

The Hinnant Prosthetics Quarterly

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i-LIMB—Sci-Fi Becomes Reality

He's hawked hearing aids on cable channels these days, but back in the 1970s the Six Million Dollar Man (Lee Majors portraying "bionic man" Steve Austin) was a big deal on mainstream TV. The concept: An astronaut/test pilot catastrophically mutilated in a plane crash is rebuilt with bionic limbs and implants and becomes endowed with super-human capabilities.

What's New

More than three decades later, the bionic man still hasn't become reality, but we're getting there: Look no further than the i-LIMB™ Hand, which

looks and acts like a real human hand and is the first widely available prosthetic terminal device with five individually powered, fully articulating digits. The fingers have the ability to bend at each joint and open and close around objects, giving upper-extremity amputees functional flexibility they previously only dreamed about.



The i-LIMB is controlled by a highly intuitive control system employing a traditional two-input myoelectric signal to open and close the hand's life-like fingers. Myoelectric control utilizes electrical signals generated by the muscles in the patient's residual limb and picked up by electrodes on the skin surface. Existing users of basic myoelectric prosthetic hands adapt quickly to the system and can readily master the device's new functionality.

(Continued on page 3)

i-LIMB Hand Grip Patterns



Key Grip—The thumb closes down onto the side of the index finger...used to hold items such as a plate or a business card...addition of wrist rotator enables the user to turn a key in a lock



Power Grip—All the fingers and the thumb close down together to create a full-wrap grip, such as used to carry a can of soda or large objects such as a briefcase or shopping bag.



Precision Grip—The index finger and thumb meet, or the index finger, middle finger, and thumb meet to pick up and/or hold small objects when performing finer control tasks.



Index Point—The thumb and other fingers close while the index finger remains extended...useful for operating keyboards, a phone keypad, and controls on a steering wheel while driving.

Photos this page courtesy Touch Bionics

Hinnant Prosthetics Quarterly is a professional newsletter published since 1998 by Hinnant Artificial Limb Co. to keep physicians, therapists and other rehabilitation professionals abreast of the latest trends and technology in prosthetics.

Hinnant has been serving the needs of amputees and patients with congenital limb deficiencies for more than 78 years. We specialize in applying the latest proven technology commensurate with each patient's capabilities, lifestyle and personal desires.

We hope you find our newsletter to be interesting and professionally relevant and encourage your comments, questions and referrals. We also encourage you to visit our website at

www.hinnantprosthetics.com

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Cosmesis—Providing the Finishing Touch for Prosthetic Limbs

In the rehabilitation community's dedication to restore an amputee to a state of wholeness, function is paramount...as it should be: Enabling a lower limb-deficient patient to walk anew or an upper-limb amputee to grasp and manipulate again is a marvelous accomplishment.

However, another aspect of modern prosthetic management is similarly essential to many patients, one that still emphasizes the "art" of prosthetics in an era generally dominated by scientific advances.

Cosmesis, the external appearance of a prosthetic system, is for many amputees an integral ingredient—for some the most significant attribute—of restored wholeness. Some, in fact, consider projecting an image of completeness to be an even more important outcome than functional restoration.

For many patients a basic level of cosmetic finishing, or no cosmesis at all, is perfectly acceptable, while others with special vocational or lifestyle needs require more advanced shaping, pigmentation and detailing of the external surface. In such instances, the results can be nothing short of amazing.

It is important to note that prosthetic covers and finishes provide protection as well as aesthetic complement to the components they envelop, which may be a key factor in securing reimbursement. Purely cosmetic enhancements are not routinely covered by Medicare or many private insurers. To qualify for reimbursement, a protective outer surface covering system (POSCS) for a medically justified prosthesis should effectively shield internal componentry from liquids, grime and other contaminants.

Cosmesis Forms

The type and degree of cosmesis applied to a prosthetic limb are determined by several factors, including the desires, vocation and lifestyle of the amputee, cost and reimbursement resources, and the



Prosthetic sleeves come in a variety of sizes colors and enhancements, such as the appearance of hair (at right).

1-10A



Myoelectric glove

Courtesy Otto Bock Health Care

construction of the prosthesis. But the most important consideration rehabilitation decision-makers should keep in mind is that amputees who don't like the appearance of their prosthetic limb probably won't wear it.

• **Exoskeletal shells.** With an exoskeletal system, now used primarily with upper-limb systems, the hard outer shell of the prosthesis can be shaped and colored to complement the residual limb to a reasonable extent, and the exterior may be painted for a closer pigmentation match.

However, because their outer surface is in fact rigid, exoskeletal systems do not lend themselves to exact cosmetic re-creation.

• **Endoskeletal covers.** The cosmetic foundation for an endoskeletal prosthesis is a foam cover, which provides the desired shape and is usually augmented with some type of exterior finish, ranging from cosmetic hose to a spray-on skin or removable sleeve to achieve the desired final cosmetic outcome.

• **Cosmetic gloves.** Upper-limb prostheses incorporating a mechanical or myoelectric hand-type terminal device are usually covered with a flexible glove that provides protection for the functional components as well as cosmesis. Some offer enhanced cosmetic details, including acrylic nails and hair.

• **Finger prostheses.** Highly detailed custom-made aesthetic finger replacements can be provided for almost any amputation level, even as minor as a nail loss. These prostheses generally attach to the remaining finger by suction and can be designed to transmit vibrations from the tip to nerves in the residual finger, providing wearers the sense that the prosthesis is an extension of themselves rather than a foreign attachment.

• **Foot shells.** As prosthetic feet have assumed high-tech design and capabilities in recent years, many now come with a standard, highly lifelike cosmetic shells. Customized foot shells providing advanced finishing are also available. Women amputees appreciate the more-detailed covers' ability to accept nail polish.

• **Prosthetic "skin."** The cosmesis of an exoskeletal shell or endoskeletal foam cover can be enhanced by a spray-on "skin," or removable sleeve. These exteriors not only provide a realistic appearance and texture but also create a waterproof protective outer layer, much like human skin. Removable skins can also act as a suspension sleeve for the limb.

• **Passive components.** In some situations, restoration of function is either not possible or not desired. Frequently in such cases, patients desire a purely cosmetic prosthesis to maintain a whole external appearance. This need can be met with a lightweight endoskeletal device, often incorporating a cosmetic hand or foot. Particularly in the case of upper-limb prostheses, a so-called "passive" limb can provide many functional benefits, notably supporting, stabilizing, pushing, pulling, holding and balancing, even though active grasping and manipulation functions are not incorporated. An example is described on page 4.

• **Detailing.** Beyond the basic cosmetic treatment for a prosthetic limb—general shaping and pigmentation to match the residual limb—



Endoskeletal form cover ready for finishing



Courtesy www.RealLifeSkin.com

advanced definition and details can be added to the cosmetic finish. These enhancements include veins, skin texture, nails, freckles and other skin variations, and hair, either real or painted on (i.e. the "appearance of hair"). The degree of detailing to be added is primarily a factor of patient desires and funding resources.

The Cosmetic Art

In planning and creating a prosthetic cosmesis, our practitioners employ a detailed knowledge of patient management, materials, shaping, and reimbursement as well as artistic skills. Among these, a keen sensitivity to patient psychological needs rates special attention. Experienced rehabilitation practitioners contend that an amputee's self-image can be as much a determinant of the ultimate rehabilitation outcome as functional capabilities.

Before amputation surgery, some patients believe the prosthesis they receive will make them "good as new," both functionally and cosmetically. Unfortunately, post-surgical reality often comes as a shock. In such cases, we appreciate that providing a cosmesis acceptable to the patient will go a long way toward attaining the functional restoration of which he or she and the prosthetic system are capable.

We will welcome the opportunity to discuss cosmetic options and solutions for your amputee patients.



Finished prosthesis with detailed cosmesis applied

'\$6 Million Man's' Hand?

(Continued from page 1)

With its individually motorized and articulating fingers and rotatable thumb, the i-LIMB has the ability to achieve many different grips (shown on page 1). Built-in stall detection tells each finger when it has sufficient grip on an object, whereupon the finger locks into position until the user triggers a muscle to open it. This capability allows a patient to grasp objects as a real hand would and perform more complex daily tasks such as typing, dialing a phone, throwing a baseball or shaking hands.

Manufactured of high-strength plastics, the i-LIMB Hand is lightweight, robust and highly appealing to both patients and health-care professionals, as witnessed by more than 1000 i-LIMBS having been provided to patients since the product debuted in 2007. The i-LIMB has won numerous awards and honors for its innovation and technology since its introduction.

Steve Austin, eat your heart out.

Helping Hands in Haiti

The Jan. 12 earthquake that devastated Haiti is a human tragedy of epic proportions. Beyond the estimated 170,000 killed in the 7.3 magnitude tremor, at least 200,000 more are believed to have suffered major injuries. Among these, 2000-4000 are predicted ultimately to undergo limb amputation surgery, many of them children.

From a rehabilitation standpoint, few countries could have been more ill-prepared to cope with this disaster than Haiti. The facility of the primary provider of prosthetic and orthotic care in the capital of Port-au-Prince, Healing Hands for Haiti International, was 80 percent destroyed at the same time the need for its services was growing exponentially.

But help is on the way, amidst an outpouring of concern from around the world. That is encouraging, but it is vital that this support be organized and focused in the right way. Handicap International, a global network focused on improving the living conditions of people living in disabling situations in post-conflict and low-income areas of the world, is leading the coordination of the rehabilitation effort. Healing Hands for Haiti is involved as a primary provider of services along with similar organizations based in various countries.

At the appropriate time, volunteer prosthetists and orthotists from many nations will travel to Haiti in temporary stints to provide the needed skills and experience largely lacking in the small country's inherent resources. It is important to note, however, that the need for device adjustments and follow-up care will remain long after the volunteers have gone home, thus the infrastructure to provide that ongoing care must be created, essentially from scratch.

Meanwhile, collections of used prosthetic and orthotic components and supplies and various patient aids have been organized in many locations for ultimate shipment to Haiti. Many of these items will be helpful, but it is likewise important to note that Haitian amputees are going to need basic, relatively uncomplicated replacement limbs or braces as compared with many of the devices provided to their counterparts in the U.S. and other developed countries. Some collected components, such as basic feet and knee units, will conceivably have value as replacement parts, but used prosthetic sockets, liners and high-end components are generally not appropriate and will only take up space.

The O&P response to the Haitian catastrophe is still developing. For up-to-date information, visit the web sites for Handicap International, www.handicap-international.org, Healing Hands for Haiti International, www.healinghandsforhaiti.org, and the U.S. Member Society of the International Society of Prosthetists and Orthotists, www.usispo.org.

Note to Our Readers

Mention of specific products in our newsletter neither constitutes endorsement nor implies that we will recommend selection of those particular products for use with any particular patient or application. We offer this information to enhance professional and individual understanding of the orthotic and prosthetic disciplines and the experience and capabilities of our practice.

We gratefully acknowledge the assistance of the following resources used in compiling this issue:

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Back to Texting with the Best of Them

If there is one signature activity that exemplifies teens and young adults in early 21st century America, it's quite likely "texting"—sending text or e-mail messages to friends and family many times a day from many different locations. Indeed, a "smart" cell phone is considered an essential appendage by the majority of young people today.

Although it is possible to text using the one finger "hunt and peck," today's accomplished practitioners of the art prefer the "flying thumbs" method of text



Cody demonstrates his preferred texting technique.

Photos courtesy RKA Photography

entry, as demonstrated in the accompanying photo. However, a closer look will reveal that while the activity shown in the image is indeed normal, one of the hands isn't. tional Rehabilitation and prosthetic referral after a year of therapy, Cody had already concluded he would be significantly handicapped for the rest of his life, and his motivation to pursue a career and be successful in life was in question. He could no longer carry things "in the palm of his hand," and more intricate activities, such as texting, were out of the question because he could no longer hold the phone or similar essential items.

Realizing the young man's future would likely be limited in a big way by his amputation without intervention, Cody's V. R. counselor secured funding for a prosthetic passive hand that would restore considerable function as well as aesthetic wholeness to his hand...and his life. His

Down to Cases

prosthetist engaged a specialist to create a silicone glove incorporating fingers that can be positioned passively.

The right "hand" is, in fact, a silicone prosthetic glove worn by Cody J., now 19, the victim of a shotgun blast at close range as he tried to flee an armed robber two years ago. The shot essentially obliterated his palm; only the skill of a dedicated hand surgeon saved his

thumb, forefinger and the supporting bones and muscles necessary to retain their function. Although those vital digits were saved, his remaining hand and three fingers were lost.

By the time he was ready for Voca-

tion without intervention, Cody's V. R. counselor secured funding for a prosthetic passive hand that would restore considerable function as well as aesthetic wholeness to his hand...and his life. His prosthetist engaged a specialist to create a silicone glove incorporating fingers that can be positioned passively.

Painstaking hours were devoted to matching the contours and skin tones of Cody's remaining hand, arm and contralateral limb. He describes the result as a "work of art."

His improved body image and renewed ability to hold and manipulate have made a major difference in Cody's life and outlook. He now back in the digital communication mainstream and striving to return to school and obtain a job as a physical therapy assistant. You might say he deserves a big "hand."



Glove close-up shows immaculate detail.



Cody's prosthetic glove closely reflects the contours and colors of his residual hand and his intact left hand and wrist.