

**Spinal, pelvic, and hip movement asymmetries  
in people with lower-limb amputation:  
Systematic review**

Hemakumar Devan, MPhy, et al.

Following limb loss, people with transfemoral amputation (TFA) and transtibial amputation (TTA) compensate with asymmetrical movements in their back and lower-limb joints. The results from our review suggest that persons with TFA compensate with asymmetrical movements in the upper back and pelvis during walking. None of the included studies examined the lower back movements during other daily activities such as stair climbing, ramp walking, and obstacle crossing in participants with either TFA or TTA. Further studies examining the lower back movements during daily activities could help to better understand the mechanisms of low back pain in this population.

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**Timed loaded standing in female chronic fatigue  
syndrome compared with other populations**

Jan b Eyskens, MSc PT, DO, Pr Ph, et al.

Veterans often experience ongoing fatigue. Like patients with osteoporosis, veterans report difficulties with standing or sitting upright for a prolonged time. We compared combined trunk and arm endurance between women with chronic fatigue syndrome (CFS), women with osteoporosis, nondisabled women from industrialized countries and women from non-industrialized countries (India, Africa) using timed loaded standing (TLS). This test measures how long a person can hold a 1 kg dumbbell in each hand in front of him/her with straight arms. TLS scores were lower in CFS than in the other populations. We propose that influencing the quality, rather than the quantity, of movement could be useful in rehabilitation.

<http://dx.doi.org/10.1682/JRRD.2014.03.0086>

**Incidence, severity, and impact of hyperhidrosis  
in people with lower-limb amputation**

Colby Hansen, MD, et al.

This survey of patients with lower-limb amputation looked at the effect of sweating on prosthetic fit and function and tried to determine which factors, if any, were significantly associated with sweating. Almost 70% of the patients reported that sweating interfered with prosthetic fit and function. Sweating was worse in patients younger than 60 yr, during warm weather, and with vigorous activity. Cause of amputation, duration of daily prosthetic use, and walking ability were not related to sweating. The patients tried multiple interventions, but these tended to be minimally effective.

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**Applying ISO 16840–2 Standard to differentiate  
impact force dissipation characteristics of  
selection of commercial wheelchair cushions**

Martin Ferguson-Pell, PhD, et al.

The properties of wheelchair cushions influence the cushion's comfort and ability to protect users from excessive forces during everyday activities such as riding over rough ground or bumping down curbs. We used an international standard test method (called ISO 16840–2) to determine the impact damping characteristics of 36 commercial wheelchair cushions. We identified two groups with distinctly different impact damping characteristics: (1) cushions that were effective at damping impacts rather than transmitting them to the body and (2) cushions that were less effective at damping impacts but had other properties important to users. Wheelchair cushion selection is a process of selecting characteristics that meet the individual's needs. The goal of ISO 16840–2 is to establish objective methods of measuring wheelchair cushion characteristics to help users compare products. Our

research helps establish the most effective measurements when using ISO 16840–2 to identify cushions that are particularly good at absorbing impacts during typical wheelchair use.

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### **Identifying obstacles to return to duty in severely injured combat-related servicemembers with amputation**

Richard K. Hurley Jr, MD, et al.

This study examined the disabling conditions and return to duty rates across all service branches of U.S. servicemembers who sustained a major limb amputation over a 10 yr period. Of all servicemembers with amputation, 16 (2%) were later found fit for Active Duty and 78 (9%) were allowed to continue on Active Duty. Posttraumatic stress disorder, loss of major nerve function, and arthritis were the most impactful disabling conditions aside from amputations. Despite continued improvements in rehabilitation, only 11% of all servicemembers with amputation are able to return to duty.

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### **Design and evaluation of voluntary opening and voluntary closing prosthetic terminal device**

Jon W. Sensinger, PhD, PEng, et al.

The majority of veterans with an upper-limb amputation use body-powered prostheses rather than myoelectric prostheses. Conventional body-powered prehensors may be controlled by either voluntarily opening or closing the device. This study proposed a new design that can switch between voluntary opening and closing. It describes the design and performance of the device and found that subjects performed better on a standardized outcome test when they could choose between modes. These results will help guide the development of future devices.

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### **Feasibility of lower-limb muscle power training to enhance locomotor function poststroke**

Patrick Morgan, MS, et al.

Stroke is a common and critical problem among the aging veteran population. The effect of stroke on walking is significant, with less than 50 percent progressing to independent community ambulation. Our overall goal is to improve walking in these persons by training subjects with an intervention that specifically targets existing neuromuscular impairments, thereby facilitating recovery of walking. Since improving walking is the most often stated goal of persons following a stroke, rehabilitation to improve walking speed, and therefore functional ability, is an important goal for improving quality of life.

<http://dx.doi.org/10.1682/JRRD.2014.04.0109>

### **Respiratory responses to stimulation of abdominal and upper-thorax intercostal muscles using multiple Permaloc® electrodes**

James S. Walter, PhD, et al.

Electrical stimulation of the diaphragm is an important method of respiratory management following spinal cord injury (SCI) in the neck; however, this method is limited by accessory abdominal and upper-chest muscle paralysis. We tested a 12-channel stimulator and surface and intramuscular electrodes in anesthetized dogs. Abdominal muscle stimulation induced large expiratory volumes, and upper-chest stimulation induced large inspiratory volumes. Combined muscle stimulation increased tidal volumes important for respiration and increased expiratory flow rates important for cough. Current methods of accessory muscle stimulation need to be studied further to improve SCI respiratory management, particularly together with diaphragmatic pacing.

<http://dx.doi.org/10.1682/JRRD.2014.01.0018>

**Ankle mechanics during sidestep cutting implicates need for 2-degrees of freedom powered ankle-foot prostheses**

Evandro M. Ficanha, et al.

When humans walk on a straight path, turn, or step on an object, the ankle rotates in all possible directions. Powered ankle-foot prostheses provide power that can improve the quality of walking in a straight path. Their ankle joint, however, allows only the up-down motion of the foot. Therefore, understanding the ankle mechanics in all the possible directions of the ankle can help in the design of powered ankle-foot prostheses that can improve quality of walking during turning. This article shows the results of a comparison of ankle mechanics during sidestep cutting and straight walking.

<http://dx.doi.org/10.1682/JRRD.2014.02.0043>

**Training with robot-applied resistance in people with motor-incomplete spinal cord injury: Pilot study**

Tania Lam, PhD, et al.

This article describes a pilot study in which we tested the possibility of using the Lokomat to apply resistance against leg movements during gait training for people with partial spinal cord injuries. Our results indicated that resistance training with the Lokomat is feasible. Our data also suggest that resistance training could lead to better improvements in the performance of skilled overground walking tasks (such as stepping over obstacles or walking up stairs) compared with standard Lokomat training (without resistance).

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