

Computer Assisted Total Knee Replacement

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Arthritis is a degenerative joint disease that commonly occurs in knees. By definition, arthritis is the loss of the cartilage that lines the ends of the bones within a joint, creating a rough surface that can be painful. In addition, symptoms can include swelling, loss of motion and decreased tolerance to activity. Arthritis can occur as the result of injury, lifestyle, inflammatory processes like gout and rheumatoid arthritis, or just "wear and tear" with aging. There appears to be a genetic link to certain types of arthritis, with some people more susceptible to cartilage damage or limited cartilage repair capabilities. Treatment for all stages of disease includes conservative measures like physical therapy, anti-inflammatory approaches (oral medicines and joint injections), bracing, weight-loss and activity modification. For advanced disease and failure of conservative treatment, the most common surgical intervention is joint replacement. The knee is the most common joint replaced in the US, with over 400,000 performed in 2003. Future population projections predict that by 2030, this number will jump 670% to an annual incidence of 3.5 million a year (www.aaos.org).

A total knee replacement involves removing the diseased surfaces of the bones that make up the joint and replacing them with smooth metal components that serve as the new joint. It is probably better termed "knee resurfacing," since only a 1/4" of the surface is typically removed and replaced with metal caps. These "caps" are cemented to the prepared ends of the bone (most common technique) or alternatively have a porous backside that allows for bone to grow into the prosthesis. A smooth piece of highly durable plastic is then secured between the metal caps and functions as a painless, low friction surface (figure 1). Knee replacement was first offered as treatment for end stage arthritis in the early 1980s. Since that time, significant advancements have been made to improve the function and durability of the total knee components. This evolution has led to current clinical outcomes that are excellent for the vast majority of patients who undergo

knee replacement surgery. These advancements have included prosthetic design and manufacturing changes, improved surgical materials/techniques, and better instrumentation to aid in the accuracy of placing the components. Modern instruments guide the bone that is removed by alignment jigs that are secured in place. The bone is removed in a precise manner that shapes the ends of the bones to accommodate and align the metal components. This is a great advancement over the first generation technique that was more of a "freehand" removal of the diseased bone surfaces. Jigs are the current standard and have greatly improved accuracy and longevity of knee replacements.

Recently, advances have been made to increase accuracy of component alignment during joint replacement through instrumentation employing the computer. Computer-Assisted Surgery (CAS) has been used with many common surgical procedures (such as Lasik) in other medical specialties. Since its introduction to joint replacement, clinical research studies have found that CAS significantly improved the accuracy and reproducibility of component alignment. This has a theoretical advantage of better joint function and longevity of the components. Long-term studies will be needed to confirm this potential benefit. The steps in CAS total knee replacement are relatively unchanged from standard techniques. What is novel are the instruments used to guide the bone removal, using real-time computer information to orient the instruments and the knee replacement components. The operative knee has its alignment determined by computer trackers attached to the leg (figure 2, courtesy of Duke University). This computer-calculated alignment is then reproduced throughout the procedure to aid the surgeon from start to finish. In this way, each step is validated for proper alignment before proceeding forward. Standard jigs do not allow this real-time analysis. New CAS technology is extremely helpful when the standard alignment instruments are compromised due to severe arthritis wear, prior trauma

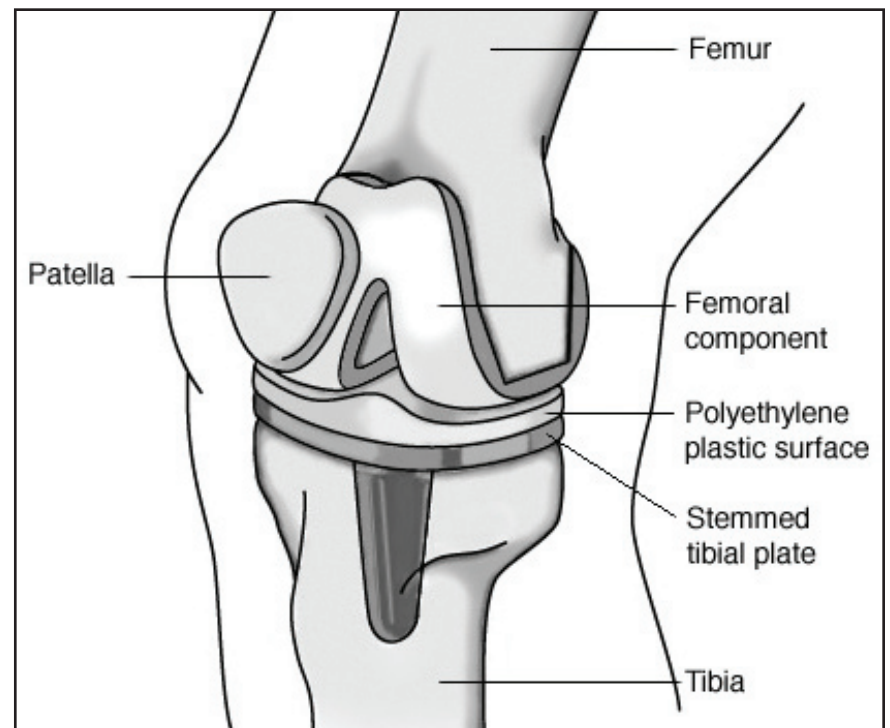


Figure 1

to the knee that causes a deformity and, especially, with minimally invasive surgery (MIS). MIS knee replacement uses a smaller incision, decreasing the visual exposure of the joint. Traditional alignment instruments require more extensive surgical exposure of the knee than computer instruments. The author has helped develop one of the current operating computer navigation systems used for total knee replacement and has found this new technology extremely helpful in many circumstances.

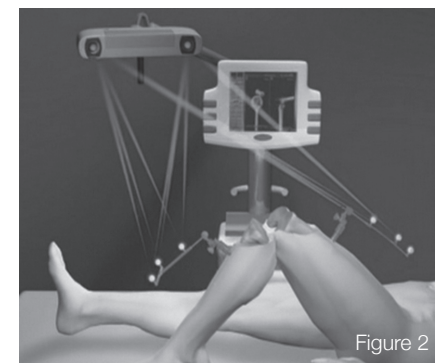


Figure 2

Total knee replacement is a good surgical procedure for patients with advanced arthritis of the knee who do not respond to conservative treatment. The current clinical success for the majority of patients underscores the improvements made in prosthetic design and manufacturing, advancements in surgical technique, and improved accuracy of the instruments used to place the components. CAS instruments are recent additions that show much promise to enhance the accuracy of alignment, overcome many deformities, and speed recovery by aiding minimally invasive surgery.



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Dr. Hocker received his MD at the University of North Carolina Medical School and completed his orthopedic residency at Duke University. Most recently, he completed a dual fellowship in both Computer-Assisted Joint Replacement and Sports Medicine at the University of Utah. While at UNC, Dr. Hocker was Captain of the 1993 Tar Heel Football Team and in 1994, he played for the NFL's San Diego Chargers. For further information, call Dr. Hocker or any of Atlantic Orthopedics' other physicians at (910) 763-2361 or (800) 833-4260. Atlantic Orthopedics is headquartered in Wilmington, with satellite offices in Burgaw, Porters Neck, Elizabethtown and Jacksonville.