Is ‘Prosthetic Parity’ a Good Thing?

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Nevertheless, the push for parity is not without controversy. Among qualified prosthetic practitioners there is a serious concern that less-than-specific language in different state bills with regard to provider credentialing may lead insurers to direct policyholders to underqualified providers. At the end of 2006, only 10 states required prosthetists to be licensed.

In concept, however, prosthetic parity laws are a step in the right direction. As supporters of such legislation in various states continue advocating for services to be provided by appropriately credentialed prosthetists, we make progress toward an acceptable level of care for all individuals with limb loss.

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BioSculptr • Ohio Willow Wood • Marlo Oritz, P.O.Össur • Otto Bock Health Care • Touch Bionics

Microprocessor-Controlled Knees

Otto Bock’s C-Leg and its recently introduced competitor, the i-Limb, use an on-board microprocessor to adjust prosthetic leg swing in real time in response to the wearer’s cadence, toe and heel loading, and other gait variables. As a result the leg is ready for heel strike at just the right instant, providing above-knee amputees with unprecedented security, gait flexibility, greater freedom of movement, natural swing motion and reduced walking fatigue.

Microprocessor-controlled knee systems enable wearers to change walking speed, negotiate uneven terrain, walk up and down slopes, and descend stairs step-over-step.

(Continued on page 2)
Prosthetic Limbs of Tomorrow Making Preview Appearances Today

(Continued from page 1)

The C-Leg now incorporates several new enhancements that improve its performance even further, including:

• a new standing mode, which stabilizes the knee, taking weight off the sound limb and allowing the user to relax while standing;
• a wireless remote control, which enables users to switch easily between modes as well as fine tune swing phase dynamics for different activities; and
• a widened scope of application that now includes transfemoral, transhumeral, and hemipelvectomy amputees.

Initially this connection is achieved by a socket suspended from the residual limb.

Among the advances in socket design and fabrication are new and improved CAD-CAM systems, through which more precise, more functional and more comfortable sockets can be provided than ever before in substantially less time.

Typically this connection is achieved by a socket suspended from the residual limb. Though not yet approved by the Food and Drug Administration for use in the United States, this process of osseointegration has been used successfully with more than 100 lower-limb and more than 30 upper-limb patients in Europe.

The C-Leg incorporates an increased range of hip motion and report the socket is more comfortable to wear, whether standing, walking, or sitting down.

Perhaps the greatest potential development in prosthetic attachment does away with the socket altogether, instead anchoring the prosthesis to the residual limb by a titanium bolt surgically implanted directly into the distal residual bone. Though not yet approved by the Food and Drug Administration for use in the United States, this process of osseointegration has been used successfully with more than 100 lower-limb and more than 30 upper-limb patients in Europe.

Osseointegration shows the potential to eliminate most if not all of the problems inherent in prosthetic socket attachment for appropriate patients:

• End weight-bearing is restored;
• prosthesis control is greatly enhanced while energy expenditure is substantially reduced;
• risk of sudden prosthesis detachment from the body is minimized;
• user perception of the limb’s place in space is much improved; and
• residual limb pain and muscle atrophy caused by constant contact with the socket environment are virtually eliminated.

Osseointegration, already approved for dental and maxillofacial applications, is expected to be approved for orthopedic use in the United States within five years.

Upper-Limb Innovation

For several decades, upper-extremity prosthetics has led the way in high-tech prosthetic applications with myoelectric control of battery-powered hand, elbow and wrist actuators. Leading systems such as Motion Control’s Utah Arm series continue to improve through upgraded components, while new offerings, such as the Otto Bock Dynamic Arm, help to raise the performance bar.

Like many newly introduced products, the Dynamic Arm offers certain advantages over the field, including faster elbow actuation, greater lifting capacity (13 pounds) and a more natural swing motion.

An intriguing new entry into upper-limb componentry is a new terminal device developed in Scotland that features five distinct fingers, each powered by separated motors. The i-LIMB Hand (see photo, page 1) is still in its infancy at this point—the fingers, though individually powered, can only move together. However, individual finger actuation is anticipated in the next few years with the development of improved control systems.

Powered Lower Limbs

Until now, powered components have been limited to upper-extremity applications. That all changed with the recent introduction by Ossur of its Power Knee and Proprio Foot prostheses. These components, and others like them that will undoubtedly follow, promise to significantly reduce the effort and energy expenditure of walking while enabling appropriate amputees to ambulate confidently over uneven terrain and on stairs and providing a major assist for sitting and rising.

These, like many of the other products described in this newsletter, are not yet ready for the general amputee population. Some are still in the research and development stage; others carry a whopping price tag well beyond the budget of the average American.

But the good news is that the innovation we see today will become the reality of tomorrow. Prospects for improved prosthetic capabilities have never been brighter.

Walter Reed, DARPA Pushing Prosthetic Horizon

Recent componentry breakthroughs like those discussed in this newsletter give testimony to new efforts to develop markedly improved prosthetic solutions for people with congenital and acquired limb deficiencies. As encouraging as these new developments might be, two major research initiatives now under way suggest “You ain’t seen nothin’ yet!”

One program has evolved from efforts to provide a new level of restored function to military personnel who have lost a limb in the ongoing war against terrorism in Afghanistan and Iraq. Most of these typically young and vital men and women are treated at Walter Reed Army Medical Center (WRAMC), an acknowledged world leader in amputee rehabilitation.

WRAMC’s determination to carry out a grateful nation’s desire to provide the maximum possible rehabilitation to more than 300 combat amputees is contributing valuable new insights into the management of younger men and women with a traumatic limb loss. This growing body of knowledge, dubbed the “Walter Reed Experience,” will likely influence amputee care in both military and civilian sectors for years to come.

• For example, lower-limb amputees are routinely evaluated at the center’s gait laboratory to analyze and optimize their prosthetic ambulation. Their outcomes could conceivably help justify Medicare and private insurance coverage of computerized gait analysis, currently not reimbursed in most instances. Walter Reed clinicians have found gait analysis particularly helpful for making component choices and as an educational tool for both patients and rehab team members.

Another finding reveals that a microprocessor knee system such as the C-Leg can be used throughout a new above-knee amputee’s progression from initial prosthetic intervention to final definitive prosthesis, saving weeks of lost time and progress while adjusting to periodic applications of sequentially more capable knee units as the patient becomes stronger and more functional. The microprocessor knee system can be programmed to accommodate the user’s abilities at any stage of rehabilitation.

• Upper-extremity amputees, who generally require a period of postoperative healing before prosthetic application, are being prepared for rehabilitation by early identification of myoelectric control sites on intact muscles in the residual limb, which the recovering patient is trained to use through video games. In learning to generate the right electromyographic signals to operate the games, amputees thus become ready to control a myoelectric prosthesis when cleared to do so, while enjoying a therapeutic, competitive activity.

Meanwhile, the Defense Advanced Research Projects Agency (DARPA) has launched a major drive to produce a better prosthetic arm for soldier amputees, and ultimately civilians as well. In a two-phase, four-year $70 million program, DARPA is involving leading engineers, prosthetists developers, neuroscientists and others to develop a replacement limb that is:

• highly functional (capable of 22 independent movements as compared with a maximum of three in today’s prosthetic arms);
• lightweight (weighing no more than a typical human arm);
• “sensitive” to pressure, heat and cold; and
• small enough where it is in space.

Lofty ambitions? Perhaps, but this is the same country whose innovation put a man on the moon within eight years of its first manned space flight. With the proper attention and resources now being devoted to the effort, don’t be surprised at what might develop.

Dynamic Arm offers new capabilities to transhumeral amputees.

© Courtesy Ohio Willow Wood

Omega Tracer T-Ring™ II captures residual limb shape in moments. Courtesy Ohio Willow Wood

Proprio Foot

© Courtesy Ohio Willow Wood

BioScanner™ portable CAD-CAM scanner

Typical CAD-CAM software display. Courtesy Ohio Willow Wood

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Research Report

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