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Prosthodontics professor on 3D-printed maxillofacial prosthetics

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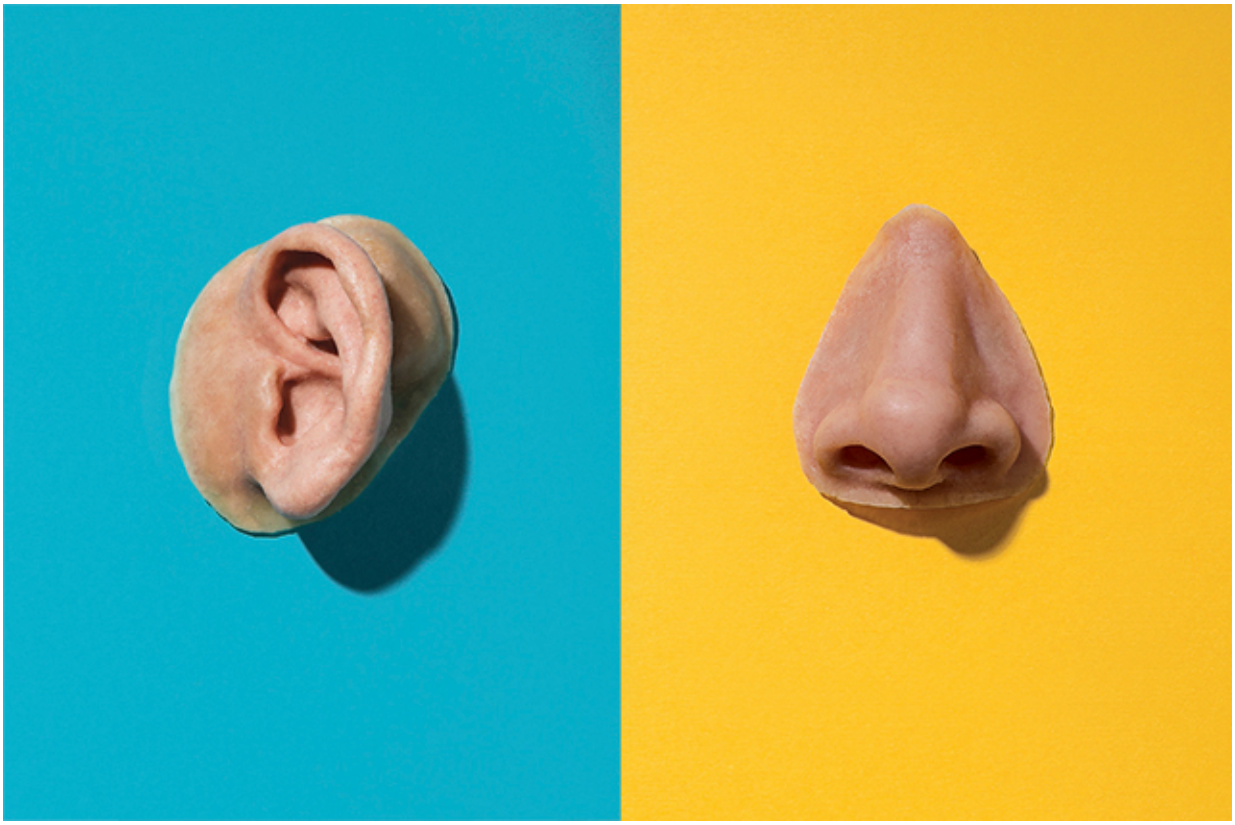

A silicone ear for an 8-year-old boy, and a nose for a woman with skin cancer. “Just to be able to give that little piece of face to someone who doesn’t have it any more—that makes this all worth it,” says Sujey Morgan. Credit: Christopher Harting

As a young girl in Colombia, Sujey Morgan saw the victim of a bear

attack on television and knew right then that she wanted a career that would allow her to help people who suffer severe facial trauma. Today she does just that. In her role as an assistant professor of prosthodontics and operative dentistry at Tufts School of Dental Medicine, she restores a modicum of normalcy to the lives of patients who need oral and facial prosthetics.

Maxillofacial prosthodontists (as such practitioners are called) make synthetic facial features for children who have birth defects or for adults who've been disfigured by accidents or cancer surgery. This specialty, Morgan says, is often the last resort, when plastic surgery, which requires a certain amount of existing tissue to build on, is no longer an option.

Inside the mouth, practitioners like Morgan can restore sections of the upper or lower jaw and teeth removed during oral cancer surgery. They can fill in a newborn's congenital cleft palate. On the face, they can build new noses to replace ones ravaged by aggressive skin cancer or acts of violence.

Or they can make a silicone prosthetic ear for a little boy born without one, as Morgan is doing when I visit her. Like so many procedures done at the dental school, this one starts with an impression. Once the impression of the young boy's ear dries, Morgan makes a master cast. Using artists' tools, she sculpts it into a mirror image of a real ear before pouring silicone into the mold to make the prosthesis. The boy had several fittings to ensure his new ear would sit perfectly on his head.

Painting a prosthetic is an art in its own right. Morgan can streak the tip of an ear with veins or add pores to a nose to make them lifelike. She carefully matches the prosthesis to the patient's skin tone, mixing paint on a palette daubed with a rainbow of flesh tones.

When it's finished, the prosthesis is attached to the patient's face with

magnets and medical glue. When there is not enough soft tissue to support the prosthetic (often the case with noses), Morgan can incorporate an acrylic base that clips directly to implants attached to the patient's bone. Then the prosthetic is mounted to this sturdy base, nestled inside the patient's skull.

Prostheses last only a year or so—if the patient is careful. Silicone eventually degrades, and can harbor mold and bacteria, so the delicate synthetic sculpture needs to be kept dry and must be cleaned after every wearing. That's why some people don't use them every day. "They usually just wear them to go out, to give a more normal appearance," says Morgan.

New scanning and 3D printing technologies have dramatically reduced the time it takes to fashion a prosthetic. Morgan has used these for her three most recent cases. A digital skin-color scanner that Morgan calls her "new best friend" can instantaneously spit out a recipe for paint that perfectly matches a patient's skin tone.

No More Second Looks

People who have had head and neck cancers, including oral and salivary gland malignancies, make up a large portion of Morgan's patients. These cancers, as well as tumors affecting the face, often require some of the most disfiguring treatments. "The surgeon is just trying to save their lives," says Morgan.

Take Sandy Johnson, whose dermatologist missed the significance of a gray spot on the bridge of her nose. A year later, an oncologist diagnosed Johnson with an aggressive squamous cell carcinoma, which by then had spread into her left cheek. A week before the surgery that would save her life, her surgeons broke the news that they would not be able to reconstruct her nose. "It didn't sink in what that actually meant," says

Johnson.

The morning after the diagnosis, she met with Morgan, who took a cast of her nose. Lying there, still and silent, with the impression material packed on the upper half of her face, Johnson says she felt Morgan's dental assistant, Nancy Hayward, gently rub her shoulder. "It was such a warm, comforting gesture," she says. "I just fell in love with them both."

That was almost a year ago. Now, two surgeries and thirty radiation treatments later, she has been declared cancer-free. But the surgeries left Johnson, who is seventy-four, with a yawning chasm where her nose used to be.

Just recently, Morgan presented Johnson with not one, but two prosthetic noses she made from the impression she took before the surgeries. One is specifically for Johnson to wear to her water aerobics classes. Scheduled to visit friends and family in California the next day, Johnson could not have been more delighted with her new nose. "I wanted so badly to have it for the trip. It looks just like my nose."

Johnson was luckier than many of Morgan's patients, because there was time to take an impression before her surgeries. "Usually, when I see the patient, it's too late," Morgan says. "There's no nose, so I have to create a nose. I say, 'If you like your sister's nose, bring her in.' "

Morgan pulls out an album of before-and-after photos of her patients. The "before" pictures are arresting—not only because of the disfigurements, but also because of the stress that is just as evident in the eyes, in the set of the mouth, in the slump of the shoulders.

"Society can be cruel," says Morgan. "It's not that we mean to be, but the first thing we do when we see something weird is take a second look. It's that second look that can traumatize these patients every day."

One patient survived a gunshot to her face. After she healed, the woman was able to speak and breathe normally. But multiple lifesaving surgeries had left a gaping hole where her nose once was. She came to Tufts for a new one. In an "after" photo, the woman beams, her physical scars barely visible. "Just to be able to give that little piece of face to someone who doesn't have it any more—that makes this all worth it," says Morgan.

Provided by Tufts University

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