

The Hinnant Prosthetics Quarterly

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Spring 2001

From Amputation to Ambulation

Early Intervention Can Play Key Role in Achieving Prosthetic Success

Few topics in prosthetics stir more debate or display more diversity of approach than the management of patients in the first days after lower-extremity amputation surgery and the timing and method of their transition into a prosthesis.

This important decision is impacted by the surgeon's natural desire to monitor closely the new amputee's recovery by regularly examining the progress of healing, and the prosthetist's and therapist's preference for resuming exercise and initiating weight-bearing and prosthetic intervention as soon as practicable.

Certainly, the age and health of the amputee 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.

Prosthetics Today

In some instances, of course, the amputee's general state of

health will rule out prosthetic intervention entirely.

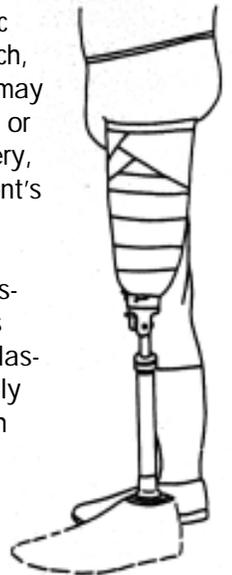
At the conservative end of the spectrum is management of the wound with soft dressings, which can be easily removed for inspection, with delay of pros-

thetic care until complete healing and residual limb maturation have occurred. The amputee is typically discharged home and subsequently referred for outpatient prosthetic care. Under this approach, prosthetic intervention may not begin until the third or fourth month after surgery, by which time the patient's motivation to ambulate may have waned.

The opposite, aggressive, approach involves application of a rigid plaster dressing immediately after amputation, which then serves as the "socket" for an IPOP (immediate post-operative prosthesis).

A pylon and prosthetic foot are attached to the dressing, and the amputee is able to begin partial weight-bearing and progressive gait training a few days after surgery.

Between these extremes are various alternative approaches, which seek to combine the best points of both.



Transfemoral IPOP—rigid dressing, single-axis knee, adjustable pylon and foot.

— About This Issue —

Dear Friends...

Welcome to the Spring 2001 **Hinnant Prosthetics Quarterly**. This issue examines the various options for early prosthetic management of amputee patients, a matter of some debate over the years.

We have attempted to present a balanced approach to this question, considering the surgeon's concern for optimizing wound healing as well as the therapist's and prosthetist's preference for an early return to activity, weight-bearing and ambulation.

This is another of those issues that we believe offers good reading for students and others entering the rehabilitation field, as well as appropriate patients. If you would like additional copies, please call our Charlotte office, 1-704-375-2587

We hope you find this discussion worthwhile and welcome your comments, questions and requests for further information.

— M. Kale Hinnant, C.P., FAAOP



Kale

The IPOP

The immediate post-operative prosthesis is usually a simple, relatively low cost device that gives the patient an immediate reason to begin using his amputated limb. Just the psychological benefits of

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POST-AMPUTATION CARE

(Continued from page 1)

this approach provide ample justification for its use, as the therapeutic objective becomes one of rehabilitation rather than mere recovery from surgery.

The IPOP is intended to be used until the amputation wound has sufficiently healed and staples or sutures have been removed. At that point, the patient is usually ready to transfer to a more substantial preparatory prosthesis.

The key to successful IPOP management is strict limitations on force applied to the wound in early prosthesis use. This restriction applies primarily to weight-bearing in lower-extremity amputees. Unfortunately, improper IPOP utilization has led to various cases of delayed wound healing, and sometimes wound breakdown, with resulting negative reaction from the medical community.

IPOP drawbacks include not being able to inspect the amputation site, and the risk of wound opening and tissue damage from excessive force applied through the prosthesis. With neurological function of the limb severely altered, the new amputee will have abnormal sensory

indication as to how much weight is being applied to the prosthesis.

Despite best intentions and precautions by all concerned, a patient can inadvertently exceed prescribed weight-bearing limitations and damage the wound. One solution to this problem is the addition of a load monitoring system to the IPOP, which will provide an aural and/or visual warning to the patient and therapist if the prescribed load limit is accidentally exceeded.

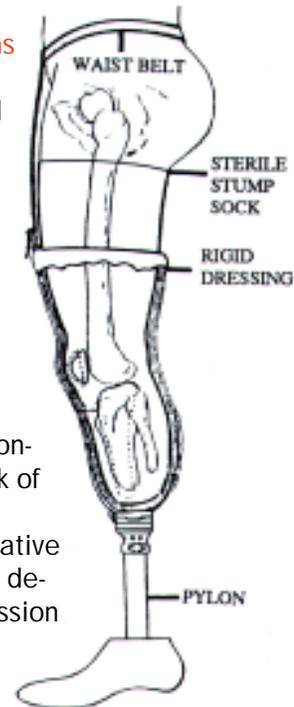
Patient ability to withstand early weight-bearing is individualized, but in general little or no weight should be applied except for prosthetic touchdown for the first day or two. Then, as patient tolerance and indications of satisfactory healing will allow, weight-bearing can gradually be increased. The amount and frequency of increase will vary with the patient; one suggested guideline is to start with 10 percent of patient body weight progressively adding an additional 10 percent every other day.

Third-party reimbursement for post-op prostheses varies widely and appears directly correlated with the providers'

level of knowledge regarding IPOP benefits. All efforts to educate insurers in this regard are important.

Dressing Options

While specific circumstances still occasionally indicate the use of a **soft dressing**, the potential drawbacks of this method with regard to early intervention are well-recognized: reduced edema control, increased risk of contractures, extended post-operative inactivity and the demotivating depression that frequently affects new amputees continuously confined to bed for long periods after surgery.



Transi-tibial amputation rigid dressing and IPOP.

When a soft dressing is considered necessary, shrinker socks or elastic bandages are generally used to help control edema.

A **rigid dressing** enables the clinical team to avoid most of these problems. This dressing is usually constructed of plaster-of-Paris and, if it is to serve as the foundation of an IPOP, will incorporate an attachment strap for the prosthesis. The dressing should provide a therapeutic degree of tissue pressure and a relatively sterile, dry wound environment with no restriction to tissue fluid exchange. A suspension system is provided to prevent the cast from pulling away distally with resulting edema.

The amputee remains in the rigid dressing until the surgeon is ready to inspect the wound—usually 3-7 days post-op. At that time, another rigid cast may be applied or transition to a preparatory socket can be made.

Why Consider an IPOP?

The paybacks for the investment of time and effort in immobilizing and supporting an amputation wound in a rigid-type dressing and providing early prosthetic care with an IPOP are substantial.

Basically, prosthetic ambulation becomes more difficult, less successful and more costly the longer intervention is delayed. Specifically, a rigid dressing and IPOP can offer these advantages:

- Healing is faster and the wound less subject to infection.
- Multiple daily soft dressing changes are avoided.
- The patient is able to begin exercise sooner, reducing risk of contractures.
- The wound is well-protected from moisture, humidity, and potentially irritating chemicals.

- Constant, controlled pressure is applied to the wound, preventing the terminal edema that typically occurs with soft dressings.
- Patient comfort is enhanced, reducing need for analgesics and sedatives.
- The patient does not experience a period of "limblessness" with attendant neurological and psychological ramifications.
- Functional restoration begins almost immediately.
- Residual limb pain is often significantly reduced.
- Established neuromuscular control pathways are more likely to remain functional.
- Time required for limb maturation, hospitalization and overall rehabilitation is substantially decreased.

PTIONS VARIED, IMPROVING

By allowing frequent inspection of the amputation site but retaining the basic benefits of a rigid cast, the **removable rigid dressing (RRD)** offers a nice compromise between the two. The RRD is fabricated of plaster or fiberglass material and suspended by stockinette and supracondylar suspension cuff or sleeve. Residual limb socks are added as necessary to maintain a close fit.

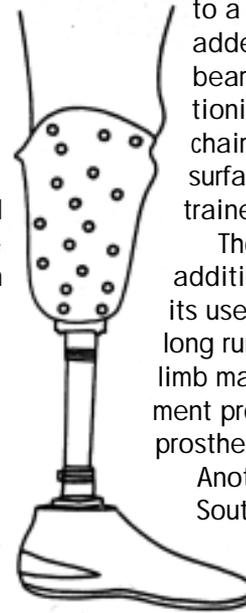
While exercise and weight-bearing can be initiated with the RRD, it is not normally used as the basis for an IPOP. Transition into a preparatory prosthesis is the usual progression.

A fairly recent innovation, the **polyethylene semi-rigid dressing (PSRD)**, has been applied in place of a initial dressing for a transtibial amputation as early as five days post-op...with the staples/sutures still in place. Fabricated from a durable, lightweight thermoplastic, the PSRD offers several advantages over

cast-type dressings: Used in conjunction with a shrinker, it has been shown to provide better edema control than either an RRD or shrinker alone; thus, the amputee is ready for his preparatory prosthesis sooner. Further, residual limb hygiene is improved, because polyethylene is nonporous and can be cleaned daily.

Finally, the PSRD's flexibility improves the new amputee's ability to apply and remove the dressing, which is similar in design to a prosthetic socket. The patient thus gets a head start on prosthetic training—adding prosthetic socks to compensate for residual limb shrinkage, donning and doffing, prosthesis care and hygiene—before transitioning to a preparatory limb.

To keep the PSRD's weight



Preparatory below-knee prosthesis with thermo-plastic patellar tendon-bearing socket

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 the supervision of a trained therapist.

Though the PSRD involves some additional cost, proponents believe its use is more cost-effective in the long run by providing earlier residual limb maturation and fewer management problems with the preparatory prosthesis later.

Another interesting approach, the Southern Illinois Shrinker Socket is in essence a removable IPOP, a custom socket that can be applied in place of the original dressing and attached to a pylon and foot 4-5 days post-op.

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Down to Cases

When 'Early' Intervention Comes Late

At first glance, B.J. would seem an excellent candidate for early prosthetic intervention after his amputation surgery: Young male, 20...vigorous and healthy at the time of his accident...highly motivated to regain his active lifestyle through rehab...and, all other factors aside, a good kid with a lot to live for. Unfortunately, complications ruled out any prosthetic attempt for four months after his initial operation.

In fact, only a heroic effort by B.J.'s clinical team made him a candidate to wear a prosthesis at all—his family was initially told he probably would not survive, much less ever walk again. In emergency surgery after he fell under the wheels of a freight train, the O.R. team saved not only the patient's life but two of his damaged limbs as well. Moreover, they were able to

preserve the knee of his severely damaged left leg and his right arm above the elbow.

The effort to save his knee necessitated substantial skin grafting and a long healing period, which ruled out early attempts at weight-bearing. It was not until four months after B.J.'s accident that his grafts were sufficiently viable to attempt the rigors of wearing a prosthetic socket.

His rehabilitation began with a preparatory below-knee prosthesis accompanied by many hours of therapy. When, despite all precautions, the socket caused abrasions on the residual limb, B.J.'s prosthetist added special abrasion pads to the preparatory socket to protect the grafted skin.

During this time, the prosthetist also fabricated a cable-actuated elbow disarticulation system to restore function to B.J.'s right arm.

Three months after prosthetic referral, B.J. remains highly motivated and is amazing both himself and his family with the progress he has made. He has already become a "community ambulator," and his gait improves daily.

He will soon be ready to turn in his training prosthesis for his definitive system, custom-fabricated to accommodate the active life he is ready to resume. The skin grafts continue to improve, although they will require additional special attention and care in the months ahead.



Preparatory Systems Help Amputees Adjust

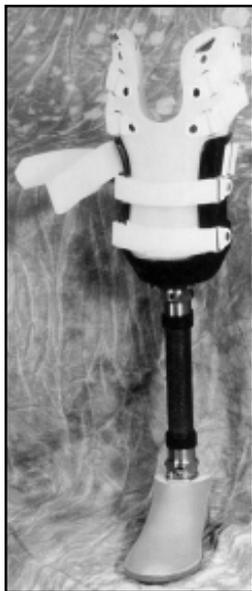
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Preparatory Prosthesis

The IPOP is a special type of a larger classification of interim systems, employed to help patients bridge the gap between surgery and their permanent prosthetic limb. With the gross anatomical changes that occur in the residual limb in the weeks following amputation surgery, a preparatory (or training) prosthesis is frequently supplied to help the new amputee through the adjustment period and begin learning to use a prosthesis gradually.

The socket for this temporary system is custom-fabricated to a positive model of the residual limb and can be adjusted to retain comfort and function as residual limb volume and muscle tone change. An adjustable pylon, foot and (if a transfemoral amputation) knee component complete the system.

The preparatory system enables the new amputee to learn to use and gain confidence in a prosthetic limb long before residual limb volume has stabilized. Limb volume changes are accommodated by a combination of socket adjustments and the addition or subtraction of prosthetic socks as needed. Preparatory



*Southern Illinois
Shrinker Socket*

systems also incorporate an adjustable alignment fixture to apply the periodic alignment corrections that become necessary as the residual limb matures and ambulation proficiency increases.

The timing of preparatory system initiation varies primarily according to surgeon preference and patient condition. The most common milestone is probably completion of primary healing (sutures or staples removed)...normally 10-21 days post-op. Whether the transition to the prosthesis begins sooner or later, our prosthetic staff is prepared to intervene with the appropriate system.

Under typical protocols, the patient remains in the preparatory prosthesis until two objectives are achieved:

- the size, shape and muscle tone of the residual limb have stabilized and
- the patient has attained his or her predicted level of ambulation.

The latter may take some time as the new amputee, assisted by a

physical therapist, essentially has to learn to walk again, and the prosthetist continually refines the socket and alignment for optimal comfort and function. In general, this time frame will range from two to six months.

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

The tools, techniques, technical knowledge, and fabrication abilities are all 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.

Note to Our Readers

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

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