

Conventional Vs Navigation Surgery : A Comparison

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*Using Technology and Achieving Accuracy!!
Conventional Vs Navigation Vs Mako Robotic Platform.*

A Pertinent Question:

Why are we still using traditional conventional techniques in Joint replacement surgeries despite all the evidence of accuracy with regards to navigation technology and Mako Robotic Platform?

Conventional vs navigation surgery comparison

Let's discuss some common conditions and the impact of a huge burden.

Osteoarthritis is caused due to disorders in joints and it is common amongst the aging population. The point of worry is that more and more people will suffer from it. Osteoarthritis is a chronic disease, which is caused by the breakdown of joint cartilage. An article penned by Lorio et.al, mentions that the population of elderly people is set to rise 104% between the years 2000 and 2030. This will be accompanied by a 565% increase (projected figure) in the primary total knee arthroplasty (TKA) procedures.

In India too, the scenario is critical where around 15 crores of people are suffering from different forms of osteoarthritis and need attention or surgical intervention.

Conventional Vs Navigation

Technological advancements have revolutionized the field of orthopedics. Advanced and specialized procedures like Robot-assisted Total Hip replacement, partial and total knee arthroplasty (TKA) are assisting surgeons to render better results by executing the knee and hip replacement arthroplasty with utmost precision and accuracy. If we look at a study conducted by Choong et.al they have touched upon the factor that there is a correlation between optimal alignment, better life quality

and hip functionality. Studies support the fact that proper alignment of the prosthesis during total knee replacement is vital to maximizing implant survival. If we discuss per se the evolution of technology in Joint replacement surgery, in the 1960s there were static plans and loads of instrumentation to perform Joint replacement surgery. The outcomes were good but long-term results did show early failures and there are many minute details, which need to be perfect to have a joint that can last forever. The basic fact is that our eyeballing techniques are good to judge parallel lines, but in case we have a variation of one or two degrees it is practically impossible to be sure. In Joint replacement procedures, we should be 100% perfect to give the best results in terms of patient satisfaction. The introduction of Navigation Technology in the 1990s revolutionized these complex surgeries. The question is Why and How? Basically, as mentioned that the replacement procedures are highly precise surgeries and if we have any error this may impact the longevity and survivorship of the implant and may be a cause of pain and eventually a failure. The human eyes cannot judge variations in one or two degrees and it is this point that is a big difference when we are on conventional techniques and

jigs which have been used since the 1970s.

When we talk about navigation technology, we should understand
– How it works?

What is navigation and robotic surgery?

Navigation systems refer to the special positions of the anatomical reference points in the patients. Later the surgical instruments are transferred to the computer. Also, they are processed by utilizing software, which can provide information regarding different steps of the operation in various forms like graphic, visual and numeric. This helps the surgeons by giving them greater control and precision to execute the procedure. It definitely helps us in eliminating these but we still use the power tools controlled by hand and the results are verified only but whilst in execution or cutting with handheld saws there might be iatrogenic injuries, which means if anything goes wrong will impact implant longevity and eventually a failure. The planning is done on radiographs, a 3 D model is created and the bony cuts are verified in a much precise way as compared to conventional instruments. Studies support the fact that computer navigation eliminates alignment “outliners”. Expert surgeons who use conventional alignment systems are able to accurately align the knee replacement in above 90 to 95% of cases. But studies also reveal that in 5 to 10% of surgeries, postoperative knee alignment will be less than accurate. Patients who fall in the 5% to 10% bracket are called “outliners”. It is believed that accuracy in the computer navigation procedure helps the surgeon to shrink this percentage of postoperative alignment outliners.

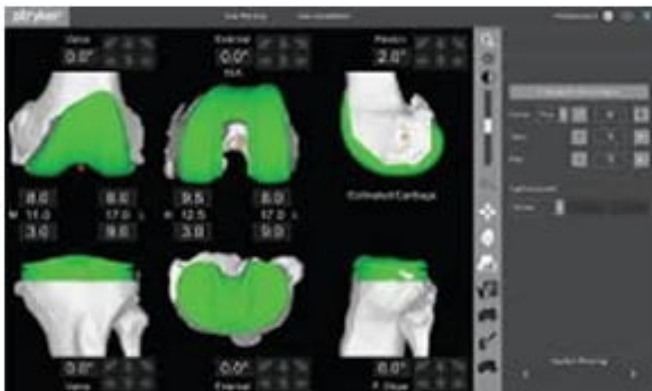
When we talk about MAK0 Robotic Platform – The smart Robotics
– The motto is ‘Know more and Cut less’ !!

The question is how? It is a different ball game and the accuracy is up to 100 percent as published in the latest Journals. Steps of How the Mako System Improves Total Knee Replacement /TOTAL Hip replacement for someone with Arthritis Pain with 100% precision.

STEP 1 : INVESTIGATIONS AND SEGMENTATION:

The X-rays and CT scans of the knee are segmented. Later it is fed into the robot, which renders a three-dimensional model of the knee joint along with the tibia and the surfaces damaged due to arthritis.

Figure 1 – Pre-Planning and Segmentation of the CT SCAN image



The surgeon can preoperatively plan the appropriate location for the femoral component based on his/her expertise and preference.

The model bone has tibia component over it based on factors that include angle of legs, patient size, location of articulating surface, and how the femur moves on top of the tibia.

STEP 2 : PATIENT-SPECIFIC PERSONALIZED PRE-OPERATIVE PLANNING PRIOR TO SURGERY

Figure 2 Patient-Specific Personalized Pre-Operative Planning prior to Surgery. The team of health providers then loads the plan onto the robot.

The surgeon in the operating room compares the plan with the patient's motion with reference to flexing, straightening, and bending of the knee while looking at how the motion gets replicated on the robot's screen. Based on whether ligaments are lax or tense, the surgeon might tweak component positioning by fractions of millimeters before locking in the final plan.

The surgeon is assisted in performing cuts when the robot arm locks the plane of the saw blade into a spot that is relative to the position of the final three-dimensional plan. The surgeon presses and pushes the saw, though the robot restricts where the saw proceeds into space.

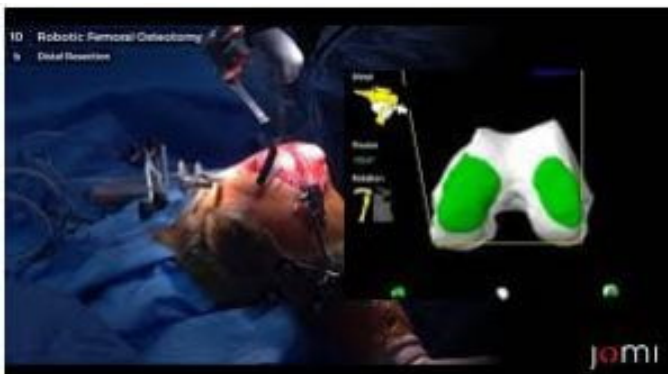
The operation has to be performed by an orthopedic surgeon, who instructs the LEO II Mako's robotic arm in the entire surgery to position in the knee joint.

Leo II Mako Smart Robotic arm does not perform surgery. Nor does it make decisions on its own or move without any guidance from the surgeon.

STEP 3 : EXECUTION OF PLAN WITHIN PRE-DEFINED LIMITS OF HAPTIC BOUNDARY ENABLING MORE THAN 99% ACCURACY

Figure 3 : Execution of Plan within Predefined Limits of Haptic Boundary so Soft tissue and Neurovascular damage cannot be done, and accurate position is visualized on a screen

whilst operating.



The surgeon performs the surgery though the only difference is that the procedure is now accurate and precise to a plan, customized to the patient's condition. This is not possible with conventional and manual instruments. The robot's haptic boundary prevents soft-tissue trauma.

There are several peer-reviewed publications on the benefits, including a reduction in post-operative pain, increased patient satisfaction, increased flexion, less opioid drug use. The lesser length of stay and readmissions due to challenges in the procedure have also been published.

STEP 3 : EXECUTION OF Benefits of Robotic-Assisted Total Knee Replacement positive outcomes:

Robotic surgery is being adopted to have the best surgical plan, the best execution, and to have a positive clinical outcome for the patient. Robotic surgery has been increasingly opted to eliminate human errors that can result in misalignment and decreased longevity of the prosthesis. The precision of robotic-assisted surgery leads to:

More accurate implant positioning that can result in a more natural feeling post-surgery, better safety, and reduced risk of injury to adjacent tissues due to lesser retraction.

Also, due to value and safety rendered by the Pre-Op, small

incisions, which might mean a quicker recovery, hospitalization for fewer days, less pain, and a potential for better functioning in the long run.

In a nutshell The Robotic Technology helps in –

More accurate implant positioning, which can result in a more natural feeling after surgery.

- Improved safety and reduced risk of injury to adjacent tissues as there is lesser retraction.
- Value & safety provided by the Pre-Op CT.
- Small incisions, which can mean a quicker recovery, a shorter hospitalization, less pain, and a potential for better long-term function.
- Minimal blood loss.
- Precision in the mapping of the joints.
- Early mobilization and early discharge from the hospitals (less hospital stay).
- A happy patient.

Joint replacement surgeries and robotic technology for knee replacement are best done at AIOR – Anup Institute of Orthopaedics and Rehabilitation
<https://www.drashishsingh.com/bookappointment/appointment.php>

Change is the law of nature and progress is inevitable. Technology is here to stay. Only the forms will vary.

Those who embrace change will survive, those who do not will perish.