

Groundbreaking Surgery Merges Passion, Computer Technology, and Teamwork



From left: Dr. David Hirsch, Dr. Lawrence Brecht, and Dr. Jamie Levine

The procedure that was performed at NYU Langone Medical Center on February 19, 2011, was nothing short of spectacular, even to an advanced team of surgeons who had spent months planning the surgery and years envisioning it. The 29-year-old patient, Maria Palma, was diagnosed with ameloblastoma, a benign tumor that forms from the precursor cells of teeth. Such tumors can become dangerously large but typically do not spread to other parts of the body. This young

woman's tumor was in the lower anterior portion of the jaw—one of the hardest parts to reconstruct—and involved most of her lower teeth.

David Hirsch, DDS, MD, FACS, oral and maxillofacial and head and neck surgeon, has devoted himself over the past five years to perfecting the computer-aided technology that enabled this surgery to take place, significantly reducing the time the patient spent in surgery as well as the cosmetic repercussions of the

procedure. Thanks to the passion of Dr. Hirsch and a highly skilled team, a process that used to require three surgeries over the course of a year can now be done in a day. So it was that on February 19, after the lower half of the patient's jaw was removed and replaced with bone from the leg, and dental implants were placed in the new bone, she woke up with a set of functional teeth—the first time this operation has been accomplished in one surgical session in the United States.

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An ameloblastoma is generally discovered on a routine X-ray, which was the case for this young woman. In the past, the surgery to remove the tumor and replace the affected jawbone with bone from the patient's leg was extremely long and almost always disfiguring. Calculations of how much leg bone was needed and its subsequent removal could not be done until the jaw bone had been removed, all with the patient under anesthesia.

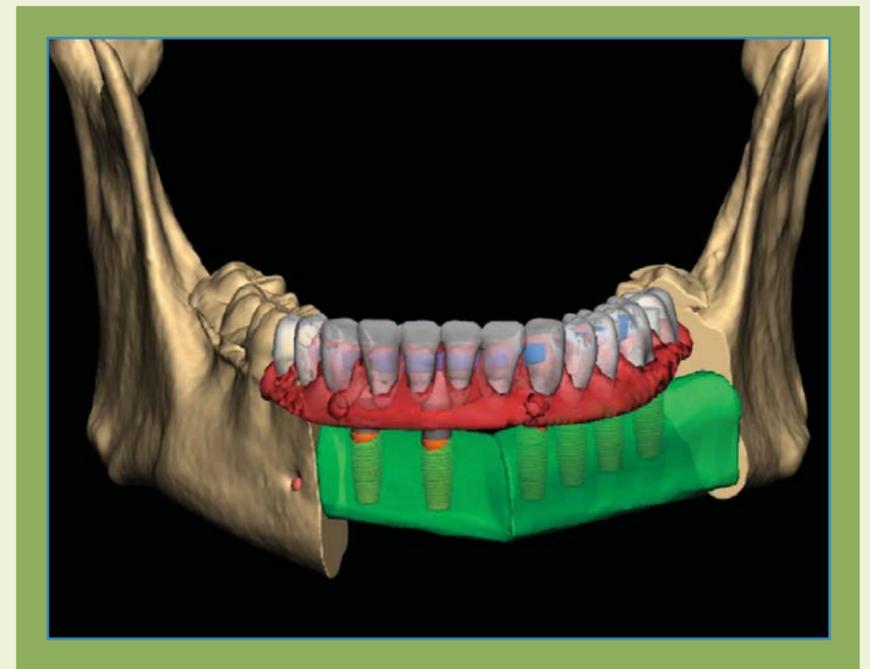
Over the past five years, Dr. Hirsch, who serves on the faculties of NYU College of Dentistry and NYU Langone Medical Center, working with Jamie Levine, MD, plastic and reconstructive microsurgeon and chief of microsurgery at NYU, and Lawrence E. Brecht, DDS, director of dental services and craniofacial prosthetics at the Institute of Reconstructive Plastic Surgery of NYU Langone Medical Center, and a member of the NYUCD faculty, has revolutionized the process for removing tumors by using computer-aided imaging to plan the entire surgery in advance. Recognizing the potential for such imaging in maxillofacial surgery, Dr. Hirsch began working with both a software company and a manufacturer that, together, created blue-

prints and actual models, enabling the surgeries on both the jaw and the leg bone to be planned precisely in advance. This planning allowed surgical teams to operate simultaneously on the jaw and leg, reducing the length of surgery from the usual 20 to only 8 hours.

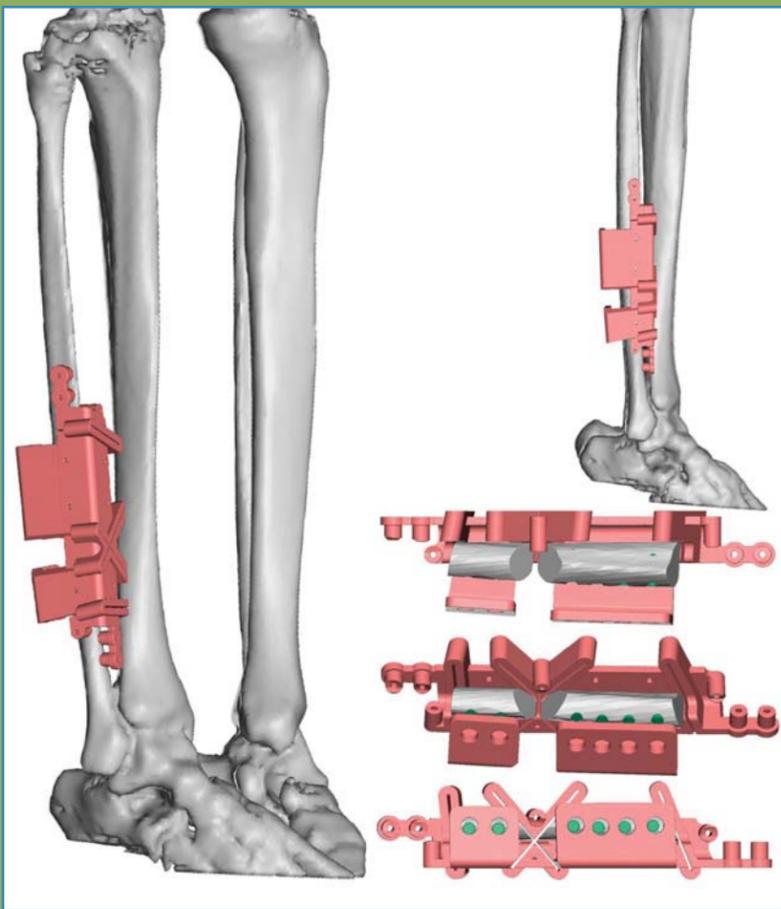
Prior to the February surgery, Dr. Hirsch and Dr. Levine had performed some 40 mandibular reconstructions using the computer-aided technique. They continually refined the procedure, on both the computer and in the operating room. Yet, patients

who underwent the much-improved surgery still needed to return in 8 to 12 weeks for a second operation to receive dental implants in their newly fashioned jawbone. It took another four to five months before prosthetic teeth could be made, because of concern as to whether the dental implants, set into the leg bone, would settle in the proper position. The entire process could take well over a year.

"Imagine what we could do for patients, psychologically, if they could leave the operating room with



Digitally fabricated reconstruction including fibula, implants, and denture.



Area of the patient's leg from which bone was removed to be placed in the patient's jaw. Computer technicians in Golden, Colorado, produced a set of cutting guides, which Dr. Hirsch humbly likens to furniture-assembly instructions.

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teeth on the same day," Dr. Hirsch asked himself. "That's what led us to the next steps."

The team studied whether dental implants—titanium cylinders that are drilled into bone—could be surgically placed with the needed precision at the same time as the transfer of leg bone, and determined that they could. This development eliminated the need for a second surgery to place the implants. The extremely delicate operation would require the surgeon to place the implants into the leg bone before it was detached from its blood supply.

A NEW ERA OF MICROSURGERY

"Historically," Dr. Levine says, "it was rare for a person who needed jaw reconstruction to receive dental rehabilitation. People were left with serious deformities. The era of microsurgery, beginning in the 1970s, led to facial-bone replacement from other parts of the body. Even so, full dental reconstruction, enabling a patient to chew and function maximally, was not even conceived of as recently as the '70s or '80s. Now we can plan these surgeries much more accurately and ensure a much better quality of life for our patients."

Planning for the February 19 surgery began a month in advance. All of the doctors and their support staff met together with the patient to explain each step in the surgical and recovery processes—a step that, in itself, might not have been done in a less patient-centered era. Once Dr. Hirsch decided where to make the cuts around the tumor in the patient's jawbone, Dr. Brecht's role was to figure out exactly where the



The surgical team at work.

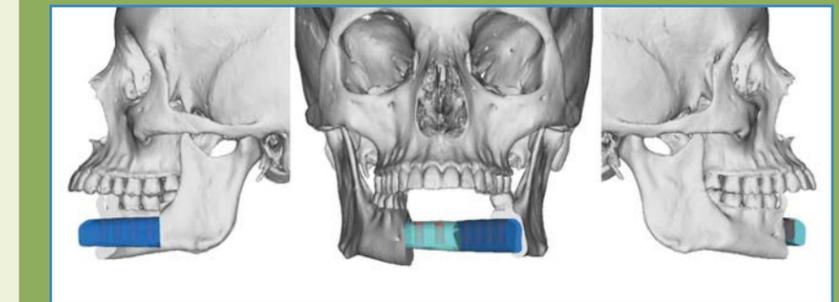
implants and new teeth needed to be placed. Finely sliced CT scans of the patient's face and leg were then formatted into digital three-dimensional images. Computer technicians in Golden, Colorado, turned the digital images into a physical model. The same company produced a set of cutting guides, which Dr. Hirsch humbly likens to furniture-assembly instructions. A second set of models was made so that the surgery could actually be performed on the model to pretest the guides. Teeth and ideal implant locations were constructed in Reno, Nevada, also using the digital plan. On the day of the surgery, cuts were made in both the jaw and the leg bone according to the computer-generated cutting guides.

"What David Hirsch has done, through his technological interest and expertise, is to find the common bond that brings together not only various specialties but the various parts of the body to get the superb results they achieved," says Robert Glickman, DMD, professor and chair

of the Department of Oral and Maxillofacial Surgery at NYU College of Dentistry.

Dr. Glickman adds that computer-aided surgery has existed for some time, but in the past it was not precise enough for maxillofacial surgery. Dr. Hirsch pushed the software developers to create a model so precise that it mirrored the actual surgery.

When it came time to perform the surgery, Dr. Levine removed about 15 centimeters of bone in the middle portion of the fibula, leaving it attached to the circulation that provides blood flow from the peroneal



Post-op CAT scan in three directions.

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blood vessels. He attached the pre-planned devices that would help guide the surgeon's cuts and ensure that the bone would bend precisely to the jaw. With the devices still attached to the leg bone, Dr. Hirsch placed the dental implants and then Dr. Brecht snapped the prosthetic teeth into position. Then, Dr. Levine, using a microscope and needles the size of a human hair, attached the peroneal vessels to the vessels of the neck. The fibula construct, including implants and the fixed prosthesis, was then connected to the patient's remaining mandible using titanium plates. Damage to the leg is minimal, he notes, because the fibula bears only three percent of the body's weight, and patients can walk soon after.

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out a very close-knit working team of specialists who really understand what each person on the team does, their skill, the risks that others are assuming, and the orchestration," says Dr. Levine.

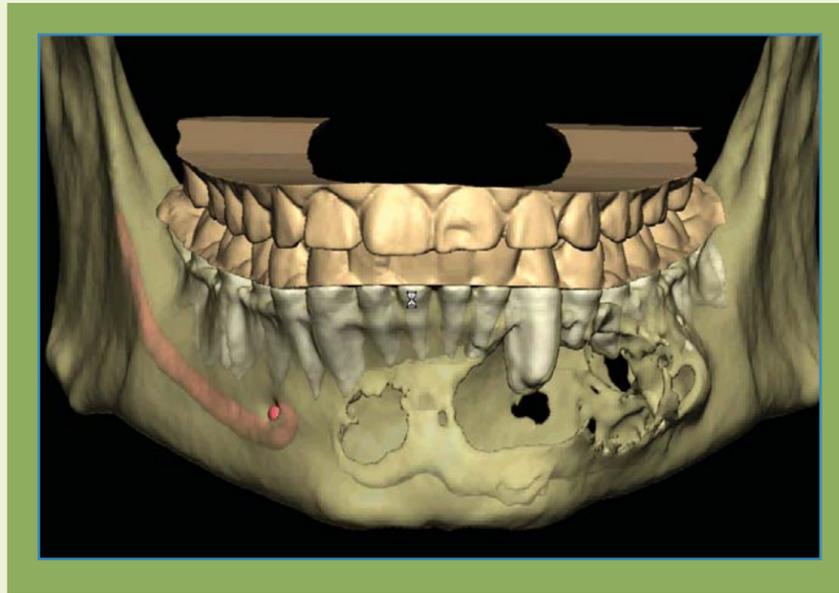
Dr. Hirsch concurs that it took an exceptional interdisciplinary team effort to conduct this surgery because so many things had to go perfectly. "With the computer-generated blueprint, everything turned out right," he says.

A WINNING COMBINATION OF SKILLS

Dr. Brecht adds that the procedure could not have happened without the combined world-class skills found at NYU in oral and maxillofacial surgery, microsurgery, and maxillofacial prosthodontics. In a prior era, he joined the team later in the process, and sometimes he wished that the space for implants had been made in a different location. Now that his expertise is incorporated from the start, implants can be placed exactly where he wants them.

The Institute of Reconstructive Plastic Surgery at NYU, where Dr. Brecht serves as director of dental services, was founded after World War II by plastic surgeons and dentists who had routinely worked together on maxillofacial units in the European theater of war. When they came back to the United States, they wanted to continue their collaborations for ordinary surgical patients.

"What's unique about the institute is that its people forged a working environment where teams



Virtual depiction of final reconstruction.

really understand one another and how their skill sets work in unison," Dr. Brecht says.

Dr. Glickman's pride in the team's work is evident. "David Hirsch is an extraordinarily well-trained surgeon. In Jamie Levine, you have one of the finest reconstructive plastic surgeons in the United States. And Larry Brecht is one of the best maxillofacial prosthodontists—of which there are very few. It would be very hard to get this level of expertise anywhere else."

Most important, the patient is making an exceptional recovery, having left the hospital after merely

seven days. Despite some facial swelling, her teeth looked natural, she can smile, and she is able to eat using her new prosthesis.

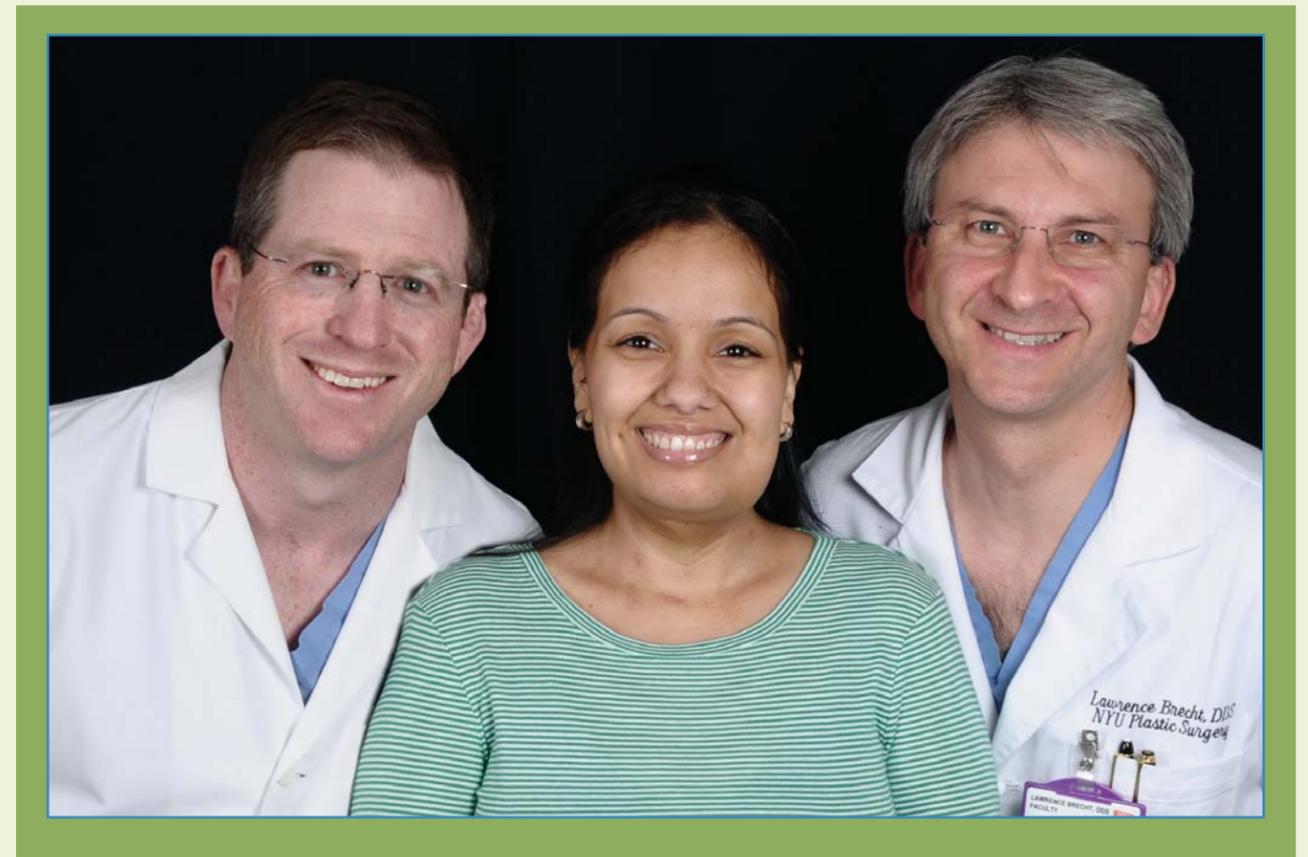
Dr. Levine compares the groundbreaking surgery to building the world's first skyscraper. All of the components had to have been invented first, and then it was a matter of someone having the vision to put them all together.

"We've been evolving toward this ability for some time. But getting there is truly unique," he says.

—BARBARA KANCELBAUM

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Dr. David Hirsch, left, with patient Maria Palma and Dr. Lawrence Brecht