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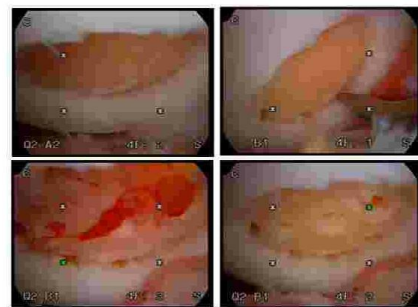
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MICROFRACTURE

Like many of the joints in the body, the knee is lined with articular cartilage. This cartilage makes it possible for your femur (thigh bone) and tibia (shin bone) to smoothly glide over one another and helps give your knee its motion. In fact, this cartilage is so smooth it has even less friction than ice sliding on ice. Sometimes, unfortunately, as a result of injury or trauma, portions of the cartilage can be scraped off or removed from the bone. This can result in pain, grinding and swelling of the knee. You may find it difficult to engage in sports activities such as running or jumping. It can even be painful with simple activities such as going up and down stairs.

Microfracture is a surgical procedure aimed at cartilage regeneration. The arthroscopic (using a camera to look inside the joint) technique involves clearing damaged tissue from the knee joint and creating small holes (“microfractures”) in the bone area where the cartilage is defective. The underlying bone marrow seeps out through the holes and becomes part of a blood clot that forms over the area of missing cartilage. The marrow contains stem cells, which have the ability to form new cartilage between the bare bone surfaces of the knee. The cartilage formed is not the same as the cartilage that was lost, but still has smoother gliding than bone rubbing against bone.

The picture at the right depicts an area of cartilage loss (upper left corner). The smooth white areas are healthy cartilage, while the yellow area is bare bone. The upper right corner depicts a microfracture awl being placed into the bone, while the picture in the lower left shows the blood flowing after the bone has been fractured. The resultant bleeding bone is seen in the bottom right picture. This blood clot will be the source of new cartilage cells to line the area of bare bone.



In some published reports, the success rate of microfracture is about 75%. It is important to remember that this procedure is not a perfect means of restoring cartilage but does have a good track record helping with pain and returning patients to sporting activities.

Perhaps more important than the procedure itself is the rehabilitation after the procedure. It will be important to protect your repair and use a continuous motion machine as well as crutches and keeping weight off your knee. Strict adherence to the protocol is essential to maximize the results of your surgery.

Activities and advice for in the hospital and while at home:

1. Please call with any concerns: (609) 747-9200
2. Apply ice to the knee, as it will be quite helpful. After two days, you can change the dressing to a smaller one to allow the cold to better get to the knee. Be sure to leave the little pieces of tape (steri-strips) in place.
3. After two days it is okay to shower and get the wound wet, but do not soak the wound as you would in a bath tub or hot tub.
4. After knee surgery there is a variable amount of pain and swelling. This will dissipate after several days. Continue to take the pain medicine you were prescribed as needed. Remember it is called pain control, not pain elimination. If you notice calf pain or excessive swelling in the lower leg, call your doctor.
5. It is important to look out for signs of infection following joint replacement surgery. These can include: fever (temperature $> 101.5^{\circ}$, chills, nausea, vomiting, diarrhea, redness around your incision, or yellow or green drainage from your incision. Should any of these be present please contact Dr. Mc Millan's office immediately.
6. You should start your physical therapy approximately 5 days after your surgery.
7. You will have an office visit scheduled approximately 10-14 days after your surgery.

REHABILITATION AFTER MICROFRACTURE

Phase I: immediate post-op phase (0-2 weeks after surgery)

Goals:

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

Activities:

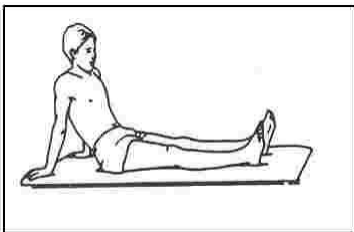
1. Continuous passive motion (CPM). This must be used at least 10 hours per day. Do not wear your brace while in the machine. You may use it anywhere that is comfortable. Use it at night while sleeping. It is very important that you straighten your knee completely. The flexion can gradually be increased to 90 degrees as your knee tolerates each new setting.
2. Brace/crutches/weight bearing: your knee brace is set to allow you to bend and straighten your knee. Use it when walking or out of bed, but it may be removed for range of motion exercises.
 - a. If you had a defect in your patellar groove (trochlea) or patella (knee cap) you will wear a brace that will allow your knee to bend 30 degrees and straighten fully. You should use it when walking. If you had a defect in the femoral condyle you will not wear a brace.
 - b. If you had a defect in your trochlea or patella you can begin bearing weight on your operated leg as soon as you're comfortable doing so. You should use crutches in the beginning but can discontinue using them when you have confidence in your knee to support you.
 - c. If you had a defect in your femoral condyle you will be on crutches and not allowed to put weight on the operated leg for at least six weeks. Dr. Mc Millan will tell you when it is okay to begin weight bearing on your operated leg.
3. Your nurse or therapist will demonstrate the proper form for walking with crutches:
 - a. Put the crutches forward about one step's length
 - b. Put the injured leg forward in line with the crutch tips
 - c. Touch the foot of the injured leg to the floor and put as much weight down as is comfortable (brace on and locked)
 - d. While bearing weight on the injured leg, take a step through with the uninjured leg.

4. Elastic stockings: wear an elastic stocking below the knee until your first postoperative visit. Do at least 10 ankle pump exercises each hour to help prevent blood clots. Take one adult aspirin daily for the first two weeks
5. It is okay to 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 wrap) around the knee at other times to control swelling. You may shower and get your incision wet (unless there is any drainage from your incisions). Do not soak the incision in a bathtub or hot tub until the stitches have been removed.
6. Use your cryocuff regularly to help with knee pain and swelling.

Exercises

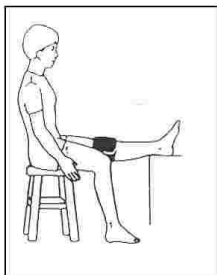
Program: 7 days per week, 3-4 times per day.

Quadriceps setting	1-2 sets	15-20 reps
Heel prop	5 minutes	
Heel slides	5-15 minutes	
Sitting heel slides	1-2 sets	15-20 reps
Straight leg raises	1-2 sets	15-20 reps
Ankle pumps	10 per hour	



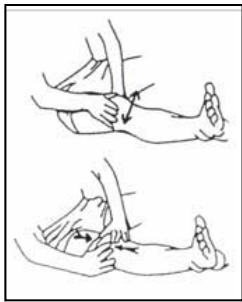
Quadriceps Setting

Lie or sit with knee fully straight. Tighten and hold the front thigh muscle making the knee flat and straight (this should make your knee flatten against the bed or floor). Hold 5 seconds for each contraction.



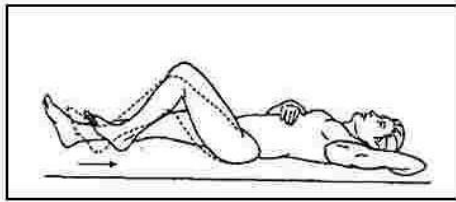
Heel Prop

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



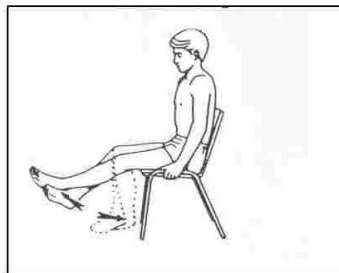
Patellar Mobilization

With the knee fully extended, grasp the edges of your kneecap between your thumb and index finger. Move the kneecap side to side and up and down.



Heel slides

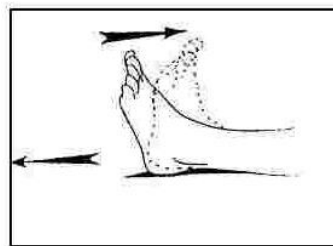
While lying on your back, actively slide your heel backward to bend the knee. Hold this bent position for five seconds then slowly relieve the stretch and straighten the knee. While the knee is straight, you may repeat the quadriceps setting exercise.



Sitting Heel Slides

While sitting in a chair or over the edge of the bed, support the operated leg with the uninvolved leg. Lower the operated leg, with the unoperated leg controlling, allowing the knee to bend.

Do not go past 60° of bend at the knee. Hold for 5 seconds and slowly relieve the stretch by lifting the foot upward with the uninvolved leg to the straight position.



Ankle Pumps

Move the ankle up and down to help stimulate circulation in the leg.



Phase II: intermediate post-op phase (2-8 weeks post-op)

Goals:

1. Protect the knee from overstress and allow healing
2. Regain full motion
3. Begin muscle strengthening

Activities:

1. Brace, crutches and weight bearing are as previously described.
2. Continue using your CPM machine for at least 10 hours per day. This is designed to keep the cartilage healthy and maximize the chances of new cartilage growth.
3. If your operated leg is your left leg, it may be alright to begin driving provided you are no longer taking pain medicine and have an automatic transmission. If your operated leg was your right leg it is not yet safe to drive.
4. You may stop wearing the compression stockings and can stop taking the aspirin.
5. You should continue to use ice to help with pain and swelling.
6. You will have a visit with Dr. Mc Millan at 10-14 days after surgery. If your wound is dry, you will likely be able to get the wound wet in a bath or hot tub at this point.

Exercises

The following exercises will be demonstrated to you by your physical therapist. He or she will also give you a home exercise program. You should strive to do your home exercise program at least 3-4 times per day, every day. The success of your reconstruction depends on your rehab.

- Stationary bicycle
- Water workout (aqua jogger, no foot contact with the bottom of the pool)
- Quadriceps setting
- Heel slides
- Heel prop
- Straight leg lift
- Short arc lifts
- Standing hamstring curls
- Standing toe raise
- Hip abduction

Phase III: 8-12 weeks after surgery

Goals:

1. Walk normally
2. Regain full motion
3. Regain full muscle strength

Activities:

1. You may discontinue using the brace at this point.
2. Progressively bear full weight and walk on the operated leg. Try to avoid limping and walk slowly but with a normal gait. Start by walking with normal weight and full crutches for 3-5 days. If you have no pain, then switch to using one crutch on the opposite side from your surgery for 3-5 days. Discontinue using the crutch when you can walk normally and pain free without a limp.
3. Continue using ice if there is any knee pain and/or swelling.
4. If your right leg was the operated leg you may drive when you have normal muscle control and balance in your leg.

Exercises:

- Stationary bicycle (keep resistance low, increase time)
- Water workout (aqua jogger, no foot contact with the bottom of the pool)
- Continue phase II exercises – if these are easy and can be completed pain free, it is okay to add a light ankle weight to the program.
- Wall slides
- Leg press (0-90 degrees)
- Bilateral squats (0-60 degrees)
- Unilateral step-ups progressing from 2” to 8”
- Forward lunges
- Walking program week 10
- Progress open kinetic chain extension (0-90°), for patellofemoral lesions, may begin week 12, perform from 90-40° or avoid angle where lesion articulates – Progress 1 pound every 2 weeks beginning week 20 if no pain or crepitation – must monitor symptoms closely
- Balance and proprioception exercises
- Swimming
- Nordic-Trak/Elliptical

Phase IV: 12 weeks onward

Goals:

1. Regain full muscle strength
2. Gradual return to activities

Exercises:

- Bicycle (may start outdoor cycling on flat terrain). If riding outdoors should have brace on with free ROM
- Stretching
 - Hamstrings
 - Quadriceps
 - Calves
- Straight leg raises
- Leg press
- Wall squats
- Hip abduction / adduction
- Front lunges
- Step-ups

Criteria to start sport specific programs:

1. Full, painless ROM
2. Strength within 80% of contralateral side
3. Balance and stability within 75% of contralateral side
4. No pain, inflammation or swelling

In general the patient can expect the following return to sports:

- Swimming, skating, cycling, rollerblading usually 2 months for patellofemoral lesions and 3 months for femoral condyle lesions
- Jogging, running, aerobics usually 4 months for patellofemoral lesions and 5 months for femoral condyle lesions
- Tennis, basketball, football, baseball, soccer, lacrosse are allowed at 6-8 months.