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# THE NATIONAL ATHLETIC ELIMINATION OF ATROPHY IN QUADRICEPS



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A new field of physical therapy, called progressive resistance exercises, has been developed during World War II by Dr. DeLorme. This method of rehabilitation and strengthening of muscles is now used extensively by a majority of orthopedist and physical medicine and rehabilitation departments.

Progressive resistance exercises is not actually a new field to college and university trainers, as are the principals and technics as they are used therapeutically. The majority of trainers have used resistance exercises for many years with fine results; however, no one had a definite pattern or method to follow out the exercise. Our methods were excellent up to a certain point. Now, with the aid of Dr. DeLorme, you have a definite technic, a scientific approach. In other words, the system, even though old, has been polished up and refined to where it is one of the most scientific methods of rehabilitation for certain types of injuries.

Our aim is to write about the quadricep muscles and ligaments as they are the prime factors involved in all knee rehabilitation. We hope to bring to your attention a method by which bad knees will become good knees and good knees will become strong knees.

Without tonus of the anti-gravity muscles, the gluteus maximus, quadricep, and the gastrocnemius-soleus, the lower extremities would collapse. We are all aware that the most important and most common cause of instability is the knee joint. This joint is a hinge which can collapse in only one way, namely, flexion. Lateral motion and extension are limited by ligaments and the contour of the bones. With only a few exceptions the quadricep muscles keep the knee from giving away in flexion. This group also tends to maintain erect position and primarily an active function in extension of the knee in walking, running, and climbing.

The quadricep group of rectus femoris, vastus lateralis, vastus intermedius and vastus medialis have a common insertion and four different origins. The vastus lateralis forms the muscular mass on the outer surface of the thigh and blends with the vastus intermedius close to the bone. Only the rectus femoris originates from the pelvis where it is attached in front and above the acetabulum by two heads. The other three muscles originate from the lateral, anterior, and medial aspects of the femur. The four muscles merge as the patella tendon. With only one exception, in hip flexion by rectus femoris, the action of the quadriceps is primarily that of extension of the knee. Vastus lateralis and vastus intermedius extend the knee to within 10-15 degrees of full extension, and the vastus medialis, by far the most important com-

ponent of the extension group, gives the final 10-15 degrees of extension. These final few degrees of extension are the most important for the stability and the protection of the knee joint from injury. Any athlete who has been confined to bed because of illness or injury soon finds that atrophy is taking a toll of his muscles, but primarily the tonus of the quadriceps that result in statements upon rising such as "Gosh, I am sure weak in my knees." A few minutes twice a day with proper exercises and conditioning prevent this atrophy. Competitive athletics hold more glamour for all. However, this fact in itself will offer a stimulus for the injured to participate in these latent exercises to speed recovery. Injury, disease, or surgery to the area of the knee causes an atrophic effect on the quadricep group of muscles. Some physiologists say that actually the disease may not be all of the cause. There is some reflex mechanism at fault that has not as yet been understood. In many cases the atrophy of the quadriceps will cause an unbalance between the flexors and extensors causing a contracture of the hamstrings. This is very true, because the flexors are stronger than the extensors. This becomes a very serious complication; however, very seldom found in athletes.

We have gone over the muscles as a function in the knee joint. Now to the ligaments which are of equal importance. The cruciate ligaments, anterior



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and posterior, prevent the tibia from slipping backward and forward on the femur and to limit rotation of the tibia on the femur. The internal lateral ligament, a long, fan-shaped structure, sustains the burden of preventing lateral movement. This ligament is part of the joint capsule. The medial cartilage is attached to this ligament at the posterior part primarily to help transmit strains, to which it is subjected, on to the cartilage. The external lateral ligament is somewhat different from the internal in that it is a long cord-like bundle, which with the biceps tendon, strengthens the external side of the joint. Also, it is separate from the joint capsule and the cartilage is not attached to it.

The internal and external semilunar cartilages, also called meniscus, are fibro-cartilages interposed between the tibia and the femur. They are thick on the outer border and taper down to the inner border. The cartilage acts as a wedge between the tibia and the femur and helps to keep the cruciate ligaments tense. Both cartilages are attached to the tibia by a coronary ligament. The fibers of the coronary ligament are weak and lax and allow some movement of the cartilages on the tibia. The external cartilage attachment is so thick that it permits a wider range of movement. Both of the cartilages move with the femur on the tibia in rotary or twisting movements of the joints.

The tendency of knee injuries to recur is well known, especially in athletics. This is due to good atrophy and weakness. The desire, of course, is to prevent as much atrophy of the quadriceps muscles as possible. Regardless of whether the ligaments are torn or the cartilage is damaged or removed, the most essential and important part of the after care of the knee injuries is the development of tonus and strength of

the quadriceps. Walking, straight leg raising exercises are fine in the early stages, and will improve the tonus of the quadriceps. However, to prevent a recurrence of injury, common sense tells you that you must not only return the former strength but also attain greater strength and stability. Resistance exercises will not only restore that strength you lost but also will give you much greater strength in the supporting muscles than they possessed prior to initial injury.

Just because the knee is free from fluid, swelling, and has a normal range of motion, shows no atrophy of the thigh muscles, and can be extended against the trainer's resistance, does not necessarily mean that the knee is ready for strenuous activity. The knee joint is not ready until the athlete reaches extra-ordinary strength. A positive approach is to test the uninjured knee and compare the strength with the injured knee. When both knees are of equal strength, then and only then, is the athlete ready.

The technic to follow is to have the injured athlete sit on the edge of the table, knee flexed, and some elevation under the upper leg; a pillow is ideal. Place a boot of weights, or sand bags, on the foot of the injured leg. Test for the maximal load he is able to extend fully. Repeat this lifting ten times a day for ten days. Then a re-evaluation of the maximal load must be made. Continue the lifting procedure with the new maximal load for ten more days. How long should one continue these exercises? Until you reach the strength of your uninjured leg. We suggest that you exercise both legs to attain maximal strength in both knees. When the injured knee catches up with the uninjured, then you have two good knees. Of course, you understand, that progressive resistance exercises is not

a guarantee but merely a method of building power in quadriceps muscles to reduce the number of recurrent knee injuries. There is no need for a lot of pulleys, weights, and fancy gadgets to prevent atrophy. Many good results come from simple, but effective, measures under practically all conditions: while in bed, lifting the leg with knee locked, drawing the knee cap, flexing the thigh and buttocks, like a sailor does for the command of "attention,"

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