# Navio® Smart Surgical System

The Navio® Surgical System is the newest robotics-assisted orthopedic system – initially indicated for partial knee replacement procedures. The Partial Knee application utilizes image-free principles, this means that the patient does not have to come in prior to their surgery for a CT-scan. Instead, the surgeon digitizes into the Navio computer the patient's anatomy and kinematics (movement) during the surgery. This allows the surgeon to create a unique surgical plan tailored to the patient's specific anatomy and ligament balance. The Navio® handheld robotic-controlled instrumentation enforces the accuracy and position of the surgical plan.

The Navio system's touchscreen monitor and linear workflow are designed to re-engage the surgical user in robotics-assisted surgeries, leveraging their strengths with the strengths of the Navio smart-surgical system. The reproducible accuracy of the Navio system allow the surgeon to offer partial knee replacement surgery to early- to-mid stage osteoarthritis sufferers who might otherwise get a total knee replacement. While traditionally a difficult surgery to perform with consistency, when done well – partial knee replacements can lead to excellent intermediary outcomes for younger, more active osteoarthritis sufferers. Therefore, a surgeon who is more confident in offering partial knee replacement to their patients due to the reproducibility of the Navio system can utilize a procedure that when compared with total knee replacement may offer:

- Less pain[1]
- Quicker rehabilitation and recovery[1,2]
- Lower risk of complications[2]
- Smaller incisions[3]
- Shorter hospital stay[7]

Beyond the potential benefits of a partial knee replacement over a total knee replacement, the Navio system provides:

- Consistent results
- Accurately placed implants
- Customized planning
- No CT radiation required

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# Osteoarthritis of the knee: Causes, Diagnosis and Treatment Options

## Causes of Knee Osteoarthritis

Osteoarthritis (OA) is the most common form of knee arthritis. OA is usually a slow progressive degenerative disease in which the joint cartilage gradually wears away. It most often affects middle-aged and older individuals.[4]

Some factors that may increase risk of developing OA[5]:

- Age: The strongest risk factor for OA, although OA can start in young adulthood, in these cases it is often due to joint injury
- Gender: OA affects both men and women. However, before age 45, OA occurs more frequently in men; after age 45, OA is more common in women
- Joint injury: Traumatic injury to a joint increases risk of developing OA in the joint
- Obesity: Chances of developing OA generally increase with the amount of weight the body's joints have to bear
- Joint Alignment: People with joints that don't move or fit together correctly, like bowlegs, dislocated hips, or double-jointedness, are more likely to develop OFA in those joints

## Diagnosis

OA presents generally with pain (developed gradually), stiffness or swelling of the joint – mostly associated with activity. A doctor performs a physical examination that focuses on the patient's walk, range of motion in the joint and swelling or tenderness. Cartilage loss can be generally confirmed radiographically with X-rays showing a loss of joint space in the affected knee.[4]

## Treatment Options

OA can be treated non-surgically, with drugs or with a variety of surgical treatment options. Nonsurgical options generally begin with lifestyle modification – including losing weight, switching from running to lower impact exercises, and minimizing activities that may aggravate the patient's condition. Physical therapy can help increase range of motion and flexibility in affected joints, and supportive devices like braces, canes and specialized shoes can assist with pain and weight bearing issues.

Certain drugs are available in treatment of OA, primarily surrounding anti-inflammatory and pain management medications.

Finally, surgical treatment options are well developed for those patients whose OA does not respond to nonsurgical treatments. Among the available surgical treatment options are:[4]

- Arthroscopic surgery using fiber-optic technology to enable the surgeon to see inside the joint and clean it of debris or repair torn cartilage
- An osteotomy, which is a process of removing a wedge of bone from the tibia or femur to improve alignment of the knee joint and adjust weight bearing of the knee
- A Total Knee Replacement, which sacrifices one or both of the ACL and PCL, removes a maximum amount of bone on the femur and tibia to replace with an artificial joint

- A Partial Knee Replacement, which preserves all soft-tissue ligaments (ACL and PCL compared with TKR) while resurfacing only the diseased compartment(s) of the knee with artificial joints

When considering surgical treatment options, recent technology advances in navigation and computer-assisted surgery (including robotics-assisted techniques) have gained traction as providing enhanced planning and execution accuracy. Recent early outcomes have demonstrated gains in survivorship of partial knee replacements implanted utilizing robotic-assisted technology when compared with traditional manual technique: 0.4% revision rate at 2 years post-op which was 9 times lower than that of conventional Partial Knee Replacement.[6]

## Navio® Surgery - Partial Knee Replacement

With Navio assisted partial knee replacement, the patient does not need to come in for a CT-scan prior to their surgery. There is no special preparation or post-operative recovery that needs to occur when utilizing the Navio surgical system for partial knee resurfacing.

During the surgery, the surgeon will utilize advanced image-free navigation steps to create a virtual reconstruction of anatomy, soft-tissue/ligaments and kinematic motion of the knee. The surgeon then utilizes this information to tailor the position of the implant to the patient's femur and tibia shape, taking into account their unique cartilage wear and condylar shapes, and then balances their soft-tissue ligaments to ensure a balanced outcome. Finally, the surgeon utilizes the Navio® smart surgical handpiece to sculpt the damaged bone away to accept the artificial joint. The robotic-assistance in the handpiece enforce the target surgical plan, making sure that the final placement of the implant is accurate towards the intended position.

# Navio® Surgery – Questions and Answers

### Q: What is partial knee replacement/resurfacing?

Partial Knee Replacement, or Partial Knee Resurfacing, or Partial Knee Arthroplasty represents a surgical procedure which replaces diseased (OA) bone with artificial surfaces. The surgical procedure occurs through a smaller or minimally invasive incision, and can treat either the medial, the lateral (inside or outside) compartment of the knee. Additionally, the patellafemoral joint (PFJ) (beneath the patella/knee cap) can be singularly resurfaced if damaged or more commonly in conjunction with the medial compartment. A PFJ and medial UKR combination surgery is referred to as bi-compartmental (two compartments of the knee) knee replacement. During PKR, the surgeon not only replaces the damaged joint, but re-balances the knee's alignment. If a patient is several degrees out of neutral mechanical leg alignment, the PKR procedure can correct to near neutral – fixing bow-legged or knock-kneed deformities.

### Q: Why would I choose partial knee replacement over total knee replacement?

Partial Knee Replacement has certain potential benefits over a Total Knee Replacement procedure for those patients who are properly indicated for PKR. Whereas TKR completely reconstructs the knee and often sacrifices both the ACL and PCL, a partial knee procedure preserves any functioning and healthy ligaments and only replaces the compartment(s) of the knee that have osteoarthritic damage. This means that the patient may recover quicker from PKR surgery than TKR because of the smaller incisions and limited disruption to the soft-tissue capsular structure.

### Q: What are the results of partial knee replacement?

A well-done partial knee replacement in an appropriately selected patient can have the survival rate that is comparable to that achieved with a total knee replacement in the first decade following surgery. The literature suggests that after the second decade, the revision rate may be somewhat higher for partial knee surgery than for total knee surgery. There may be an advantage to prolonging function and reducing pain in the patient's joint prior to a total knee replacement, which is an end-of-the-line option.

### Q: Why does the Navio system work well for PKR?

The Navio system works well for PKR because it allows the surgeon to utilize advanced robotic-assisted technology for accurate bone cutting in a platform that does not require pre-operative CT scans. The robotic-controlled handpiece puts the power of a robotic-arm into the surgeon's hands for them to engage fully with the operational technique.

*"The system worked flawlessly and delivered an accurate placement and alignment of the prosthesis, one of our primary goals in partial knee replacement surgery."*

- Dr. Alberto Gregori, FRCS, Hairmyres Hospital, Glasgow Scotland

*"The surgical outcome was excellent, perfectly planning and executing the implant placement."*

- Professor Johan Bellemans, University Hospital Leuven, Pellenberg, Belgium

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