

LI Teen Killed, Pal 'Critical' in Crash **A5**

MICKELSON WINS MASTERS



For Amy

Emotional victory comes
11 months after breast cancer
diagnosis **A6**



Giant Steps

LI firm's
incredible
prosthetics
A2-3

Adriana Coffey lost a leg in 2005.

Phil Mickelson walked off the 18th green and into the arms of his wife, Amy, at Augusta.

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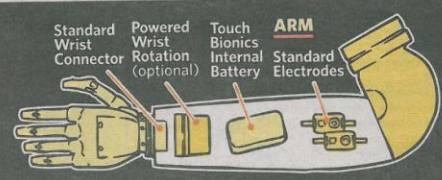
PROSTHETICS : GIANT STEPS



NEWSDAY, MONDAY, APRIL 12, 2010 www.newsday.com

HOW IT WORKS

- Supplied by Touch Bionics
- Supplied by prosthetist



i-Limb Hand

The i-Limb hand is manufactured by Touch Bionics and is considered a major advance in artificial hands. It functions through a combination of the body's own electrical signals picked up by electrodes in the device that rest on the user's skin. A Step Ahead produces a realistic "skin" to cover the electronic hand.

Almost the real thing

Accident victims, war vets swear by lifelike prosthetics made on LI

BY DELTHIA RICKS
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As she awaited a bus on May 22, 2005, in Brooklyn's Sheepshead Bay, Adriana Coffey's life changed in an instant: A drunken driver mowed her down, crushing her right leg and leaving amputation the only alternative for the Dix Hills resident.

About two months later and thousands of miles away, Sgt. Sam Cila, an American soldier on patrol outside the Green Zone in Baghdad, stepped on an explosive device. Shrapnel ripped through his left side. Ultimately, Cila, of Riverhead, decided to have his left hand and wrist amputated.

Now, Coffey and Cila are members of a new breed of amputees outfitted with robotic limbs that are covered with lifelike, silicone skin. Driven in part by the needs of wounded veterans from the Afghanistan and Iraq wars, a new generation of artificial body parts has arrived, embedded with sophisticated electronics that can anticipate a wearer's movements and duplicate some of the graceful gestures of human limbs.

Wearers of hand prosthetics can operate a computer keyboard, pat a friend on the back or pour a cup of coffee. Those with robotic legs can walk over cobblestones, or run and pivot in a game of basketball — even leap for a jump shot.

"It's a whole new world out there now," Cila said of computerized prosthetic devices. "For guys like me, coming out Afghanistan and Iraq, there's the myoelectric arm. This is a huge difference compared to guys out of the Korean War and Vietnam, who had some pretty prehistoric devices."

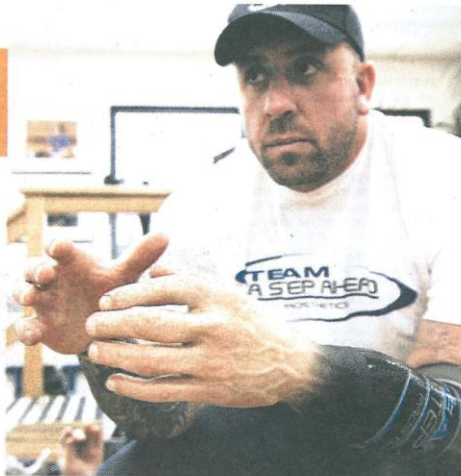


PHOTO BY CORNELIUS ECKERT

HANDY AIDS. Sam Cila at A Step Ahead in Hicksville. Below, prosthetic limbs and other aids the company produced for him.



Hicksville company a leader

Their artificial limbs, sculpted and programmed at A Step Ahead, a Hicksville prosthetics practice, were made as mirror images of their healthy leg and hand, providing aesthetically sound and technologically advanced replacements. With high-tech "skin" added, a replacement leg can cost up to \$60,000 but can provide a sense of normalcy and increase function for people who've experienced horrific trauma.

Yet, these all-but-bionic body parts, they say, are not greeted with unfiltered joy.

"The first time you see it you get emotional, because this is not your leg," said Coffey, 26, the mother of a 5-month-old daugh-

ter. "Even when they put the skin tone on it, it really hits you that it's not your leg, and you get emotional all over again."

"But it's different now. I paint my toenails," Coffey said of the acrylic nails on her robotic foot. "After five years, it feels like my own leg. You almost forget what

See PROSTHETICS on A14

READY TO RIDE.

Sam Cila is a competitive cyclist with a prosthetic arm that attaches to his handlebar. Cila lost his limb after he was wounded by a bomb in Iraq.

PHOTO BY CHRIS SURTILE

COST

About \$27,000 to \$60,000

(depending on provider, device and type of amputation)



WHAT IT CAN DO

KEY GRIP



Thumb closes onto side of index finger

POWER GRIP



Fingers and thumb close together

PRECISION GRIP



To pick up small objects

INDEX POINT



Thumb and fingers close, index extends

THUMB PARK



Thumb rests on hand

PROSTHETICS : GIANTS STEPS

Advanced prosthetics realistic — and costly

PROSTHETICS from A3

it's like to have two [natural] legs."

Cila, 36, who now makes his living as a competitive cyclist and sponsored triathlete, doesn't mince words: "I'm a firm believer that it's fake," he said of his hand with silicone skin. He switches among four prosthetics depending on what he's doing, including a cycling arm that allows him to maneuver his bike.

Coffey and Cila found their replacements at a practice that has become a global hub for people in need of new body parts.

From around the world

"People come from all over the world," said Dr. Joseph Lane, chief of metabolic bone diseases and associate director of the trauma service at the Hospital for Special Surgery in Manhattan.

Erik Schaffer, A Step Ahead's chief prosthetist and president, "has developed a worldwide reputation," said Tim McCarthy, president of iWalk Inc., a prosthetics technology company in Cambridge, Mass., founded by world renowned biomechanical engineer Hugh Herr, a professor at the Massachusetts Institute of Technology.

"People are flying in from Israel and China and at least 45 of the 50 states," McCarthy said. "He has optimized the technology, which means he fully customizes it to the needs of the individual."

Although Long Island is home to numerous private prosthetics practices, A Step Ahead is the only one in the region with a large research and development department, an in-house artificial skin workshop and proprietary processes for the skin.

"Everybody who loses a limb wants it replaced, no question about that," said Schaffer. He holds a bachelor's degree in prosthetics and orthotics. "Think of what we do as the art and science of anaplastology," he added, referring to the branch of medicine involved in the recreation of human body parts.

The Hicksville workshop is a menagerie of human anatomy: Rows of silicone legs and arms are mounted on walls, and

shelves of feet and hands, even noses and ears, await owners who've lost theirs to accidents, war and disease. Silicone skin, 1-millimeter to 1.5-millimeters thick, is fit by hand over the robotic prosthetics.

Schaffer and his staff of 18 technicians and artisans make a mirror-image mold of patients' healthy limbs to create the silicone shell. The process starts with making a cast of the opposite limb, which is improvised for double amputees. Then a series of silicone limbs are developed in-house until the final shell is done, which takes 100 to 150 hours.

Dr. David Feldman, chief of pediatric orthopedics at NYU Medical Center in Manhattan describes the work at Schaffer's practice "state-of-the-art.



I paint my toenails
... You almost
forget what it's
like to have two
[natural] legs."

— Adriana Coffey, who got a prosthesis after losing her leg to a drunken driver

... The field of prosthetics is changing and they keep up with the trends, and they are always looking for the next big development."

Artists use a range of nonfading coloring agents to create skin tones for the prosthetic that are virtually identical to the patient's natural color. Hair, warts, scars and tattoos can be added upon request.

The robotics might be a C-leg, made by the Otto Bock company, based in Germany, or the newly developed i-Limb, the robotic hand made by Touch Bionics, headquartered in Scotland.

The i-Limb myoelectric device can detect electric signals

in people's muscles. An amputee controls the hand by moving his or her shoulder in various positions, which fire electrical signals to electrodes on the skin and are connected to the prosthetic. One shoulder position might trigger the hand to open, another to close. And when the hand is settled around an object — a bottle for example — it will sense the object's weight and apply the correct grasping pressure.

The i-Limb must be fully charged for its microprocessor to function, and it must be recharged daily.

Similarly, the C-leg (technically, a microprocessor-controlled knee) gathers data 50 times a second from the device's network of sensors, Schaffer said. This allows the prosthetic to anticipate the wearer's next move while walking.

Another prosthetic, known as the Rheo knee, is even smarter with an integrated artificial intelligence system, he said. The Rheo adapts to an individual's walking style by gathering data much faster, at 1,000 times a second.

Not surprisingly, the costs of these advanced devices are steep. "The price tag varies for each person," Schaffer said. "A microprocessor-controlled knee can range from \$40,000 to \$60,000 on average. That's very conservative. But I can take a \$50,000 system and put an \$8,000 skin on it.

Cost can be an obstacle

While noting that the silicone skin is an "outstanding cosmetic accomplishment," however, a Selden prosthetist says the added cost can be an obstacle.

"I feel that maximizing function is my first priority," said Bruce Goodman of Progressive Orthotics Ltd. The company fits patients with a wide range of prosthetic devices, including C-legs and myoelectric arms. "Unfortunately, these skins are so expensive, and are not usually covered by insurance, they are not available to most."

Veterans Affairs hospitals also fit amputees with C-legs and i-Limbs and can cover them with a silicone skin. For vets, the cost can be less because the VA gets



HOW IT WORKS

THE C-LEG

The C-leg, made by Otto Bock Healthcare, is controlled by a microprocessor that receives feedback from multiple sensors 50 times a second, which helps the knee anticipate movement.

- These sensors also provide help if the wearer stumbles by stiffening to provide the support needed to recover.

- The C-leg has different modes, such as walking or driving, and one for standing that locks the leg in place so that the user can conserve energy.

- Switching modes can be done through a sensor in the toe or a wireless remote control.



the materials in bulk, said Kenneth P. Breuer, chief prosthetist at the VA hospital in Manhattan. Still, many choose not to have the silicone skin.

"We can [fit] the myoelectric i-Limb for \$27,000, whereas an outside vendor would charge about \$54,000," Breuer said. "For a C-leg, the VA will charge about \$19,500, compared to the average outside vendor that will charge about \$48,000."

Because of the large number of wounded vets, the VA receives volume discounts from the manufacturers of high-tech prosthetics.

Many insurers flatly refuse coverage for the high-tech limbs, declaring the devices experimental, said Dan Ignaszewski, government relations coordinator for the Amputee Coalition of America. Still, he said, 18 states

require insurers to reimburse patients to some degree for prosthetic devices. A bill pending in the New York State Assembly would require coverage equal to or above Medicare and Medicaid rates for any prosthetic device. The measure has not advanced past the insurance committees of either house.

Schaffer said he's had many successes securing coverage for patients, a process that can take weeks to months. His team helps convince some insurers that patients need prosthetics that function close to that of their lost limbs.

Empire Blue Cross/Blue Shield of New York covers the devices when deemed medically necessary. Even then, patients must meet strict criteria, which include frequent use of stairs and a documented need for



PHOTO BY CHARLES SEBERT

daily long-distance ambulation." The company defines that need as walking more than 400 yards a day at variable rates. It will not pay if the device is to be used strictly within the home. Like other insurance companies, it will not pay for the silicone skin.

Not all features covered

Coffey, a stay-at-home mom, said her insurance company covered the C-leg but not anything "that has to do with cosmetics, like getting my skin done, or my toenails. All of that is out-of-pocket."

The rapid advancements in prosthetics in recent years, experts say, were spurred largely by the growing number of wounded veterans. Active and otherwise healthy, he added, the young vets want to remain fully mobile and productive. Dr. Jeffrey

Cohen, a clinical professor of rehabilitation medicine at NYU's Langone Medical Center in Manhattan, said many of the robotic developments have been driven by military researchers.

"What's coming out now is a new rugged C-leg developed at Walter Reed [Army Medical Center in Washington, D.C.], which can go for days without charging," Cohen said.

Shaffer said he's excited about the range of new developments coming down the pike. "Neurobionics is the next step," he said of devices that will tap into signals from the central nervous system, allowing the brain to control the prosthesis.

"It's all about helping patients achieve better function," Shaffer added. "There are a lot of exciting things ahead."

LIFELIKE LEG. Adriana Coffey, holding her baby, Abigail, lost her right leg when a drunken driver ran over her in 2005. A close-up of her feet, upper left, shows the realism of the silicon skin and acrylic nails.



PHOTO BY COUS BOUTLE

NOT JUST LEGS. When a person's injured or diseased nose cannot be reconstructed surgically, a prosthetic one can be attached to the face.

The thinner the skin, the better it looks

BY DELTHIA RICKS
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Technicians at A Step Ahead in Hicksville are now impregnating a silicone leg with fire-retardant compounds for an amputee firefighter.

"We're going to really trick it out for him," said Erik Schaffer, founder and president of A Step Ahead. "It's going to look so hot."

The skin that A Step Ahead fits over high-tech prosthetics is made of the company's proprietary form of silicone. It's 1 millimeter to 1.5 millimeter thick and has the warmth and near-feel of human skin.

Human skin varies in thickness depending on the part of the body it's covering, according to the Merck Manual. It ranges from 0.5 millimeters on the eyelids to 4 millimeters or more on the palms of the hands and soles of the feet.

At Schaffer's prosthetics factory, artisans color the silicone on both sides to match each patient's skin tone. Fingernails and toenails, made of acrylic and added to hands and feet, complete a realistic look.

"Our skins are as thin as possible," Schaffer said, but strong and flexible enough, he added, to create feet for women that can accommodate a 4-inch high heel or an open-toed shoe.

The use of artificial skin is not unique to Schaffer's practice. Touch Bionics, makers of the i-Limb hand, a high-tech prosthetic, makes a product called Livingskin. Other Long Island prosthetists and the Veterans Affairs Medical Center in Manhattan fashion silicone or latex skins onto robotic legs and other replacement limbs.

MAKING IT REAL



BEFORE

Photos from A Step Ahead of Hicksville show a patient's hand that was fitted with the company's prosthetic fingers. Artisans color the silicone to match each patient's skin tone and acrylic fingernails are added.

& AFTER



The development of flexible, thin silicone skin has complemented parallel advances in highly articulated artificial limbs.

"If it's too thick, it would not allow the i-Limb to function," said Lisa Prasad, spokeswoman for Touch Bionics. A thicker material, she said, might bunch when a wearer tried to pick up an object, impeding the hand's ability to grip.