Disclaimer

This movie is an educational resource only and should not be used to manage knee pain. All decisions about the management of knee pain must be made in conjunction with your Physician or a licensed healthcare provider.
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INTRODUCTION

The knee can be divided into three compartments: Patellofemoral, the compartment on the front of the knee which contains the knee cap, medial compartment, the compartment on the inside of the knee, and lateral compartment which is the area on the outside of the knee joint.
Introduction

Bicompartmental Knee Resurfacing is a less invasive surgical alternative to Total Knee Replacement surgery for patients who have only 2 of the 3 compartments of the knee damaged by arthritis.

In order to learn more about Bicompartmental Knee Resurfacing, it is important to understand the normal anatomy of the knee.

Normal Knee Anatomy

The knee is essentially made up of four bones. The femur or thighbone is the bone connecting the hip to the knee. The tibia or shinbone connects the knee to the ankle. The patella (kneecap) is the small bone in front of the knee that rides on the knee joint as the knee bends. The fibula is a shorter and thinner bone running parallel to the tibia on its outside. The joint acts like a hinge but with some rotation.

The knee is a synovial joint meaning it is lined by synovium. The synovium produces fluid lubricating and nourishing the inside of the joint. Articular cartilage is the smooth surfaces at the end of the femur and tibia. It is the damage to this surface that causes arthritis.

(Fig. 1)

Femur

The femur (thighbone) is the largest and the strongest bone in the body. It is the weight bearing bone of the thigh. It provides attachment to most of the muscles of the knee.

(Fig. 2)

Condyle

The two femoral condyles make up the rounded end of the femur. Its smooth articular surface allows the femur to move easily over the tibial (shinbone) meniscus.

(Fig. 3)
Tibia

The tibia (shinbone), the second largest bone in the body, is the weight bearing bone of the leg. The menisci incompletely cover the superior surface of the tibia where it articulates with the femur. The menisci act as shock absorbers, protecting the articular surface of the tibia as well as assisting in rotation of the knee.

(Fig. 4)

Fibula

The fibula, although not a weight bearing bone, provides attachment sites for the Lateral collateral ligaments (LCL) and the biceps femoris tendon.

The articulation of the tibia and fibula also allows a slight degree of movement, providing an element of flexibility in response to the actions of muscles attaching to the fibula.

(Fig. 5)

Patella

The patella (kneecap), attached to the quadriceps tendon above and the patellar ligament below, rests against the anterior articular surface of the lower end of the femur and protects the knee joint. The patella acts as a fulcrum for the quadriceps by holding the quadriceps tendon off the lower end of the femur.

(Fig. 6)

Menisci

The medial and the lateral meniscus are thin C-shaped layers of fibrocartilage, incompletely covering the surface of the tibia where it articulates with the femur. The majority of the meniscus has no blood supply and for that reason, when damaged, the meniscus is unable to undergo the normal healing process that occurs in the rest of the body.

(Fig. 7)
Menisci
In addition, a meniscus begins to deteriorate with age, often developing degenerative tears.

Typically, when the meniscus is damaged, the torn pieces begin to move in an abnormal fashion inside the joint.

The menisci act as shock absorbers protecting the articular surface of the tibia as well as assisting in rotation of the knee.

As secondary stabilizers, the intact menisci interact with the stabilizing function of the ligaments and are most effective when the surrounding ligaments are intact.

(Refer fig. 7)

Anterior Cruciate Ligament (ACL)
The anterior cruciate ligament (ACL) is the major stabilizing ligament of the knee. The ACL is located in the center of the knee joint and runs from the femur (thigh bone) to the tibia (shin bone), through the center of the knee. The ACL prevents the femur from sliding backwards on the tibia (or the tibia sliding forwards on the femur).

Together with the posterior cruciate ligament (PCL), ACL stabilizes the knee in a rotational fashion. Thus, if one of these ligaments is significantly damaged, the knee will be unstable when planting the foot of the injured extremity and pivoting, causing the knee to buckle and give way.

(Refer fig. 8)

Posterior Cruciate Ligament (PCL)
Much less research has been done on the posterior cruciate ligament (PCL) because it is injured far less often than the ACL.

The PCL prevents the femur from moving too far forward over the tibia. The PCL is the knee's basic stabilizer and is almost twice as strong as the ACL. It provides a central axis about which the knee rotates.

(Refer fig. 9)
What is Arthritis?

Arthritis is a general term covering numerous conditions where the joint surface or cartilage wears out. The joint surface is covered by a smooth articular surface that allows pain-free movement in the joint. This surface can wear out for a number of reasons; often the definite cause is not known.

When the articular cartilage wears out the bone ends rub on one another and cause pain. This condition is referred to as Osteoarthritis or “wear and tear” arthritis as it occurs with aging and use. It is the most common type of arthritis.

Causes of Arthritis

There are numerous conditions that can cause arthritis but often the exact cause is never known. In general, but not always, it affects people as they get older (Osteoarthritis).

Other causes include:

- Trauma (fracture)
- Increased stress such as overuse and overweight
- Infection of the bone
- Connective tissue disorders
- Inactive lifestyle and Obesity (overweight); Your weight is the single most important link between diet and arthritis as being overweight puts an additional burden on your hips, knees, ankles and feet.
- Inflammation (Rheumatoid arthritis)

Symptoms

Knee Arthritis causes pain and decreased mobility of the knee joint. In the arthritic knee there is an absent joint space that shows on X-ray. In the normal knee there is a normal joint space.

Arthritic knee

The joint space is narrowed and irregular in outline; this can be seen in an X-ray image.

Bone spurs or excessive bone can also build up around the edges of the joint.
**Symptoms**

*Arthritic knee*

The cartilage lining is thinner than normal or completely absent. The degree of cartilage damage and inflammation varies with the type and stage of arthritis.

The capsule of the arthritic knee is swollen.

The combinations of these factors make the arthritic knee stiff and limit activities due to pain or fatigue.

*(Refer figures. 10)*
Diagnosis

Evaluating the source of knee pain is critical in determining your treatment options for relief of the pain. Knee pain should be evaluated by an Orthopaedic specialist for proper diagnosis and treatment.

- Medical History
- Physical Examination

Depending on what the history and exam reveal, your doctor may order medical tests to determine the cause of your knee pain and to rule out other conditions.

X-rays: X-rays are a form of electromagnetic radiation that is used to take pictures of bones. An X-ray can reveal if osteoarthritis from degenerative changes is causing your knee pain.

The diagnosis of osteoarthritis is made on history, physical examination & X-rays. There is no blood test to diagnose Osteoarthritis (wear & tear arthritis).

Conservative Treatment Options

The diagnosis of osteoarthritis is made on history, physical examination & X-rays. There is no blood test to diagnose Osteoarthritis (wear & tear arthritis).

- Anti-inflammatory Medications
- Physical Therapy
- Orthotics such as canes, braces, or insoles
- Activity Modification and Limitations
- Weight Reduction
- Injection of steroid & analgesic into the knee joint
Surgical Introduction

Bicompartmental Knee Resurfacing surgery may be recommended by your surgeon if you have early to moderate osteoarthritis in 2 of the 3 knee compartments and you have not obtained adequate relief with conservative treatment Options.

Traditionally, a patient with two compartments of knee arthritis would undergo a Total Knee Replacement surgery. Bicompartmental Knee Resurfacing is a newer less invasive surgical option that preserves the knee parts not damaged by arthritis as well as the stabilizing anterior and posterior cruciate ligaments, ACL and PCL. This less invasive bone and ligament preserving surgery is especially useful for younger, more active patients as the implant placed more closely mimics actual knee mechanics than does a total knee surgery.

The implants used in the partial knee resurfacing surgery are customized to the patient’s anatomy based upon CT scans of the patient’s knee. A surgical Robotic Arm assists the surgeon with preoperative planning and intraoperative component placement, positioning, and alignment. The assistance of the robotic arm limits human error and may improve performance and durability of the artificial components.

Another advantage of Bicompartmental Knee Resurfacing surgery is that it will not alter the ability of the patient to eventually move to a Total Knee Replacement in the future should that become necessary.

Treatment Options: Surgery

Bicompartmental Knee Resurfacing surgery is performed in an operating room under sterile conditions with the patient under general anesthesia or spinal anesthesia with sedation. It may be performed on an outpatient basis as day surgery, or inpatient basis with a 1-3 day hospital stay.

The surgeon makes a small incision over the affected area of the knee to expose the knee joint. The length is about half of what is required with total knee replacement surgery.

With the assistance of the robotic arm, the surgeon removes the arthritic damage to the bony surfaces of the femur and tibia in the medial or lateral compartments, depending on which one is affected by arthritis.

(Refer fig. 13 to 20)
Treatment Options: Surgery

The artificial components are inserted into the new prepared area and bone cement is used to fix it in place.

The patellofemoral compartment is then prepared by removing the damaged part of the patella and trochlea, the groove at the end of the femur. The new components are fixed in place with the use of bone cement.

With the new components in place, the knee is taken through a range of movements. The muscles are then approximated and the incision closed and covered with a sterile dressing.

(Refer fig. 13 to 20)
Treatment Options: Surgery

(Refer fig. 13 to 20)

Post Operative Recovery

Common Post Operative guidelines include:

- You will be taken to the recovery room and monitored for any complications.
- You will be given pain medication or a PCA (patient controlled analgesia) machine to keep you comfortable.
- Swelling is normal after knee surgery. Ice, compression, and elevation of the knee will be used to minimize swelling and pain.
- You will be given specific instructions regarding activity. Usually there are few activity restrictions.
- You will be referred to a rehabilitation program for exercise and strengthening.
- Eating a healthy diet and not smoking will promote healing.

Risks and Complications

As with any major surgery there are potential risks involved. The decision to proceed with the surgery is made because the advantages of surgery outweigh the potential disadvantages. It is important that you are informed of these risks before the surgery takes place.
Risks and Complications

Complications can be medical (general) or specific to knee surgery. Medical complications include those of the anesthetic and your general well being.

Almost any medical condition can occur so this list is not complete. Complications include:

- Allergic reaction to medications
- Blood loss requiring transfusion with its low risk of disease transmission
- Heart attack, strokes, kidney failure, pneumonia, bladder infections
- Complications from nerve blocks such as infection or nerve damage
- Serious medical problems can lead to ongoing health concerns, prolonged hospitalization, or rarely death.

Specific Complications related to Bicompartmental Knee Resurfacing surgery include:

Infection

Infection can occur with any operation. In the knee this can be superficial or deep. Infection rates are approximately 1%. If it occurs it can be treated with antibiotics but may require further surgery.
Deep Vein Thrombosis

DVT are blood clots that can form in the calf muscles and travel to the lung (Pulmonary embolism). These can occasionally be serious and even life threatening. If you get calf pain or shortness of breath at any stage, you should notify your surgeon.

(Refer fig. 23)

Ligament Injuries

There are a number of ligaments surrounding the knee. These ligaments can be torn during surgery or break or stretch out any time afterwards. Surgery may be required to correct this problem.

(Refer fig. 24)

Injury to Blood Vessels

Also rare but can lead to weakness and loss of sensation in part of the leg. Damage to blood vessels may require further surgery if bleeding is ongoing.

(Refer fig. 25)

Arthrofibrosis

This is the development of thick, fibrous material around the joint that often occurs after joint injury or surgery and can lead to joint stiffness and decreased movement.

(Refer fig. 26)
Wear

The components eventually wear out over time, usually 10 to 15 years, and may need to be changed.

(Refer fig. 27)

Dislocation

An extremely rare condition where the ends of the knee joint lose contact with each other.

(Refer fig. 28)

Fractures

Can occur during surgery or afterwards if you fall. To fix these, you may require surgery.

(Refer fig. 29)
Risk factors that can negatively affect adequate healing after surgery include:

- Poor nutrition
- Smoking
- Alcoholism
- Chronic Illness
- Steroid Use
- Age (over 60)

(Fig. 30)
Summary
A good knowledge of this procedure will make the stress of undertaking the procedure easier for you to bear. The decision to proceed with the surgery is made because the advantages of surgery outweigh the potential disadvantages. It is important that you are informed of these risks before the surgery.

Disclaimer
Although every effort is made to educate you on Unicompartmental Knee Resurfacing surgery and take control, there will be specific information that will not be discussed. Talk to your surgeon or health care provider about any concerns you have about this surgery.

You must not proceed until you are confident that you understand this procedure, particularly, the complications.
Bicompartmental Knee Resurfacing
Multimedia Health Education

- Your Surgery Date
- Read Your Book and Material
- View Your Video / CD / DVD / Website
- Pre-Habilitation
- Arrange for Blood
- Medical Check Up
- Advance Medical Directive
- Pre-Admission Testing
- Family Support Review

Physician's Name: ____________  Patient's Name: ____________
Physician's Signature: ____________  Patient's Signature: ____________
Date: ____________  Date: ____________

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