Hamstring, Calf and Quadriceps stretching
- Quadriceps setting 20 repetitions, 3 times a day with heel prop

If you do not have access to gym equipment, the following exercises from phase 2 can be substituted using ankle weights (Start with one pound and add one pound a week until 5 pounds):

- Straight leg raise
- Side lying abduction
- Standing hamstring curl

Precautions When Exercising

- Avoid pain at the patellar tendon site
- Avoid pain and/or crepitus at the patella
- Build up resistance and repetitions gradually
- Perform exercises slowly avoiding quick direction change and impact loading
- Exercise frequency should be 2 to 3 times a week for strength building
- Be consistent and regular with the exercise schedule

Principles of Strength Training

- Warm-up prior to exercising by stationary cycling or other means
- You are "warmed -up" when you have started sweating
- Gently stretch all muscle groups next
- Do exercises involving multiple muscle groups first and individual muscle groups last
- Do aerobic workouts *after* strength workouts
- Cool-down by stretching after finishing exercise

DO NOT do any of the following exercises:

1. Knee extension weight lifting machine
2. Running
3. Jumping
4. Pivoting or cutting
5. Lunges
6. Stairmaster
7. Step exercises with impact

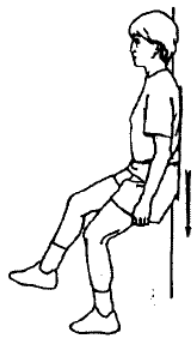
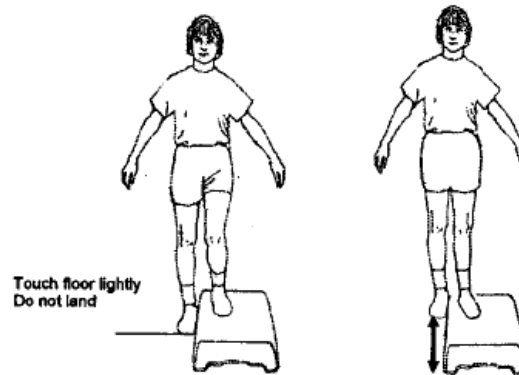
OFFICE VISIT

Please make an appointment to see Dr. Sanders in 6 to 8 weeks (about three to four months after surgery).

Instructions for Single Leg Exercises

Step Up- Down Exercise

Place the foot of the operated limb on a step or stool. Maintain balance, if necessary, by holding onto the wall or chair. Slowly step up onto the stool and slowly straighten the knee using the quadriceps muscles. Keeping an upright posture and bending only at the knee, slowly lower the opposite foot to touch the floor. Keep the back straight and do not let your hips go backward. Do not land on the floor, just touch gently and repeat the step up motion.



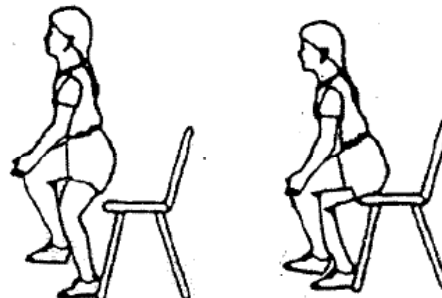
Wall Slide

Single Leg Wall Slide Exercise

Stand on the single leg with your back and buttocks touching a wall. Place the foot about 6 inches from the wall. While maintaining balance, slowly lower your body by bending the knee and slide down the wall until the knee is flexed about 45 degrees (illustration). Pause five seconds and then slowly slide back up to the upright starting position. Keep the hips level and be sure you are using your knee muscles to perform the exercise.

Single Leg Squat Exercise

In the single leg squat exercise, while maintaining balance, you stand on the single leg and then lower your buttocks toward the chair. Slowly return to the standing and starting position. Remember to keep your head over your feet and bend at the waist and hips as you descend. You do not have to squat all the way to the chair, instead, try to stay in a comfortable range of motion where there is no knee pain. As you gain strength, try to do the exercise without holding on to anything



Progression for Single Leg Strengthening

Step Up-Down exercise (6 to 12 weeks after surgery)

Start with a step of 3 inches in height

Start with 3 sets of 5 repetitions

Add one repetition per set, per workout, until you can do 3 sets of 10 (about 2 weeks)

If pain free, progress to a step of 6 inches in height

Repeat progression starting with 3 sets of 5 repetitions

Add one repetition per set until you can do 3 set of 10 (about 2 weeks)

If pain free, progress to a step of 9 inches in height (the height of a standard stair)

Repeat process of progression from 3 sets of 5, to 3sets of 10 (about 2 weeks)

At this point, you can begin to add the single leg wall slide exercise. The strength workouts should be practiced 3 times a week (every other day).

Single Leg Wall Slide (12 to 16 weeks after surgery)

Start with 3 sets of 5 repetitions

Add one repetition per set, per workout, until you can do 3 sets of 10 (about 2 weeks minimum)

At his point, you can begin to add the single leg squat exercise. The strength workouts should continue every other day at the most, with more time between workouts if the knee gets sore after a session. Alternate the workouts between single leg wall slide and the single leg squat, e.g.,

Monday Single leg wall slide

Wednesday Single leg squat

Friday Single leg wall slide

Single Leg Squat (16 to 24 weeks after surgery)

Start with 3 sets of 5 repetitions

Add one repetition per set, per workout, until you can do 3 sets of 10 (about 2 weeks minimum). After working up to the point where you can do 3 sets of ten of all three drills, you can hold dumbbells to add resistance. Start with 3 pounds in each hand and add 1 to 2 pounds a week until you reach 10 pounds in each hand. As you get stronger and gain better control of you leg muscles, try not to hold onto anything for balance. When you return to sports or recreational activities, decrease the strength workouts to 2 times a week and do 1 set of 10 of each of the three drills &, as a maintenance workout.

ACL Rehabilitation Protocol

Phase IV: 12-16 weeks after surgery

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Goals:

1. Regain full muscle strength.
2. Work on cardiovascular conditioning.
3. Do sports-specific training.

ACTIVITIES

Muscle-Strengthening Exercises

You should continue muscle-strengthening exercises from phase 2 and 3 on a three times a week basis. At this time, you can decrease the number of repetitions per set from 15 to 10. This will allow you to work with more resistance. Remember to do all exercises slowly, with good form. You may begin to hold dumbbells when doing the chair squat, single-leg knee bends and single-leg wall slides. Weights can be increased when you can do a particular weight easily, for 3 sets of 10 repetitions, for 3 consecutive workouts. At all times, be cautious of pain or crunching at the kneecap or patellar tendon while exercising. You may use resistance machines at your gym, but **DO NOT use the knee extension machine and DO NOT do lunging or high impact drills.**

Cardiovascular Conditioning

You can use Nordic track, stationary bicycle, rowing machine or swimming workouts to build cardiovascular fitness. Three to five times per week for 20 to 30 minutes is sufficient for improvement in this area. Please note that excessive long duration cardiovascular exercise can retard or delay muscular strength development when strength improvement and gains in muscle size are the programs primary goal. At this time, light running on a soft level surface with a sports brace can begin if your surgeon advises. You need to have full range of motion, good strength and no swelling to run safely. If you run, 3 times per week for 10 minutes is advisable for the first 2 weeks. If there is no pain or swelling, you can increase your running time by 1 minute per session for a maximum of 30 minutes. Walking and hiking on gentle trails can also be used for conditioning activity.

Progressive Resistance Exercise (PRE) Principle -

- To build muscle strength and size, the amount of resistance used must be gradually increased.
- The exercises should be specific to the target muscles
- The amount of resistance should be measurable and gradually increased over a longer period of time
- To avoid excess overload and injury, the weight or resistance must be gradually increased in increments of 5 to 10 %
- Resistance can be increased gradually every 10 to 14 days when following a regular and consistent program
- Adequate rest and muscle recovery between workout is necessary to maximize the benefit of the exercise
- If the PRE principle is followed too strictly, the weights potentially will go higher and higher.
- At a certain point, the joints and muscles will become overloaded and injury will occur.
- This eventuality can be avoided by refraining from using excessive weight during strength training.

Basic Knee Strengthening Program (Weeks 6 to 12 after surgery)

- Frequency: 2 to 3 Times per week
- Sets: 3 -
- Repetitions per set: 10- 15
- Emphasis is to build muscle strength using BOTH legs
- Progress according to the PRE principle

Basic Program Exercises- see illustrations at the back of the handout.

- Leg Press
- Hamstring Curl
- Wall Slides (hold dumbbells for resistance)
- Roman Chair (strengthens hamstrings)
- Chair Squat (hold dumbbells for resistance)
- Calf Raises
- Hip Abductor/Adductor machine
- Step Up/Down (see attachment for progression)

If you do not have access to gym equipment, the following exercises can be substituted using ankle weights (see illustrations and instructions attached):

- Straight leg raise
- Short-arc lift
- Side lying abduction
- Standing hamstring curl
- Toe raises

In general, the Basic Knee Strengthening Program is good for most people who are active recreationally, but who do not participate in running and jumping sports. For people who will participate in running and jumping sports, the following Advanced Knee Strengthening Program can be used to develop a higher level of knee strength.

Advanced Knee Strengthening Program (12 weeks after surgery onward)

- Frequency: 2 to 3 Times per week
- Sets: 3
- Repetitions per set: 10
- Emphasis is to continue to build muscle strength using both legs and progress to Advanced Exercises using the Single leg.
- Advanced Single leg exercises are integrated with the exercises from the Basic Knee Strengthening Program (see attachment for progression of single leg drills).

The following single leg drills are integrated into the workout on a rotating basis:

- Step Up/Down
- Single Leg Wall Slide
- Single Leg Squat

So that the Advanced Knee Strengthening Program would be as follows:

- Leg Press
- Hamstring Curl
- Wall Slides
- Roman Chair
- Chair Squat
- Calf Raises
- Step up/down
- Alternate workouts with single leg wall slide and single leg squat
- When starting the new single leg drills, start with 3 sets of 5, and add one repetition per set, per workout until you can do 3 sets of 10.
- When 3 sets of 10 are easy and pain free, then you can hold dumbbells to increase resistance and strength.

PRECAUTIONS

The following exercises are known to cause injury to the knee and are **NOT** recommended:

- Leg extension machine (quadriceps extensions)
- Stairmaster or stair climber machines
- Lunges
- Squats past 90 degrees of knee flexion
- High Impact and plyometric exercises

ACL Rehabilitation Protocol

Phase V: 16-24 weeks after surgery

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Cardiovascular Conditioning

Continue with the program outlined in phase 4.

Muscle Strengthening Exercises

Continue with the program outlined in phase 4.

Sports-Specific Training

To reach your ultimate goal of returning to sports participation, you must follow an orderly sequence of drills which are designed to re-train the muscle-to-joint coordination that is necessary to provide the proper control of your knee. The following time-table illustrates an ideal progression sequence:

<u>Activity</u>	<u>Weeks post-surgery</u>
Running slowly	12-16
Golf	16-20
Rollerblading	18
Sprinting	20-24
Tennis	20-24
Backward running	20-24
Zigzag running	20-24
Figure-of-eight running	20-24
Circle running	20-24
Carioca running	20-24
Running quickly with slow starts and slow stops	24
Running with sprinting with fast starts and stops	24
Hopping and jump training	24
Quickly pivoting and cutting	24
Return to sports practice	24-32
Full return to sports	32-36

Your physical therapist can provide you with specific instructions for each step in the sequence.

Returning to Sports

You should discuss the timing of return to sports activities and brace use with your surgeon.

ACL Rehabilitation Protocol

Phase VI: 24 weeks after surgery onward

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Athletes can usually progressively begin to return to the running, jumping and direction change drills necessary to train the knee to withstand the demands of full sports participation.

Goals:

1. Safely recondition the knee for the demands of sports activity.
2. Provide a logical sequence of progressive drills for pre-sports conditioning
3. Provide objective criteria for safe return to sports.

Sports Specific Training

Phases of Training

Straight-ahead running phase
Direction change running phase
Advanced direction change and impact phase

Prerequisites

Full Range of Motion
Strength at least 90 % of uninjured limb
Thigh girth within 1/2 inch of unaffected limb
No tenderness at the graft harvest site
Symmetrical quad and hamstring flexibility
Perform and pass sports tests

Sports Tests

Before starting the **running sequence** you must be able to:

1. Hop forward on both legs at least 2 feet
2. Hop to either side at least 1 foot
3. Hop up and down on both feet 10 times
4. Jog with no limp for 100 feet

Before starting **advanced direction change and impact training** you must be able to:

1. Hop forward on the affected limb for at least 80% of the distance of the unaffected side.
2. Hop to either side for 80% of the distance of the unaffected limb.
3. Hop up and down on the operated limb 10 times with no pain.
4. Perform single-leg exercises for 10 repetitions without pain.

Warm-up and Stretch and Ice

Be careful to be sure that you warm-up well and stretch before workouts, and stretch well again after workouts. Generally, you should do some walking, cycling or jogging so that you break a sweat before starting the running program. You should then stretch before beginning the running drills. Ice your knee for 20 minutes following workouts.

Phase 1: Straight Ahead Running

Frequency: every other day or 3 to 4 times per week.

Illustration:

DAY	1	Run 1/2 speed 100 yards, 10 repetitions
	2	No Run
	3	Repeat Day 1
	4	No Run
	5	Repeat Day 1
	6	Run 3/4 speed 100 yards, 10 repetitions
	7	No Run
	8	Repeat Day 6
	9	No Run
	10	Repeat Day 8
	11	No Run
	12	Run 1/2 speed, 100 yards, 3 repetitions Run 3/4 speed, 100 yards, 3 repetitions Run full-speed, 50 yards, 4 repetitions
	13	No Run
	14 -42	Continue workout from Day 12, adding one 50 yard run each workout until you can do (10) 50 yard full speed runs. This progression should take a minimum of 24 days (3 weeks, 3 days), but may take longer if pain or swelling occurs. Do not progress to the next step in the progression until the present step is pain free, without swelling.

Phase 2 Basic Direction Change Running

- DAY 1 Continue 100 yard run 1/2 speed, 2 repetitions; 3/4 speed, 2 repetitions; full speed, 2 repetitions
Start zig-zag run, round comers, 50 yards, 5 repetitions
- 2 No Run
- 3 Repeat Day 1
- 4 No Run
- 5 Repeat Day 1, add backward run 25 to gradual stop, then forward run 25 yards to gradual stop, 5 repetitions
- 6 No run
- 7 Repeat Day 5
- 8 No run
- 9 Repeat Day 7, add circle run, 20 foot or greater diameter circle, 3 repetitions to left and 3 reps to right
- 10 No Run
- 11 Repeat Day 9
- 12 No Run
- 13 Repeat Day 1 1, add figure of eight run, 20 foot or greater length, 5 repetitions
- 14 No Run
- 15-42 Repeat Day 13

This phase should take no less than 2 weeks to complete to day 14.

Phase 3 Advanced Direction Changes and Impact Training

- DAY 1 Continue Step 13, Phase 2, as warm-up. Add Carioca, 50 yards, 5 repetitions left, 5 repetitions right
- 2 No Run
- 3 Repeat Day 1
- 4 No Run
- 5 Repeat Day 3
- 6 No Run
- 7 Repeat Day 5, add run forward to plant-and-cut off of unoperated limb, Vz speed, 5 repetitions. Also add double-leg forward hopping, 3 sets of 10 repetitions
- 8 No Run
- 9 Repeat Day 7
- 10 No Run
- 11 Repeat Day 9
- 12 No Run
- 13 Repeat Day 11, add run forward to plant-and-cut off of the operated limb, 1/2 speed, 5 repetitions. Also add double-leg side-to-side hopping, 3 sets of 5 repetitions to each side
- 14-32 Continue alternate days of day 1 3

Phase 3 Continued

- 33 Continue all step 13 drills, increasing to full speed as tolerated. Add single-legged forward hopping, 3 sets of 10 repetitions
- 34-44 Continue alternate days of day 33
- 45 Continue Day 33, add single-legged side-to-side hops
3 sets of 5 repetitions to each side
- 46-55 Continue alternate days of day 45
- 56 -66 Shuttle run, 50 yards, direction change every 10 yards, 5 repetitions
Box drill, 20 yards square, 6 repetitions

Phase 4 Return to Sports Practice

Phase 5 Return to Sports Competition

Shuttle Run

4

3

2

1

Run and touch each line with right hand then return and touch start line with left hand.

Start/Finish

Box drill

