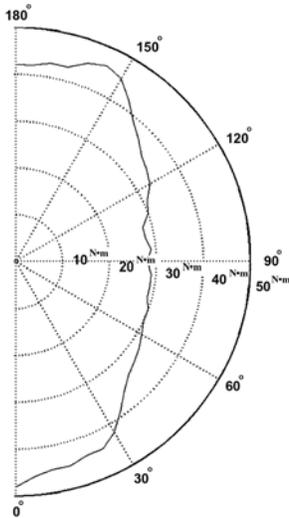


## Feasibility of functional electrical stimulation for control of seated posture after spinal cord injury: A simulation study

Ari J. Wilkenfeld, MD, PhD, et al.



Spinal cord injury (SCI) among veterans that results in paralysis can affect seated posture. We analyzed the potential for controlling pelvis and trunk position with functional electrical stimulation (FES) via computer simulations that approximated a seated subject's attainable postures. The results indicated that controlling seated posture through coordinated FES in individuals with paralysis was feasible and may lead to improved stability. We implanted stimulating electrodes in a subject with SCI in selected

muscles to compare the moments required to maintain various positions with those the model predicted. This demonstrated that we needed more complete activation of the paralyzed muscles for the subject to fully achieve the theoretical workspace. Activation of these muscles can increase available postures for individuals with SCI, expanding their access to and control of their environment.

## Influence of terrain on metabolic and temporal gait characteristics of unilateral transtibial amputees

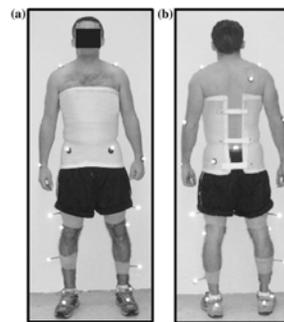
Jean Paysant, MD, et al.

We investigated the influence of ground surface on walking in prosthesis-wearing transtibial amputees compared with nondisabled subjects by measuring gait parameters, energy expenditure, and perceived exertion. Active transtibial amputees and nondisabled control subjects walked on three ground surfaces (asphalt, mown lawn, and high grass). In both groups, changes in terrain caused modifications in the gait characteristics: self-selected velocity decreased and energy expenditure increased. Differences between amputees and nondisabled subjects on asphalt were found only for the velocity

and oxygen cost (not for oxygen uptake), whereas major significant differences between amputees and nondisabled subjects were found for all the metabolic and temporal gait characteristics when walking in the high grass.

## Effect of restricted spinal motion on gait

Regina Konz, MS, et al.

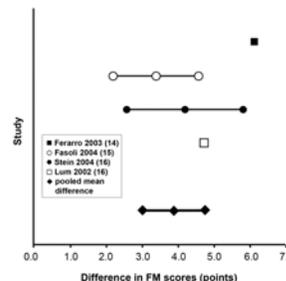


Spinal orthoses are commonly used to treat conditions that affect the spine, mostly by restricting spinal movement. However, because spinal orthoses encompass both the spine and pelvis, they may also affect pelvic and leg motion during walking. The authors investigated the effect of spinal restriction on gait in 10

able-bodied persons. The participants' gait with and without spinal restriction by a fiberglass body jacket was analyzed while they walked at five speeds (from very slow to very fast). The results indicate that spinal restriction minimally affects gait in able-bodied persons. By understanding how restricted spinal motion affects gait, clinicians can anticipate and prevent additional problems caused by spinal restriction.

## Systematic review of the effect of robot-aided therapy on recovery of the hemiparetic arm after stroke

Gerdienke B. Prange, MSc, et al.



High-intensity and task-specific therapy with active, repetitive movements provided by robotic devices may effectively restore arm and hand function after a stroke. The authors reviewed eight clinical trials to assess the effect of robot-aided therapy on motor control and functional abilities of stroke patients' arms. In all studies, they found that robot-aided therapy improved shoulder and elbow motor control; however, they did not find any consistent influence on functional abilities. Two studies compared

robot-aided therapy with conventional therapy and reported significantly larger improvements after robot-aided therapy.

### Employment issues and assistive technology use for persons with spinal cord injury

Brad Hedrick, PhD, et al.

The purpose of this study was to determine the effect of assistive technology (AT) on employment for two groups (civilian and veteran) of working-age adults (18–64 yr) with spinal cord injury or dysfunction (SCI/D). AT is designed to maximize independence and increase activity participation and employability for persons with SCI/D. The study indicated that AT is important to employment success for persons with SCI/D. The majority of AT was characterized as important to work and was 3.5 times more than AT identified as not important to work. Satisfaction with AT was very high regardless of employment status. By identifying the cost of AT devices that enhance employment outcomes for persons with SCI/D, our results could influence policy makers as they discuss issues related to AT for working-age individuals with disabilities.

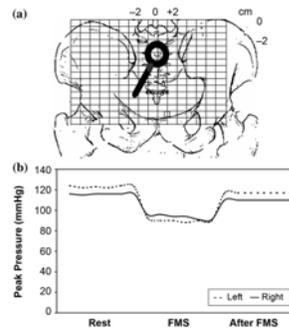
### Overarching principles and salient findings for inclusion in guidelines for power mobility use within residential care facilities

William B. Mortenson, BScOT, MSc, et al.

Given the advantages of power mobility and improvements in the technology, its use is expected to increase. Little research has explored power mobility safety, and no gold standard exists for determining safe driving skills. We describe findings of a research project to develop power mobility safety guidelines. Some of the issues explored include who should be considered for power mobility, who should be deemed incapable, and when use should be discontinued. This information highlights many power mobility safety issues encountered in residential-care facilities, may be helpful for anyone attempting to develop similar guidelines, and provides insight into future areas of study aimed at understanding and improving power mobility safety.

### Pressure changes under the ischial tuberosities of seated individuals during sacral nerve root stimulation

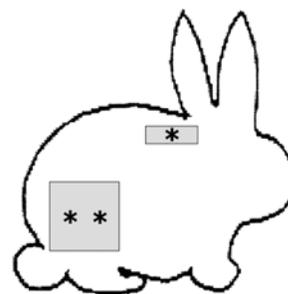
Liang Qin Liu, MBBS, et al.



Pressure ulcers are a serious complication of spinal cord injury (SCI). The authors studied whether sacral nerve-root stimulation would induce gluteal muscle contraction and reduce sitting pressures. They used functional magnetic stimulation to stimulate the sacral area of nondisabled participants and functional electrical stimulation to stimulate the sacral anterior root implant (currently used for bladder emptying) of participants with SCI. They found that sacral nerve-root stimulation significantly reduced sitting pressures in both the nondisabled and SCI participants. Stimulation of sacral anterior root implants may become a method of reducing sitting pressures, which will help prevent pressure ulcers and improve quality of life for people with SCI who use wheelchairs.

### Experimental wound healing using microamperage electrical stimulation in rabbits

Mohammad Bayat, PhD, et al.



Some wound types such as pressure sores are notoriously slow to heal. We investigated the effects of microamperage electrical stimulation (MES) on the healing of wounds in rabbits. The experimental group received an MES of 200  $\mu$ A current intensity two hours per day, which significantly accelerated the healing process. We can conclude that MES serves to enhance healing by stimulating the circulatory system rather than the neural system. MES may be an effective method to accelerate the healing of open wounds and, thus, warrants a more widespread use in clinical setting. Further investigations are required to address the stimulation effects in patients (or animals) suffering from conditions that seem to slow healing.

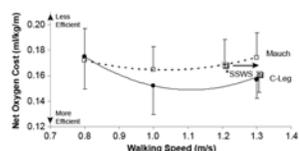
### Personal and treatment factors associated with foot self-care among veterans with diabetes

Mark V. Johnston, PhD, et al.

We developed a survey for diabetic patients with high-risk feet to investigate the quality of professional and patient foot care, document foot-care needs, and identify factors related to the quality of foot care. Well-coordinated preventive foot care can reduce diabetes-related lower-limb complications. The scales derived from the survey can be used for evaluation of foot-care education needs and outcomes for persons with high-risk feet. Using such tools, quality improvement efforts can target remediable deficiencies in foot care and decrease the associated morbidity to patients and costs to society.

### Gait efficiency using the C-Leg

Michael S. Orendurff, MS, et al.



Microprocessor-controlled prosthetic knees claim to improve walking efficiency in people with transfemoral (TF) amputation. To test this hypothesis, the

authors compared the Mauch swing and stance (SNS) knee with the C-Leg microprocessor-controlled knee in eight people with TF amputation. The C-Leg knee led to higher participant-selected walking speeds than the conventional Mauch SNS knee but did not cause increased net oxygen cost. Individual assessment of walking efficiency may provide the evidence necessary for provision of the optimal prosthetic prescription rather than one “best” device for all TF amputees. Future work should assess amputees’ perceptions of gait stability versus efficiency and the programmable characteristics of microprocessor-controlled knees.

### Functional electrical stimulation reinforced tenodesis effect controlled by myoelectric activity from wrist extensors

Rune A. Thorsen, MSc, PhD, et al.

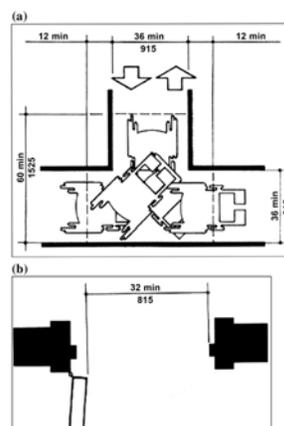


Our objective was to test a method for enhancing functional hand grasping capability in individuals with sustained tetraplegia using a noninvasive myoelectrically controlled single-channel functional electrical stimulation system. Using the stimulation to control the long thumb and finger flexors resulted in an immediate improvement of functional grasping capability in all 5 enrolled patients. This method of reinforcing the teno-

desis effect can be an option for some individuals with sustained tetraplegia to compensate for insufficiency of grasp force. The system proved simple and intuitively easy to use, and subjects required training to obtain immediate functionality. The results obtained and the limited invasiveness encourage further research, and the system could be proposed to selected patients as a supplement or alternative to existing treatment and aids.

### Development of a remote accessibility assessment system through three-dimensional reconstruction technology

Jong Bae Kim, MS; David M. Brienza, PhD



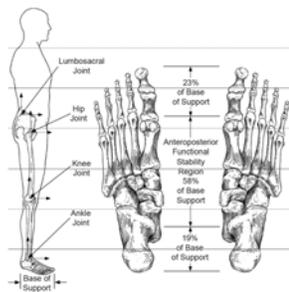
We developed a Remote Accessibility Assessment System (RAAS) to analyze environments for wheelchair accessibility from a remote location. Our goals were to investigate the system’s accuracy, compare different cameras, and demonstrate the feasibility of applying the system in an actual environment. We performed an accuracy analysis and a comparison of camera systems with the hardware and software

components; therefore, we can specify a consumer-level digital camera and PhotoModeler (EOS Systems, Inc,

Vancouver, Canada) software for the system. Finally, we tested the system in an actual environment to evaluate its assessment of accessibility in a wheelchair user's environment, which resulted in accurate validation of our system. The RAAS could improve rehabilitation outcomes by making accessibility assessments and modifications available to a larger proportion of the population of people with mobility limitations.

### Selection of an optimal muscle set for a 16-channel standing neuroprosthesis using a human musculoskeletal model

Benjamin P. Heilman, MS, et al.



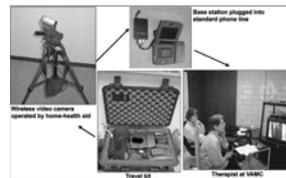
Functional losses from paralysis, such as walking or standing, often limit independence. This study proposes a set of muscles to be stimulated electrically with a neuroprosthesis to allow persons with paraplegia to stand and shift postures.

We used a model of a standing adult to assess different muscle combinations to maintain specific postures while minimizing the metabolic energy consumed. The muscles selected would augment the current set of eight muscles used to produce standing from

the seated position, allowing users to shift postures over 75 percent of the nondisabled range with a user-controlled device. The results of this study will allow a user to shift weight smoothly while standing, thus providing longer standing periods and saving energy.

### Development of a teletechnology protocol for in-home rehabilitation

Helen Hoenig, MD, et al.



This paper describes the feasibility of teletechnology for delivering in-home rehabilitation interventions to community-dwelling adults recently prescribed a mobility aid. We

provided telerehabilitation interventions with wireless videoconferencing equipment that used standard telephone lines to provide live, two-way video and audio interaction between the patient and a technician located in the home and a therapist located at the hospital. The interventions included prescription of functionally based exercises, home-hazard assessment, and prescription and/or training in use of assistive technology, environmental modifications, and adaptive strategies. Telehealth technology has great potential to increase patients' access to rehabilitation providers in the home setting.