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O & P OPTIONS

Upper Limb Replacement

by George Wiley

O & P practitioners discuss limb replacement, treatment, and reimbursement for hand and arm patients.

⌈Some people would like an arm just like the one they lost,■ says John N. Billock, CPO, clinical director at the Orthotics and Prosthetics Engineering Centre in Warren, Ohio. ⌈They expect to get the 'bionic▒ devices we see on television. It is just not possible.■

Jack E. Uellendahl, CPO, a bilateral upper limb specialist at the Rehabilitation Institute of Chicago, tells patients not to expect too much from the replacement upper limbs they are receiving. ⌈A prosthesis cannot replace the function of a hand,■ he says. ⌈It is not an artificial hand. It is a tool that might look a lot like a hand.■

Prosthetists who specialize in upper limb replacement tend to have lengthy wish lists. They face frustrations rarely encountered by colleagues who specialize in lower limb replacement. And they are hampered by not only the technical hurdles of replacing the more intricate upper limbs but the fact that they are working with a much smaller patient base, which acts as a financial disincentive for manufacturers to develop high-technology upper limb assistive devices.

John M. Miguelez, CP, owner of Advanced Arm Dynamics Inc, in Rolling Hills Estates, Calif, is a traveling consultant on upper limb replacement who estimates that he sees more than 1,000 patients per year. He has compiled national data on upper limb loss and the usage of replacement limbs. ⌈There are [in the United States] about 10,000 new upper limb amputees per year,■ he says. ⌈Of those, only half get fitted with a prosthesis, and of those who get fitted only about half are still using their replacement limb at the end of a year. So only about one-fourth of those who could use a prosthesis are actually wearing one.■

Myoelectrics

Miguelez, Uellendahl, and Billock agree that the state-of-the-art upper limbs have myoelectric controls. Myoelectric devices include artificial hands, wrists, and elbows that use electromagnetic (EMG) signals from muscles in the patient▒s residual limb to activate sensors built into the socket of the replacement limb. By learning how to use the flexor and extensor muscles in their residual limb, patients can achieve a fairly natural-looking opening and closing of the artificial hand because they are using muscle movements to control the device similar to those they would use to maneuver a real hand.

Myoelectric limbs can be suspended from the residuum in several ways. The most common method of attachment is vacuum suspension in which the residual limb is inserted into a tightly fitting socket while a valve is left open to let air escape. When the residual limb is inside the socket, the valve is closed, and this creates a vacuum that holds the prosthesis in place. Vacuum suspension for a below-elbow amputee is strong. Another, more recent suspension method utilizes gel liners that fit tightly over the residuum and lock in place by means of a snap-in pin in the tip of the liner that clips into a slot in the socket of the replacement limb. ⌈It makes for a tight-fitting socket, and it is very comfortable,■ says Peter Stasica, CP, of Fairview Orthopedic Laboratories in St Paul, Minn. ⌈They work well. They work better than a harnessing system.■

Myoelectrically controlled limbs range from hands to electric wrists and elbows and even include whole arms that attach at the shoulder. Some hands now have built-in slip-control monitors that can increase the grip strength on a glass or other object when the microprocessor built into the limb detects slippage. Because the sensors that control movement are located inside the socket, myoelectric replacement limbs can be covered with reasonably lifelike skins of silicone or polyvinyl chloride (PVC). This cosmesis has made the myoelectric devices particularly popular with female upper limb amputees. But myoelectric devices do have their drawbacks, one of which is that they are expensive. According to Stasica, below-elbow myoelectric devices can cost from $8,000 to $11,000, and above-elbow devices from $10,000 to $40,000.

A Practical Approach

Kim Doolan, clinical coordinator for Allen Orthotics and Prosthetics in Midland, Tex, not only works in O&P, she is also a patient. Born with no right arm below the elbow and with only the heels of her feet, Doolan uses both upper and lower limb prostheses. Yet, she drives a car and is an avid weekend hiker. Doolan is also a member of the board of directors of the Barr Foundation, a national group that funds replacement limbs for patients who could not otherwise afford them. As a lifelong user of prostheses and an activist in O&P, Doolan says she has had more opportunities than most patients to try the latest technologies. Like many amputees, she opts for the simple approach. She wears a cable-driven arm with a hook hand while working and utilizes a passive hand that appears almost identical to her real hand at social events. The passive hand plays only a cosmetic role. Around the house, she mostly forgoes a replacement upper limb altogether.

Doolan says myoelectric devices are too heavy for her to use. Although a myoelectric below-elbow arm weighs only about 1 lb, that is twice as much as her cable-driven system. She did not like the suction suspension system either. ⌈I did not like the feel of it against my skin,■ she says.

Stasica frequently finds himself fitting patients with mechanically driven cable and hook arms even though the technology could be construed as old-fashioned. Most of his customers in the Midwest are men who have lost an arm in a farm accident. They cannot use a myoelectric device because they work in areas where dust builds up that would disrupt the sensitive EMG sensors. ⌈Farmers do not want all the gadgets. They want something they can put on and function with. They still want that old locking elbow, which is a lot sturdier and more stable,■ Stasica says.

Hybrid Designs

Many upper limb patients are fitted with what Billock calls ⌈hybrid prostheses,■ usually consisting of a myoelectric wrist and hand coupled with a mechanical elbow. One reason for this, says Billock, is that electric elbows cannot support much weight. Recent advances in the design of counterbalancing units to reduce the force needed to flex a mechanical elbow with a shoulder harness also make the mechanical devices attractive. ⌈I am not an advocate of electric elbows unless absolutely necessary,■ Billock says.

Patients that have lost both arms are also candidates for hybrid prostheses. Uellendahl says that a bilateral patient might be fitted with one myoelectric arm and one mechanically driven arm. The electric limb is used because two harnessing systems (which would be required if both arms were mechanically driven) would tend to get in the way of one another and be difficult for the patient to control. And the mechanical limb gives the patient better feedback on position, speed, and force of movement than two myoelectric devices. ⌈It is necessary to provide a variety of tools so the patient can perform a wider range of tasks,■ Uellendahl says.

Training

It is critical that patients are trained to use the prescribed limb replacement devices. Early fitting is key in both congenital and traumatic cases. If patients are left without an upper limb for too long, they adapt to having only one arm and become quickly exasperated with and tend to reject whatever replacement device they do receive. Billock estimates the rate of rejection for mechanical limbs is as high as 60%, and for myoelectric devices about 25%. To counteract this rejection, congenitally limb-deficient children are now being fitted with passive limbs at 3 months of age. According to Miguelez, upper-limb specialists are also turning to the technique called IPOP (Immediate Post-Operative Prosthesis), which was pioneered by lower limb prosthetists, and is getting good results. With IPOP, patients wake up from surgery wearing temporary replacement arms. ⌈The patients are thrilled,■ Miguelez says. ⌈They never learn to be one-handed, so you don▒ have to reprogram them to be two-handed again.■

Carolina Bulow, PT, who is a member of a rehabilitation and therapy team put together by Stasica▒s clinic in St Paul, says half the battle with patients is getting them to accept their limb loss. After that, the other half is training them to use their replacement limbs. ⌈If you leave them untrained, they build up bad habits,■ says Bulow, who is herself a lower limb amputee.

Surgical Input

One of the frustrations frequently expressed by upper limb prosthetists is that orthopedic surgeons rarely consult them before amputations are performed. They recognize that with trauma cases where a patient▒s life may be at stake, the surgeon has no time to consult with a prosthetist about the best amputation site, but they point out that surgical decisions do often determine what sort of device can be prescribed. Although the principle of leaving limbs as long as possible is generally agreed upon, there are situations where having a shorter residuum would benefit the patient. For example, using myoelectric limbs, which contain a wealth of microprocessor hardware, might produce a replacement arm that is longer than the patient▒s natural arm. There are also cases where elbow disarticulation surgery is preferred to below-elbow surgery if the residuum below the elbow is only a few centimeters in length, making limb attachment impossible. ⌈The likelihood of teamwork with the surgeon depends on how the treatment center is structured,■ Uellendahl says. ⌈If O&P is offered, there is more likely to be input, but that is quite rare.■

Reimbursement

⌈These managed health care companies are just strangling my profession and its ability to provide a high level of care for our nation▒s amputees,■ Billock says. ⌈There are so many L-codes. For the upper limb there are probably 40 to 50 codes that apply. There is a code for the myoelectric device, a code for the suspension system, a code for the glove, for the battery, for the battery charger. It is a very complex system.■

Kathleen Fike, administrative director of Billock▒s Ohio facility, calls getting reimbursed ⌈a difficult mountain to climb.■

She says health carriers will often fund, or attempt to fund, only one prosthetic device per lifetime per patient, a ridiculous circumstance in the case of a child with congenital limb loss and a growing body. Even full-grown adults wear out prostheses every 5 to 6 years and need replacements, Fike adds.

Miguelez makes handling reimbursement part of the service he offers the O&P providers he contracts with. ⌈We try to create a case that the insurance carrier cannot deny,■ he says. ⌈We detail the patient▒s life, the activities of daily living, and then add the medical reason why the prosthesis will solve the patient▒s need.■ Miguelez says that keeping meticulous records showing the insurance carrier why each item of funding is needed and ⌈making the reimbursement agency a partner with the prosthetics provider■ have helped him achieve a low rate of turndown. ⌈But you have to be a little tenacious, too.■

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