GULF COAST ORTHOTICS & PROSTHETICS

FIRST STEP

Current Developments in Orthotics & Prosthetics Spring 2006

Early Prosthetic Management Can Lead to Better Outcomes

Few topics in rehabilitation elicit more debate and exhibit less consensus than the management of patients in the first days after lower-extremity amputation surgery and the timing and method of their transition into a prosthetic limb.

This important decision is impacted by (1) the surgeon's natural desire to closely monitor the new amputee's recovery by regularly examining the progress of wound healing; (2) rehabilitation practitioners' preference for resuming exercise and initiating weight-bearing and prosthetic intervention as soon as practicable; and (3) reimbursement realities.

Prosthetics Today

Certainly, the age and health of the patient affect the decision. A young, traumatic amputee may be capable of taking his first steps a few days after surgery, while an elderly, dysvascular patient may take weeks or months before the clinical team feels comfortable initiating prosthetic care. In some instances, of course, the amputee's general state of health rules out prosthetic intervention altogether.

In 2003, the American Academy of Orthotists and Prosthetists funded a Clinical Standards of Practice (CSOP) consensus conference on lower-limb post-amputation management. The CSOP concept is used by various medical professionals to examine practice concepts that are poorly or under-reported in the literature.

In an intensive two-day process, the assembled multidisciplinary team of experts reviewed and compared the five predominant post-amputation management strategies:

- Soft dressings
- Non-removable rigid dressings
- Non-removable rigid dressings with an immediate post-operative prosthesis (IPOP)
- Removable rigid plaster dressings (RRDs), and
- Prefabricated post-operative prosthetic systems.

The participants concluded that the current level of research does not make possible evidence-based protocols or recommendations favoring one approach over another. However, the CSOP literature review did confirm that rigid dressings do produce significantly accelerated rehabilitation periods and considerably less edema than soft dressings, and that significantly fewer post-operative complications are experienced with prefabricated post-operative prosthetic systems than with soft dressings. Other definitive comparisons are lacking at present.

This CSOP has focused new attention on the benefits and drawbacks of the various approaches and accentuated the need for future research comparing all types of dressings within one study.

(Continued on page 2)

An immediate post-operative prosthesis (IPOP) consists of a non-removable rigid cast, a simple pylon and basic foot.

Welcome to the Spring 2006 issue of *First Step*, a professional publication of Gulf Coast Orthotics & Prosthetics. Through this quarterly newsletter, we endeavor to keep the West Florida rehabilitation community abreast of the latest trends, developments and technology in the orthotic and prosthetic management of physically challenged patients.

We are proud to announce that we recently had a successful fitting of a patient with a Rheo™ prosthetic knee, the first microprocessor knee to feature artificial intelligence (see page 4). Our patient was able to ambulate step-over-step downstairs and also down ramps after only a short acclimation period. This task is essentially impossible in traditional mechanical prosthetic knee systems. Our patient is only the eighth amputee in Florida to be fit with a Rheo knee and is enjoying the features of this component's incredible technology.

We hope you find this *First Step* issue to be a useful resource and welcome your input, referrals and requests for further information. Call us at (850) 477-4880 or contact us through our website at **www.gulfcoastoandp.com.**

Moving from Amputation to Ambulation

(Continued from page 1)

Dressing Options

Examining amputation dressing alternatives in more detail:

• A **soft dressing**—soft gauze used alone or in conjunction with a device such as an ACE wrap, shrinker sock, or gel liner to achieve compression and perhaps some form of a knee immobilizer to counter contractures—can be easily removed for wound inspection. However, potential drawbacks impacting early prosthetic intervention are significant: reduced edema control, increased risk of contractures, extended inactivity and depression from being confined to bed for a long period. Prosthetic management may not begin until the third or fourth month after surgery, by which time the patient's motivation to ambulate may have waned.

Casting materials for a transtibial rigid dressing include (from left) conformable fiberglass, fibula and medial tibial pads, patella pad, cast padding, lambs wool, sterile post-op socks, adjustable waist belt with pick-up (top) and reticulated distal foam cup (bottom).

• A **rigid dressing** can prevent most of these problems. This dressing is usually constructed of plaster, fiberglass or a combination, and if it is to serve as the foundation of an IPOP incorporates an attachment for the prosthetic components. In addition to controlling edema and preventing contractures, a rigid dressing helps reduce pain and guards against wound contamination.

• By allowing frequent inspection of the amputation site but retaining many benefits of a rigid cast, the **removable rigid dressing** (RRD) offers a compromise between soft and rigid dressings. The RRD is fabricated of plaster or fiberglass and suspended by stockinette and supracondylar suspension cuff or sleeve; residual limb socks are added as needed to maintain a close fit. The RRD has lower trimlines than a non-removable rigid dressing and thus permits knee range of motion exercises. Care must be taken not to leave the wound exposed for lengthy periods as edema build-up can begin within 20 minutes. While exercise and weight-bearing can be initiated with the RRD, it is not normally used as the basis for an IPOP.

• The **polyethylene semi-rigid dressing** (PSRD) has been applied in place of an initial dressing as early as five days post-op...with staples/sutures still in place. Used in conjunction with a shrinker, it has been shown to provide better edema control than either an RRD or shrinker alone. Moreover, the PSRD's flexibility enables a new amputee to apply and remove the dressing, which is similar in design to a prosthetic socket. To keep weight to a minimum, no pylon or foot is added; however, partial-weight bearing can be initiated by positioning the distal end in a wheelchair seat or other appropriate surface under qualified supervision.

What About IPOPs?

The immediate post-operative prosthesis is usually a simple, relatively inexpensive device that gives the new amputee an immediate reason to begin using his or her amputated limb. The therapeutic objective becomes one of rehabilitation rather than simply recovering from surgery.

The rigid dressing applied in the operating room serves as the IPOP "socket," to which are attached a basic pylon and prosthetic foot. The IPOP is intended to be used until the amputation wound has sufficiently healed and staples or sutures are removed. At that point, the patient is usually ready to transfer to a more substantial prosthesis.

The key to successful IPOP management is strict limitations on weight-bearing in early use. Patient ability to withstand early weight-bearing is individualized, but in general little or no weight should be applied except for prosthetic touchdown for the first day or two. Then, as patient tolerance and indications of satisfactory healing allow, weight-bearing can gradually be increased.

APOPPS transfemoral (left) and transtibial systems provide prefabricated post-amputation management options for wound protection and early weight-bearing.
Courtesy of FLO-TECH

An IPOP alternative gaining some measure of popularity of late is the early post-operative prosthesis, or EPOP, which is typically applied five-to-seven days post-op. EPOPs are sometimes considered a better choice for patients with vascular disease, as the wound can be regularly examined before the EPOP is applied. Another advantage is that the prosthetist can fabricate an EPOP at the bedside rather than having to be present in the operating room during surgery.

Prefabricated Post-operative Systems

For appropriate patients, prefabricated post-operative prosthetic systems, such as the Adjustable Postoperative, Protective and Preparatory System (APOPPS), offer a nice compromise between a soft and a rigid dressing, allowing for periodic wound evaluation and providing a degree of residual limb protection and contracture prevention and edema control.

Like the RRD and PSRD, prefabricated protective sockets can be removed for wound inspection, but unlike those options, systems like the APOPPS are intended to be used as the basis for an immediate prosthesis. APOPPS models are available for both transtibial and transfemoral amputees.

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Today's certified prosthetist is well-prepared to assist surgeons in post-operative amputee management, beginning with initial dressing in the operating room if desired, and to work directly with nurses and therapists during early prosthetic activity.

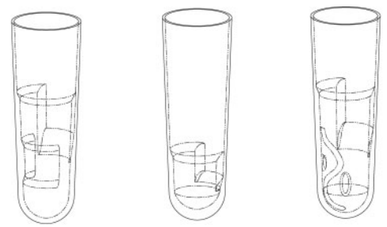
The tools, techniques, technical knowledge, and fabrication abilities are readily available to give patients the ample benefits of early prosthetic support. It only remains for those who chart the amputee's rehabilitation course to put these resources to use.

Custom Socket Liners Fill in For Difficult Residual Limbs

DESIGN liners fill in the blanks for residual limbs with uneven limb surfaces.
Courtesy Ohio Willow Wood

The introduction of gel socket liners in the early 1990s opened new vistas of comfort and improved prosthesis suspension for lower-limb amputees and spawned a steady stream of new liner designs and materials, which continues today.

Most prosthetic liners are off-the-shelf products of uniform gel thickness throughout and available in various sizes. These products work well for most transtibial and some transfemoral amputees; however, those with residual limbs that are particularly bony, short, uneven, deeply scarred and/or invaginated often experience pain when wearing their prosthetic limb and sometimes difficulty in maintaining suction suspension.



Line drawings shows areas of gel build-up in DESIGN liners created for (from left) bony, short and scarred limbs.
Courtesy Ohio Willow Wood

Alpha® DESIGN™ custom liners can extend a comfortable, secure prosthetic fit to individuals with one or more of those limb characteristics. These liners are made to conform to the unique variations of a challenging residuum, as modeled by an OMEGA® Tracer® computer-assisted design (CAD) system or a plaster cast of the limb. In the absence of a CAD image, the amputee's prosthetist can participate in the fabrication of the custom liner through an interactive online consultation with the designer, known as Web Assist. The resulting liner will be one of a kind.

DESIGN liners feature varying gel thickness at strategic points that contact difficult areas on the residual limb surface. The standard 6mm gel thickness can be decreased as needed or increased up to 12mm in the distal end and up to 15mm over invaginations. The additional padding enhances comfort; the closer fit improves suction continuity.

The first DESIGN liners were available only for transtibial amputees; transfemoral liners are now offered as well. Both can be ordered in a suction version or incorporating a distal attachment for a locking pin. DESIGN liners come in one of three fabric coverings (two for the transfemoral version), many sizes, and three fabric colors.

Custom Liner Helps Defeat Osteomyelitis

Down to Cases

After almost four decades as a Level 4 (high-activity) amputee, David T., 59, suddenly faced a major curtailment of his activities. A persistent infection in the distal end of his very short (3 inches) transtibial limb was diagnosed as possible osteomyelitis. If the prescribed antibiotics, or something else, didn't defeat the infection and attendant swelling, further surgery would be the likely next step.

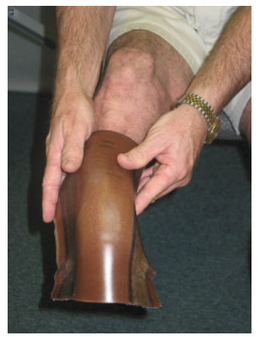
David's bony, scarred residual limb is a good candidate for a custom liner.

When your limb is as short as David's, more residual limb surgery is spelled "major lifestyle change." Loss of the knee joint would mean having to learn to walk again, with likely ramifications for his 10 miles-a-week running regimen and frequent long-hour days as a county executive. Though already wearing an advanced prosthetic system, David consulted his prosthetist to determine what else could be done.

Together, they discovered that the standard prefab locking pin liner David was wearing was allowing considerable movement of his residual limb within the socket. Moreover, despite having little sensation in the distal end of his limb, he was experiencing significant discomfort on the fibula head. Compounding the issue were the significant irregularities—scarring, and bony prominences—on his residual limb resulting from amputation necessitated by an auto accident at age 21.

The prosthetic solution was to switch to suction suspension and an Alpha DESIGN custom liner.

The new interface produced almost-instant benefits: David noted an immediate pain reduction when wearing his prosthesis, even after having it on for up to 16 hours a day, and limb movement within the socket was all but eliminated. "I asked my wife to try to pull the leg off," he recalls. "She really tried...and she couldn't do it."



David rolls on his Alpha DESIGN liner.

With the new liner in place, David's edema subsided within 10 days, and the infection came under control in 30. "My doctor treated my problem, my prosthetist treated the cause," he says. He has temporarily traded running for swimming and biking until he can be reasonably confident the infection will not recur.

The remainder of David's prosthetic system consists of a hybrid PTB (patellar tendon-bearing)/hydrostatic socket, Endolite Elite all-terrain foot, and suspension sleeve incorporating a suction valve.

A-K Amputee Gait Takes Another Step

Computerized knee componentry, possibly the major prosthetic technology breakthrough of the last decade, has taken another step forward with the introduction of the Rheo Knee™, a microprocessor-controlled swing and stance system that continuously samples and "learns" the user's gait pattern and optimizes cadence response.

Courtesy Össur

The Rheo Knee thus joins the C-Leg and Adaptive Knee in the growing arena of microprocessor-actuated advanced knee componentry.

The Rheo name derives from the knee's "magnetorheological (MR) fluid actuator," which varies swing resistance to adapt to its user's movements in real-time. Electronic sensors within the knee measure changes in knee angle and load bearing 1000 times per second. A computer chip creates and regulates magnetic field intensity to control the viscosity of the MR fluid and thereby deliver the proper degree of resistance with each step.

For above-knee amputees, this technology can mean greater security, more natural motion, less ambulation fatigue, and the ability to walk with confidence on uneven surfaces.

By continually sampling the sensors' force measurements, the microprocessor is always aware of how the limb is being loaded. Disturbances in the user's path are readily detected and stance support instantly activated to protect against a potential stumble and fall. The Rheo also provides safeguards against inadvertent stance release: The knee must be fully extended, momentarily still and achieve 20 percent of the average maximum extension moment during each step to initiate flexion.

The Rheo Knee's microprocessor-controlled stance feature enables amputees to negotiate a ramp, stairs or uneven terrain with confidence, some for the first time.

Unlike conventional hydraulic knee systems, Rheo Knee swing resistance is activated only when necessary. Veteran amputees who have worn the Rheo report the welcome experience of walking freely and resistance-free with easy motion and less effort, reducing oxygen consumption and fatigue.

What's New

The Rheo Knee, developed by Ossur in conjunction with the Massachusetts Institute of Technology, has won various accolades including the 2005 Frost & Sullivan Technology of the Year Award and inclusion in Fortune Magazine's 25 Best Products of 2004 and Time Magazine's Coolest Products of 2004.

Courtesy Össur

Like most advanced technology, the Rheo Knee is not inexpensive and definitely not for everyone.

However, this new technology promises even greater prosthetic capabilities for amputees in the future.

Note to Our Readers

Mention of specific products in our newsletter neither constitutes endorsement nor implies that we will recommend selection of those specific 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.

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