

Artificial Knees Made to Order

A startup company uses medical imaging and rapid prototyping to create customized knee implants.

By Courtney Humphries

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A startup company is taking a customized approach to knee replacement surgery, creating knee implants on demand that exactly match a patient's anatomy. The company, [ConforMIS](#), based in Burlington, MA, is bringing the technology of rapid prototyping, which converts a three-dimensional computer design into a physical object, into the field of orthopedics. The company believes that such custom-made implants can make knee replacement surgery faster, more accurate, and less traumatic to the patient.



Customized knees: A depiction of a knee implant designed to cover one part of the knee joint.
Credit: ConforMIS

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▶ Watch how a customized knee implant is made.

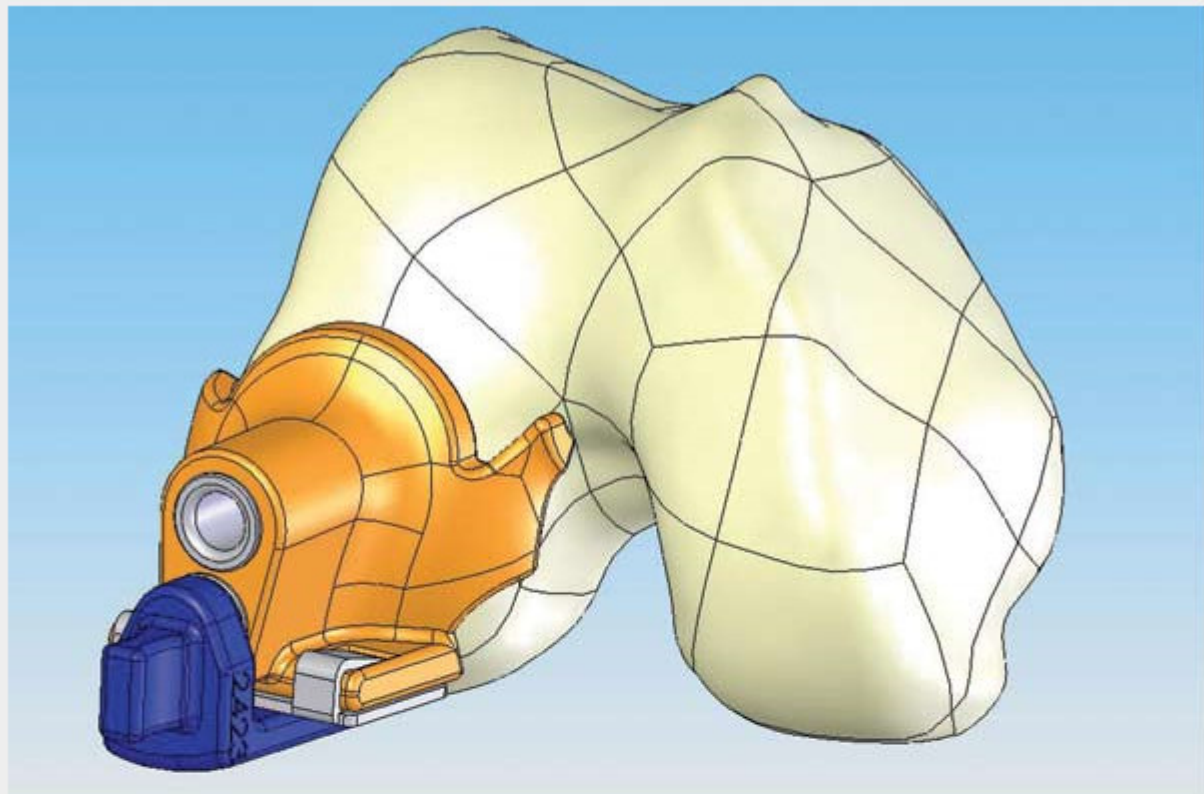
Knee replacement surgery repairs damage and relieves pain in patients with severe osteoarthritis or knee injury. Total knee replacement involves removing diseased cartilage and bone from the surfaces of the knee joint--the thigh bone, shin bone, and kneecap--and replacing them with an artificial joint made from a combination of metal and plastic. A partial knee replacement can also be performed on one part of the joint.

Typically, a surgeon chooses an artificial joint from several options of different sizes. ConforMIS, however, creates a custom implant based on imaging data of a patient's knee joint, a technology that the company calls iFit. ConforMIS transforms images from CT or MRI scans into a three-dimensional computer model using computer-aided design (CAD) software, which serves as a template for manufacturing the implant.

Philipp Lang, president and CEO of ConforMIS, says that typically, surgeons must shape the patient's bone to fit the implant. Because the bone-facing side of ConforMIS's implant is matched to the patient's anatomy, it can reduce the amount of bone that the surgeon must cut. On the joint-facing side of the

implant, Lang says, "we want to re-create the geometry that the patient had before he or she developed arthritis." He says that the ability to fit the implant to the patient without removing excess bone will speed recovery time and lessen pain.

[Andrew Freiberg](#), an orthopedic surgeon who heads the joint replacement services at Massachusetts General Hospital and is not involved with the company, says that ConforMIS is an early example of an approach that has the potential to be important in the orthopedic field. However, he adds, "I'm not aware of any study that shows that custom-made implants give a better outcome" than traditional ones do. Lang says that the company is working with medical centers to conduct studies that will gather data about their outcomes.



Precise localization: In addition to creating knee implants, ConforMIS uses CT data to create personalized, single-use guides that help surgeons determine the exact placement of the implants.
Credit: ConforMIS

Freiberg says that the ability to model what a knee replacement would look like before it's performed could have advantages, although he notes that many surgeons prefer to actually see and measure the patient's anatomy before making decisions. He says that replacing a knee properly is a geometrically complex task that requires a great deal of precision, and companies have been looking for ways to eliminate guesswork with technology.

Along with the implants, ConforMIS also creates customized instruments, called iJig, which assist surgeons in placing the implant. Because the knee joint must be precisely aligned to function properly, surgeons use cutting and placement guides to ensure that any cuts to the bone are made at the correct angles so that the implant is placed in proper alignment. ConforMIS uses the imaging data from the patient to create disposable instruments that are calibrated to the patient's specific implant and anatomy. Lang says that the instrumentation will enable surgeons to perform the operation more quickly and easily, and it will also reduce time spent sterilizing reusable equipment.

ConforMIS announced today that it has raised \$50 million in funding from investors worldwide in its latest round of fund-raising. Currently, the company has released three products for partial knee replacements, along with instrumentation, and it plans to make an implant available for a total knee replacement in 2010. Lang says that it takes about six weeks to create the implant, from imaging to shipping, and ConforMIS hopes to reduce that time to four weeks.

One concern about such a customized approach is the cost. As volume grows, the company hopes to provide its customized products at the same price as that of a standard implant.



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This video shows how ConforMIS uses a patient's CT and MRI imaging data to create a customized knee implant, as well as a customized instrument that helps guide the surgeon in placing the implant correctly.

Video by ConforMIS - [Read the Article](#)