

WINDY CITY ORTHOPEDICS & SPORTS MEDICINE

ACUTE KNEE AND CHRONIC LIGAMENT INJURIES

This packet is an attempt to give you as much information as possible about your problem. I have tried to be as specific as possible and present as much information as possible. You must realize that it is NOT possible to discuss all possibilities of diagnosis, treatment options or possible complications regarding ligament injury. I will attempt to outline general principals that you may then apply to your individual circumstances.

A FEW WORDS ABOUT YOUR KNEE

The purpose of this first section is to define the words that you will encounter when we discuss knee ligament injuries. (fig. 1)

The **FEMUR** is the thigh bone.

The **TIBIA** is the shin bone.

The **PATELLA** is the kneecap.

MEDIAL means toward the inside. The medial aspect of your right knee is the left side of the knee.

LATERAL means toward the outside. The lateral side of your right knee is the right side.

There are two kinds of cartilage in the knee; the articular cartilage and the meniscus cartilage.(fig 2)

The **MENISCUS** is more commonly known as “the cartilage” that a football player tears. It is C-shaped and sits between the femur and the tibia. There is a medial and a lateral meniscus. The meniscus adds some stability and helps the joint function smoothly. The meniscus can be torn in an injury or become damaged from long term activity.

The **ARTICULAR CARTILAGE** is the gliding surface that covers the end of the femur and the top of the tibia. It is somewhat analogous to the tread on a tire. This is the same smooth white material that is on the end of a chicken leg. These surfaces can be injured directly or by slow

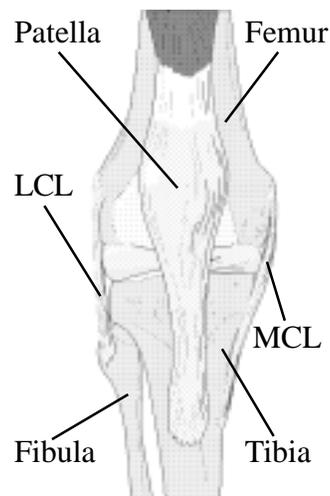


Fig. 1 Bones of the Knee

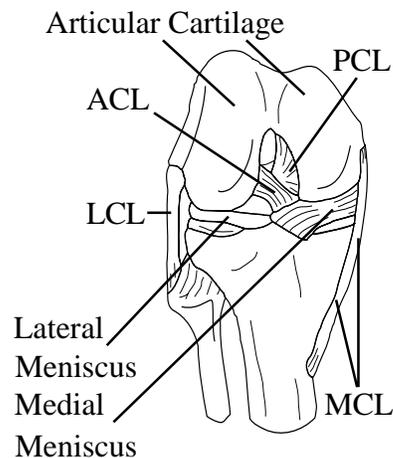


Fig. 2 Meniscii & Ligaments of the Knee



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ARTHROSCOPIC SURGERY
KNEE RECONSTRUCTION
SHOULDER SURGERY
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wear and tear. The articular cartilage can also be roughened (termed chondromalacia) or cracked (termed a chondral fracture). Complete loss of articular cartilage (i.e. a bald tire), is called osteoarthritis.

There are four **LIGAMENTS** in the knee (fig 2). Ligaments are strong bands of tissue that are made up of many fibers (like a telephone cable made up of many tiny wires) that connect two bones and allow motion in one or more directions but prevent motion in other directions. They allow us to bend the knee and twist but prevent it from going past straight into hyperextension. There is a medial (**MCL**) and a lateral (**LCL**) collateral ligament. These two ligaments stabilize the knee as you move side to side. The anterior cruciate (**ACL**) and posterior cruciate (**PCL**) ligaments are inside the knee and stabilize twisting and turning movements. Ligaments can be injured one at a time or in combination with other ligaments and/or with menisci.

The **SYNOVIUM** is the thin lining of the knee joint that covers everything except the menisci and the articular cartilage. It is somewhat similar to the inner tube of a tire. The synovium generates synovial fluid which is the “oil” that lubricates the knee. When the knee is irritated for any reason, the synovium secretes a large amount of fluid and the knee is said to have “water on the knee” or what is medically known as an **effusion**. There are several conditions in which the synovium overgrows and becomes very thick and redundant (medically called a **synovitis**). This is the primary problem in rheumatoid arthritis. However, the synovium can also become traumatized and locally irritated as a result of injury.

The **TENDONS** are tough bands of tissue that connect the muscles to bone so that they can move the joints. They are analogous to cables. When a tendon becomes inflamed and tender from overuse, it is known as a **tendinitis**. Note the differences between ligaments and tendons. Ligaments connect two bones while tendons connect muscle to bone.

The **BURSA** are sacks filled with a small amount of fluid that are normal and occur around all joints. They allow tendons, muscles and ligaments to slide over each other efficiently with minimal friction. However, they can become irritated and become filled with excessive fluid. Medically, this is known as a **bursitis**.

SUBLUXATION AND DISLOCATION indicate the partial or total loss of contact between two bones. This is most commonly seen when a kneecap is unstable but the knee joint itself is said to be dislocated when all ligaments are torn and the tibia and femur separate.

LIGAMENT INJURY CLASSIFICATION

The severity of any ligament injury is graded as:

GRADE I- A mild stretch, with mild pain and swelling but no permanent lengthen-

ing or damage to the ligament.

GRADE II- The ligament is stretched out (like taffy) and lengthened. There is generally more pain and swelling, and often bruising. The ligament will heal, usually without surgery. The joint will have some increased laxity (i.e. “give” or “open up”) when compared to normal, but the joint will heal and can usually function almost normally with little residual instability.

GRADE III- The ligament is stretched so far that it is torn in half. Frequently there is relatively little pain. However, the joint is very unstable, and weight bearing is often difficult even with crutches. The knee will give away or buckle. There is frequently bruising around the knee. Surgery is often required for repair.

ACUTE HEMARTHROSIS

A common history is a twisting or hyperextension injury in which a pop or snap is felt (and sometimes heard). The injured joint swells within 12 hours (often as fast as 2 hours). The reason that there is such rapid swelling is that something has been injured that bleeds. There are only four things that can bleed in the knee; the cruciate ligaments, the cartilages (the menisci), the synovium, and the bone (a broken bone) (fig 3).

It has been shown that there is a 95% chance of having damaged something surgically significant in the knee with this triad of findings.

- 1) Approximately 70% of these individuals will have a torn anterior cruciate ligament.
- 2) Approximately 50% of these individuals will have a torn meniscus.
- 3) Ten to fifteen per cent will have knocked off a piece of bone and/or cartilage to form a loose body (fig. 3).
- 4) Only 5% will NOT have a surgically significant injury.

Pinching the synovium (see p.2) is like biting the inside of your cheek; it is very painful and bleeds but is not dangerous. These will usually resolve on there own and account for the 5% of knees with an acute hemarthrosis that don't require surgery.

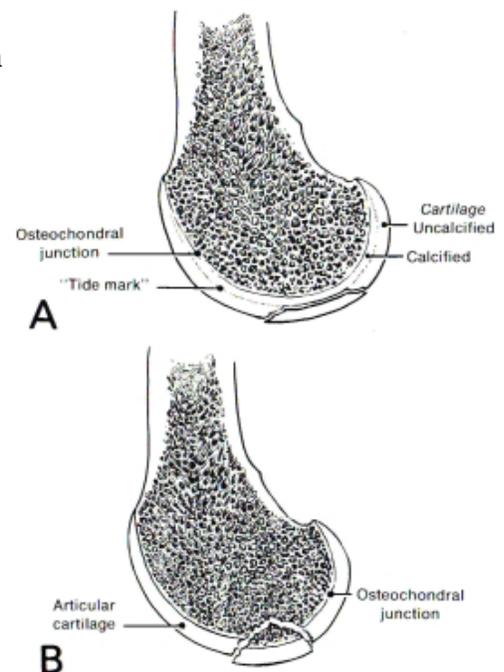


Fig.3A a pure chondral fracture involves only the articular cartilage

Fig. 3B an osteochondral fracture in which the bone and the articular cartilage are involved in the loose piece

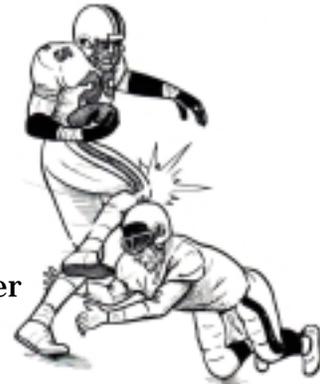
SPECIFIC LIGAMENT INJURIES

Ligament injuries of the knee are often, but not always, caused by a blow (as in an auto accident or in a football “clip”) (fig 4 & 5).

However, a severe twisting (such as “catching an edge” while skiing or while running for a ball) or hyperextension injury can also tear ligaments (especially the anterior cruciate ligament) (fig 6 & 7). Some injuries occur by simply flexing the knee too far such as a backwards fall in skiing (fig 8). This last mechanism commonly causes an ACL tear.



Left Fig. 4 The classic football clip causes the “Terrible Triad of O Donaghue”. A torn MCL, ACL & a torn medial meniscus



Right Fig. 5 A posteriorly directed force to the front of the tibia from a tackle or a car bumper will cause a PCL tear.



Fig. 6 A twisting and hyperextension injury commonly causes an ACL +/- PCL tear.



Fig. 7 A hyperextension injury in a nonweight bearing leg can cause an ACL or PCL tear.



Fig.8 A hyperflexion injury such as a fall in skiing causes an ACL tear.

Clinical exam in ACL injuries looks for instability with the Pivot shift (fig 9) and Lachman tests (fig 10). The pivot shift phenomenon occurs when you twist your foot inwards. The tibia subluxes on the femur and your knee collapses or buckles. The Lachman test tests the other direction of instability. The KT-2000 is a computerized testing machine.(fig 11).Normally there is a difference of 2 mm. or less in laxity between the left and right knees. When measured by the KT-2000 test, a difference between knees of greater than or equal to 3 mm., confirms a torn ACL is present in more than 95% of the time (fig 12).

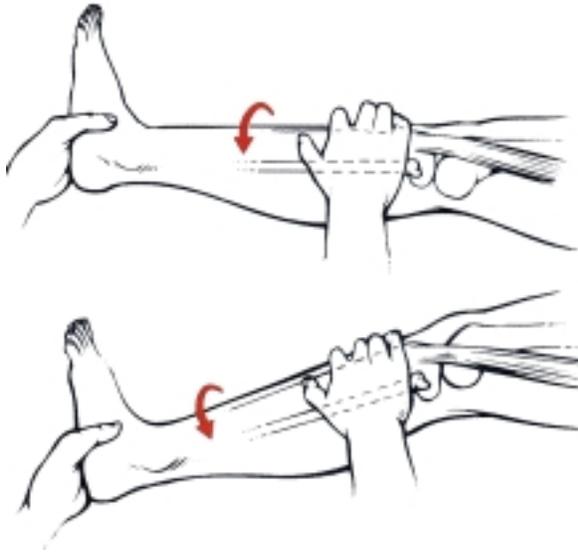


Fig. 9 The pivot shift test

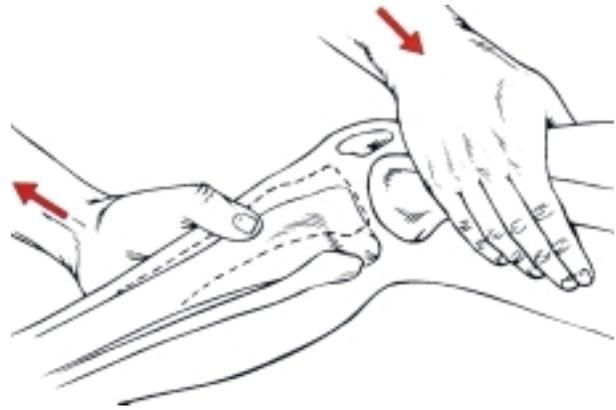


Fig. 10 The Lachman test

An MRI (Magnetic Resonance Imaging) may also be useful in evaluating a knee injury. MRI's are 90-95% accurate for torn ACL's, However they are TEN times more expensive than a KT-2000 test and therefore are probably not worth spending the money if only an isolated ACL tear is suspected. MRI's are approximately 80% accurate for a torn meniscus. When an MRI makes an error in a knee, it usually is because the MRI misses a tear that is really there, rather than finding a tear that is not really there. MRI's also routinely miss loose bodies. Therefore, even if the MRI is negative, you have a one in three chance of really having something surgical! Also your insurance company may deny surgery because your "MRI says your knee is normal".

Sometimes, an examination under general anesthesia (in which you will feel no pain and your muscles are relaxed) and an arthroscopy are recommended to accurately define all components of your injury. If I suspect an isolated MCL injury, I may recommend a diagnostic arthroscopy of the knee in the office rather than an MRI. This allows the most

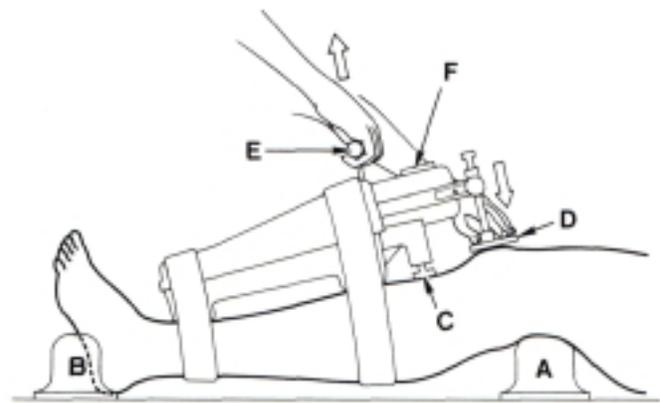


Fig. 11 The KT-2000 computerized testing machine

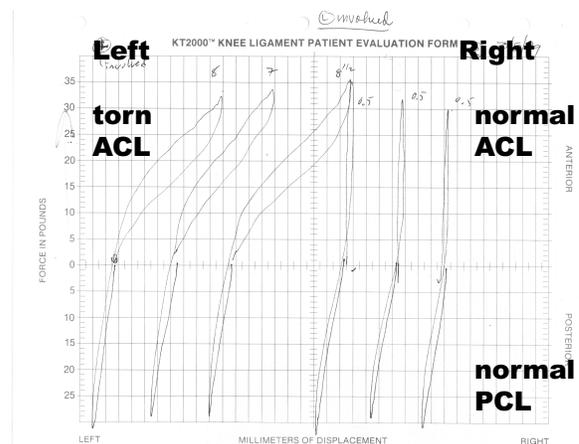


Fig. 12 The actual printout of a KT-2000 test showing a completely torn ACL of the Left knee (8 mm.) and a normal Right knee (0.5 mm.). Both PCL's are intact

accurate diagnosis outside the hospital operating room. However, it is good only for diagnosis and not treatment.

Ligaments can be injured individually or in various combinations. Sometimes the best treatment for one ligament injury is harmful to another component. Sometimes compromises must be made based on the “total picture”. These factors include your age, job requirements, level of sporting activity, presence or absence of arthritic changes, and ability and desire to participate in the postoperative rehabilitation program.

Sometimes after the arthroscopy, no formal surgical treatment is recommended. Physical therapy and bracing can effectively treat some of these injuries. Sometimes open surgical repair is recommended. Please remember that the best treatment is not always surgical repair. **There is no single answer!** Everyone is different and decisions must be made for you as an individual after I know as much about your injury as possible.

A common combination of ligament injuries is the “TERRIBLE TRIAD OF O’DONAGHUE”. This is a tear of the medial collateral ligament, anterior cruciate ligament and the medial meniscus (fig 13 & 14). This is the injury suffered by Joe Namath, Dick Butkus, and Gayle Sayers. It is most commonly caused by a clip in football.

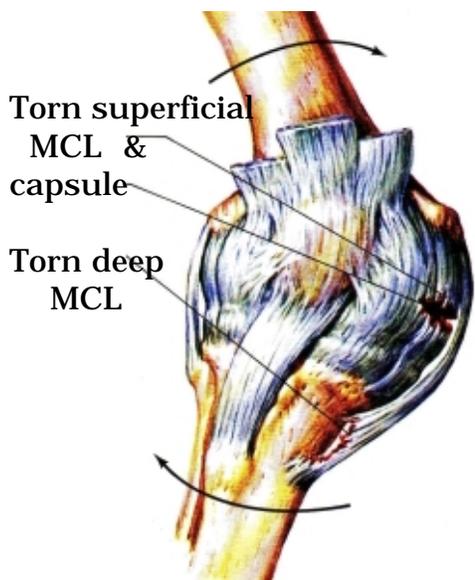


Fig. 13 Torn superficial & deep components of the MCL and ruptured medial capsule

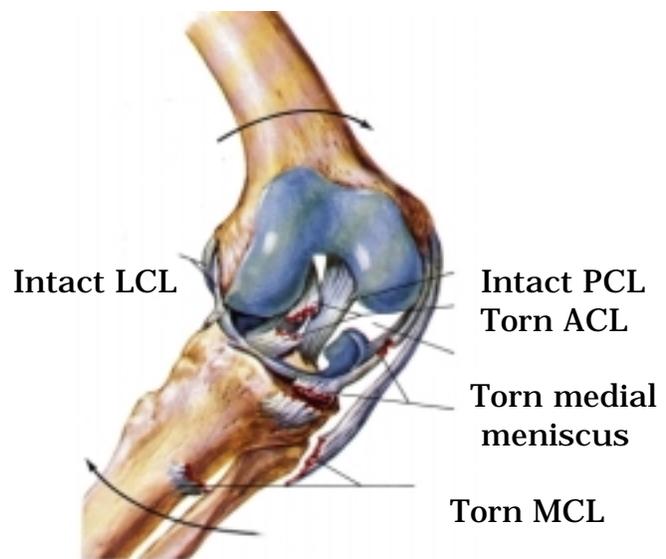


Fig. 14 Terrible Triad of ODonaghue
Torn ACL, MCL and medial meniscus

CHRONIC LIGAMENT INJURIES AND THE “**RULE OF THIRDS**”

If you were injured sometime in the past (called a **CHRONIC INJURY**) The knee may buckle (give away) with twisting, swell, make noises, and/or be painful. Some or all sports may be limited or impossible. Whether or not surgery is necessary is determined by the same factors as for new (**ACUTE**) injuries. The presence of any arthritis is more common in chronic injuries than in acute injuries. I will almost always try physical therapy or a prescription brace before recommending surgery.

With this program, approximately 1/3 of the people with a true ACL tear can return to most sports. Another 1/3 will improve their functional level, but because of one or more of the factors mentioned earlier, these individuals feel that for them, surgical reconstruction would not improve their over-all situation. Finally, 1/3 will be unhappy with the level of function obtained with physical therapy and bracing, or the instability is so severe that the program literally can't work. It is this last 1/3 that requires surgical reconstruction. The backup systems of the knee have failed and the knee has become completely unstable for any significant functional activity.

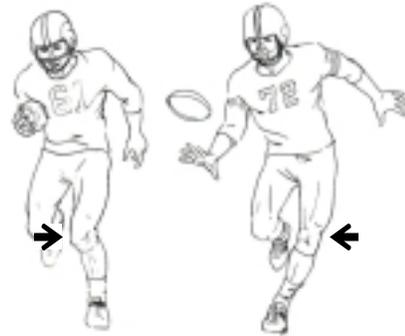
There is another reason to recommend surgery other than to return to sports. It has been well shown that if you have recurrent buckling or giving way episodes (as little as 4 to 5 times per year), you may develop osteoarthritis. Therefore, surgery is recommended in these cases, not to allow you to return to sports, but to prevent the development of, or slow its progression if you already have some early osteoarthritis. Again, arthroscopy is usually necessary to make sure that a torn cartilage is not causing the buckling by itself, or to evaluate if it can be repaired. Please see the section on meniscectomy and meniscus repair.

ACUTE MCL, LCL & ACL INJURIES

The knee has primary and backup systems, just like the space shuttle. The MCL & ACL are the backup systems for each other. If only one is injured you may function well enough. However if both are torn (such as in the Triad of O'Donoghue) the knee will be functionally unstable. It has been studied and shown conclusively that if both the ACL & MCL are torn, surgery for the MCL is not necessary **IF** the ACL can be reconstructed. Similarly if the ACL is intact, only a brace for 6 weeks is necessary to treat the MCL tear.

Medial laxity (a torn MCL) causes you to fall away from the injured side and therefore the other leg allows you to “catch yourself” without falling (fig 15A). Isolated lateral laxity causes the leg to collapse towards the involved side (fig 15B). However you don't have the advantage of the other leg to catch yourself and therefore you will almost always fall. Fortunately lateral sided injuries are rare but are much more disabling and usually require surgery. ACL SURGERY ACL surgery

Fig. 15A MCL injuries cause you to fall towards the other leg and you can prevent yourself from falling.



Medial Instability Lateral Instability

Fig 15B LCL injuries cause you to fall away from the other leg and you nothing to catch yourself, so you fall down.

ACL Surgery

ACL surgery is certainly the most common ligament procedure done today. In athroscopic ACL reconstruction a graft is used to substitute for the torn ligamnet. A true repair by suturing the ends of the ligaments has been a universal failure. There are three common grafts.

1) Hamstring grafts are becoming more popular with both surgeons and patients. Most studies have shown comparable results to Patella tendon grafts. However, while they recommend hamstring grafts for the female gymnast, they will almost always agree that they will do a patella tendon graft for the 250# football linebacker.

2) Personally, I believe that the patella tendon is still the best graft. Some surgeons believe that the patella tendon cases have a higher incidence of patella problems. I have not seen this with the aggressive rehabilitation program outlined below.

3) The third potential graft is a patella tendon or achilles tendon allograft. An allograft is from a human donor just like a liver or kidney is donated. Fortunately tendon allografts do not require the sophisticated tissue typing that are required for kidneys and liver transplants. However, they are very expensive (several thousand dollars per graft). While it has never been reported, there is theoretical possibility of disease transmission from the donor. Therefore, while I have done them, I do not recommend them for routine use.

Regardless of which graft is used, the surgical technique is very similar. Holes are drilled in the tibia and femur (fig 16) to enter the joint at the ends of the old ACL. The chosen graft is passed with sutures and fixed with screws or sutures tied over a screw or staple.

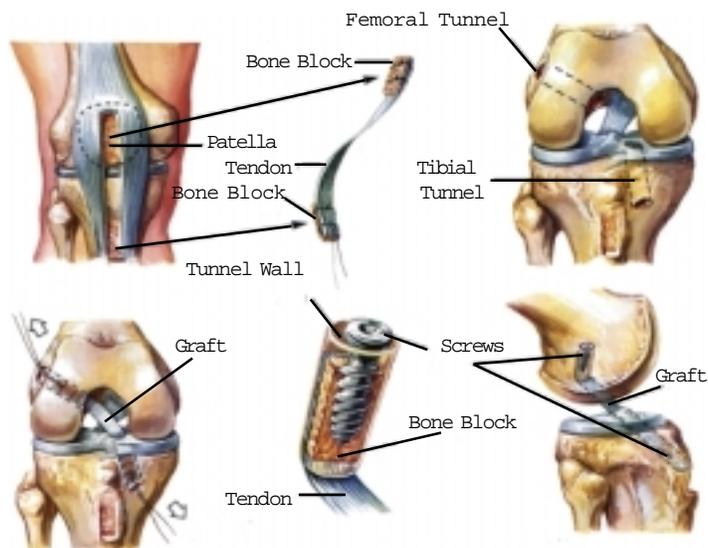


Fig. 16 Surgical Technique for ACL with patella tendon graft

RESULTS AND COMPLICATIONS OF LIGAMENT RECONSTRUCTION

After these severe injuries, nothing can be done to give a truly normal knee. However statistically, 70-80% of the people show significant improvement and can return to most sports. The knee is still NOT normal. Fifteen to twenty percent will be improved, but may not be able to play twisting sports. Five percent will be unimproved or even worse due to infection or graft failure. Infection occurs in 1% or less. Phlebitis, numbness, weakness, and arterial or nerve injury can occur. Allergic reactions and pneumonia can also occur.

HOSPITALIZATION AND SURGERY

If you schedule surgery, you will usually receive physical therapy prior to surgery to learn how to walk with crutches and for instruction on exercises. Whether for an acute or chronic injury, post operatively you will usually be in a splint. Most ligament reconstruction are done as an outpatient. You will be discharged with a small number of Dilaudid pills. Dilaudid is the oral equivalent of morphine. Take one or two pills every 4 hours if you are having pain. You will receive a second prescription for Tylenol #3 or Vicodin. These are not as strong as Dilaudid but usually are more than adequate to control the pain after 3-4 days of Dilaudid. The dosage of both Tylenol #3 or Vicodin is 2-3 tablets every 3-4 hours.

POSTOP PHYSICAL THERAPY

PHASE I (1-7 days post op):

Range of motion and muscle strengthening. Full extension is maintained at all costs. Crutches are used. Full weight bearing is permitted with a full knee corset. Use of cryocuff to control swelling and pain.

PHASE II (1-2 weeks post op) (First post operative visit in the office):

Maintain full extension. Increase flexion. Bilateral knee bends progress to where crutches are no longer needed. Maintain straight leg raising exercises and quadriceps tone. Use of cryocuff to decrease swelling and control pain.

PHASE III (2-6 weeks post op):

Continue as above. Add exercycle, stairmaster, swimming, and unilateral knee bends.

PHASE IV (6-12 weeks post op):

Should be off crutches by this time. Full motion should be obtained. If full motion is not obtained you may require manipulation under anesthesia or an arthroscopy to cut the adhesions (an arthroscopic lysis of adhesions) in order to gain full motion. Continue all of the above. Add leg presses, functional exercises, agility drills, etc.

PHASE V (3-6 months post op):

Add running forwards and backwards. Figure 8 drills, sprints and further agility drills.

PHASE VI (6-9 months post op):

Full functional activities. Isokinetic testing shows strength testing shows strength at 80-90% of the opposite side.

PHASE VII (9-12 months post op):

Training to return to unrestricted activity. Isokinetic testing should reveal that the muscle strength of the involved leg is 90% or more of the uninjured leg.

PATIENT EVALUATION OF THE CONDITION OF THE KNEE

This section is designed to make you address your true feelings and needs. There is no right or wrong answer to any of these questions. An NFL halfback's knee injury will be treated differently than an injury suffered by a 50 year old librarian who has been skiing for the first time. The treatment of your knee will be based in part on your answers.

1) **Regarding my activity level:**

- A. I am willing to give up all recreational activities that involve jumping, twisting or turning, if these will cause my knee to worsen.
- B. I am willing to decrease my activity level so that my knee doesn't worsen.
- C. I will continue to participate in full recreational athletics despite the problems that might arise with my knee.
- D. I will continue to participate in full competitive athletics despite problems that may arise with my knee.

2) **I think the severity of my knee injury is:**

- A. Very serious.
- B. Moderately serious.
- C. Liveable-not serious.
- D. Just a nuisance-not serious.

3) **In the long run, I feel my knee will:**

- A. Get better and continue to improve until it's normal again-I anticipate no future problems.
- B. Probably get better as long as I know my limits.
- C. Stay about the same; some limitations but liveable.
- D. Probably get worse as I continue to participate in activities that cause knee pain and swelling, and end up with arthritis.

4) **How important are athletics to me?**

- A. Extremely important: I am willing to risk future arthritis by continuing

active sports participation.

B. Important: I am willing to give up major competitive sports but will continue recreational activities despite the risk of future arthritis.

C. I am willing to give up major sports to give my knee added years and prevent arthritis but I would still like to participate in at least some sports.

D. Not important enough to risk knee damage. I am willing to give up most activities to protect my knee as much as possible.

5) A. I was clearly told by my Dr. about the risk of developing arthritis in my knee in the future.

B. I was told by my Dr. about the risk of developing arthritis in my knee in the future, but I didn't understand well.

C. I was told by my Dr. about the risk of developing arthritis in my knee in the future, but I don't remember what was said.

D. Nothing was said to me about arthritis.

SUMMARY

1) The ligaments stabilize the knee.

2) There are four major ligaments which can be injured singly or in many different combinations.

3) Other structures, including menisci, articular cartilage, and secondary restraints can also be injured.

4) Intelligent treatment requires understanding all components of the injury.

5) Treatment recommendations for the individual are based upon such factors as the preoperative disability, age, job, level of sporting activity, presence of arthritic change, and desire and ability to participate in postoperative physical therapy.

6) Rehabilitation is prolonged. Inadequate physical therapy can cause the best surgical repair to fail.

ARTHROSCOPIC SURGERY

BACKGROUND

Technological advances have permitted surgical procedures to be performed inside joints without arthrotomy (the process of making a long incision so that something can be corrected under direct vision). The advent of a small diameter (4 mm.) telescope called the **ARTHROSCOPE** has given doctors the capability to indirectly see the inside of the joint with a miniature video system. This has improved diagnostic accuracy. We are now able to perform many procedures inside the knee through 1/4" incisions that previously would have required a formal arthrotomy and a large scar.

I have performed arthroscopy on every major joint in the body except the finger and spine. Common procedures are excision of torn menisci, repair of torn menisci, removal of loose bodies, removal of degenerated and roughened cartilage, fixation of fractures and treatment of infected joints. Arthroscopy is also an aid in some ligament reconstructions. Many other procedures are also possible.

SURGICAL EXPECTATIONS

It is not possible to make a damaged or arthritic knee perfectly normal. It is possible to improve the internal mechanics, stability, or alignment of the knee. These surgical procedures are intended to relieve pain and make the knee more dependable. They are not intended to, and cannot, restore a 100 percent normal knee.

When possible, surgery is done arthroscopically. An open operation is usually required for ligament repair although the arthroscope is used to assist in viewing. Although arthroscopic incisions are small, you have had major surgery inside. Healing and recovery time varies depending on the problem and the type of surgery necessary. A knee that begins swollen and painful takes longer to quiet down than one that begins quiet. Degenerative conditions require prolonged recovery as do some fresh injuries. There are no instant or "magic" cures! complete recovery from an abrasion arthroplasty or arthroscopy for degenerative knee commonly takes 6 to 12 months.

HOSPITAL OR SURGICENTER

Almost no insurance company (including Medicare) allows arthroscopy as an inpatient. Only people with severe medical problems can be admitted. Thus you will come to the hospital or Surgicenter on the day of surgery, have surgery done, and go home that afternoon. Depending on your individual medical problems and age, routine preoperative tests will be done (chest xray, urine analysis, EKG, blood tests, etc.) some time in the week prior to surgery. Surgery can be usually be performed under general, spinal or local anesthesia. Don't hesitate to discuss your preferences with me. While you are in surgery, your family and friends can wait in the waiting room.

Unless you have a ligament injury or a meniscal repair, there will be no cast or brace after surgery. A soft compressive dressing will be applied in surgery. Crutches are usually recommended for the first few days after surgery. Unless an abrasive arthroplasty has been performed, you will be allowed to ambulate with weight bearing as tolerated immediately after surgery and allowed to discontinue the crutches as soon as the pain level is tolerable. People who have had an abrasive arthroplasty are to be non-weightbearing on the operative leg and thus require crutches for approximately eight weeks.

You will be discharged from the outpatient surgery suite approximately 3-4 hours after surgery. You must have another adult drive you home or you will not be sent home.

PAIN

If your pain is too severe to be controlled with pain pills, you may be admitted overnight for pain shots. When discharged, you will be given a prescription for pain pills. Please inform me of any drug allergies. The application of an ice pack to the knee will decrease swelling and discomfort in the first forty-eight hours. Please do not use aspirin as it may increase bleeding in the first few days. Tylenol can be substituted. Long term pain is almost always less than with conventional surgery, but you must remember that much was done through the small incisions, and mild aching and/or a discomfort with the weather change is not unusual and can persist for several months.

COMPLICATIONS

Complications in arthroscopy are very rare compared to standard surgery but do occur. **By law, I am required to inform you of possible complications.** Infection rates are approximately one-tenth or less of conventional surgery. Because arthroscopy allows the individual patient to move his knee earlier, stiffness and restricted motion are less common, but can occur. Swelling, especially with activity, commonly occurs for six weeks or even longer in certain instances. Similarly, aching, stiffness and soreness are inevitable for some period of time. The time off work depends largely on the type of work an individual does and also on the problem treated. Jobs requiring heavy manual labor require a knee capable of much higher function, and therefore, longer periods of time off work. Individuals with "desk jobs" can usually expect to be back to work within 5 to 10 days if a simple meniscectomy or loose body removal is done. Similarly, return to sports may depend as much on the initial condition of the knee as on the surgery performed. After meniscus repair (meniscoscopy), you must delay competitive sports for 6 months

.NERVE AND ARTERY INJURY

Most of the major nerves and arteries are in the back of the knee. Injury can occur with any arthroscopy but especially when a cartilage tear is in the back of the knee and a repair is performed. In order to avoid this complications, I will sometimes make standard incisions in order to protect the nerves and arteries. However, in spite of all precautions, nerve injury can occur and be permanent. Another nerve that is sometimes injured is on the anterior and medial aspect of the knee. This nerve is very variable in position but when injured usually only causes mild numbness that requires no specific treatment.

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