TOUCH BIONICS™

Transforming the Everyday Lives of Extraordinary People

# i-LIMB™ HAND

## Get a Grip on Functionality

Touch Bionics is a leading developer of advanced upper-limb prosthetics (ULP). One of the two products now commercially available from the company, the i-LIMB Hand, is a first-to-market prosthetic device with five individually powered digits.

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The Touch Bionics i-LIMB Hand was developed using leading-edge mechanical engineering techniques and is manufactured using high-strength plastics. The result is a next-generation prosthetic device that is lightweight, robust and highly appealing to both patients and healthcare professionals.

The i-LIMB Hand is controlled by a unique, highly intuitive control system that uses a traditional two-input myoelectric (muscle signal) to open and close the hand's life-like fingers. Myoelectric controls utilize the electrical signal generated by the muscles in the remaining portion of the patient's limb. This signal is picked up by electrodes that sit on the surface of the skin. Existing users of basic myoelectric prosthetic hands are able to quickly adapt to the system and can master the device's new functionality within minutes. For new patients, the i-LIMB Hand offers a prosthetic solution that has never before been available.

## PARTIAL HAND

In another industry first, the i-LIMB Hand's finger technology has been adapted for patients who have a partial hand, due either to congenitally missing fingers or fingers lost through an accident. Partial hand is an area of prosthetics that has been without suitable powered products in the past. ProDigits are another first from Touch Bionics. Not having fingers or a thumb to act in opposition to one another makes simple tasks such as holding a fork or a drink difficult and frustrating.

The modular nature of the ProDigit finger design and the individually-powered motor located within each digit means that a clinician can build replacement fingers to the correct anatomical length of the patient's remaining undamaged fingers. This new solution can help the many individuals who so far have had no effective options available to them.

## ADVANCED CONTROLS

With its first commercially available i-LIMB Hand, Touch Bionics is utilizing the myoelectric principles used in existing devices while taking advantage of the mechanical advance of five fully-articulating powered digits. The inclusion of a thumb that can, like the human thumb, be rotated into different positions enables important grip configurations, many of which have not been available to amputees before. The grasp of the hand is much more like that of a human hand with the articulating fingers able to close tightly around objects. Built-in detection tells each individual finger when it has sufficient grip on an object and, therefore, when to stop powering. Individual fingers lock into position until the patient triggers an open signal through a simple muscle flex.

Whereas previous myoelectric hands could only be opened and closed, the i-LIMB Hand offers numerous different grip patterns. These new grip options enhance dexterity and support almost all daily living activities, giving doctors, prosthetists and occupational therapists completely new options for enhanced patient rehabilitation and quality of life. For example, patients are now able to point the index finger to operate a PC keyboard, or to rotate the thumb to meet the side of the index finger to hold a plate or turn a key in a lock. None of these functions have been possible before.

The i-LIMB Hand is anatomically correct both when resting and in motion. This is a key innovation that has been very much appreciated by patients – many of whom simply wish to blend back into society without others noticing their amputation.

## ADVANCED DESIGN

Touch Bionics is the first company to offer commercial availability of a true bionic upper-limb product. Both the i-LIMB Hand and ProDigits have been fitted to many different patients at a number of leading prosthetic and orthopedic clinics in both the U.S. and U.K.

The modular construction of the i-LIMB Hand means that each individually powered finger can be quickly removed by simply removing one screw. This means that a prosthetist can easily swap out fingers that require servicing and patients can return to their everyday lives after a short clinic visit. Traditional devices would have to be returned to the manufacturer, often leaving the patient without a hand for many weeks.

## CONTROLLING BIONIC DEVICES

The i-LIMB Hand relies on some of the most advanced control software yet seen in the prosthetics industry. This software provides speed and grip-strength control to the device while patients generate signals to control the device in a way that does not differ from how traditional devices operated in the past. Two small metal electrode plates, which detect the minute electrical signals generated by the remaining muscles in the limb stump, are placed against the skin to pick up signals. Traditionally one electrode is placed on the top of the forearm and the other on the bottom.

Patients usually have a sensation that their hand still exists despite it being amputated, something often referred to as 'phantom' feelings. When encouraged to generate a strong signal, the patient is often asked to move and flex their missing hand to generate a strong control signal. Before too long, these reflexes become intuitive.

Feedback from early patient studies identified that software adjustments can allow patients to perform simple tasks and improve functionality. An example of this is thumb parking, instructing the thumb to close down against the side of the hand to allow a jacket to be out on. Another is a completely new grip function for prosthetic hands, the index point, whereby the hand grasps into a fist whilst leaving the index finger extended. Patients have found this very useful for operating computer keyboards, telephone dial pads, ATM cash machines and a host of other everyday requirements.

## ADVANCES IN COSMESIS

Cosmesis is the flexible skin covering that covers the i-LIMB Hand and ProDigits. By applying in-house expertise and partnering with companies that specialize in cosmesis, Touch Bionics has achieved major breakthroughs in the aesthetic appearance of its prosthetic products. The Touch Bionics products are the first prosthetic hands to imitate the true movement and lifelike accuracy of a human hand.

The challenge has been to find materials that can move and flex in the same way that human skin does.

This has been addressed in two ways, in order to support two distinct patient preferences.

Some patients, mainly military personnel, particularly love the robotic nature of the uncovered i-LIMB Hand and prefer not to wear it with a cosmesis glove. However, because of the need to provide a grip surface and to protect the hand from dust and water, Touch Bionics has developed the i-LIMB Skin. This is a thin layer of semi-transparent material that has been computer-modeled to accurately wrap to every contour of the hand.

Other patients wish their device to blend anatomically with the rest of their body, and have a life-like covering for the i-LIMB Hand and ProDigits. As these products are more anatomically correct than any currently on the market, which not only allows for increased functionality but also a vastly improved cosmetic appearance, the challenge has been to find a high-definition cosmesis of superior quality. Touch Bionics is launching with custom cosmesis products from two of its cosmesis partner companies.

## FURTHER INFORMATION

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