

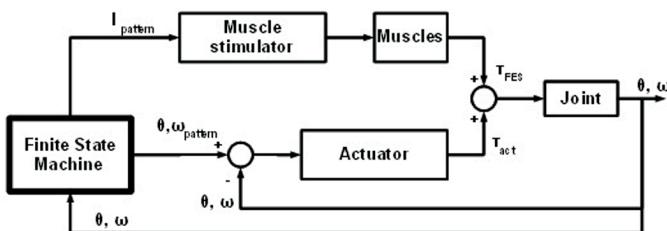
## Effects of robot-assisted therapy on stroke rehabilitation in upper limbs: Systematic review and meta-analysis of the literature

Nahid Norouzi-Gheidari, MSc, OT, et al.

We systematically reviewed and analyzed the literature to find studies that used robotic devices in upper-limb rehabilitation of people with stroke. We found that when the duration/intensity of conventional therapy is matched with that of robot-assisted therapy, no difference exists between *intensive* conventional therapy and robot therapy groups in terms of motor recovery, activities of daily living, strength, and motor control. However, depending on the stage of recovery, extra sessions of robot-assisted therapy in addition to conventional therapy are more beneficial than regular therapy alone in motor recovery of the shoulder and elbow of patients with stroke. This review provides researchers a summary of how robotics therapies and technologies can help stroke survivors regain movement of their arms and hands and will help guide researchers and policy makers about the future direction of research in this field.

## Review of hybrid exoskeletons to restore gait following spinal cord injury

Antonio J. del-Ama, Eng MSc, et al.

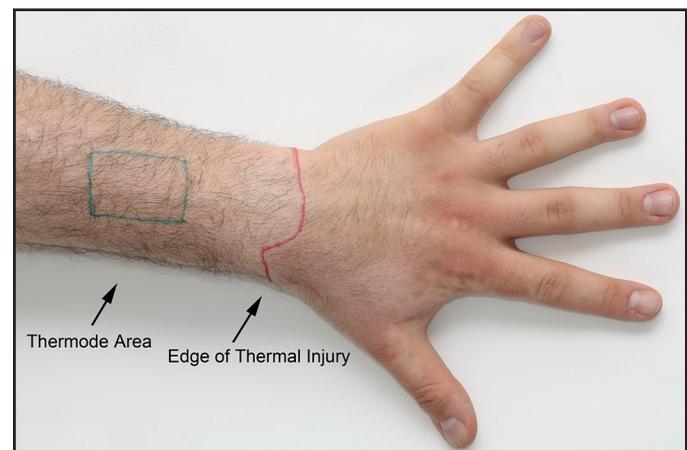


Losing the ability to walk is one of the most disabling impairments after a spinal cord injury. Among the technologies developed to recover walking ability, stimulating the person's own muscles or using active orthoses (also called robotic exoskeletons) are promising areas in

which research and development are being done. While several drawbacks hamper widespread use of each technology, combining the technologies can overcome the disadvantages of each. One such combined system is the hybrid exoskeleton (or hybrid orthosis). We review the hybrid exoskeletons developed to restore walking ability, present recent developments in the field, and identify areas in which more research is need.

## Extraterritorial temperature pain threshold abnormalities in subjects with healed thermal injury

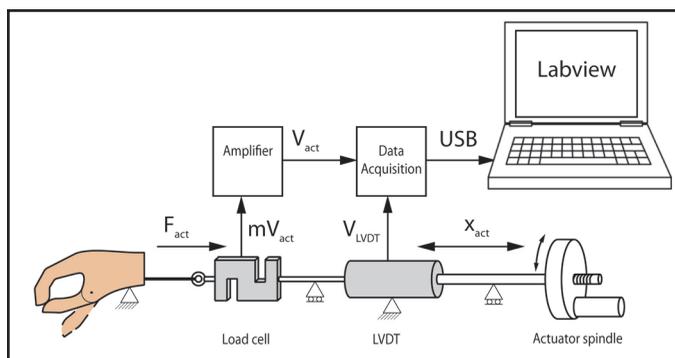
Tanya Z. Fischer, MD, PhD; Stephen G. Waxman, MD, PhD



Approximately 1.25 million individuals annually sustain burn injuries in the United States. Pain is frequent in patients with burn injuries and often does not respond to medication. We report results from 5 subjects who were burned on their limb(s) 8 weeks to 11 years previously. These subjects demonstrate reduced pain threshold to temperature outside the burn injury zone. These results complement data from animal models that demonstrate that pain can develop in locations outside of the region of a burn injury as a result of changes within the spinal cord and suggest that central mechanisms contribute to pain after burn injury.

### Efficiency of voluntary opening hand and hook prosthetic devices: 24 years of development?

Gerwin Smit, MSc, et al.



We mechanically tested nine voluntary opening (VO) upper-limb prostheses, four hooks and five hands. The first goal was to objectively compare the different devices. The second goal was to see whether VO devices had improved during the past two decades. We measured multiple parameters, e.g., pinch forces, cable pull forces, and cable displacements. The outcomes will help the clinician and the patient select the optimal prosthesis. The results showed that the tested hooks performed much better than the hands. The performance of the tested hands was insufficient. No improvements were shown compared with the devices tested in 1987.

### Metabolic analysis of male servicemembers with transtibial amputations carrying military loads

Barri L. Schnall, MPT, et al.

For soldiers who have sustained amputations and wish to return to Active Duty, it is essential to be able to perform common soldier tasks such as marching while wearing a rucksack. The purpose of this study was to examine the metabolic requirements of servicemembers with transtibial amputations walking at a steady state while wearing a loaded rucksack and compare these

requirements with uninjured controls. Results showed significant differences between groups, though not as great as previous literature would predict. Knowledge of realistic outcomes will help guide rehabilitation.

### Initial developmental process of a VA semistructured clinical interview for TBI identification

Rodney D. Vanderploeg, PhD, et al.

Identifying a traumatic brain injury (TBI) is challenging for clinicians. The current standard for determining a history of TBI is self-report during an in-depth clinical interview. In April 2007, the Veterans Health Administration mandated that the TBI Clinical Reminder screening instrument be completed on all individuals returning from Operation Iraqi Freedom/Operation Enduring Freedom. Hoping to improve the TBI Clinical Reminder and provide a structured method for identifying TBI, we developed a “gold standard” semistructured clinical TBI identification interview. This article describes the six steps we took to develop the interview and presents the resulting interview and its accompanying manual.

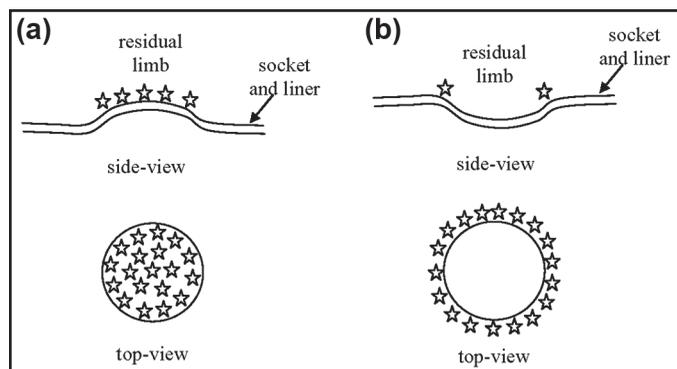
### Computer-adaptive test to measure community reintegration of Veterans

Linda Resnik, PT, PhD, OCS, et al.

The Community Reintegration of Injured Service Members (CRIS) measure has three scales that measure extent of, perceived limitations in, and satisfaction with community integration. The long length of the CRIS may be a barrier to its widespread use. This study developed and evaluated a shorter community reintegration measure that uses computer-adaptive testing (CAT): the CRIS-CAT. The CRIS-CAT showed promising measurement properties and is recommended for community reintegration assessment. Use of the CRIS-CAT will benefit Veterans by providing an efficient way to monitor and assess their community integration.

### Computer-socket manufacturing error: How much before it is clinically apparent?

Joan E. Sanders, PhD, et al.



This research was directed toward the development of quantitative standards for the quality of computer-manufactured prosthetic sockets for people with transtibial limb loss. We compared errors in the shapes of computer-manufactured sockets with clinical evaluations of socket fit. Results showed that three computed metrics (mean radial error, interquartile range, and surface normal angle error) matched well with practitioner evaluations of socket fit. These metrics may be useful in the future as standards are developed for the prosthetic socket fabrication industry.

### Obstacle course: Users' maneuverability and movement efficiency when using Otto Bock C-leg, Otto Bock 3R60, and Catech SNS prosthetic knee joints

Margrit R. Meier, PhD, et al.

The purpose of this study was to test performance of participants fitted with different knee joints (C-leg, SNS, 3R60) on an obstacle course (OC) with challenging sections such as a rock field and vacuumized beanbags to simulate sand. Participants completed the OC twice: first without a mental loading task (MLT), then with an MLT. Within the bean-bag sections, two participants fell with the C-leg, one with the 3R60, and none with the SNS. There were no statistically significant differences in the measured variables when comparing the C-leg and the SNS, indicating that, under the test conditions, users performed similarly with both joints.

### Application of self-report and performance-based outcome measures to determine functional differences between four categories of prosthetic feet

Robert S. Gailey, PhD, PT, et al.

We examined the application of clinically friendly outcome measures to determine the effects of gait training and prosthetic feet on the function and mobility of people with a transtibial amputation. Of the five outcome measures used, the Amputee Mobility Predictor was able to detect functional differences between prosthetic feet. Gait training can improve function in those with transtibial amputation and enable them to take advantage of various prosthetic foot designs.

### Robot-assisted practice of gait and stair climbing in nonambulatory stroke patients

Stefan Hesse, MD, et al.

Gait and stair climbing restoration is pivotal in neurological rehabilitation. A novel gait robot helped to increase training intensity, which is regarded as essential for a successful outcome. A harness-secured patient stands on two footplates, whose movements are fully programmable, so that he or she can practise gait and stair climbing repetitively, up to several hundred steps and stairs per session. A controlled trial with 30 subacute stroke patients revealed a superior gait and stair climbing ability in the experimental group compared with the control group. More studies must follow to better understand the robot's promising potential.

### Participant perceptions of the use of Cywee Z as an adjunct to rehabilitation of upper-limb function following stroke

Leigh A. Hale, PhD, et al.

This article reports on a study in which we asked 14 people with stroke what their perceptions were of playing computer games with the CyWee Z controller as an adjunct to the rehabilitation of arm function following

stroke. The participants enjoyed playing the computer games, and they thought the activity was beneficial for their arm function, concentration, and balance. Six participants did, however, report some shoulder and/or arm

pain or discomfort while engaged in play, but this discomfort appeared to ease during rest. Participants provided opinions on using computer games in rehabilitation.