

Robodoc–A New Era InReplacement Surgery

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Pain due to arthritis is a major indication for which replacement surgery is performed. The aim is to achieve pain relief and early return to routine activities.

Several factors affect the outcome of a replacement surgery for example a total knee replacement (TKR) such as patient and implant characteristics, surgical technique and restoration of normal limb alignment. Mechanical alignment and soft tissue balance play a pivotal role in implant longevity. ^(1,2,3) Since the early 1970's several improvements in implant design have produced longer lasting and better functioning implants.

Recent years have seen a lot of revision replacement surgeries. Hence an ideal replacement surgery is the one that lasts longer. Improved implant geometry, perfect surgical technique, accurate implant placement, a good rehabilitation program and now with computer navigation and ROBOT ASSISTED REPLACEMENT SURGERY we are close to achieving this dream.

Why do we require robotic assistance?

Several studies have shown that misalignment of implants decreases the implant longevity. ^(1,2,3,4) Robotic assistance helps us achieve better accuracy in implant placement and consistent results.

The Robodoc Surgical System was acquired at Civil Hospital Ahmedabad in 2011.

HISTORY OF ROBODOC

Robodoc System was developed in 1986 by a team of Researchers. It is the first of its kind to be used on humans for computerized arthroplasty procedures where surgical bone cuts and surface shaping are done by the robot. Rapid development of 3-dimensional image directed pre-operative planning and computer guided robotic surgery is done. In 1994 commercialization of the ROBODOC System began in Europe. Clinical studies at 3 major Hospitals in United States were successfully completed.

ABOUT ROBODOC

Robodoc is a computer controlled robotic system for joint replacement surgeries. It delivers a precise, repeatable

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surgical technique to prepare the bone surface for joint replacement procedures. It allows the surgeon to select an ideal implant according to patient's anatomy. Implants to be used are fed in the robot memory. It enables surgeons to preview implant placement and surgical outcome before the actual operation. Range of motion is checked in 3D virtual reality in the software.

COMPONENTS OF ROBODOC

The System includes two components :

ORTHODOC - a computer workstation equipped with proprietary software for 3-D preoperative surgical planning

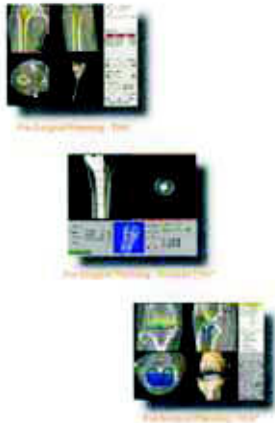
ROBODOC Surgical Assistant - a computer-controlled surgical robot utilized for precise cavity & surface preparation for hip and knee replacement surgeries.



OVERVIEW

Worldwide, ROBODOC has been used in over 24,000 joint replacement surgeries, namely:

1. TOTAL KNEE ARTHROPLASTY (TKA)
2. PRIMARY TOTAL HIP ARTHROPLASTY (THA)
3. REVISION TOTAL HIP ARTHROPLASTY (THA)



ORTHODOC Implant Library

The currently available implants are compatible for use.

3 - D CT Scan for pre-operative planning

Preoperative planning starts with a CT scan of the patient's anatomy. These images are digitally recorded as an exact representation of the bone structure within ORTHODOC. The software formats the CT image into 4 working windows, 3-D joint views, AP LATERAL & TRANSVERSE and 3-D bone model view.

Virtual Patient Specific Planning

Utilizing ORTHODOC, the exact internal prosthesis (joint components) is selected from a library of implants. It insures precise bone cuts for a perfect anatomical fit. It can be viewed in all 4 windows. The surgeon virtually plans the surgical process of implanting the prosthesis.

Develop & Preview Surgical plan

It allows the preview of the entire surgical plan prior to surgery and assures proper leg length and range of motion as a result of exact placement of the prosthesis. Provides precise, accurate & repeatable surgical technique, minimizing human error and intra-operative complication.



Implement the surgical plan using the ROBO Surgical Assistant

Robotic set up for orientation of the cutting tool in space. Registration is process of matching the points in the preoperative image data with the patient's limb. After

the pre-surgical plan is uploaded to the Robodoc Surgical Assistant, incision is made and the leg is positioned in the robot workspace. Robot locates the exact position of the patient's limb.

Implement the Exact Surgical Plan

The robot arm is guided to the surgical location. Robot cuts the bone surface with sub-millimeter accuracy. Robot arm is removed & surgeon installs the prosthesis exactly as planned. In all application the robotic system precisely implements the surgeon pre-operative plan.

Our experience at Civil Hospital, Ahmedabad

At Civil Hospital Ahmedabad, from July 2011 to May 2012, 25 robotic total knee replacements have been performed of which 7 were bilateral and 10 were unilateral. 11 male patients and 6 female patients were operated upon with a minimum follow up of 1 year.

From the post-operative radiological hip-knee-ankle axis measurements, excellent results (within 2 degrees of neutral axis) were achieved in 20 cases and good results (within 3 degrees of neutral axis) in 4 patients. However, long term studies are required.

1 case was aborted due to technical error.

Males	Females	Unilateral	Bilateral
12	5	11	7
Results		No. of Cases	
Excellent		20	
Good		4	

In our experience we conclude that ROBOT ASSISTED TOTAL KNEE REPLACEMENT allows placement of components with unparalleled accuracy, but further development is mandatory to integrate soft-tissue balancing into the procedure and make it faster, easier and cheaper.

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