

# Mako<sup>®</sup> Robotic-Arm Assisted Surgery

for total  
knee replacement

**Patient guide**



# Common causes of knee pain

Your joints are involved in almost every activity you do. Movements such as walking, bending and turning require the use of your hip and knee joints. When the knee becomes diseased or injured, the resulting pain can severely limit your ability to move and work.

The knee is the largest joint in the body and is central to nearly every routine activity.

The knee joint is formed by the ends of three bones:

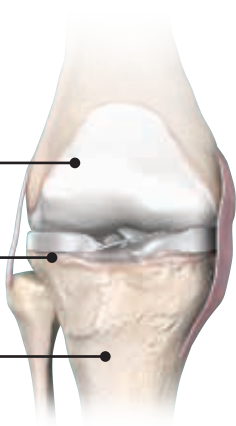
- The lower end of the thigh bone, or femur.
- The upper end of the shin bone, or tibia.
- The kneecap, or patella.

## A normal knee

Femur  
(thigh bone)

Healthy  
cartilage

Tibia  
(shin bone)



Thick, tough tissue bands called ligaments connect the bones and stabilize the joint.

A smooth, plastic like lining called cartilage covers the ends of the bones and prevents them from rubbing against each other, allowing for flexible and nearly frictionless movement. Cartilage also serves as a shock absorber, cushioning the bones from the

forces between them. Finally a soft tissue called synovium lines the joint and produces a lubricating fluid that reduces friction and wear.

Each patient is unique, and can experience knee pain for different reasons. One common cause of knee pain is **osteoarthritis (OA)**. OA is sometimes called degenerative arthritis because it is a “wearing out” condition involving the breakdown of cartilage in the joints. When cartilage wears away, the bones rub against each other, causing pain and stiffness.

## An **arthritic** knee

Femur  
(thigh bone)

Diseased  
cartilage

Tibia  
(shin bone)



Another common cause of knee pain is **rheumatoid arthritis (RA)**. RA produces chemical changes in the lining of the joints, or synovium, that causes it to become thickened and inflamed. In turn, the synovial fluid destroys cartilage. The end result is cartilage loss, pain, and stiffness.

If you haven't experienced adequate relief with conservative treatment options, like bracing, medication or joint fluid supplements, your doctor may recommend total knee replacement.

# Mako Total Knee replacement

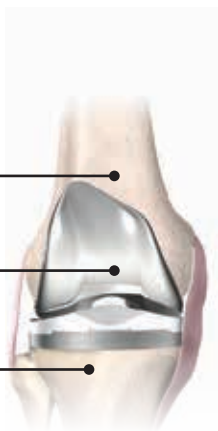
Total knee replacement is a surgical procedure in which a diseased or damaged joint is replaced with an artificial joint called an implant. Made of metal alloys and high grade plastics (to better match the function of bone and cartilage, respectively), the implant is designed to move much like a healthy human joint.

## A replaced knee

Femur  
(thigh bone)

Artificial  
knee implant

Tibia  
(shin bone)



## Did you know:

1 in 10 people over the age of 60  
will be affected by **osteoarthritis**.<sup>1</sup>



Over the years, knee replacement techniques and instrumentation have undergone countless improvements.

When you hear 'robotic-arm assisted technology,' it's important to understand that the Mako Robotic-Arm doesn't actually perform the surgery. Surgery is performed by an orthopaedic surgeon, who uses the Mako System software to pre-plan your surgery. Your orthopaedic surgeon will guide the Mako robotic-arm to remove diseased bone and cartilage. Then the surgeon will insert an implant.

Mako Technology was designed to help surgeons provide patients with a personalized surgical experience based on their specific diagnosis and anatomy.



# How Mako Technology works

## 1 Before **surgery**

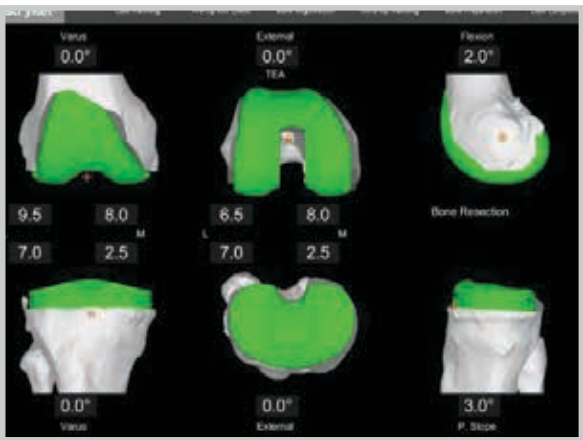
It all begins with a **CT scan** of your knee joint that is used to generate a 3D virtual model of your unique anatomy. This virtual model is loaded into the Mako System software and is used to create your **personalized pre-operative plan**.

## 2 In the **operating room**

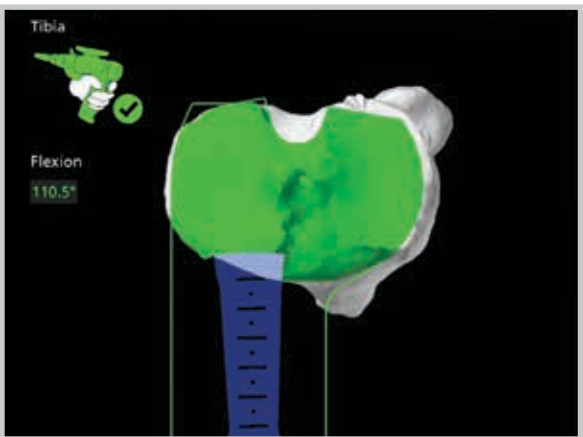
In the operating room, your surgeon will use the Mako System to assist in performing your surgery based on your **personalized pre-operative plan**. When the surgeon prepares the bone for the implant, the surgeon guides the robotic-arm within the predefined area and the Mako System helps the surgeon stay within the planned boundaries that were defined when the personalized pre-operative plan was created. The Mako System also allows your surgeon to make adjustments to your plan during surgery as needed, for the placement and alignment of your implant.

## 3 After **surgery**

After surgery, your surgeon, nurses and physical therapists will set goals with you to get you back on the move. They will closely monitor your condition and progress. Your surgeon may review a **post-operative x-ray** of your new knee with you.



**1** Personalized pre-operative plan



**2** Bone preparation



**3** Post-operative x-ray

# Frequently asked questions

## Did you know?

Knee replacement patients may **return to driving** in **4-6 weeks**.<sup>2</sup>



### **Q: Is Mako covered by health insurance providers?**

**A:** We understand that making sure your total knee replacement is covered by health insurance is important to you. Check with your health insurance provider to verify your specific coverage.

### **Q: How long has the Mako procedure been available?**

**A:** The first Mako procedure was a partial knee replacement performed in June of 2006.

### **Q: Does the Mako robotic-arm actually perform surgery?**

**A:** No, the robotic-arm doesn't perform surgery, nor can it make decisions on its own or move without the surgeon guiding it.

### **Q: How long do knee implants last?**

**A:** Individual results vary and not all patients will have the same postoperative recovery and activity level. The lifetime of a knee replacement is not infinite and varies with each individual.



# Preparing for surgery

Preparing for total knee replacement surgery begins weeks before the actual surgery. The checklist below outlines some tasks that your surgeon may ask you to complete in the weeks prior to your surgery date.

- Exercise under your doctor's supervision
- Have a general physical examination
- Have a dental examination
- Review medications
- Stop smoking
- Lose weight
- Arrange a pre-operative visit
- Get laboratory tests
- Complete forms
- Prepare meals
- Confer with a physical therapist
- Plan for post-surgery rehabilitative care
- Fast the night before
- Bathe surgical area with antiseptic solution

## Did you know?

**Realistic activities** following knee replacement may include **walking, biking, swimming** and other low impact activities.<sup>3</sup>



# Important information

## Knee Replacements

**General Indications:** Total knee replacement is intended for use in individuals with joint disease resulting from degenerative, rheumatoid and post-traumatic arthritis, and for moderate deformity of the knee.

**Contraindications:** Knee replacement surgery is not appropriate for patients with certain types of infections, any mental or neuromuscular disorder which would create an unacceptable risk of prosthesis instability, prosthesis fixation failure or complications in postoperative care, compromised bone stock, skeletal immaturity, or severe instability of the knee.

### Common Side Effects of Knee Replacement

**Surgery:** As with any surgery, knee replacement surgery has serious risks which include, but are not limited to, peripheral neuropathies (nerve damage), circulatory compromise (including deep vein thrombosis (blood clots in the legs)), genitourinary disorders (including kidney failure), gastrointestinal disorders (including paralytic ileus (loss of intestinal digestive movement)), vascular disorders (including thrombus (blood clots), blood loss, or changes in blood pressure or heart rhythm), bronchopulmonary disorders (including emboli, stroke or pneumonia), heart attack, and death.

Implant related risks which may lead to a revision include dislocation, loosening, fracture, nerve damage, heterotopic bone formation (abnormal bone growth in tissue), wear of the implant, metal sensitivity, soft tissue imbalance, osteolysis (localized progressive bone loss), and reaction to particle debris. Knee implants may not provide the same feel or performance characteristics experienced with a normal healthy joint.

The information presented is for educational purposes only. Individual results vary and not all patients will receive the same postoperative activity level. The lifetime of a joint replacement is not infinite and varies with each individual. Your doctor will help counsel you about how to best maintain your activities in order to potentially prolong the lifetime of the device. Such strategies include not engaging in high-impact activities, such as running, as well as maintaining a healthy weight.



# References

1. Musculoskeletal Health in Europe Report v5.0 – p18.  
<http://www.eumusc.net> accessed on 10/04/2018.
2. Marecek GS, Schafer MF. Driving after orthopaedic surgery. *J Am Acad Orthop Surg.* 2013 Nov;21(11):696-706.
3. Rocco Papalia, Angelo Del Buono, Biagio Zampogna, Nicola Maffulli, Vincenzo Denaro; Sport activity following joint arthroplasty: a systematic review, *British Medical Bulletin*, Volume 101, Issue 1, 1 March 2012, Pages 81–103, <https://doi.org/10.1093/bmb/ldr009>.

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