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VA/NIH Prosthetics Roundtable
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Presentation highlights: Patient perspectives

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BIOGRAPHICAL INFORMATION

Dr. Czerniecki is Associate Director of the VA Center of Excellence in Limb Loss Prevention and Prosthetic Engineering at the VA Puget Sound Healthcare System, and the Director of Amputee Rehabilitation. He is also Associate Professor in the Department of Rehabilitation Medicine at the University of Washington. After receiving his MD from the University of British Columbia, Vancouver, and interning in General Internal Medicine, he completed a residency in Rehabilitation Medicine at the University of Washington, where he continues his academic career.

His current research interests are in the area of amputee rehabilitation and prosthetic engineering. Projects he is involved with include:

- the investigation of pain as a secondary disability in amputation,
- the role of social support in amputee outcome,
- the effect of intelligent prosthetic knees on amputee outcome, and
- the effect of impact absorbing pylons on amputee outcome.

He and colleagues are currently evaluating novel approaches to adaptive foot ankle components in lower-limb prosthetics.

PRESENTATION

To explore service delivery to the prosthetics user requires examination of their issues of concern and the posing of basic questions. Does “comfort” mean the same to a clinician and a patient? What primary and secondary disabilities are most troublesome for amputees? What factors limit the participation of amputees in sports?

Focusing on user comfort as the primary goal in designing and fitting prostheses, recent research by Marcia Legro identified comfort—along with the avoidance of injury to the residual limb, because of an ill-fitting socket—as the chief concern of amputees. A recent study by Robert Gailey, of the University of Miami, also identified comfort as the leading concern among 1,200 amputees. A 1980 study by B. Kegel ranked discomfort and mechanical skin injury as the top obstacles to sports participation among amputees. These were even ranked above fatigue and the inability to walk distances or to run.

Clinicians often site socket fit as the single biggest comfort problem for prosthesis wearers. If a socket is ill-fitting, a patient cannot live with it. Some sockets developed in the 1940s and 1950s continue to be fitted, and prosthetists may still be taught how to fit sockets using a 40-year-old manual. Conceivably, sockets could be designed to adapt to changes in the volume of the residual limb, a property that would help reduce discomfort and skin injury.

Lower back pain and arthritis of the knee are secondary disabilities that pose serious problems for large percentages of amputees and can lead to significant loss of function. Various studies show that as many as three-quarters of lower-limb amputees suffer lower back pain. In a recent paper, back pain was suggested to be surprisingly common in persons with lower-limb amputations and, for some who experience it, may greatly interfere with function.

Given these patient-derived findings, the top three priorities for prosthetics research appear to be enhancement of comfort, enhancement of biomechanical function, and prevention of secondary disability.

When exploring the exact nature of what "comfort" means to prosthesis wearers, comfort is seen to be the integration of physical and psychological elements. It is not simply the loading of the residual limb, and it is not merely the absence of pain. Additional factors in comfort may also be attitude and expectations. Amputees approaching a prosthesis may have expectations that influence their perception and sensation of comfort. Comfort is a positive psychological state. Measures of comfort should include not only pain and fatigue but also the perception of exertion and cognitive interference.

Research underway at the Puget Sound VA is evaluating the existing prosthetics systems that incorporate "adaptive control." The long-range goal is to build artificial limbs that can adapt to widely varying conditions.

Prosthetic limbs are tools that, if designed for specific tasks, are relatively easy to create. However, the variety of everyday tasks requires the design of complex tools. A 250-pound basketball player requires a prosthesis designed for playing the game; that same component would be too stiff for normal walking on a level surface. Multitasking ability and the adaptive control it requires are essential.

KEY POINTS

- Comfort and biomechanical function are the two priorities for prosthetic design and fitting.
- To achieve these two aims, prosthetic limbs must incorporate "adaptive control."
- Comfort should be considered in a broad framework, not merely as the absence of pain.

REFERENCE INFORMATION

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Web Site

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[University of Washington Biorobotics Laboratory; McKibben artificial muscles]