

## Treatment Options for Osteoarthritis in the Knee

### Non-Surgical

- Exercise and Weight Loss
- Bracing
- Medication
- Viscosupplementation
- Cortisone Injection

### Surgical

- Arthroscopy, Chondroplasty
- Microfracture / Abrasion
- Autograft OATS
- Allograft OATS
- Meniscus Reconstruction
- Tibial Valgus Osteotomy
- Femoral Varus Osteotomy
- Autologous Chondrocyte Implantation
- Unicompartmental Arthroplasty
- Total Knee Arthroplasty



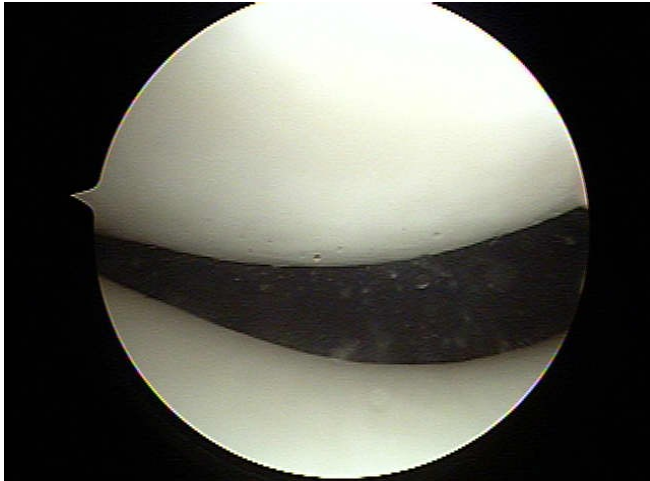
*Figure: Non-arthritic Knee*



*Figure: Arthritic Knee*

### Osteoarthritis of the Knee

Osteoarthritis is the most common cause of musculoskeletal pain and disability in the knee joint. In the knee joint, the end of the femur (thigh bone) and tibia (shin bone) are covered in smooth articulate cartilage. Between the two bones sits a second type of cartilage, called menisci, which act as cartilage shock absorber pads. Joint fluid also adds lubrication to the knee joint. Osteoarthritis (OA) starts as the lack or loss of this articulate (surface) cartilage and then progresses into involvement with the surrounding bone, tissues, and synovial fluid. In osteoarthritis, cartilage may have areas of partial thickness loss (thinning) or complete loss of surface cartilage resulting in areas of exposed bone. Isolated cartilage loss may be a result of isolated trauma or it may be a result of chronic wear and tear of the joint.



Patella - femoral joint (kneecap- thigh bone), showing intact surface cartilage.



Patella with areas of exposed bone / osteoarthritis. White= surface cartilage, pink=exposed bone.

It has been estimated that 12% of Americans aged >25 years have clinical signs and symptoms of OA. Further studies have shown 80% of people older than 75 have symptoms of OA, and cadaveric studies have shown universal signs of arthritis in patients 65 and older. Studies have provided conflicting evidence regarding activities and the development of osteoarthritis. While moderate physical stress helps maintain the integrity of the surface cartilage, excessive stress may result in cartilage degradation. Risk factors for OA include age, injury, anatomic joint abnormalities, heredity, high bone mineral density, joint hypermobility, obesity, muscle weakness, and overuse or under use of the joints.

Symptoms of osteoarthritis include joint pain with activity, night pain, morning stiffness, limited motion, joint inflammation, crepitus or noise from the knee, and deformity. Below are pictures of osteoarthritis in a knee joint.

There are several options in treating osteoarthritis, both surgical and nonsurgical. All options are not always appropriate for each patient. Information gained from X-rays, MRI and knee arthroscopy all are helpful in determining an appropriate treatment plan.

## **Nonsurgical Treatment Options**

### Exercise and Weight Loss

Nonsurgical management starts with weight loss and muscle strengthening. Each pound of weight can put up to 6 pounds worth of pressure on the knee joint during activity. Thus people of a larger size tend to develop arthritis at an earlier age and to a greater severity than their slim counterparts.

Muscle strength is also vital in combating osteoarthritis. The muscles surrounding the knee joint act as shock absorbers for the pressure that daily activities and sports place on the joint. The stronger the muscles are that surround the knee joint are, the more stress they can absorb for the knee joint. Increasing muscle strength will decrease pressure otherwise placed on the joint, thus decreasing symptoms.

Exercises that will increase quadriceps, hamstring and calf strength include ¼ squats, leg press and leg extension. These exercises should be pain free and done with limited flexion or bending of the knee, not greater than 45 degrees. In addition to these focused strengthening exercises cardiovascular exercise such as cycling, elliptical, rollerblading, and swimming will also be beneficial. Strengthening exercises should be done at least 3x/week to build muscle strength.

### Bracing

Knee braces are available for treatment of medial compartmental osteoarthritis (arthritis on the inside of the knee joint). These braces work by unloading the medial (inside) portion of the knee. These braces need to be custom made and therefore can be expensive.

### Medications

In addition to weight loss and strengthening, anti-inflammatory medications may also help decrease symptoms. These medications are available in both over the counter and prescription doses. Aspirin, Ibuprofen (Advil) and Naprosyn (Aleve) are all examples of over the counter anti-inflammatory medications (NSAIDs). Other prescription strength NSAIDs include Indocin, Daypro, Relafen, Celebrex, Lodine, and Mobic. Acetaminophen (Tylenol) may also be taken for OA pain but it is less effective for inflammation than other medications.

The most common side effect from NSAIDS is stomach irritation. Other potential side effects include be stomach ulceration (greatest in those with acid reflux, use corticosteroids, smokers, and those who drink alcohol), and renal damage (greatest in those older than 65, individuals with hypertension or congestive heart failure or those taking diuretics or ACE-inhibitors). Patients who are on anticoagulation therapy should use NSAIDs with caution.

The most common side effects of Tylenol are nausea, constipation and occasionally drowsiness. The most worrisome side effect from Tylenol is liver toxicity which is rare when the medication is taken as directed.

All medication use and dosages should be discussed with Dr King, Laurel or Melissa.

### Nutritional Supplements

Supplements such as glucosamine sulfate and chondroitin sulfate are widely used but not regulated by the FDA. Glucosamine, an aminomonosaccharide, is a primary component of connective tissue (including cartilage). It is not known however, if taking glucosamine orally has any effect on the knee joint. Chondroitin sulfate is found in proteoglycans which contribute to the stability of cartilage. In supplementation form, chondroitin is derived from bovine and calf cartilage. Several clinical studies are in process evaluating effectiveness, efficacy, and monitoring any long term adverse effects of glucosamine and chondroitin.

#### Viscosupplementation

Within the knee joint synovial fluid is highly viscous which provides a friction-free environment. Hyaluronic acid (HA) which is present in our synovial fluid is also found in most body tissues. In a healthy adult, synovial fluid HA has a molecular weight of 4-5 million. As a result of this large size HA molecules entangle, forming coiled configurations which in turn provide elasticity and viscosity to synovial fluid. HA also binds to proteoglycans to stabilize the structure of the articulate cartilage. In patients with OA, the molecular weight of the HA decreases causing the synovial fluid to become less viscous thus leading to increased friction and abnormal joint movement.

Lubrication or Hylagan injections provide the joint extra lubrication and shock absorption, as well as decrease friction or rubbing within the joint which may slow the progression of osteoarthritis. However, of all the patients who receive Hylagan injections, only about 50% have symptomatic relief. One injection is given into the knee each week for three weeks and may be repeated as soon as 6 months. Up to five injections may be given, but studies have shown no difference in symptom relief after 3 or 5 injections.

#### Cortisone Injection

Injection of cortisone into the knee joint has been shown to be effective for 'flares' of arthritis symptoms, as they are a direct acting anti-inflammatory medication. However, research has also shown deterioration of articulate cartilage after repeated cortisone injections. Therefore, these injections are only used with caution in the knee joint.

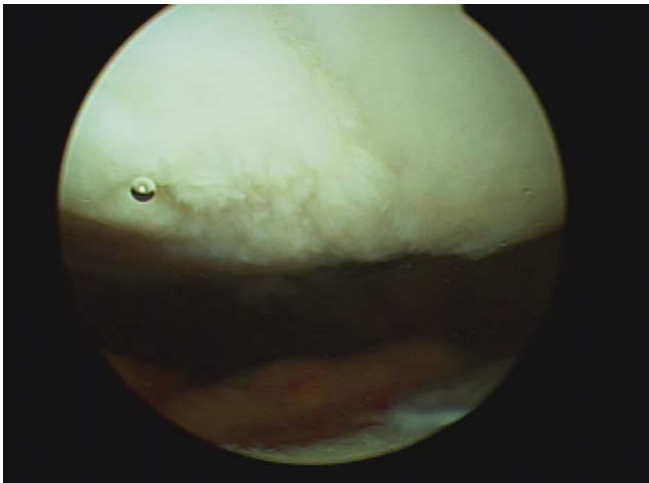
### **Surgical Treatment Options**

#### Chondroplasty

In addition to nonsurgical management of osteoarthritis, several surgical options exist. Surgical options include first a knee arthroscopy (scope) and chondroplasty. Chondroplasty is a smoothing of roughened articulate cartilage. The smoothing may decrease the friction inside the joint but is performed conservatively as to prevent thinning of the surface cartilage.



Chondromalacia or thinning / wearing of the surface cartilage (seen in white). Mechanical shaver seen bottom right.



After a chondroplasty (smoothing of the worn surface cartilage).

#### Abrasion / Microfracture

Abrasion arthroplasty, or micro-fracture, is appropriate for small areas of exposed bone or complete loss of cartilage. Abrasion of the area exposed bone is performed with a surgical pic which stimulates the bone to bleed allowing the bone to in response grow scar cartilage over the previously exposed area. The resulting cartilage growth and its effectiveness are variable between patients.

*I will get good pre-post abrasion photos and email to you.*

#### OATS Procedure

Osteochondral Autograft (or allograft) transplant (OATS procedure) can be performed for small to moderately large area of full thickness surface cartilage loss. These areas of full thickness cartilage loss are also referred to as grade IV chondromalacia. This procedure involves first removing a cylinder shaped dowel of bone which is lacking surface cartilage and replacing it with a dowel or cylinder of bone with intact surface or articulate cartilage. Both dowels are the

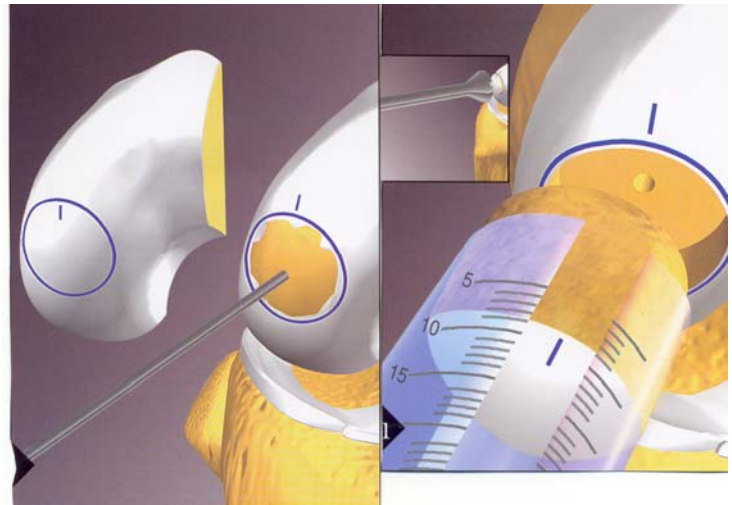
same size so when they are switched there is a press fit and no hardware is needed to secure it in place.

The replacement dowel of bone with surface cartilage can either come from a non weight bearing area of bone and surface cartilage from your knee (AUTOGRAFT) or from a cadaver (ALLOGRAFT). If the lesion or area lacking surface cartilage is less than 20mm an autograft OATS may be performed, using either one or a few bone and cartilage plugs. If the lesion to be resurfaced is larger than 20mm, taking tissue from a cadaver or an allograft is needed. This tissue must be ordered and this may require a second surgery. The size of the lesion and appropriateness of either procedure is usually not known until the arthroscopy is performed.

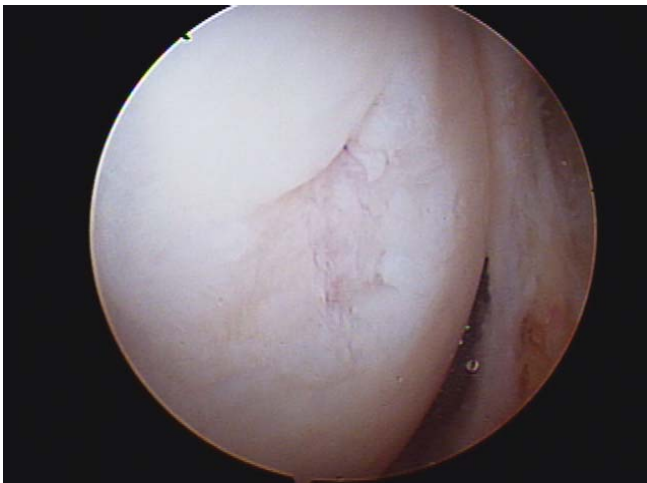
Rehabilitation after an OATS procedure includes using crutches and partial weight bearing activity only for 3- 6 weeks, depending on the size of the lesion.



*Figure: Autograft OATS (Arthrex Inc., 2005)*



*Figure: Allograft OATS (Arthrex Inc., 2005)*



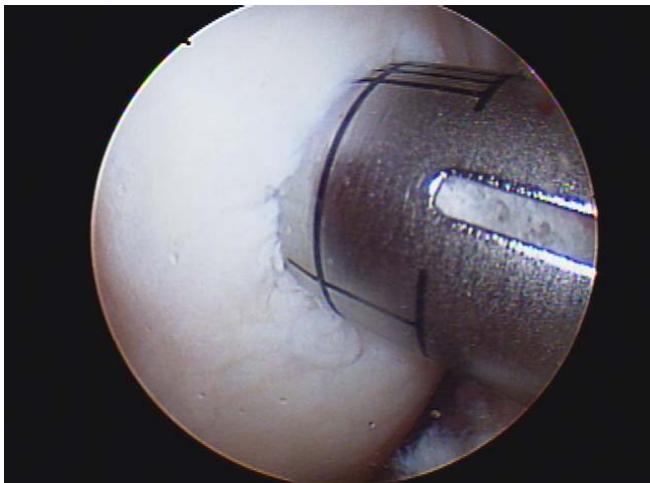
Defect in surface cartilage down to exposed bone before autograft oats procedure.



Measuring the size of the chondral defect before oats procedure.



After removal of bone cartilage plug around defect of cartilage.

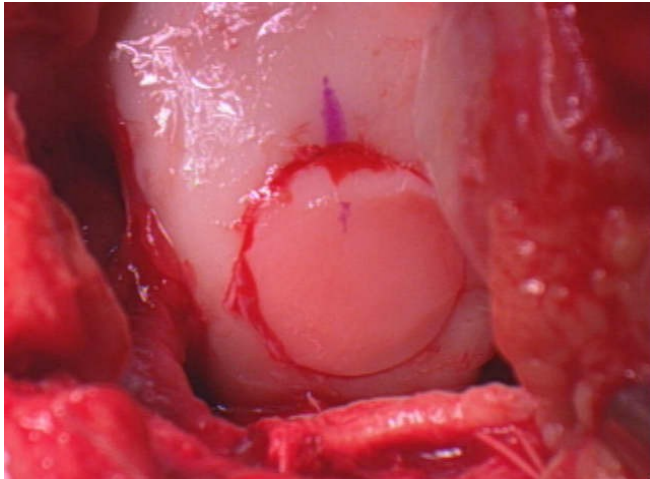


Insertion of new bone-cartilage plug.

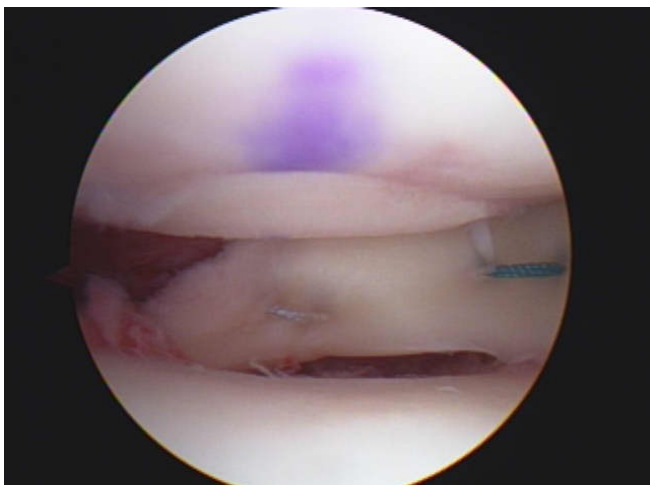




After insertion, showing intact surface cartilage.



After a large allograft oars procedure.



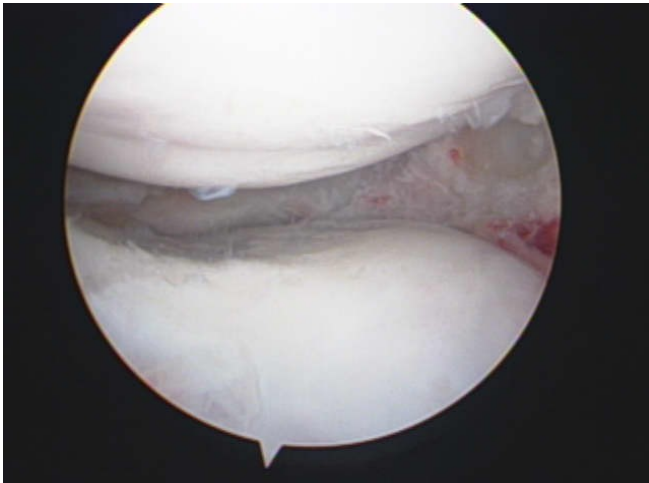
After oars procedure on femur (above) with meniscus reconstruction.



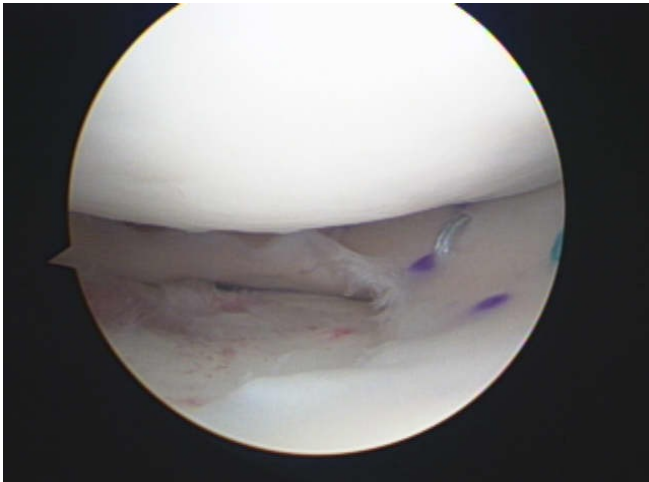
### Meniscus Transplant

A meniscal transplant involves implanting either a medial or lateral meniscus from a cadaver into a knee joint that is lacking greater than 50% of meniscal cartilage. X-rays or an MRI are used to measure the patient's knee to determine the dimensions of the meniscus needing to be ordered. The wait for a meniscus may be a few weeks to several months. This procedure however, has only been found to be useful in patients with intact surface cartilage above and below the meniscus. Thousands of meniscal transplants have been done world-wide; Dr. King has done hundreds.

Rehabilitation after this procedure includes walking with crutches and a knee brace for the first 3-6 weeks with physical therapy usually starting the first or second week after surgery.



Absence of meniscus between femur (above) and tibia (below).



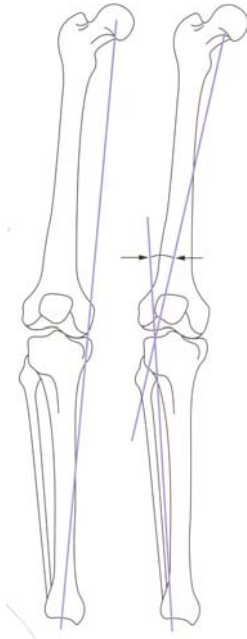
After meniscus has been reconstructed. Meniscus is stabilized with suture.

### Osteotomy- Tibial and Femoral

Often patients with knee osteoarthritis may have more arthritis on either the inside (medial) or outside (lateral) of the knee, causing the alignment of the knee joint to shift towards becoming bow-legged or knock-knee. Unfortunately once alignment is no longer even activity and pressure

on the knee joint can cause an acceleration of wearing of the vulnerable side of the knee as more and more weight is now transferred onto that area. An Osteotomy is a realignment procedure that unloads the vulnerable or arthritic side of the knee and puts the majority of the load of the knee joint onto the underutilized cartilage on the other side of the knee.

An Osteotomy is performed by wedging open either the tibia (shin bone) or femur (thigh bone) and adding bone graft putty to create new bone growth into the wedged area. After this procedure patients are on a home motion machine then progress to physical therapy, while using a brace and crutches for the first 4-6 weeks after surgery until the bone is well healed. This procedure is very successful in relieving symptoms and preventing or delaying an artificial knee in many patients.



*Figure: Alignment Change with Osteotomy (Arthrex Inc., 2005)*



*Figure: Femoral Varus Osteotomy (Arthrex Inc., 2005)*



*Figure: Tibial Valgus Osteotomy (Arthrex Inc., 2005)*

### Autologous Chondrocyte Implantation

Autologous Chondrocyte Implantation or Carticel is a procedure that first requires a knee arthroscopy where a biopsy of your cartilage cells is obtained and then shipped to a laboratory where these cells are used to produce more cartilage cells. Six weeks after the biopsy these cells are reimplanted into your knee over the cartilage defect. A fibrous sleeve is used to hold the cells over the defect. These cells have been shown to grow and result in new cartilage matrix.

The first disadvantage to this procedure is that it requires two procedures, the second of which is an open procedure. The second disadvantage is that some reports note that the new cartilage is not significantly different from the new cartilage found after an abrasion or microfracture procedure (please see above).

### Unicompartmental Knee Replacement

Another option for patients with osteoarthritis in one area of the knee- usually medial or lateral is an artificial resurfacing of the cartilage surface, called a unicompartmental knee replacement.

This procedure is successful in relieving symptoms from osteoarthritis if the arthritis is limited to one compartment or area of the knee.

#### Artificial Joint Resurfacing or Total Knee Replacement

Artificial joint resurfacing involves capping the end of the femur (thigh bone) and tibia (shin bone) with plastic and or metal pieces. These pieces are glued in place to form an artificial joint surface.

This procedure can be very effective in eliminating painful and severe OA, but it is limited by the fact that the articular components (plastic and metal) will eventually wear out and need to be replaced. **Inactive** people early loosening of the components can occur. For these reasons most orthopedic surgeons try to delay artificial resurfacing procedures until late in life. Biologic living joints can live 60-80 years. No artificial joint can do this.