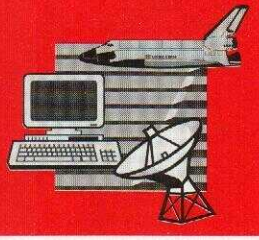
Technology Today



Alan]. Pierce

Robodoc

ROBODOC performed its first human surgery at Sutter General Hospital in Sacramento, CA, on November 7, 1992. Since then, Robodoc has completed more than 500 operations without ever, in the physical sense, seeing its patient. Robodoc is a 3', 250 lb. robot that is now playing a routine surgical role in Germany and will soon be performing operations throughout Europe and Japan. Robodoc is awaiting final approval from the federal Food and Drug Administration for use in the U.S.

Until the introduction of Robodoc, human surgeons performed all surgery. Machines were limited to improving the surgeons' sight or further steadying their grip on medical instruments. Robodoc changes all this because it can outperform human surgeons when it comes to preparing a thighbone for an artificial hip implant. Following the information contained in a CAT (computer axial tomography) scan, Robodoc carves out the femur with 96 percent accuracy, which far exceeds the 20 percent accuracy normal for this type of surgery.

In manufacturing, CAD/CAM industrial robotic systems shape materials while following a CAD drawing, The significant difference between this industrial setting and Robodoc's surgical setting is that Robodoc's computer-aided plan comes from CAT scan data rather than a drawing prepared by a drafter.

Before Robodoc's surgery, a surgeon places three steel pins in the hip of the patient. These will become part of the CAT scan that helps Robodoc know its exact location relative to the bone surface and the size ond shape of the bone. The CAT scan data produces a 3-D surgical image on Robodoc's computer monitor workstation. The surgeon then uses a mouse to manipulate an appropriate implant model into the correct location in the bone. Computer software converts the graphic image into the surgical plan that contains all the cutting and placement directions that Robodoc will follow during the operation.

During the surgery, the surgeon exposes the three pins and the bone, removes the ball at the top of the femur, and prepares the hip socket. The robot is then oriented to its patient by touching its ball probe to each locator pin. This ball probe is then replaced by a high-speed rotary milling cutter. While Robodoc cuts a cavity in the bone, the workstation computer screen displays an image of what is taking place.

After cutting the cavity, Robodoc withdraws its cutting tool, and the surgeon completes the operation using traditional techniques. Robodoc will soon be part of many of the medical teams that now perform more than 750,000 hip replacements each year.

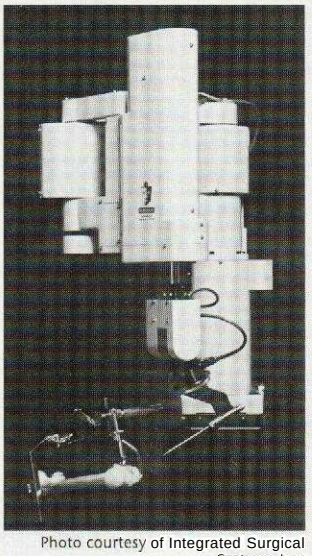


Photo courtesy of Integrated Surgical Systems Inc.

Robodoc

Recalling the Facts

1. Describe the procedure that must be followed before Robodoc can perform its part in a hip replacement surgery.
2. Before Robodoc, what role did machines play in assisting surgeons during operations?
3. What are the significant differences between conventional CAD/CAM systems and the Robodoc integrated system?
4. Why isn't Robodoc currently in use in hospitals in the U.S.?

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