G. Charles Roland, MD
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THE SAN DIEGO KNEE CLINIC

ARTHROSCOPY AND MENISCUS SURGERY

We will be offering counseling on diet and exercise. If interested, please contact my office and schedule a medically supervised *Health and Orthopedic Fitness* assessment appointment which will include a spine and joint health assessment evaluation. This assessment will not be covered by health insurance.

G. Charles Roland, M.D.
Director of The San Diego Knee Clinic
Orthopedic, Arthroscopic and Reconstructive Surgery
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The term arthroscopy (*arthro* meaning joint, *scope* meaning to view), is presently used to describe the use of a special type of microscope to view the internal structures of a joint. The joint most commonly studied by this method is the knee, although it is also employed in the elbow, shoulder, ankle, and hip. (Wilkerson, 2010)

The use of an arthroscope was first performed in Japan in the 1920s. These devices were crude and cumbersome. The early attempts were not performed on live patients (Pässler, 2012). It was not until the 1970s that the technology had reached a point where arthroscopy was used exclusively as a diagnostic tool. Arthroscopy has an advantage over other diagnostic techniques in that the surgeon can actually see the extent of the injury to the soft tissue structures of the knee and other joints (Wilkerson, 2010). This powerful diagnostic capability alone makes the arthroscope a valuable tool. However, with increasing use, surgeons developed the ability to perform certain surgical procedures through the arthroscope. The majority of these procedures involved repair or removal of damaged menisci (cushions) in the knee. Ligament surgery is also being performed.

Arthroscopy is an intricate technique requiring careful study and training to achieve proficiency. This proficiency is gained through the performance of several hundred of these procedures. I have personally performed several thousand of these procedures. Fellowships of the study of the knee only have only recently been available for interested surgeons to learn this technique. Following my orthopaedic residency at the University of Wisconsin, Madison, I accepted one of the first arthroscopic and reconstructive knee surgery fellowship in United States, The San Diego Knee and Sports Medicine Fellowship, which was sponsored by Kaiser Foundation, UCSD, Veteran's Administration Hospital, and the San Diego Charger Football Team. I finished the fellowship in 1979. My research included studying and lecturing on the knee menisci. I then entered private practice emphasizing general orthopaedic problems with a special emphasis on knee, shoulder, and spine-related problems.

Basic Anatomy of the Knee

The knee joint is the largest and most mechanically complex joint in the body. Because of its location and functional relationship to the rest of the body, the knee is very vulnerable to injury (Bahr, 2005). And, unlike the elbow and ankle, which derive the majority of their stability from the bones that form the joint, the knee relies on its stability almost entirely from muscles, tendons, and ligaments.

The knee joint is formed by four bones (Figure 1): The patella (kneecap), the femur (thigh bone), the tibia (shin bone), and fibula of the lower leg. The fibula is the

smaller of the two lower leg bones and is located on the outside of the lower leg. The lower end of this bone forms the bump at the outside of the ankle (Betts, 2016). We think of the knee as a simple hinge joint when in fact its motion is the most complex in the human body. Consequently, diagnosis and treatment of injuries to the knee must be aimed at preserving the normal parameters of motion.

As previously mentioned, the knee relies almost entirely on soft tissue structures for stability. Among these soft tissues are the ligaments which connect bone to bone. There are four primary ligaments in the knee: 1) the medial collateral, which connects the inside of the femur to the inside of the tibia, 2) the lateral collateral, which connects the outside of the femur to the head of the fibula, and the 3) anterior and 4) posterior cruciate ligaments. The anterior cruciate ligament prevents the tibia from sliding forward on the femur and the posterior cruciate prevents the tibia from sliding backward on the femur. The ligaments serve as static dynamic check reins to control the motion of the knee, which is powered by the muscles of the upper and lower leg (see Figure 1).

Figure 1. Knee Joint Anatomy

The portions of the bones which meet to form a joint and move against one another are called articular surfaces. Interposed between these two bones in the knee are semilunar cartilages or menisci (Figure 2).

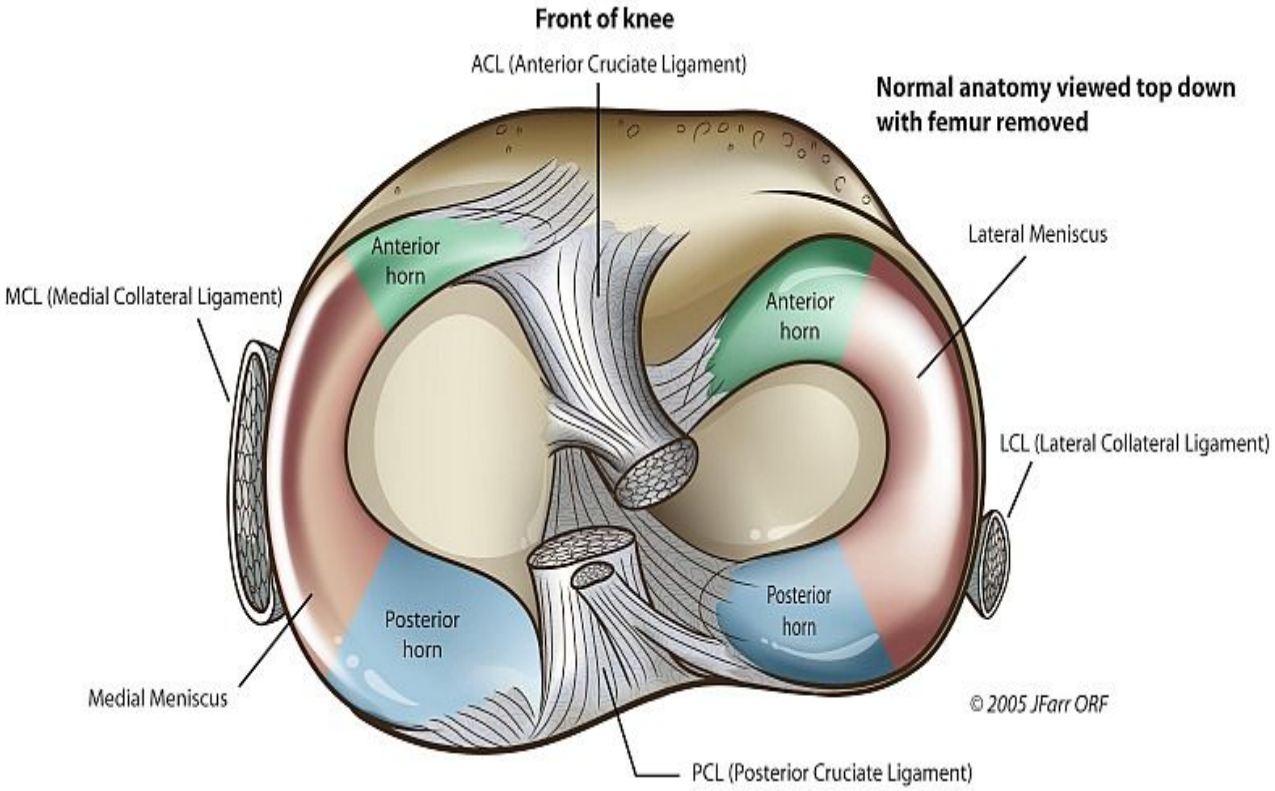

Figure 2. Medial and Lateral Menisci

These meniscii serve several purposes. They provide 1) adequate contact between the ends of the femur and tibia, 2) load distribution in the joint, and 3) lubrication of the joint. The menisci are "C" shaped and are very mobile to provide adequate contact through a full range of motion. Because of their mobility and location in the joint, they are also quite easily injured. An injury to a meniscus is the most common serious knee injury (Logerstedt, 2010) and the medial is more frequently injured than the lateral. The lateral meniscus is more mobile and not as easily injured.

Probably the most important substance within the knee joint is the hyaline or articular cartilage, which covers the ends of the bones of the femur, tibia, and undersurface of the patella (Strauss, 2013). Articular cartilage is a spongy membrane that is necessary to provide smooth and fluid motion of the joint. Damage to the menisci or ligaments in the knee can cause abnormal motion in the knee and may cause abnormal wearing away of the articular cartilage (Figure 3). The entire joint is bathed in a viscous liquid known as synovial fluid. Within the fluid is a substance called hyaluronic acid(HA) which a very important substance in the knee and provides needed protection for the articular cartilage. The synovial fluid lubricates the joint and also provides nutrition to the articular cartilage, the menisci, and the cruciate ligaments.

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Meniscal Tear

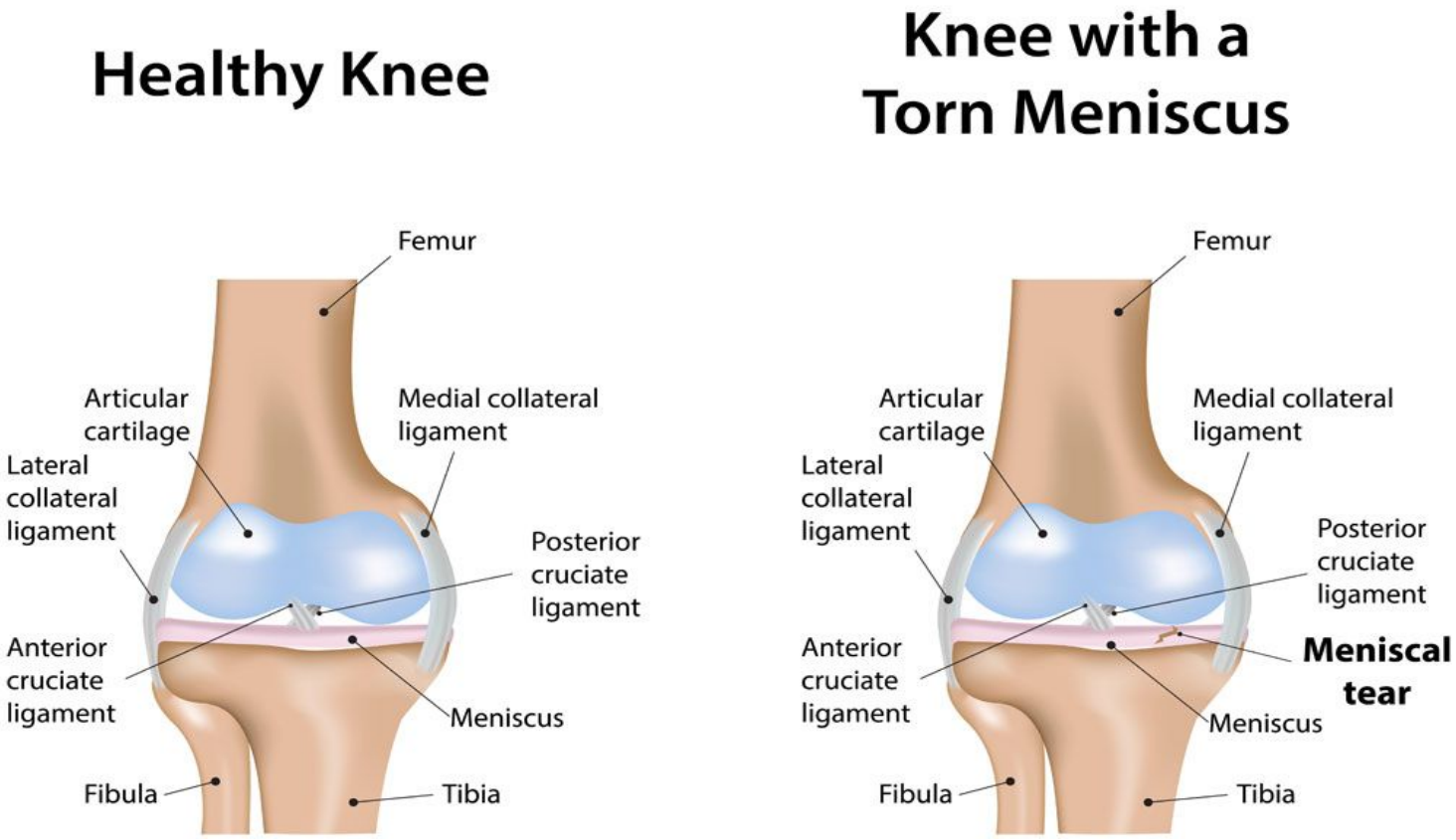

Figure 3. Meniscus Injury

As previously mentioned, injury or tearing of one of the menisci is the most common serious knee injury. A good history, or "knowing exactly what happened," is one of the keys to accurately diagnosing this injury. There is usually a history of a twisting injury to the fixed knee, or there may have been a direct blunt trauma to the knee. The meniscus is injured when it is caught between the femur and the tibia.

If the force is sufficient, the meniscus will tear. This injury is called a "torn meniscus" and has both immediate and long-term consequences.

Immediately following the injury, pain is localized over the medial (inside) or lateral (outside) portion of the knee depending upon which cartilage has been torn (Mordecai, 2014). This may be accompanied by swelling. Loss of normal motion is common and snapping or popping may be heard or felt when the knee is moved. It may be difficult for the patient to bear weight or squat on the injured knee.

When the patient comes to the office with the symptoms just described, I will also evaluate him or her for any serious ligament injury which may accompany the meniscus injury. I am developing two devices for testing the knee ligaments: The ROLAND COLLATERAL LIGAMENT ANALYZER, and the ROLAND KNEE A-P LIGAMENT ANALYZER. The testing is not always done on the initial exam and if indicated is done later in the treatment course. If the clinical exam shows a serious injury, x rays are done and a MRI is usually prescribed to assist in making a thorough diagnosis. If the injury is serious enough, and with failure of conservative treatment, arthroscopy is then recommended to evaluate and treat the injury. Anesthesia is normally required for arthroscopy.

In the initial state, if swelling is minimal and there is no evidence of ligament damage after clinical testing, I usually elect to treat the patient conservatively using rest, crutches, elevation, a knee brace, and physical therapy once the injury is adequatley healed or treated. Tears near the outside of the meniscus have a potential for healing without surgery. Thus, after an initial diagnosis of meniscus tear without any evidence of ligament damage, and with the knee motion at least partially intact, I am hoping the meniscus tear will heal without surgery. However, in many cases, the meniscus tear doesn't heal because of the complexity of the tear and the poor blood supply to the meniscus. An MRI is very helpful in assessing acute injuries since it is important to gain as much information about the injury prior to instituting treatment. After the initial phase of protection of the knee joint injury, it is decided whether or not in meniscus tears whether early surgery is indicated to repair the meniscus arthroscopically with suture material using special repair devices.

In some cases of a torn, displaced meniscus, the patient will experience locking or a blocked range of motion and a feeling of instability or giving way of the knee. In these cases, a portion of the torn meniscus has displaced between the bones and is blocking motion. If these symptoms are present, i.e. locking, I usually recommend an immediate arthroscopy in an attempt to prevent permanent stiffness and/or further joint or meniscus damage. It is clear in the current literature that failure to treat displaced meniscus tears can lead to early traumatic arthritis and degeneration of the joint surfaces (Leon, 2005). In those patients treated conservatively who continue to experience pain and disability at the end of a three to six week conservative treatment period, including the use of crutches, I recommend arthroscopy to evaluate the meniscus injury and to repair (sew together) or partially remove the torn remnants of the meniscus. The entire meniscus in not removed, only the damaged part, with careful remodeling of the remnant tear.

Arthroscopic Surgery

Arthroscopy is performed generally as an outpatient. Prior to the surgery, blood counts and urinalysis are done. A thorough medical evaluation is done prior to the operation, including a discussion of any prior medical problems. If any contraindications to surgery are discovered, appropriate consultation is sought, as the patient requires a medical clearance for surgery. The patient reports to the hospital/outpatient center at least two hours prior to his or her surgery time. You are advised not to eat or drink anything at least 8 hours prior to surgery.

This type of surgery is performed under either a spinal or general anesthetic. I have no personal preference in this regard and have had no complications with either form of anaesthetic. Most patients prefer a general anesthesia, as recovery is faster. A spinal anesthetic may require bed rest for 3-4 days following surgery, as many patients experience what is known as a “spinal headache” after its use (Jabbari, 2013). Patients who experience severe headaches and nausea and vomiting must be admitted to the hospital to be hydrated with intravenous fluids. General anesthesia involves a combination of intravenous and inhaled agents and the patient is awakened immediately after surgery. The anesthesiologist will discuss your preference of anaesthetic with you prior to the operation.

Shortly before surgery, your leg will be shaved above, below, and around the surgery site and will be prepped with a Betadine solution. The anesthetic is administered in the operating room and the leg is thoroughly prepped once again with Betadine. Strict sterile technique is observed throughout the procedure. After performing or been involved over 10,000 arthroscopic procedures I have yet to have one operative infection and have specific rules in place to avoid infection.

Once the leg is thoroughly prepped and draped, the arthroscope is inserted through a 3-4 millimeter incision at the outside of the knee. The interior of the joint and associated structures are then examined. This exam includes the menisci, the anterior and posterior cruciate ligaments, the undersurface of the kneecap, and the articular surfaces of the bones. The large pouch above the kneecap, called the suprapatellar pouch, is examined as is the lining of the joint called the “synovial membrane.” If the synovial membrane is found to be abnormal, a biopsy is taken. If an abnormal membrane appears to be part of the pathologic process, it is often referred to as a “plica” (Bigelow, 2016) or hypertrophic synovium and it is excised.

Arthroscopic Surgery of the Meniscus

After an accurate examination under anesthesia, I then proceed with the operative procedure with confirmation of the meniscus tear. Very small instruments are used to perform this surgery. They are inserted through a second 3-4 millimeter incision at the front inside aspect of the knee. These minute instruments consist of small scissors, punches, and grabbing devices. Most of the required instruments are only used by me as I have collected my own special instruments over time. There are also several types of powered instruments such as shavers and drills available. As I have previously mentioned, the articular cartilage which covers the ends of the bones provides protection of the bones and is essential to normal function. This articular cartilage is very sensitive to injury, and if significantly nicked or gouged by any instruments, traumatic arthritis may develop later.

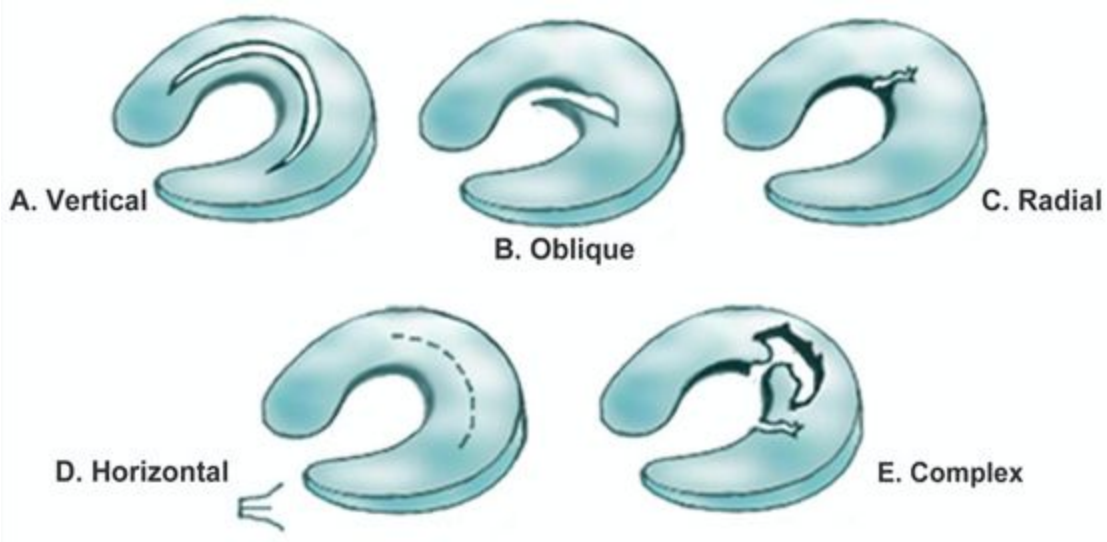

Figure 4. Types of Meniscus Tears

Thus, it is my feeling that vigorous manipulation of the articular surface of the joint by drilling instruments leads to later problems, and I normally do not use them unless more severe arthritis is present, or there are residual bone defects that require an attempt to revascularize the damaged areas.

The type of meniscus surgery will depend upon the type of meniscus tear identified by arthroscopy (Lefevre, 2016). There are as many different types of tears as there are numbers of patients, but the majority of tears are seen in the medial (inside) meniscus. The types of tears seen in the meniscus fall into several broad categories. I will discuss the most commonly encountered meniscus tears.

A typical tear is short and angular and involves the inner periphery of the meniscus in the mid to rear, or posterior, portion (see Figure 5). This may be described as a “short oblique tear.”

Figure 5. Short Oblique Tear

Unfortunately, the blood supply to this region of the meniscus is poor and these tears rarely heal. If this tear is large and in the mid to posterior (back) portion of the meniscus, it usually produces symptoms of pain. Since the meniscus does not have very large nerve fibers, the pain is thought to originate at the outside of the meniscus where the meniscus interfaces with the other soft tissues. However, recent reports suggest very small nerves are within the body of the meniscus. The current philosophy is to insert small cutting instruments and perform a saucerization or removal of the portion of the meniscus containing the tear (see Figure 5). In active individuals, because of the mechanical shearing forces at the site of the surgery, further tearing can occur. However, no suitable alternative approach has been proposed and at least 90% of the patients in whom this technique is employed do very well with no recurrence of symptoms.

The next type of tear commonly encountered is the called peripheral, circumferential, or circular type of tear (see Figure 6).

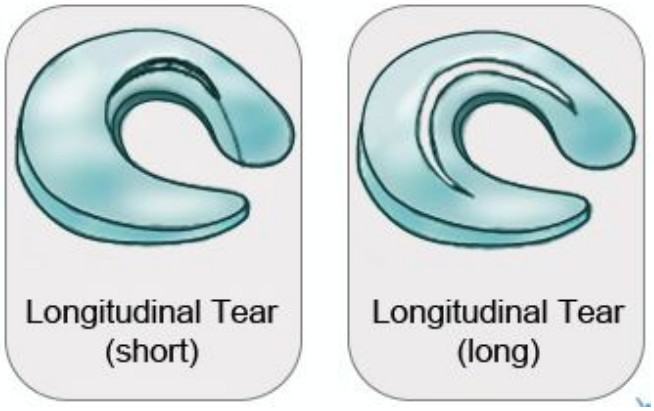

Figure 6. Circumferential Tear

When this tear(short) occurs in the mid to posterior (back) portion of the meniscus, and is located in the central portion or near the inner periphery of the meniscus, it rarely heals as well, as there is minimal blood supply in this area. Again, saucerization or removal of the involved portion of the meniscus is recommended. Recent experimental literature suggests the possibility of promoting healing of this tear after creating a “vascular access channel” to the periphery. This provides a blood supply to the torn region. We recommend this approach when feasible. The percentage of

success in a large series is presently not known. A second arthroscopic surgery may be required if appropriate healing does not occur or a re-tear occurs.

If a peripheral tear involves the outer border or periphery of the meniscus where there is an adequate blood supply to promote healing, then the tear may be repairable (stitched together) because the outside 20–30% of the meniscus is vascular (see Figure 7) and has a better chance of healing.

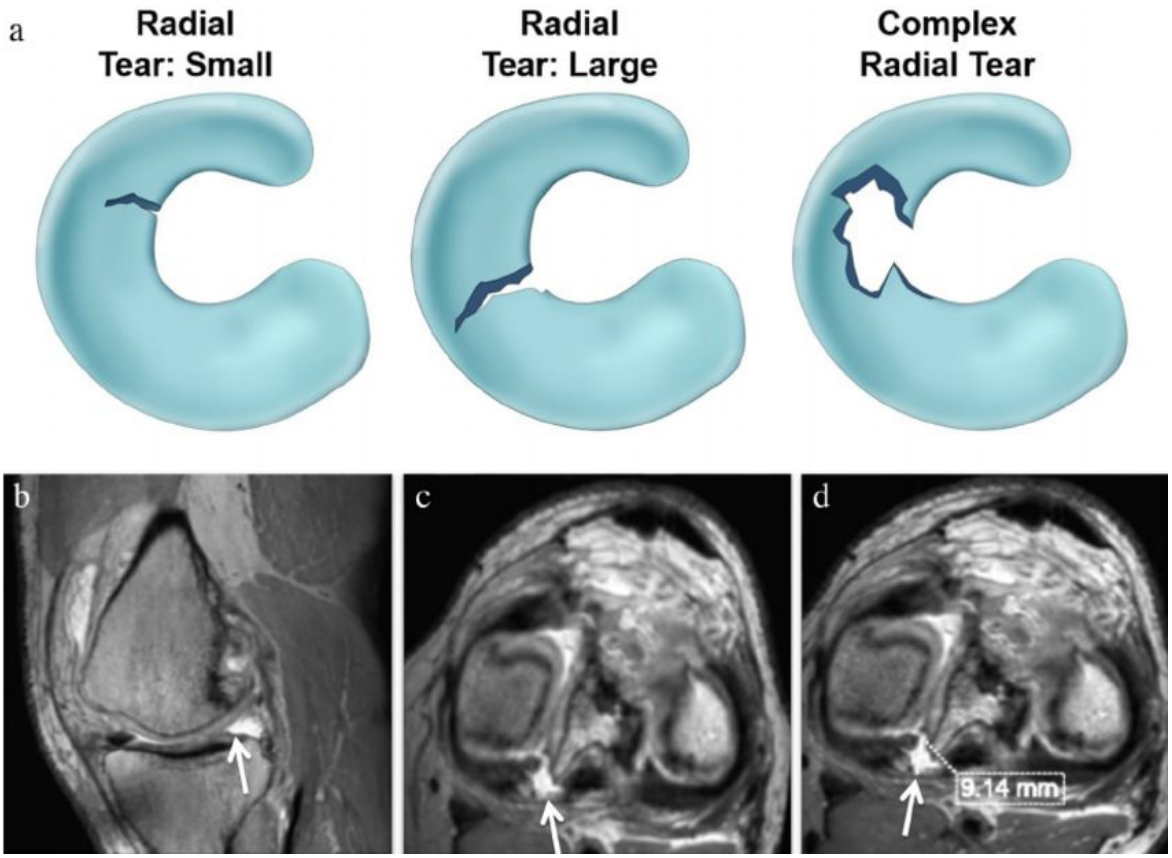

Figure 7. MRI (a–d) Radial tear—illustration (a) showing the radial tear and its complex variant. 3D PD images (a–c) show complete width radial tear of posterior medial meniscus (arrows). Rim width is 9.1 mm (>5 mm, zone 1–3). (Wadhwa, 2015)

With the repairable type of tear, a small incision is made in the skin, the meniscus is repaired with absorbable suture from the inside out or outside in. Small absorbable sutures are used to close the tear (see Figure 6b). Vascular access channels may also be created. This type of tear is seen in only one to two of every 100 meniscus injuries. The patient is then placed in a immobilizer for at least four weeks to immobilize the limb and allow the meniscus to heal. Over 90% of the menisci repaired in this way heal satisfactorily. The healing rate with creation of vascular access channels is unknown. A second arthroscopy is required if healing doesn't occur.

Occasionally, the circumferential tears will extend through the entire circumference of the meniscus. The inner portion of this tear is unstable and through repetitive stress, separates from the remainder of the meniscus and is pushed deep into the knee. This is referred to as a "Bucket Handle" meniscus tear (see Figure 8). This loose loop of tissue can pop in and out between the bones, causing momentary or long-term locking of the knee, thus limiting full range of motion. In most cases, the displaced portion of the meniscus must be removed. If this tear occurs in the peripheral 20% of the vascular tissue and if no other tears of significance are found, then it may be repaired.

Figure 8. Bucket-handle Tear

It is also common to find comminuted or complex tears of the meniscus in which there are multiple tears in several planes (see Figures 9). Even when these complex tears occur near the periphery of the meniscus, they are usually not repairable. In most cases, that portion of the meniscus containing the tear must be removed.

Figure 9. Complex Tear

Long-term Consequences of Arthroscopic Meniscus Surgery

The current medical literature shows that a high incidence (>20%) of those patients who have had a complete removal of the meniscus through an arthrotomy or large open incision will develop a mild to moderate form of premature, post-traumatic degenerative arthritis approximately ten to twenty years after surgery (Papalia, 2011). Patients with high activity levels may be more prone to forming arthritis. In patients that develop severe arthritis a total replacement of the joint with a prosthesis may be the only answer. In cases of moderate to severe arthritic change, an arthroscopic debridement technique is used. In selected cases, bare bone is debrided (microfracture) to promote fibrocartilage ingrowth. Fibrocartilage may form a new articular membrane and requires a 6–8 week postoperative period of non-weight bearing or limited weight bearing status

using crutches or a walker. Patients are encouraged to flex-extend the knee 500 times per day and or use a CPM (constant passive motion) device.

While arthroscopy is a relatively new procedure, the long-term effects of arthroscopic partial meniscectomy points to a linear relationship between loss of meniscus tissue and the amount and severity of arthritis developing. The more meniscus removed, the higher the chance of developing arthritis later. Recent animal studies have shown that there is a direct correlation between the amount of meniscus removed and the amount of secondary arthritis (McDermott, 2006). Theoretically, the less meniscus removed, the less likelihood of secondary arthritis developing at a later date.

The decision regarding how much of the meniscus to remove can only be made at the time of surgery after the extent of the tear has been evaluated with the arthroscope. It has always been my policy to remove as little of the meniscus as possible and thus decrease the likelihood of secondary arthritic changes later in the knee. Further tears in the meniscus can occur after surgery, but further tearing is rare unless too much stress is placed on the knee too soon after arthroscopy. Repeat arthroscopies for new meniscus problems are occasionally performed. I have repeated none in a five-year follow-up period.

If early or moderate arthritis is found in combination with a meniscus tear at the time of arthroscopy, then the arthritic deposits are also removed. However, it is noted that the long-term results are not as successful with both problems present. Finding isolated arthritis generally means that the patient is too heavy or there has been a direct injury or blow to the articular cartilage, and the articular cartilage on the ends of the bones is broken or simply wearing away from too much pressure. A resolution of symptoms may be seen with rapid weight loss and with appropriate arthroscopic techniques. In the younger patient, articular cartilage replacement surgeries are available.

Patellar chondromalacia, or damaged articular cartilage under the patella, is also commonly seen (Pak, 2013). If the damage is more severe, the damaged component is removed. However, the results of meniscus surgery and patellar chondromalacia surgery are not as good as isolated meniscus surgery alone. It is fairly common to require further arthroscopic surgery at a later date when more severe arthritis and/or chondromalacia are present.

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Platelet Rich Plasma

Platelet Rich Plasma (PRP) is a new technique we are using to promote faster and better healing after knee surgery especially in meniscus surgery. As there is evidence that PRP may accelerate the healing of residual meniscus tears in the knee. **Platelets** consist of proteins, cytokines, and other bioactive factors located in the peripheral blood. They contribute to the regulation of homeostasis and promote wound repair. **Plasma** contains clotting factors, proteins and ions. Recent literature suggests that for optimal therapeutic purposes physicians should use a platelet concentration of
1 million platelets per microliter and a 3- to 5-fold increase in growth factor concentration and cytokines" (Mehta, 2008). In the plasma, numerous proteins are contained, such as insulin-like growth factor (IGF), platelet-derived growth factor (PDGF), platelet factor interleukin (IL), platelet-derived angiogenesis factor (PDAF), epidermal growth factor (EGF), transforming growth factor (TGF), vascular endothelial growth factor (VEGF), and fibronectin (Lubkowska, 2012). In the dense granules of platelets such bioactive factors are also found, specifically calcium, dopamine, serotonin, histamine, and adenosine. Such non-growth bioactive factors control inflammation, proliferation, and remodeling in the process of wound healing (Boswell, 2012). PRP is also used in an attempt to slow down the arthritic degeneration process, preserve chondrocytes which are cartilage cells that line the joint. PRP also stimulates ligament, tendon tissue repair, and meniscal healing.

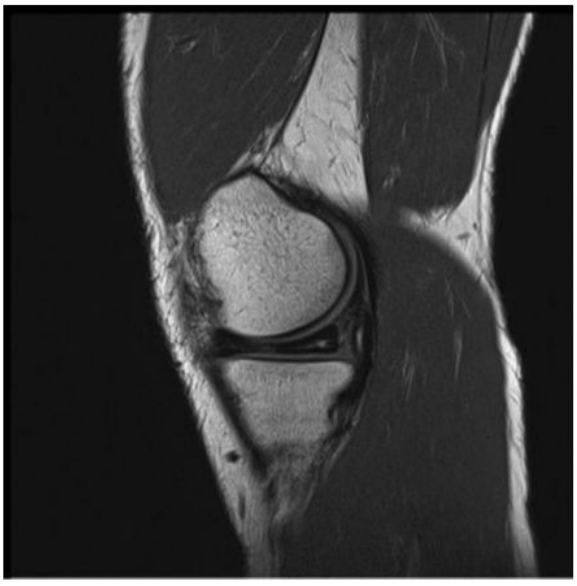

Figure 1. Meniscal lesion before injections (patient 7).

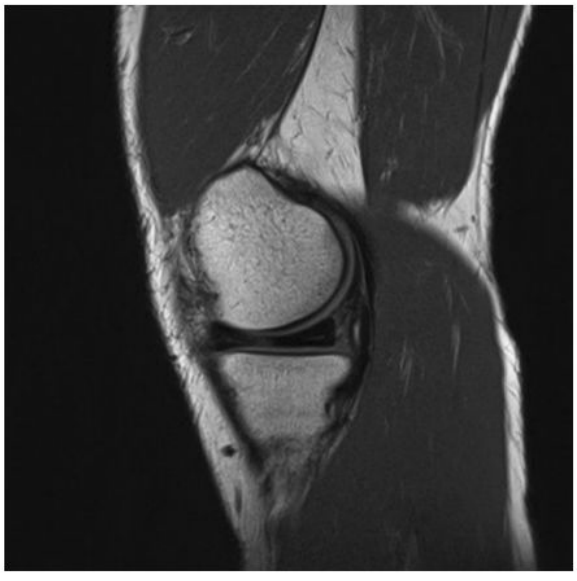

Figure 2. Meniscal lesion 6 months after injections (patient 7).

Image Source: Blanke, F., *Percutaneous injections of Platelet Rich Plasma for treatment of intrasubstance meniscal lesions.* Muscles, Ligaments and Tendons Journal 2015;5 (3):162-166

German and Swiss scientists confirmed that PRP percutaneous injections release therapeutic properties for pain relief and promote the decrease in grade 2 meniscal lesions progression in patients over a 6 months time period (Blanke, 2015).

Another study on animals treated with PRP injections for meniscal tissue defects revealed the curative properties of PRP of the inner, avascular meniscus. Subjects treated with PRP showed significantly greater scores for the number of fibro-chondrocytes and production of extracellular matrix compared to the control group (Ishida, 2007). Moreover, several studies suggest the additive effect of PRP-containing growth factors for increased meniscal cell activity and augmentation of meniscal repair and healing during horizontal cleavage meniscal tears repaired via an open surgery.

A team of surgeons from France in one such study invited 17 patients for open meniscal repair surgery of horizontal tears extending into the avascular zone-Group 1, and additional 17 patients underwent same surgery with introduction of PRP injections at the end of the open meniscal repair-Group 2 (De Chou, 2015). The MRI results of this study demonstrated that 5 patients from Group 2 had full disappearance of hypersignal within the repaired meniscus at the 24 months postoperative time-frame (De Chou, 2015). Such evidence suggest the additive effect of PRP to improve outcome results after open meniscal repair surgery. Due to patient's individual meniscal injury variations, PRP can be injected in the knee at the time of surgery or fairly soon after surgery.

Meta-analysis of PRP technology confirms that PRP treatment promotes more robust healing in an attempt to preserve the meniscus tissue and to provide faster and better healing of the residual meniscus and knee joint tissues, including the ACL and PCL ligaments.

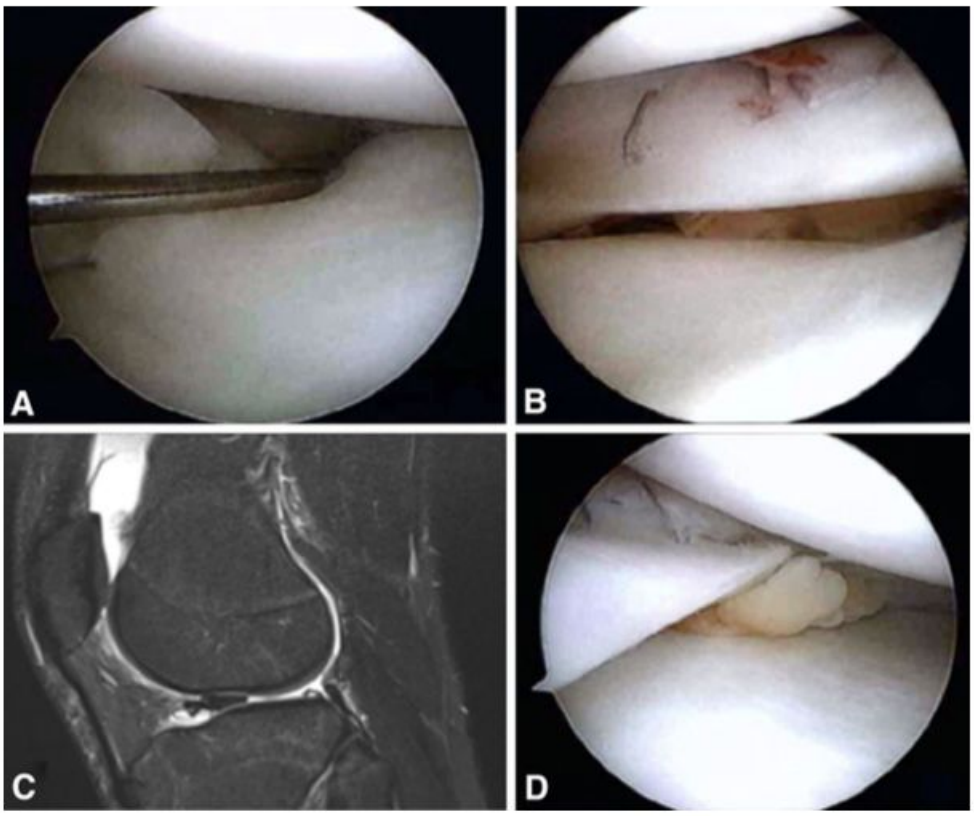

Fig. 1A–D (**A**) An intraoperative image of a displaced meniscus tear is shown. (**B**) An inside-out repair is performed with PRP augmentation. (**C**) MRI demonstrates a bucket-handle lateral meniscus tear and (**D**) PRP augmentation of this meniscus repair.

Source: Griffin, J.W., et al. *Platelet-rich Plasma in Meniscal Repair: Does Augmentation Improve Surgical Outcomes?* Clinical Orthopedics and Related Research. 2015. 472: 1665-1672.

Currently health insurance coverage does not pay for PRP treatment. We will discuss various payment options to receive this treatment if it is felt to be advantageous to your condition(s).

Hyaluronic Acid

Hyaluronic Acid (HA) is also used in either post-surgery cases or in non-surgical cases applied within the joint to ameliorate arthritis-associated pain.

Hyaluronate or hyaluronan is contained in cartilage and the synovial fluid. HA is a large viscoelastic glycosaminoglycan molecule that is contained in synovial fluid and cartilage matrix. Chondrocytes (cartilage cells), fibroblasts (collagen producing cell) and the synovial cells all secrete HA into the joint. HA Is approved by the The Food and Drug Administration (FDA) and is either generated from bacterial fermentation in vitro or from harvested rooster combs. Such HA contain Hylan G-F 20, sodium hyaluronate, and high-molecular weight hyaluronan (McArthur, 2012). In healthy patients, synovial fluid contains a normal HA amount or concentration and serves as a viscous lubricant for healthy knee movements, much like a lubricant in a car.

There is a decreased amount of HA in the synovial fluid of OA patients (Trigkilidas, 2013). In OA patients, where the synovial membrane secretes abnormal proteases, free radicals, and cytokines which leads to the disruption of organic HA synthesis and contributes toward the progression of OA (Brockmeier, 2006). A healthy level of HA is crucial in providing anti-inflammatory properties to regulate cartilage homeostasis, and to slow the chondrocyte apoptosis (cell death) which occurs with OA.

Stem Cell Technology

Mesenchymal stem cells (MSCs) exhibit properties both in multipotent differentiation (cells that may develop into more than one cell type) and immunomodulation (immune response alteration to a desired level) (Wyles, 2015). Based on these unique properties, stem cells have the therapeutic potential to treat osteoarthritis (OA). Since 1990 there have been promising clinical trial results from the U.S., India, Germany, Singapore, and Iran that the intra-joint injection of MSCs can be an effective therapy for treating OA (Sarabi, 2016). Furthermore, clinical trials in Spain have illustrated MSCs injected with more advanced stem cells technology for localized treatment of OA, using bioabsorbable material (hydrogel) as a vehicle carrier (Lamo-Espinosa, 2016). Many of these clinical trials were performed with bone marrow derived MSCs, but other MSCs derived from adipose and the umbilical cord can also have great potential to treat OA, as they share similar characteristics to bone marrow MSCs (Uth, 2014). In general, adipose and umbilical cord MSCs have a higher culture life expansion potential (have a higher duration to secrete regenerative factors) and

may be more readily available, but not necessarily exhibit strong therapeutic regenerative (ability to heal damaged tissue) potential as BM-MSCs.

Interestingly, both allogeneic (donor cells) and autologous (host cells) MSCs have therapeutic potential to treat OA, and it may be that allogeneic MSCs may be a more convenient "off-the-shelf" therapy to utilize due to the immune-evasive nature of MSCs lacking HLA antigens (does not stimulate the host immune response as a foreign substance) and other co-stimulatory molecules to elicit an immune rejection response (Gupta, 2012). Lastly, dosages from 10–100 million MSCs per intra-articular injection are recommended for a therapeutic response to treat OA corresponding to the severity of disease or injury, and the patient's Body Mass Index (BMI) (Lamo-Espinosa, 2016), but potentially a smaller dosage of MSCs could be used in a scaffold (hydrogel) to have a stronger localized treatment effect.

I consider the stem cell technology as a new technique in orthopedic surgery, aimed to rejuvenate joint and body parts. We are currently researching the use of stem cell techniques in joints, muscles, and tendons. It appears based on the current literature that the technique is promising. I have been considering applying stem cell technology in practice however I do not think the current literature supports the use of either bone marrow or adipose derived stem cells. The technique in my opinion, is experimental and further research is required. And I am currently using advanced arthroscopic techniques in selected cases to attempt to stimulate the body's own stem cells, while performing various complex surgical arthroscopic procedures.

Metabolism and Arthritis

Metabolic problems may also result in arthritis in a joint. Gouty arthritis is due to a buildup of uric acid. Pseudogout is caused by a buildup of pyrophosphate crystals in the joint (Higgins, 2016). At the time of arthroscopy, these crystals can be washed from the joint space, usually giving some relief of symptoms. Oral medication is also usually required. Rarely, an unusual infection and/or tumor is found and the appropriate surgery is required. Various forms of arthritis are also seen, including rheumatoid arthritis and even septic arthritis (infection). I have seen most types of arthritis and if I suspect a diagnosis of arthritis, we will perform the necessary testing, which would include a microscopic evaluation of the fluid and lining membrane with protein and sugar measurements, pathologic tissue specimen and crystal examination, with bacterial cultures. Often, more than one problem is present. Diabetic joint disease is also seen, which produces premature aging of the joint, concomitant skin-related problems, and neuropathy (damaged nerves).

After the patient has undergone arthroscopy, he or she is able to go home the same day, usually within a few hours of surgery. Crutches will be used for the first couple of days following surgery. In a case where weight bearing is not allowed and arthritis surgery was performed, then weight bearing is modified for up to 6 weeks. The patient returns to the office within one to seven days following surgery. It is imperative to check all wounds within 48–96 hours of surgery. The sutures from the small entry sites are removed generally within the first week. While the sutures are in place, the patient is not allowed to shower unless the puncture wounds are totally protected, plastic or saran wrap can be placed around the surgical site dressings to shower after 72 hours. If the wound becomes wet, the risk of infection increases.

The patient is encouraged to begin exercising the leg as soon as possible, preferably the same day of the surgery, to limit the loss of strength and range of motion. As soon as the sutures are removed, a knee rehabilitation program is often instituted under the supervision of a licensed physical therapist or a home program depending on the type of surgery performed.

When the patient has regained adequate strength and range of motion, and has no swelling or pain, he or she is ready to return to modified activity. With simple meniscus surgery, return to normal activity will usually occur between the second and sixth week following surgery. With arthritis and meniscus surgery, protected or no-weight bearing is initially permitted, and the recovery period is much longer. Healing of these tissues can take several weeks/months.

Very few complications associated with arthroscopic surgery have been reported. Infection is always a concern with any type of surgery, but meticulous sterile technique is always maintained with arthroscopy. Liberal use of antibiotics also reduces the risk of infection. In the literature, the infection rate associated with arthroscopy is less than one in a thousand. My patients have never had an infection in over 35 years.

One complication that has been reported in the literature is the leakage of the irrigation fluid (Cavaignac, 2013). This fluid is used to inflate the knee to provide better visualization of the knee and to remove any loose matter in the knee. When excessive leakage occurs and high pressure injection techniques are used, nerves and arteries can be damaged. I personally do not use high pressure techniques, and my patients have experienced no nerve or artery damage. More complex surgery may require various pressurized pump systems. The fluid used to irrigate the knee-- Ringer's Lactate and its components are very close to those of normal body fluids. Normal saline is also used.

As we age, there is an increased incidence of postoperative vein irritation or phlebitis. (There is less than 1% incidence.) Thus, it is recommended that patients over the age of 35 take a 300 mg regular aspirin a day starting one day prior to surgery and continuing for two to four weeks after surgery. Aspirin can be an effective anticoagulant as it helps to prevent clotting of blood. Patients that develop phlebitis are treated with an anti-inflammatory and/or a blood thinning medication.

After the patient has completed the initial knee rehabilitation period, a gradual return to activity is permitted. Jogging and running are permitted when the patient is pain free, has normal strength, and there is no swelling. I must caution you to be conservative in returning to full activity, especially running and twisting activities. Returning to full exercise too rapidly can cause problems; it is necessary to work up slowly to heavy activity. If you have any questions in this regard, please discuss your questions with me.

I hope you have found this patient education literature informative and helpful. If you have any questions regarding this material, please feel free to contact me.

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