

## Beyond componentry: How principles of motor learning can enhance locomotor rehabilitation of individuals with lower limb loss—A review

Andrew Sawers, CPO, PhD, et al.

The physical rehabilitation of individuals with lower limb loss has typically focused on the design and function of the patient's prosthesis rather than on how he or she should be taught to use it. Little attention has been given to the use of well-established motor learning strategies during the physical rehabilitation of individuals with lower limb loss. This article reviews these motor learning strategies and suggests ways in which they can be used during physical rehabilitation to improve the mobility of individuals with lower limb loss. Additional research is necessary to understand how these motor learning strategies should be combined and used during rehabilitation.

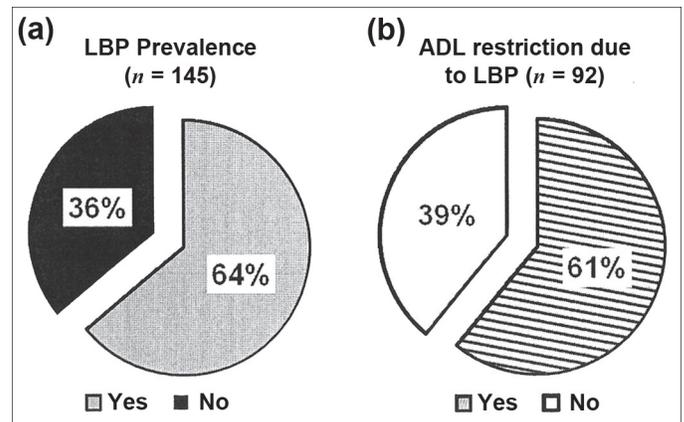
## Traumatic amputation: Psychosocial adjustment of six Army women to loss of one or more limbs

Janet K. Cater, PhD, CRC

This is an interview research study with six female U.S. Army/Army National Guard veterans. It briefly describes their journey of adaptation to the traumatic amputation of one or more limbs, with five losing limbs in combat. They reported that physical adjustment, personal safety fears, body image issues, grief, and loss were issues they struggled with after limb loss. Social support, recovery in a military culture, a sense of humor, personal courage, a positive attitude, resiliency, and the belief this loss had meaning were key to their adaptation to life with limb loss.

## Physical activity and lower-back pain in persons with traumatic transfemoral amputation: A national cross-sectional survey

Hemakumar Devan, MPhy, et al.



Lower-back pain (LBP) is often experienced in persons following leg amputation. In this New Zealand-based study, we aimed to (1) determine the prevalence of LBP in persons with above-knee amputation caused by trauma and (2) explore whether LBP in this population is linked to levels of physical activity (PA). Our study identified a high prevalence of LBP in the New Zealand population with above-knee amputation and no link between PA and LBP. However, the presence of moderate to high PA levels in two-thirds of persons with LBP indicates the pain coping strategies adopted by this population.

## Preliminary investigation of residual-limb fluid volume changes within one day

Joan E. Sanders, PhD, et al.

We used a technique called bioimpedance analysis to test how quickly fluid volumes inside residual limbs changed while people wore their prosthesis. We tested 12 people with transtibial amputation in two test sessions in 1 day. Our results showed that the rate of fluid volume loss within test sessions of sitting, standing,

and walking activities tended to be greater than that between sessions. This difference was greater for people who had peripheral arterial complications. Other factors that may influence within-day fluid volume change include being female, time since amputation, and not taking the socket off for extended periods.

### Revisiting risks associated with mortality following initial transtibial or transfemoral amputation

Barbara E. Bates, MD, MBA, et al.

This study's objective was to determine how treatment-, environmental-, and facility-level characteristics contribute to mortality prediction following a lower-limb amputation. It included 4,153 Veterans who underwent an amputation in Department of Veterans Affairs facilities during fiscal years 2003 and 2004. Older age, higher amputation level, and more comorbidities increased the risk of mortality. Patients hospitalized in the Midwest were less likely to die early after discharge than those in the Mountain Pacific region, but the difference became insignificant by 90 days. Improving a mortality risk model will be helpful to clinicians caring for Veterans. Adding treatment-, environmental-, and facility-level characteristics contributed additional information to a mortality risk model.

### Prosthetic fitting, use, and satisfaction following lower-limb amputation: A prospective study

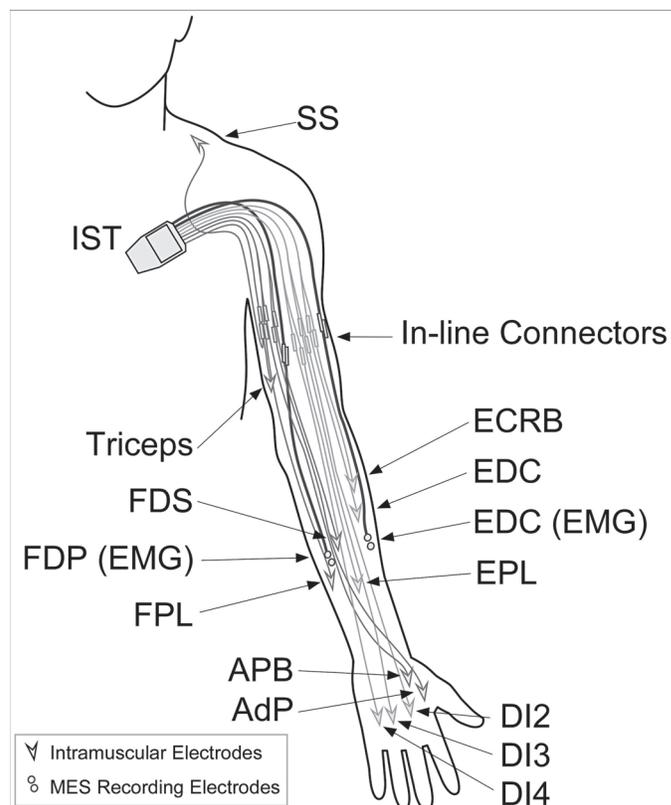
Joseph B. Webster, MD, et al.

One of the main goals of rehabilitation following lower-limb amputation is the successful use of a prosthesis to walk and perform activities of daily living. Satisfaction with the function and appearance of the prosthesis is also important. This study found that persons with transfemoral (above-knee) amputations were less likely to achieve prosthetic fitting success by 1 year following a first major lower-limb amputation. Transfemoral amputation, increased age, major depression, and history of dialysis were also associated with

less walking with a prosthesis at 1 year. Persons who achieved prosthetic fitting were overall satisfied with their prosthesis.

### Implanted neuroprosthesis for assisting arm and hand function after stroke: A case study

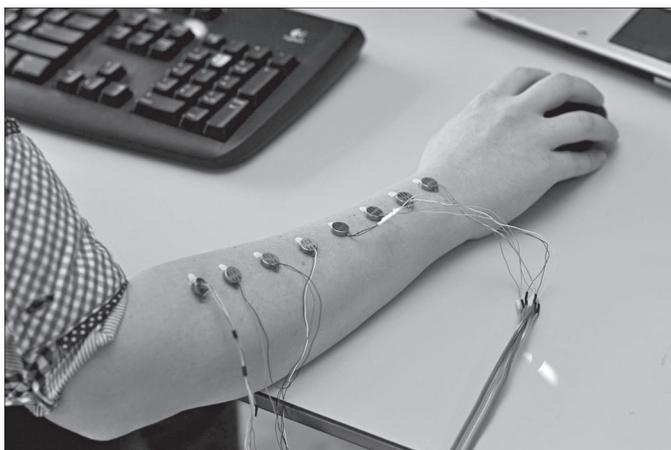
Jayme S. Knutson, PhD, et al.



Loss of arm and hand movement is common after stroke, and recovery is often incomplete. By activating the muscles with electrical current, useful arm and hand movements can be produced. An implanted electrical stimulation system (called a neuroprosthesis) may be an effective permanent assistive device to enable stroke patients to move and use their weak arm and hand again for daily tasks. This study presents the first stroke survivor to receive an implanted stimulator with the capability of activating 12 muscles for assisting arm and hand function. The participant experienced gains on several measures of arm and hand movement and function, but the improvement was limited by muscle tone and fatigue.

### **Hand-opening feedback for myoelectric forearm prostheses: Performance in virtual grasping tasks influenced by different levels of distraction**

Heidi J. B. Witteveen, MSc, et al.



Today's myoelectric forearm prostheses do not return any information about the level of hand opening back to the prosthesis user. However, this information is required to optimally control the prosthesis and helps the user avoid continuously watching the prosthesis. We have developed a method to give feedback about the level of hand opening by using an array of small vibrating motors. Furthermore, we found that it is possible for subjects to successfully use this hand-opening feedback while performing another distractive task. Therefore, this feedback method will improve the controllability of a forearm prosthesis in daily life.

### **Effect of velocity on shoulder muscle recruitment patterns during wheelchair propulsion in nondisabled individuals: Pilot study**

Liping Qi, PhD, et al.

Veterans with spinal cord injury or amputation often rely on manual wheelchairs for independent mobility over several decades. As a result, the joints and soft tissues of the upper limb (hand, arm, and shoulder) are repeatedly loaded as the manual wheelchair user goes about activities of everyday life. We used electromyography and kinematics to determine the influence of propulsion speed on the recruitment of shoulder mus-

cles and fast and slow motor units during wheelchair propulsion. The results suggest that different muscle activation strategies occurred for different propulsion speeds.

### **Exercise intensity of robot-assisted walking versus overground walking in nonambulatory stroke patients**

Michiel P. M. van Nunen, MSc, et al.

Robot-assisted treadmill training has a potential for longer training activity than conventional overground therapy. We investigated whether exercise intensity during robot-assisted walking was within recommended levels for aerobic training and systematically studied whether the settings of the robotic device had an influence on exercise intensity. Results show that for severely disabled patients with stroke, exercise intensity during robot-assisted walking was below recommended levels and lower than during overground walking. Furthermore, within a certain range, exercise intensity was not affected by device settings. Therefore, within the range of settings used in this study, robot-assisted training seems not to be a useful tool for aerobic training.

### **Feasibility of computerized brain plasticity-based cognitive training after traumatic brain injury**

Matthew S. Lebowitz, AB, et al.

This study tested whether adults with a history of traumatic brain injury (TBI) could use a computer program designed to improve mental speed and attention. The program uses training exercises for the brain. The study showed that participants with TBI were able to use the program independently in their homes. Some participants reported fatigue when using the program, but the fatigue decreased over time. Some participants also reported that their mental functioning improved. The program studied may be a viable option for veterans with TBIs, but further research is necessary to find out whether the program actually improves mental speed and attention.

**Effectiveness of adjustable dorsiflexion night splint  
in combination with accommodative foot orthosis on  
plantar fasciitis**

Winson C. C. Lee, PhD, et al.



Plantar fasciitis commonly occurs in older people. Successful orthotic treatments can avoid more invasive approaches like steroid injection. However, orthotic treatments are not always successful. This study suggests that using foot orthoses with adjustable dorsiflexion night splints is more effective than foot orthoses alone in relieving foot pain in plantar fasciitis.