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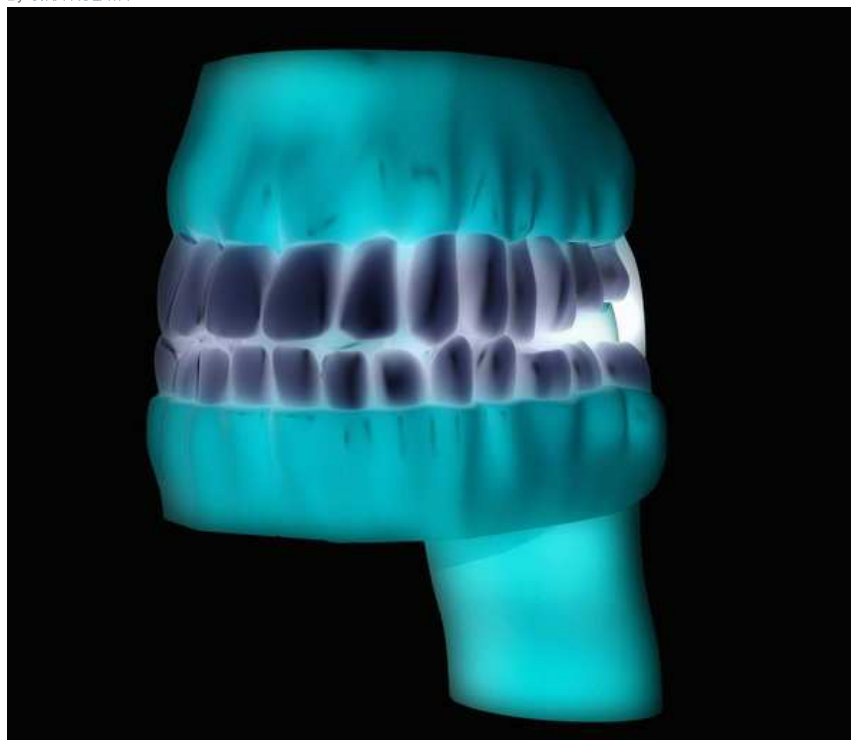
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A New Tooth, Made to Order in Under an Hour

By GINA KOLATA



Getty Images

I was chewing a piece of steak on a Saturday night last month when an old filling shattered. Suddenly, along with steak I had chunks of gray amalgam and shards of tooth in my mouth. I felt the hole with my tongue — it seemed as large as a crater.

My dentist later confirmed that I now had a big hole in a molar, too big for a filling. But, the dentist said, if I could spare an hour he could make a crown and put it in, right then and there.

An hour? Aren't crowns — those tooth-shaped caps that fit over teeth — supposed to require at least two visits? First, the dentist numbs the area and drills the tooth, filing it down to make room for the crown. Then, he or she makes an impression of the tooth to send to a lab. The hole

The Digital Doctor

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in the tooth is covered with a temporary filling while you wait for your crown.

It arrives at the dentist's office two or three weeks later. You return for another appointment. The dentist numbs the area, removes the temporary filling and glues the crown in place.

Now, new technology has produced a better way. My dentist happened to be one of the approximately 10 percent who use CAD/CAM — computer-aided design and computer-aided manufacturing — to create a crown while a patient waits. The result is a ceramic crown that can be glued in place. You are done less than an hour after you first sit down in the dentist's chair.

Maybe you think that dentists are stuck in the technological dark ages, waving pliers and babbling about fluoride. In truth, the profession has quietly embraced sophisticated technology, and I was lucky enough to stumble upon a prime example.

The process starts the same way it used to: The area is numbed, and the dentist drills the tooth to shape it for the crown. But instead of making an impression of the tooth, the dentist uses a tiny camera to create a three-dimensional image of the drilled tooth. A computer program uses that to construct an image of what the tooth will look like with the crown in place. I could see it on the computer screen — a tooth that looked just like mine would when I left the dentist's office.

Then all the details — the size and shape, the little ridges and indentations — are transmitted to a machine in an adjacent room that mills the crown from a chunk of porcelain. The result is an exact replica of what I saw on the computer screen. When the crown is ready, about 15 minutes later, the dentist glues it in.

I was thrilled, if it is possible to be thrilled with a visit to a dentist.

Sirona, a company with 95 percent of the market for CAD/CAM crowns, began distributing its system, Cerec, in the 1990s, said Roddy MacLeod, a vice president of Sirona, adding that the technology had gone through several generations of upgrades. The system costs the dentist about \$100,000. (The company provides a registry of dentists who offer it at findcerec.com.)

Some dentists who use it, like Dr. Matthew Messina of Cleveland, a spokesman for the [American Dental Association](http://www.american-dental-association.org), do not charge more for CAD/CAM crowns. "The market won't bear charging more," Dr. Messina said.

Still, Dr. Stephen Campbell, a prosthodontist at the University of Illinois at Chicago, said that before dentists invest in the equipment they should have a business plan to recoup their costs. For many, that can mean charging more for a CAD/CAM crown. (Prosthodontists are dentists with specialty training in aesthetic and reconstructive procedures, implants and digital technologies.)

There are limitations to the use of the technique, though. The crown I had made, Dr. Campbell said, "is a good way to do a simple little restoration."

The tooth, for example, cannot have broken off below the gumline or the scanning device will not be able to make a precise 3-D image. And since the crown is carved from a solid ceramic block, it cannot have the complex visual nuances of a real tooth. Outside labs can create crowns for teeth that are highly visible, like front teeth, and that look exactly like the real thing. They use a variety of techniques and materials, including alloys, to make crowns that are strong enough to withstand the forces on back teeth and are realistic enough in their coloring to be used on front teeth.

But even when an outside lab makes the crown, computerized systems come into play, Dr. Campbell said, although patients may not realize it. The cast made from a mold of a tooth is scanned and digitized, and the central lab sends back an image of what the crown will look like. The dentist can

approve it or ask for modifications. Then, using machines that can cost one million dollars, the lab makes a crown that can fit a tooth broken below the gum line or that fits and matches a front tooth.

In the past, Dr. Campbell said, the dentist and patient had little control over the result. "It is what it is," he said.

The new technology is even more important for tooth implants, where precision is critical. Dentists start by implanting a sort of artificial root in the bone to hold the artificial tooth in place. But it is not the same as a real root, which lets the tooth move and flex. Then, the dentist puts a screw in a sort of artificial tooth stub and attaches it to the artificial root. A crown goes on top of the stub.

It is best if the stub is custom-designed for the patient, Dr. Campbell said. The fit must be precise. If not, parts of the implant can break and the implant can fail.

These days, Dr. Campbell said, almost half of all-ceramic crowns and many implant stubs are made with this behind-the-scenes CAD/CAM technology, and he encouraged patients who need crowns or implants to ask their dentists if they use it. If not, he said, they might want to find a dentist who does.

"It's an incredible world right now," he said. "What they are doing is so cool."

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