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Marilyn Tinsley, a trilateral amputee and prosthetic user, works with occupational therapist Tiffany Ryan, MOT, OTR, CSCS. Marilyn is able to pursue her love of gardening thanks to her two upper-extremity prosthetic devices.

Specialized, comprehensive therapy maximizes outcomes for individuals with upper-limb loss

By Tiffany Ryan, MOT, OTR, CSCS

PEAK PROSTHETIC PERFORMANCE

People with upper-limb amputation or congenital upper-limb difference face challenges specific to their diagnosis and level of limb loss. These include functional limitations, psychosocial concerns and physical problems, all of which are further complicated by a lack of knowledge about or access to the specialized care that could help them the most. The complex array of needs for this patient population calls for specialized prosthetic and therapeutic intervention in order to achieve a maximum level of rehabilitation.

According to the Bureau of Labor Statistics, thousands of prosthetists and hundreds of thousands of occupational therapists

work in the U.S.; however, a small percentage focus on upper-limb loss patients. The National Center for Health Statistics estimates about 185,000 amputations occur annually, with over 90 percent involving a lower limb. Less than 18,500 people a year experience upper limb loss, resulting in a small patient population with a high level of specialized medical and therapeutic needs.

Comprehensive Rehabilitation

Comprehensive upper-limb prosthetic rehabilitation encompasses therapeutic training, coordination of community assimilation resources, integration of prosthesis training with general rehabilitation services, and collaborative management of case-management services.

Rehabilitation is overseen and/or provided by occupational or physical therapists

with advanced training and expertise. Because this is such a specialized niche, most higher-education programs do not emphasize comprehensive upper limb prosthetic therapy. Therefore, therapists treating this population must receive extended training on the job as well as with manufacturers of advanced prosthetic components to become competent in meeting patient needs.

Prosthetic rehabilitation and training is divided into three stages: pre-prosthetic, interim and advanced. Specialized therapeutic services are provided during all three stages. Initially, coordination of prosthetic rehabilitation is time intensive. Patients prepare their limbs to wear prostheses and then learn to incorporate the use of the prostheses to help them return to higher levels of functional independence.

After pre-prosthetic and initial training, ongoing rehabilitation coordination services continue to ensure patients can effectively utilize their prostheses in any aspect of their lives. Therapists may visit a patient's home to assess and improve adaptive features that can make activities of daily living much easier. As the individual becomes more advanced in his prosthetic use, therapists may also suggest adaptations to the patient's vocational environment or his approach to various vocational tasks. Recreational activities and/or functional goals are always discussed, and again, the therapist works alongside the prosthetist to meet the patient's needs and expectations. Often, the prosthetist fabricates activity-specific prostheses or adaptive devices the patient can wear to engage in activities such as swimming, golf, cooking and rock climbing.

Some patients experience frustration, depression and a tendency toward social isolation. One helpful strategy is to follow expedited prosthetic-fitting protocols that include concurrent occupational therapy in order to reduce the length of time a patient goes without wearing a prosthesis. Patients with unilateral amputation who spend months without a prosthesis often adapt to living with one hand, then face increased frustration when they attempt to integrate a prosthesis into their daily routines. Patients with bilateral amputations who spend months



Army Sgt. Ramon Padilla (RET) golfs with the help of an activity-specific prosthesis.

without prostheses may develop adaptive behaviors utilizing the residual limbs and may become quite dependent on the assistance of others. Even with expedited fitting protocols, patients with residual limb issues like scar tissue, neuromas or comorbid conditions may be forced to spend extended periods of time without prostheses.

A Long Road Back

Carlos never imagined he'd have an occupational therapist pitching him softballs or telling him—a bass tournament fisherman—how to refine his technique for tying fishing lures. He also never imagined his hand would get caught between two massive rollers at the paper mill where he worked and that the injury would be so severe it would require amputation.

Prior to his accident in 2009, Carlos worked out five days a week and ran three miles a day. He went salsa dancing, had an active social life, loved bass fishing and worked a fulltime job. In the wake of his amputation all of those things disappeared, leaving him depressed and feeling like he had no future.

Carlos came to Advanced Arm Dynamics (AAD), a provider specializing exclusively in upper limb prosthetic rehabilitation, for his initial evaluation. It was determined

that a neuroma in the residual limb was preventing him from moving forward with rehabilitation. Revision surgery was recommended, further delaying his progress and preventing him from wearing a prosthesis.

Once he was able to begin preparing his limb for a prosthesis and was no longer battling constant pain from the neuroma, Carlos began to think he could reclaim some of his life. Wearing a prosthesis with a cosmetic glove was an important milestone that gave him the confidence to slowly start going out in public again. With the help of his occupational therapist he began setting rehabilitation goals: preparing food, driving, changing his infant son's diapers, doing his own laundry and folding his clothes.

"Getting a prosthesis has been a good thing for me," said Carlos. "It has definitely enhanced my life... For me it just helps aesthetically. I don't like to go out in public without a prosthesis."

Over the past six months, Carlos' activity level and confidence have increased significantly and he has been able to use his prosthesis to fish and play softball. In June, after almost three years of unemployment, Carlos found a job. He still has some issues with phantom limb pain, but finds that therapeutic exercises and actively using his prosthesis reduce the pain significantly.

Redefining Independence

Limb loss related to vascular compromise can be particularly agonizing because, over time, the vascular disorder can lead to the loss of more than one limb, slowly stealing away pieces of a person's body. This forces the patient into a repetitive and prolonged state of medical and rehabilitative intervention. Marilyn Tinsley knows this scenario all too well. Although her limb loss began with the fingers of one hand, it continued over time, resulting in the loss of both hands and a portion of her left leg.

Without prosthetic rehabilitation services, bilateral upper-limb amputees can become very dependent on the assistance of others for their most basic needs including eating, personal hygiene and toileting. Marilyn initially lost one hand and underwent prosthetic fitting, training and rehabilitation ►►

before the loss of her other hand. Not only did this help her from a functional standpoint, it also gave her a clear frame of reference for what to expect in the second round of upper-limb prosthetic rehabilitation.

Marilyn's rehabilitation has been complicated by skin allergies and fragility on both upper residual limbs. The prosthetic interface, which is in direct contact with the surface of the residual limb, is fabricated from thermoplastics. This material proved to be an irritant and discouraged her from wearing her prostheses. The solution was to create custom rolled silicone liners that fit precisely over the residual limbs, adding a protective layer between the sensitive skin and the prosthetic interface. The silicone provides cushioning and does not trigger an allergic reaction. The complications Marilyn experienced have delayed the fitting of her final, definitive prostheses and she is cur-

rently wearing preparatory prostheses. This has allowed her prosthetist and therapist a longer period of time for testing and modifying the interface and overall design, which will improve her comfort and function when she receives her final prostheses.

An avid gardener, Marilyn gives her preparatory prostheses a real workout and wears both when planting flowers, pulling weeds or mowing the yard. Around the house, she tends to wear only the left prosthesis and relies on its grip to assist her with cooking, housecleaning and vacuuming. She enjoys spending time with her grandchildren and takes care of her four-year-old grandson, Jordan, most weekdays. When it comes to personal care like shaving her legs and applying makeup, Marilyn's therapist introduced her to assistive cuffs that slip over the residual limb and can securely hold a razor, makeup brush or toothbrush.

Better Outcomes

Individuals with upper-limb loss are a small patient population who need highly specialized therapy and prosthetic rehabilitation. How quickly a patient progresses through the rehabilitation process is variable and depends on numerous factors that influence each person's recovery. Specialized therapeutic services focusing exclusively on upper-limb prosthetic rehabilitation can help individuals with upper-limb loss return to more active and independent lifestyles. ■

Tiffany Ryan, MOT, OTR/L, is the national director of therapeutic service for Advanced Arm Dynamics. She supervises a nationwide team of therapists at five Centers of Excellence, integrating therapeutic services into each patient's prosthetic rehabilitation process. She has 15 years of professional experience.