Robotics

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> ***Taking a leap with Mako Robotic Arm Assisted Technology at Leo II Center of Excellence for Joints Replacement***
> ***Total Joint Replacement***
> *Author*

(Total knee Replacement, Partial Knee Replacement and Total Hip replacement) is one of the most successful surgical procedure in present day. It is a reliable and a proven method of treatment for pain and crippling deformities that with arthritis. Clinical evidence suggests that patient outcomes and satisfaction in joint replacement surgery isomer than 90 percent (Reference1)A successful Total joint replacement surgery typically leads to an improved quality of life by reducing pain and improving patient’s mobility. Many patients in my practice (you can give reference of your personal experience where even bed ridden patients could improve mobility and their life quality) Arthris is one of the leading cause of disability and presently in India more than 15 crore people suffer from osteoarthritis and more than 4 crore can benefit from Total knee or Partial knee replacement.

Robotic and computer-assisted technologies in orthopedics have the potential to drive a transformation in patient outcomes and productivity. Robots have been in use for different procedures for over 2 decades but adoption of this technology has lagged that of the manufacturing industry. The use of robotic technology in orthopedics increases the alignment and accuracy of implants, which improves the longevity of implant thereby reducing the long-term healthcare cost burden. Further, pre op planning also helps in reducing the instrumentation and inventory cost, which significantly

impacts the productivity.

In recent times, robotics is being used extensively in surgical space like urological, ocular procedures in a bid to improve delivery of care, reduce risk of complications and improving clinical outcomes. For example. Around 90% of all radical prostatectomy for cancer of the prostate in the United States are performed with robotic assistance. Recently, ROBOTICS IN JOINT REPLACEMRNT SURGERY has gained momentum and is the talk of the day.

Robotic-arm

Assisted surgery is a new approach to joint replacement that offers the potential for a higher level of patient-specific implant alignment and positioning. The technology allows surgeons to create a patient-specific 3D plan and perform joint replacement surgery using a surgeon controlled robotic-arm that helps the surgeon to execute the procedure with a high degree of accuracy.

> *"ROBOTIC ARM" is changing the way joint replacement surgeries are performed. Routine radiographs are obtained followed by a Computed Tomography(CT)scan for the patient. This CT scan is segmented and loaded into the system.. Once in the system the surgeon can Use a virtual 3D model, to personalize each patient's surgical plan pre-operatively, thereby providing complete clarity on implant positioning before entering the operating room. During surgery, surgeon validate that plan and make any necessary adjustments. During the procedure, the robotic arm enables operating surgeon to execute that plan with a high level of accuracy and predictability using haptic boundaries that restricts bone preparation to happen within the predefined region only. The combination of these three features of the system has the potential to lead to better outcomes and higher patient satisfaction. The accuracy and haptic boundaries ensure that only the required amount and planned part of bone is removed, this helps with bone conservation and availability of more bone stock if revision surgery is required. Lesser retraction of soft tissue is done enabling enhanced recovery.*

Let us discuss the common things

Robot-assisted orthopedic surgery does have the potential for improving surgical outcomes. These days ter robot is a loosely used term and it is important to understand what a true robotic surgery means.

We would discuss the different types of robotic systems available for use in orthopaedics. The term ‘robot’ is derived from the Polish word robata meaning forced labor, and describes a machine that carries out a variety of tasks automatically or with a minimum of external impulse, especially one that is programmable. There are two main types of robotic surgery systems: haptic and autonomous. In Haptic or Tactile systems, the surgeon uses or ‘drives’ the robot to perform the operation. This technology requires constant input by the surgeon for the procedure to proceed. It has a free held burr technology that assists the surgeon in cutting the bony surfaces and it does not let the surgeon go beyond cuts that have been planned.. Mako Robot Arm assisted technology at Leo II Center of Excellence uses Haptic system to perform the surgery and aids in precision that is miles ahead to conventional system.

Let us Get There……

Before the procedure, surgeon uploads the the digital X ray and computed tomography (CT) scans of the patient’s joint. The CT scan and X-Ray images are segmented and analyzed using an advanced precision preplanning software in Mako Robotic Arm Assisted Technology. This pre planning allows the surgeon to position the virtual knee implants onto the patient’s specific virtual knee bone models. Pre-planning allows the surgeon to plan the exact size, the implant depth, alignment sagittal, coronal & transverse rotation, posterior slope, and coronal plane alignment of the chosen implants prior to the procedure. During the procedure, the surgeon uses the robotic arm to precisely shape the surrounding bone before placing the implant. Real-time 3Dvideo images provide visual

reinforcement, which helps surgeons navigate hard-to-see areas. At the same time, the system uses the CT image data to create a predefined, three-dimensional “envelope” of space in which the surgeon works. The robotic arm will only allow surgeon to operate in that predefined space, so there is no chance of an instrument slipping and injuring adjacent tissues.

Steps of How Mako Robotic Arm Assisted Technology at Leo II , Centre of Excellence for Joints Replacement Improves Total joint Replacement for anyone with Arthritis Pain:
The CT scan of the patient’s knee is segmented and fed into the robot to obtain a three-dimensional model of the knee joint -the femur, the tibia, and the surfaces that have been damaged by arthritis.

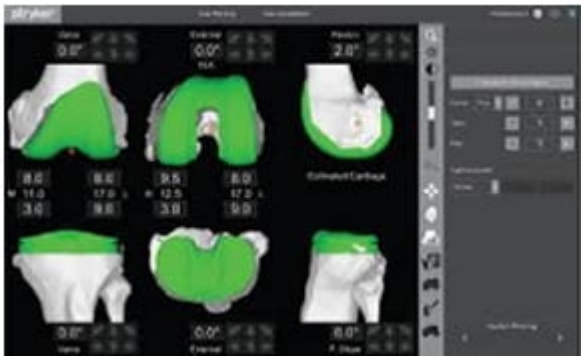

Figure 1 – Pre-Planning and Segmentation of the CT SCAN image

The surgeon with his or her own preferences can then preoperatively plan the best location for the femoral component (upper part of knee) and tibia component (lower part of knee) over the model bone, based on factors including patient size, angle of legs, location of articulating surface, and how the femur moves on top of the tibia.

Figure 2 – Patient Specific Personalized Pre-Operative Planning prior to Surgery

The pre operative plan is then uploaded onto The Robotic Arm system. The surgeon in the operating room compares the plan to the individual patient's motion – bending the knee, flexing, straightening it out, all while looking at how the motion is 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 robot arm will lock the plane of its saw blade (blade used to cut the bone)into a place relative to the position of the final three-dimensional plan – and assists the surgeon with performing the cuts. The surgeon pushes the saw, but the robot limits where the saw can go in space.

Figure 3:Execution of Plan within Predefined Limits of Haptic Boundary so Soft tissue and Neuro vascular damage cannot be done, and accurate Position is visualized on a screen whist operating

"The surgeon still performs the surgery, but now with the accuracy and precision specific to a plan, specific to a patient , which was not possible before with conventional,

manual instruments,”

The robot’s haptic boundary prevents soft-tissue trauma. There are several peer-reviewed publications on the benefits, including reduction in post-operative pain, increased patient satisfaction, increased flexion, less opioid drug use; reduction in length of stay, and fewer readmissions due to complications from the procedure has been published
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 chosen as an option to address human errors that could potentially result in misalignment and decreased longevity of the prosthesis. The precision of robotic-assisted surgery allows for: 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, and less pain and a potential for better long-term function.

In a Just 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, and less pain and a potential for better
- Minimal blood Loss
- Precision in Mapping of the Joins

- Early mobilization and Early Discharge from the Hospitals
- A Happy Patient

If you are facing surgery, you might be wondering if robotic-assisted surgery is appropriate for only certain patients. But anyone is a good candidate if you're a
good candidate for joint replacement surgery in robotic joint replacement is for you. "It's a technology that's not limited to any particular type of patient," , But its ideal if you consult a Surgeon who is formally trained in Robotic and Computer Assisted Surgeries. Surgeons currently are using robotic technology for partial knee replacements, full knee replacements and hip replacements around the word and there are more than 1500 centers in the United States which offers Robotic Joint Replacement Surgeries.
Padmashree Dr. R.N.Singh & Dr. Ashish Singh Consultant Orthopedic surgeon and Lower Limb Joints Replacement Surgeon & Medical Director Anup Institute of Orthopedic and Rehabilitation) feel proud to announce that we would be the First Hospital in Upper India to provide Leo II MAKO ROBOTIC ARM Assisted JOINT REPLACEMENT SERVICES at Patna. It would be Boon for the People of this state to have world class services at par with International Standards at their doorsteps.