



Knee Injuries & Postrehabilitation

INTRODUCTION:

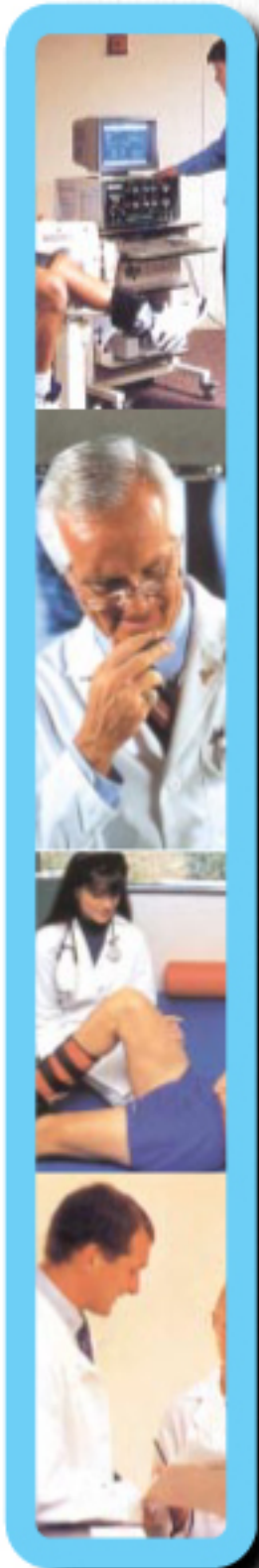
The knee is the most frequently injured joint in both daily and sports activities. The knee can be injured in one of two ways: either through a sudden accident or more slowly through years of overuse and strain. The two joints comprising the knee are the tibiofemoral joint (lower and upper leg bone, respectively) and the patellofemoral joint. The patellofemoral joint includes the kneecap, or the patella, and the femur (the upper leg bone). The patella is contained within the tendon of the quadriceps muscle—the large muscle that makes up the front of the thigh and contracts to straighten the leg. There is a groove in the femur in which the patella slides up and down during leg bending. This joint can become irritated in strenuous physical activity, especially if a considerable amount of jumping is involved.



The medial and lateral menisci are two fibrocartilaginous discs that are located within the knee joint, between the femur and the tibia. They help distribute weight, increase the stability of the joint interface, and also serve as shock absorbers. The medial meniscus is rigidly attached to the ligaments of the joint capsule while the lateral meniscus is more mobile. Consequently, because of this relative immobility, the medial meniscus is more susceptible to damage with injuries of the knee. Two other ligaments are contained within the knee joint capsule. The anterior cruciate ligament prevents the tibia from moving forward on the femur, while the posterior cruciate ligament prevents the opposite motion.

There are various ligaments around the knee and between the knee joint and the bones of the upper and lower leg. Also surrounding the knee are more than a dozen different bursa, or fluid-filled sacs, that function to cushion and insulate the moving parts. All of these bursa are susceptible to injury and inflammation. The major nerves and blood vessels of the lower leg pass either beside or behind the knee and are at risk during substantial injuries.

The rehabilitative approach to the knee is unique because of the considerable number of ligaments and the amount of soft tissue injury usually involved. A step-by-step pattern is followed. The first measure is to relieve pain and discomfort, perhaps using medications or the application of cold or hot packs. Immediately following a knee injury the joint should be treated with a cold pack. If it is not possible to use a medical cold pack, a package of frozen vegetables can be used. Place the cold pack on the knee for 20 minutes, take it off for 20 minutes and gently bend the leg as much as the pain allows, then place the cold pack back on for another 20 minutes. Do this up to three times a day.



A therapist may recommend the use of a compression bandage, ice, and elevation. An elastic wrap with a moderate amount of tension to provide compression may be applied to the joint. You will need to dampen the elastic wrap to allow the cold pack to affect the knee. It is important to not let the cold pack rest on the outside edge of the knee; keep it on the inside edge or on top. There is an important lower leg nerve, called the peroneal nerve, that passes near the skin on the outer side of the leg just below the knee. This nerve can be injured by cold. The knee should also be elevated approximately 30 minutes an hour while awake. Elevate the knee by placing pillows under the knee and thigh, not under the lower leg. Placing them below the knee joint can force the knee into an over-bent position, known as hyperextension.

If you have severely injured your knee, you may need to use crutches or possibly a cane. Crutches are actually better than a cane—even in minor injuries where a cane seems adequate. A cane causes an unequal distribution of weight on the hips and unaffected leg that can sometimes aggravate the situation. Crutches allow a more normal gait pattern and also make it possible during healing to put progressively greater amounts of weight on the injured leg in a more consistent pattern. A therapist can ensure that the crutches are adjusted properly.

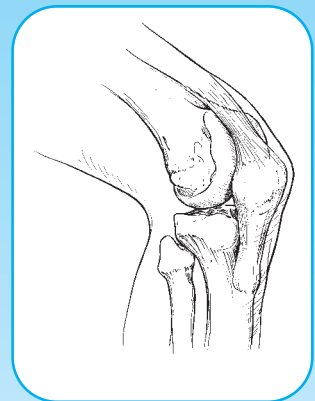
There are several important muscles given special consideration in knee rehabilitation. The first is the quadriceps muscle, the large muscle in the front of your thigh that straightens, or extends, your leg. This is actually a set of four muscles whose tendons unite and pass over the knee to insert on the lower leg bone; the kneecap is contained in this tendon. This group of muscles begins to lose strength almost immediately after a knee injury. Also exercised with this set of muscles are the hamstrings. These muscles are responsible for bending, or flexing, your leg. Likewise, the muscles that pull your legs together, called the adductors, are strengthened along with the muscles that pull your legs out, the abductors. This is a standard principle in rehabilitation medicine: always treat together muscles with opposite motions.



Another consideration involves what is termed proprioceptive or balance training. This is begun as soon as you are able to comfortably bear weight on the leg. Balance training involves shifting weight to the injured leg, and then moving in ways to test your balance, such as picking up items from the floor. A circular platform called a balance board is sometimes used to improve balance, simulating motions that would occur when walking on uneven terrain.

This manual describes common knee stretches and exercises designed to help patients during recovery. The goal is to promote pain relief, then to gradually strengthen weak muscles and stretch tight muscles and ligaments so that healing can be accomplished with a return of both strength and function.

The programs described below are arranged in levels of intensity and also for specific knee injuries. The therapist will instruct you as to the intensity and frequency of each of the activities. Note any difficulties or unusual sensations you may experience for discussion with the therapist or physician. If you experience an exacerbation or flare-up of symptoms, decrease either the number of repetitions or the frequency of exercises per day until you can discuss the matter with the therapist or physician.



This book was designed to improve the ability of individuals to engage in self-directed exercise and therapy programs. Although they can be used in conjunction with a medical physician, physical therapist, personal trainer, or exercise physiologist, they are also adequate for self-study and application. The exercises are illustrated and described in visually appealing detail. They also provide a wide range of stretches and exercises that can be tailored to almost any condition, frequent or rare.

Self-care and rehabilitation are synonymous. Rehabilitation has more medical connotations, but someone does not need a medical condition to begin taking better care of themselves. Many of the conditions seen by physicians can be alleviated or substantially decreased through diligence with a home stretching or exercise program. This is becoming more important as people engage in jobs that overuse only a few muscles, for example, computer operators who maintain static positions of their neck, shoulder and arms for possibly an entire work day. Likewise, weekend warriors—whether they are doing battle on the ball field or the front lawn—frequently suffer from pain generated by strained muscles or ligaments that have been dormant the remaining six days of the week.

As with any exercise program, the input of a physician is necessary if an individual suffers from any type of chronic condition, e.g. heart disease, osteoporosis, diabetes, or chronic obstructive pulmonary disease. This is especially important if someone is just beginning a program after many years of sedentary activity. If there is any type of heart condition, you need to consult a physician before engaging in even the simplest of activities. Never underestimate the damage done by years of neglect or lack of activity.

The goal of this book, as with any approach to human health, is to promote a balance between the external environment and the internal body. Life is an interaction between mind, body and soul, that is shaped and influenced by job, family, and lifestyle. The latter has been sadly influenced to a large degree by television, time restraints, and commodities designed for a fast-paced existence. However, there is no short-cut to health. The good news is that very little time is required to maintain long term and cumulative gains. All that is needed is dedication, encouragement and the realization that everything that is done, no matter how minimal an effort, can add up to years of energy, relaxation, and improved health. I hope this book can contribute in some way to that path and outcome.

Mark H. Scheutzow, MD, PhD

LEVEL I: INITIAL RANGING

The first phase of treatment involves range-of-motion stretches in which the leg is progressively straightened. The goal is to maintain as much range of motion as possible during the initial stages of healing so that muscle spasms are gently dissipated and contractures do not develop. Full extension is only possible if there is no fluid collection within the knee. Any persistent swelling needs to be evaluated by the therapist or physician as it may require draining. This phase of rehabilitation should cause some discomfort that may be felt the next day. If you are still in pain the third day, you have done too much. It is sometimes helpful to use cold packs before and during extension stretching—ask the therapist for guidance.

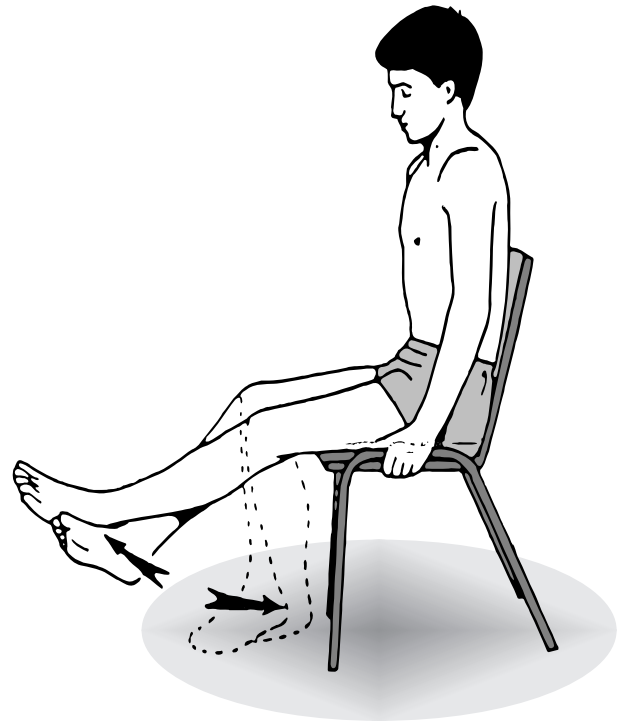
Exercise 1

Figure 1. Extension and flexion stretching.

This stretch is performed ideally while sitting on the edge of a table so that your legs can dangle over the side. If you do not have a sufficiently strong table then try to use as high a chair as possible. If you cannot use your uninvolved leg to move your injured leg you will need someone to duplicate this motion. Have them kneel in front of you and slowly move your injured leg by grabbing it at the ankle. If there is no one to help you, this stretch can be duplicated using a rocking chair by gently and slowly rocking forward and backward. Starting with your injured leg at different distances from the rocking chair can accentuate the stretching. Both stretches begin with your legs hanging in a neutral position.

Cross your legs at the ankle with your injured leg **on top** of your uninjured leg. Use your uninvolved leg to slowly raise the injured leg. Do not use any muscles of the injured leg. All the lifting power must come from the uninjured leg. Raise your injured leg as high as possible, hold this position for five seconds, and then slowly lower your leg, again using the uninjured leg to bear all the weight.

Recross your legs so that your injured leg is **underneath** your uninjured leg. Use your uninjured leg to bend or pull your injured leg back under the table as far as possible. Hold this position for five seconds and then slowly allow your uninjured leg to swing back to neutral.

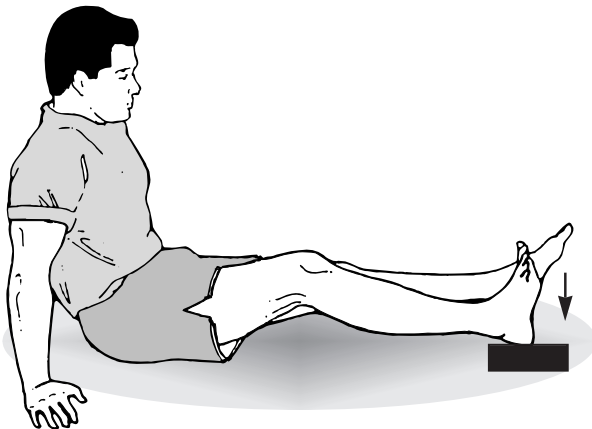
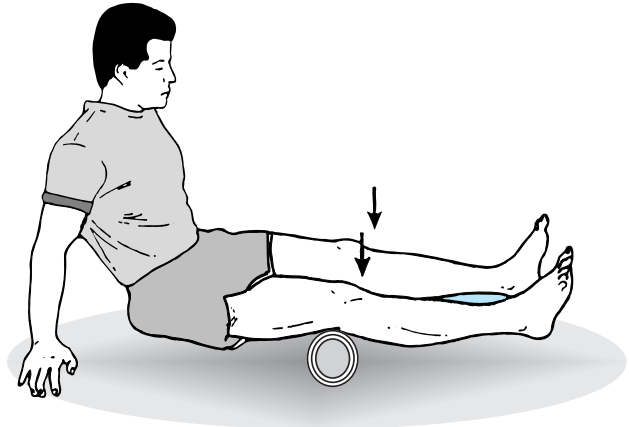


LEVEL II: ISOMETRIC EXERCISES

Graded isometric exercises are begun only when the knee can be fully extended. In isometric exercises the muscle does not shorten but it still develops a forceful contraction. Three groups of muscles will be isometrically strengthened in this phase of your program: the quadriceps, hamstrings, and hip adductors.

Exercise 2

Figure 2. Quadriceps isometrics. Sit on the floor with your legs outstretched. Place a small towel roll under the knee of your injured leg. This should be small enough to raise it only 1-2 inches. Tighten the muscles on the top of your thigh, pulling your kneecap up towards your hip and trying to push your knee into the floor. You should also feel the back of your knee press against the rolled towel. Hold this position for at least 5 seconds.



Exercise 3

Figure 3. Hamstring isometrics. Sit on the floor with your legs outstretched. Place a flat towel under the heel of your injured leg. This should be small enough to raise it only 1-2 inches. Slightly bend the knee of your injured leg. Attempt to dig the back of your heel onto the floor, pushing down the towel. Hold this position for at least 5 seconds.

Exercise 4

Figure 4. Hip adductor isometrics. Sit on a chair with a pillow or folded towel between your knees. Squeeze your knees together. Hold the point of maximal squeeze for at least 5 seconds.

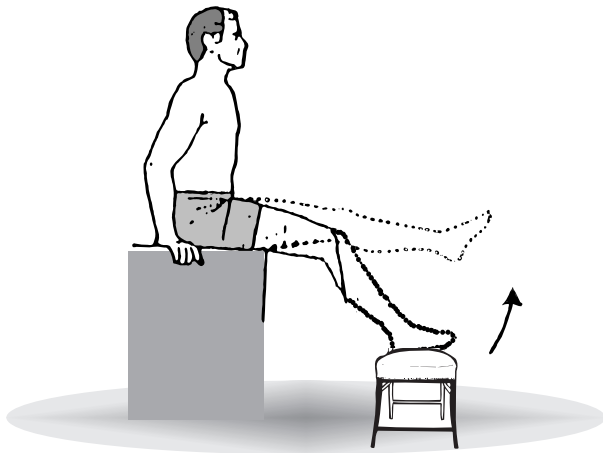
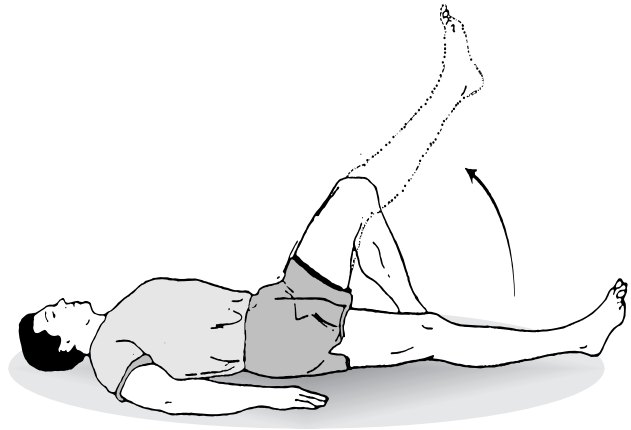


LEVEL III: ISOTONIC EXERCISES

These exercises involve muscle shortening and are termed isotonic exercises. At first, the only amount of force generated is that used to move the body part. Later, the therapist may recommend ankle weights to increase the resistance and further strengthen the muscles.

Exercise 5

Figure 5. Quadriceps strengthening. Lie on the floor with your injured leg straight. Keep the opposite leg bent at the knee with your foot firmly placed on the floor. Tighten your quadriceps muscle and slowly lift up your injured leg. You need to keep the leg straight. Do not let it bend at the knee. Try and bring the injured leg up so that its kneecap is at the same level as your other knee. You should try to take 5 seconds to bring the injured leg up, hold it at this position for 5 seconds, and then take 5 seconds to lower it back to the floor.

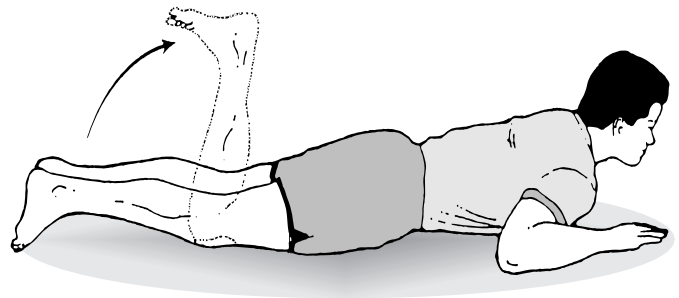


Exercise 6

Figure 6. Quadriceps strengthening in terminal extension. This exercise strengthens the quadriceps in its last stages of contraction. Sit on a table with your injured leg supported by a stool so that it is bent approximately half-way at the knee, as shown in the illustration. Take 5 seconds to lift your injured leg up from the stool until it is completely straight and hold it in this position for 5 seconds, then slowly lower it back to the stool over a period of 5 seconds.

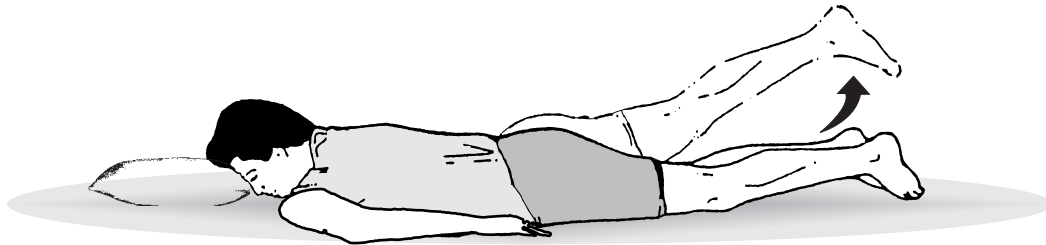
Exercise 7

Figure 7. Hamstrings strengthening. Lie on your stomach. Bend your injured leg up as far as you can. You should try to take 5 seconds to bring the injured leg up, hold it at this position for 5 seconds, and then take 5 seconds to lower it back to the floor.



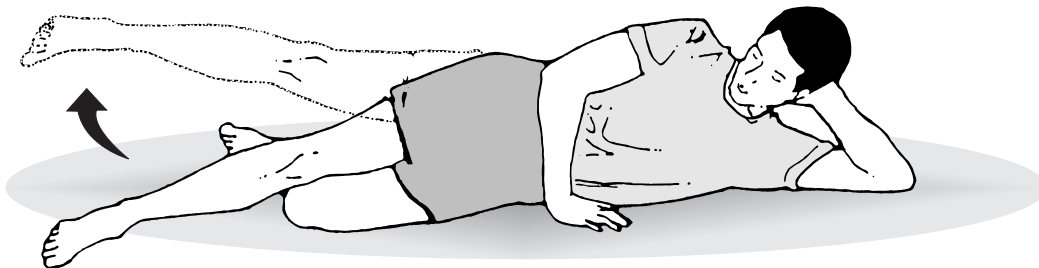
Exercise 8

Figure 8. Back extensor strengthening. Remain on the floor after performing the previous hamstring strengthening exercise. Place your hands under your pelvic bones and raise your injured leg, keeping the knee straight. When you begin to feel your pelvic bone start to move away from your hand, stop raising your leg and hold it in this position for at least 5 seconds. Then lower your leg to the floor over a period of 5 seconds.



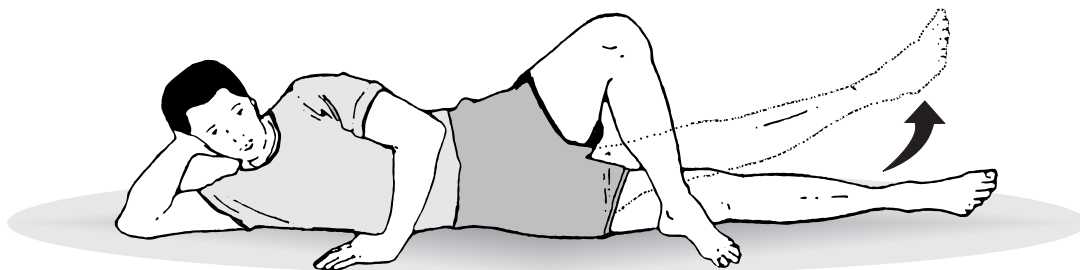
Exercise 9

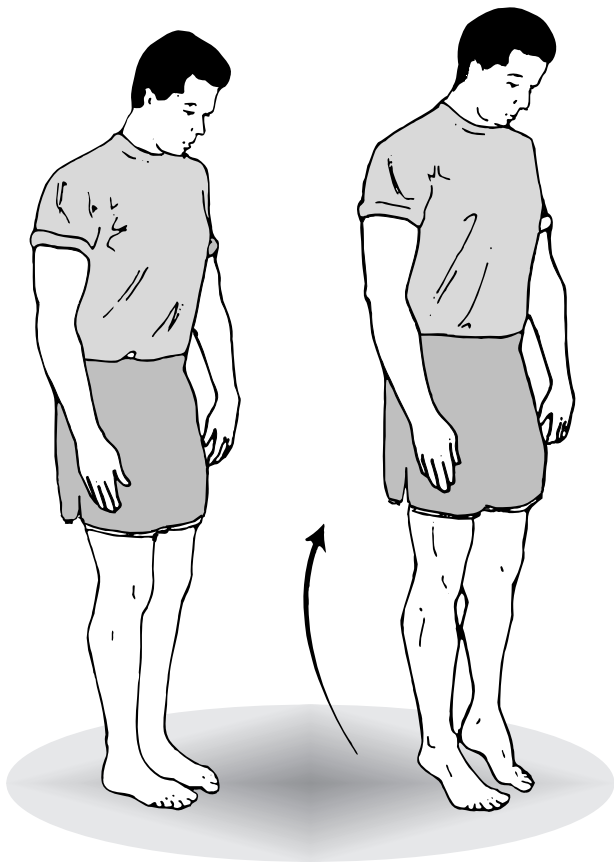
Figure 9. Abductor strengthening. Lie on the floor on your uninjured leg and bend this leg so that your foot is behind you. Keeping your injured leg straight, slowly raise this leg over 5 seconds to the approximate height shown in the illustration, always keeping it in line with your body. Hold it at this height for 5 seconds and then lower it back to the floor over a period of 5 seconds.



Exercise 10

Figure 10. Adductor strengthening. Lie on the floor on the side of your injured leg. Take your uninjured leg and bend it at the knee so that you can put this foot in front of your injured knee. Shift your position to be able to raise your injured leg without hitting your other leg. Keeping your injured leg straight, slowly raise this leg over a period of 5 seconds to the approximate height shown in the illustration, hold it in this position for 5 seconds, and then slowly lower it back to the floor.



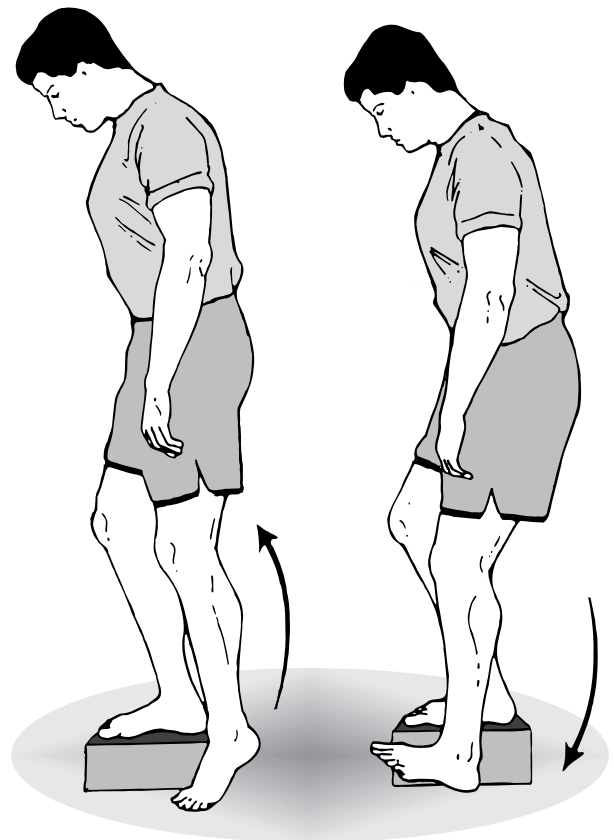


Exercise 11

Figure 11. Toe-heel raises. Rise up on your toes over a period of 5 seconds, stay up on your tiptoes for 5 seconds, and then slowly lower yourself over a period of 5 seconds. It is a good idea to do this standing in a corner facing out, so that if you lose your balance you can either lean back or to the side for support.

Exercise 12

Figure 12. Side step-ups. Stand sideways with your injured foot on a block. You may also use a step or curb. Lift yourself up by pushing up with the toes and foot of your uninjured leg and transfer your body weight to your injured leg. Step down by first slowly touching the heel of your uninvolved foot to the floor.



Level V : HOME MODALITIES

You may use either heat or ice. You can purchase professional cold packs that are kept in a refrigerator; however a package of frozen peas works just as effectively. In either case, place a damp towel between the cold pack and the skin. After you stretch or exercise, or for general pain relief, keep the cold pack on the knee for 20 minutes, then off for 20 minutes. Repeat this for two to three sessions for a total of 60 minutes of cold treatment.

You can also fill small paper cups with water and freeze them. These are nick-named “ice popsicles” and are used by holding them in one hand and rubbing over the affected area, peeling away the paper as the ice melts. The therapist may recommend three phases to the home exercise program: (1) apply heat to the knee before stretches and exercise, (2) proceed with exercise, and (3) finish with either heat or cold.

Some people cannot tolerate ice and prefer heat using a heating pad. Again, 20 minutes on and 20 minutes off is an appropriate schedule. Another option is to alternate ice and heat. Ice will be more effective in reducing swelling and providing pain relief, but if it is not comfortable, heat can also provide some benefits. In some cases heat may be harmful. Check first with the therapist.

NOTES

BREATHING

Breathing is a natural pattern that can be utilized to provide additional comfort during the exercise program. Learning to breathe deeply and slowly helps you relax during exercises and stretches. Following is a script you can use to help breathe more appropriately.

“Begin by first noticing your breathing pattern before you start your program. Take in a deep breath, relax, and exhale all the air you possibly can. Do not force yourself to over-breathe on your inhaled breaths, but do try to empty your lungs as much as possible when you exhale. Do this in a rhythmic pattern before, during, and after either stretching or strengthening. This pattern of breathing will soon become more natural and you will find that it not only helps you deal with any discomfort that is part of your exercise program, but can also be used as a relaxation aid during the day, before sleep, or in periods of high stress.”

NOTES

SCRIPTS

The knee is likely to be re-injured unless the inciting causes are corrected, especially those due to repetitive overuse in an activity or working environment. The most important factor to consider after rehabilitation is how to minimize or eliminate the activity that originally caused the problem.

- “Paying attention to the mechanics of the back and hip can minimize the workload placed on the knee. Twisting is an important motion to master as you need to protect both your back and your knees. Often a series of small steps is used rather than whole body turning. **NEVER** twist in a crouched position. The therapist or physician can provide recommendations to improve your work environment and can also teach you to integrate other body motions to lessen the strain on your knees. It may be helpful to consider a knee brace during particularly stressful activities, especially shortly after rehabilitation.”

- “An important part of your therapies will be a home exercise program that involves the stretches and isometric exercises described in this pamphlet. The goal will be to incorporate these activities into your daily routine, not only at the beginning and end of the day, but also during the work day as well. Running through a program of knee and leg stretching before and after heavy work and during prolonged sitting or long drives can have ample rewards. Although simple preventive techniques, some people may not like the idea of interrupting their activities during the day. These exercises, as well as any other techniques demonstrated by the therapist, are only effective if incorporated into your lifestyle.”

- “Knee pain is preventable, but it requires some effort and vigilance. Good posture in conjunction with a daily stretching and strengthening program and recognition of your limitations are simple but effective ways to minimize discomfort and injury, curbed only by your initiative.”

- “An aerobic exercise program of walking or bicycling (either stationary or moving) will also help minimize recurrent pain, as well as contribute to an overall improvement in health. Check with your physician before starting any exercise program. An appropriate plan, especially if you have been relatively inactive, is to start with six brisk, 30-minute walks a month. Almost anyone can incorporate this into his or her monthly schedule and recent studies have shown that even such a minimal improvement in aerobic exercise can lead to substantial improvements in long term health.”

Mark H. Scheutzow, MD, PhD, is a cum laude graduate of The Ohio State College of Medicine. His training is in Physical Medicine and Rehabilitation, Pain Medicine, Addiction Medicine, and Medical Acupuncture. He practices pain medicine in Charlotte, North Carolina.

DISCLAIMER NOTICE:

These manuals are presented only as a summary of information for health care providers involved in the rehabilitation of musculoskeletal conditions. No standard of care is stated or implied. These manuals are not intended nor properly used as a substitute for treatment, only as an adjunct to aid clinical expertise. The exact protocol and progress employed is the determination of the health care provider who assumes all responsibilities for its application.

EXERCISE LOG:

Record your progress in the log below, noting the number of repetitions or sets of each exercise completed. Record any additional notes you may wish to discuss with the therapist or physician.

EXERCISE	DATE	DATE	DATE	DATE	DATE	DATE	DATE	NOTES

REFERENCES:

Agur, Anne M. 1991. *Grant's Atlas of Anatomy*, 9th. ed. Williams and Wilkins, Baltimore, MD. 650 pp.

Braddom, Randall L. 1996. *Physical Medicine and Rehabilitation*. W.B. Saunders Company. Philadelphia, PA. 1301 pp.

Brotzman, S. Brent. 1996. *Handbook of Orthopaedic Rehabilitation*. Mosby. St. Louis, MI. 384 pp.

Buschbaker, Ralph M. 1994. *Musculoskeletal Disorders. A Practical Guide For Diagnosis and Rehabilitation*. Andover Medical Publishers. Boston, MA. 326 pp.

Buschbaker, Ralph M., and Braddom, Randall L. 1994. *Sports and Rehabilitation: A Sport-Specific Approach*. Hanley and Belfus, Inc. Philadelphia, PA. 319 pp.

Fu, Freddie H.. and Stone, David A. 1994. *Sports Injuries: Mechanisms, Prevention, and Treatment*. Williams and Wilkins. Baltimore, MD. 1040 pp.

Magee, David J. *Orthopaedic Physical Assessment*, 3rd. ed. W.B. Saunders, Philadelphia, PA. 805 pp.

Snider, Robert K. ed. 1997. *Essentials of Musculoskeletal Care*. American Academy of Orthopedic Surgeons. Rosemount, Ill. 686 pp.