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BY **JILL CULORA**

Advancements in Caring

FOR PELVIC-LEVEL AMPUTATIONS

Technological innovations facilitate better outcomes for this small but growing group of patients

Treating hip disarticulation and transpelvic patients can be an intriguing departure from the routine. But the challenges associated with this amputee population might be daunting to those who aren't fully up-to-date with the latest knowledge and technology.

In the past, hip disarticulation and hemipelvectomy (HDHP) patients represented only 0.5 percent of all lower limb amputations. These days, however, 2.2 percent of all limb amputations among injured soldiers returning from Iraq and Afghanistan are HDHP procedures. And advances in surgical techniques mean pelvic-level amputations are saving the lives of more trauma patients. The recent growth in this small population coincides with some exciting technological advances, especially in the past three years.

HDHP patients face greater challenges than other lower limb amputees for a variety of reasons, many associated with the fact that three weight-bearing joints are lost: the hip, the knee, and the ankle. An amputation at the hip—either as disarticulation, meaning removal of the lower limb at the hip level, or transpelvic, meaning removal of the lower limb plus a portion of the pelvic bone—is more complicated than amputation at the knee or ankle joints because it affects sitting, has a greater impact on balance and weight distribution, and can affect bowel, bladder, and sexual functions.

In addition, controlling a hip disarticulation prosthesis is extremely challenging, as a lower-torso "swing through" motion is physically demanding and takes a lot of practice. Patient discomfort on the load-bearing prosthesis is another serious concern, and it often leads to rejection of the device.

Scott Sabolich, CP, LP

Helix3D - Systematic Fitting

Newer and Better

New developments in materials and components are helping address some of these issues. Among the latest offerings are softer plastics, gel liners that aid in suspension, better hip joints, and smarter and better knees.

"With newer products and newer components, like the new hip joints that are out, we can actually conceive that a hip disarticulation patient can walk downstairs—they can ambulate. It's because of proper fitting techniques mixed with the technology coming out," says Scott Sabolich, CP, LP, owner of Scott Sabolich Prosthetics & Research in Oklahoma City.

The new hip Sabolich is referring to is a Helix3D hip joint system by Otto Bock. It is a polycentric, hydraulically controlled hip joint that provides motion on both the sagittal and transverse planes, allowing it to mimic a normal hip more closely than earlier devices.

"In the old days, hip joint devices only moved in one plane—like a door hinge," he adds. "They were very fragile—they broke, and they were a pain. Even with a C-leg or other computerized knee with it, it still was a very antiquated, hard to walk with prosthesis. Hips don't move on one plane like a door hinge. They move on all planes—like a ball and socket. Even when a person walks, their legs don't go straight forward and straight back, they go in a circumferential, circumductive gait."

The Right Approach

David Rotter, CPO, clinical director of prosthetics for Scheck and Siress, who is based at the University of Illinois, recommends taking different approaches with HDHP patients depending on whether they are new prosthesis users, previous or long-term users, or previous users who have rejected the device in the past but are considering giving it another try.

New users might be at an advantage over previous users, says Rotter. If their insurance will cover the latest technology, they can learn to use the device without having been accustomed to previous components that work differently. The new technology feels very different from traditional hip devices, and, for the highly motivated, it provides the best opportunity to ambulate.

Updating devices for patients who currently wear older, more traditional devices requires a "slow weaning off" process. "If they are a prosthetic wearer, then whatever system they have is what they know, and it's almost like the body and brain are hardwired to make the mechanism work," says Rotter. "So you might want to change one variable at a time—for example, a new socket, then a new hip joint, and knee joint, so that the person can feel the difference and slowly acclimate themselves without being overwhelmed with the different feelings."

With each component change, Rotter starts the patient on the parallel bars and then using a cane so the patient can work out how the mechanism operates before ambulating on their own. "A standard 7E7 hip joint, which is basically just a single hinge, then going to the Helix, which is a polycentric mechanism with a hydraulic, is a very different feeling," Rotter says. "It can be both exciting and disconcerting for the person who is used to a certain type of feeling for the leg underneath them."

Patients who have previously rejected a device might be using crutches or a wheelchair for mobility, allowing them to get around more quickly than they will at first with the new prosthesis. Since they've already experienced disappointment and rejected a device, setting realistic goals is crucial so patients don't have the same experience all over again.

"It's important not to promise someone the moon, even though you have these new and exciting offerings," says Rotter. "I ask them what their goals are to get a sense of their expectations. It might be to go shopping, to stand with peers at social functions—those are all very realistic goals. I use establishing realistic goals as a starting point. If the patient finds he wants to

David Rotter, CPO

use the prosthesis more extensively as he gets more experience, that's great. If not, then there isn't that same feeling of disappointment."

Rotter further recommends establishing realistic goals with any patient. "It's important to preach realism, not just to say that the latest and greatest is going to do all the work," he says. "There is work involved, and for someone who uses a prosthesis at this level of amputation, it is a commitment to do the work."

The Right Fit

Because discomfort on the load-bearing prosthesis is a common reason patients reject devices, obtaining an optimum socket fit is essential, says Mark Edwards, MHPE, CP, director of professional and clinical services at Otto Bock HealthCare in Minneapolis.

"The socket fit has to be intimate in the anterior and posterior dimension so that patients have good control when they do use their pelvis to make the prosthesis move," he says. "There must be no lost motion when they want to make the prosthesis function."

The next issue is the suspension. "If there's no lost motion up and down, then patients will have an easier time clearing the floor in swing phase, so it makes it more efficient to walk, because they do less gait deviations in order to compensate for a prosthesis that's not holding on so well," says Edwards. This is achieved by taking an accurate impression, modifying the cast correctly, and making sure the check socket has been fabricated and assessed properly.

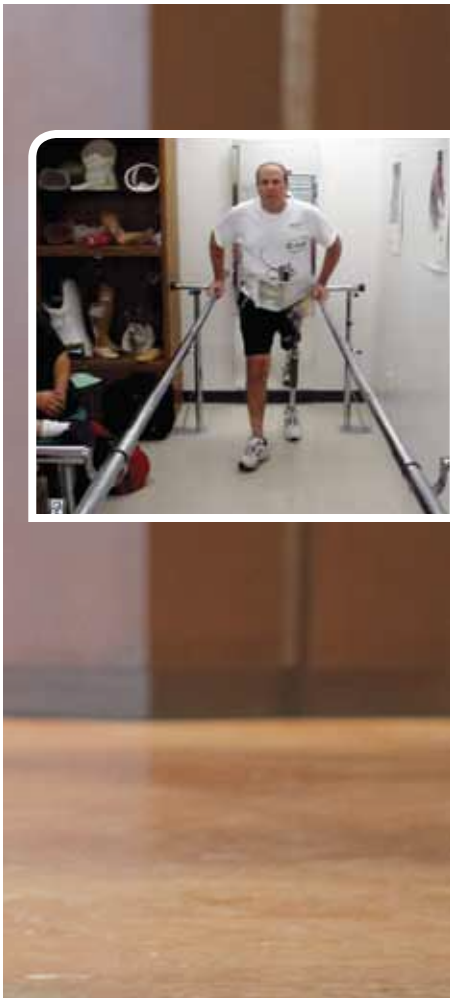
The alignment of the prosthesis is critical because the patient has no control over the prosthesis in stance phase, says Edwards. "There's no lever arm for them to control the prosthesis, so the prosthetist has to align it in such a way that it is stable for walking, but not so stable that it becomes inefficient," he adds.

"It is complicated because you are balancing three joints and everything is a closed kinetic chain, so everything affects everything," says Rotter. "The hip placement affects the knee, the knee affects the foot, and they all affect each other, so it's important that all the phases are working together and efficiently and they are complementary of one another."

Gait Training

Typically, gait training falls under the care of a physical therapist, but as Rotter points out, there are so few HDHP patients that it's unrealistic to expect a physical therapist to know exactly how to gait-train this type of patient. He suggests giving patients strong basic criteria on how to ambulate with the device.

"It's important to know when to cue a person to stand with their shoulders erect, to stand with good posture, and then to initiate the movement to their hip," he says. "I spend a lot of time in the gait-training process with my patients teaching them how to utilize technology—for example, how to best take advantage of all the components that are underneath them. It isn't just automatic. You can't expect someone to intuitively understand—you have to work with the person to give them that very solid foundation on how to optimally activate the prosthesis."



The newest components will provide the best opportunities to ambulate, but this doesn't necessarily mean a patient will be successful because the energy and motivation required often exceeds a person's strength or will. It is estimated that a hip disarticulation amputee needs to use 200 percent more energy to ambulate than an able-bodied person.

"It's untenable to use 200 percent more energy with each step, and, in reality, they don't use that," Rotter says. "What they do is auto-regulate the energy they are expending by slowing their speed down. So someone with a hip disarticulation prosthesis will tend to walk a little slower so that they are not expending that level of energy. There's also technique: Someone who has been using the device for a long time knows how to use it in the most efficient way that they can. As they go through their gait cycle, they know exactly when to move their pelvis with the least amount of effort."

For some, the effort is not worth the reward, Rotter says. "There are people who just say, 'I'm not going to bother with this, it's easier to use crutches or a chair.' And then there are people who have the motivation and say, 'This is important to me, and I'm going to do this.' More than anything else, it is the motivated person that stands the best chance of success."

Physical Conditioning

HDHP patients considering a prosthesis or those who have a newly acquired one need to work on their physical conditioning, especially their core strength—stomach and back muscles—and their posture.

"It's the muscles that aren't normally used in walking. They need to focus in on those core muscles to provide them with the strength in order to function with the prosthesis correctly," says Edwards. "They need to be able to stand up nice and tall in the prosthesis and use their stomach muscles to propel that prosthesis forward, and that is an aspect that a lot of individuals never master very well because they either don't get enough physical therapy or training, or they just don't spend the time to focus on those muscles to get them good at doing the things they need to do to ambulate correctly."

Assistive devices such as crutches or canes are often used to help with balance either as a temporary or a permanent measure. "The better balance the patient has, the less reliance they will need on assistive devices," Edwards says. "Any time you can take something out of a person's hand and keep their hands free for walking and doing other things, then you've freed them up to walk better, have more confidence, more balance, and they can do activities in daily living better."

Some patients do need that help, however. "Some people just don't have the balance because of other medical complications, or they just aren't trained enough to get their balance because they never shift their weight onto the prosthesis enough," Edwards says. And, he adds, others simply feel more stable using crutches or a cane.

The HDHP population is a small one, and it could be the case that a practitioner goes a few years between seeing such patients. Many advances could have been made in the intervening years, so to get the best patient outcome, practitioners should brush up on the basic principles, review fitting procedures, and contact manufacturers and fabrication services to seek the most up-to-date product and component options.

"If this is your first patient and you know someone you can get advice from, then do so—there's no shame in that," says Rotter. "Everyone is going to benefit—most importantly of all, the patient." O&P

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