

Neck range of motion and use of computer head controls

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Purpose of the Work. Computer head controls provide an alternative means of computer access. This study determined whether neck movement limitations are associated with reduced performance with such head controls. This study also identified features of the cursor movement path that could help assess computer access limitations. **Subjects and Procedures.** Fifteen subjects without disabilities and ten subjects with disabilities received neck range of motion evaluations and performed computer exercises using head controls. **Results.** Reduced neck range of motion was correlated with reduced accuracy ($R^2 = 93.5\%$) and speed ($R^2 = 79.5\%$) in icon selection. We developed a model using cursor positioning time and number of velocity peaks to identify when a person was having difficulty with target acquisition ($\kappa = 0.81$). The results indicate that higher peak movement velocities are associated with larger movement amplitudes ($p < 0.01$), but variability in peak velocity for each movement amplitude prevents the use of peak velocity as a predictor of the desired movement amplitude ($\kappa < 0.5$). **Relevance to the Veteran Population.** Neck movement limitations were found to be associated with reduced performance in computer tasks with the use of head controls. If a person is unable to use head controls as an alternative access method, he or she may have to resort to slower, more inefficient methods, reducing his or her employment options. Models such as those derived in this work may allow head controls to adapt to a user's needs, accommodating difficulties resulting from neck range of motion limitations.

Edmund F. LoPresti, PhD

Postoperative dressing and management strategies for transtibial amputations: A critical review

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Purpose of the Work. Consensus on the most effective postoperative management strategies for transtibial amputation is lacking. This paper reviews the published literature to compare measures of safety, efficacy, and

clinical outcomes. **Procedures.** A critical review of over 60 published studies was conducted. **Results.** Analysis of 10 controlled studies supported only 4 of 14 claims cited in uncontrolled descriptive studies. The literature supports that rigid plaster cast dressings result in significantly accelerated rehabilitation times and significantly less edema compared to soft gauze dressings. In addition, prefabricated pneumatic prostheses were found to have significantly fewer postsurgical complications and required fewer revisions compared to soft gauze dressings. No reports compared all types of dressings within one study. **Relevance to the Veteran Population.** The type of postamputation management is an important determinant of recovery from amputation. Current protocols are based on local practice, skill, and intuition. The published evidence is primarily antidotal and is insufficient to determine optimum clinical guidelines.

Douglas G. Smith, MD

Bereitschaft (readiness potential) and supplemental motor area interaction in movement generation: Spinal cord injury and normal subjects

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Purpose of the work. This study compared the brain areas represented by the "readiness potential," which may cause purposeful movement by "turning on" the spinal cord and the supplemental motor area. **Subjects and Procedures.** Sixteen spinal cord injury (SCI) patients and ten normal subjects agreed to be examined and receive 128-channel electroencephalograms (EEGs). The EEGs were recorded while the subjects were moving a finger (active movement) and when the same finger was moved by an operator, that is, a person trained to do this test (passive movement). **Results.** The EEGs showed a change in the location of active brain areas in SCI patients compared to normal controls, both with active and passive movement. The brain activity had moved backward. **Relevance to the Veteran Population.** Those patients who later returned to the more forward position had a better outcome.

Joseph B. Green, MD

Assessment of an electronic goniometer designed to measure equinus contracture

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Purpose of the Work. The condition in which ankle dorsiflexion is restricted is known as equinus contracture (EC) and is associated with several foot disorders. To improve measurements of EC, we developed the equinometer, a device that allows the measurement of ankle motion under controlled conditions. This study assesses the accuracy of this device across different subjects and examiners. **Subjects and Procedures.** Two examiners used the equinometer on five subjects. Statistical analysis of the results was performed. **Results.** The upper range of standard deviation was 1.36°, which suggests that the developed equinometer is an appropriate instrument for measuring ankle dorsiflexion. **Relevance to the Veteran Population.** EC is a condition that is difficult to evaluate by untrained examiners and may have a deleterious effect on foot function. The developed instrument is a reliable tool that provides accurate and reliable measurements. This may help physicians make appropriate clinical decisions in patients suffering from EC.

Mathieu Assal, MD

Long-term user perceptions of an implanted neuroprosthesis for exercise, standing, and transfers after spinal cord injury

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Purpose of the Work. The study was conducted to understand the perceptions of recipients of a surgically implanted neuroprosthesis, regarding system performance, satisfaction, clinical complications, health benefits, and patterns of use. **Subjects.** Participants included those with low cervical or thoracic spinal cord injury (SCI) with more than 12 months of experience with the Case Western Reserve University/Veterans Affairs implanted standing neuroprosthesis. **Procedures.** A standardized telephone survey was administered to 11 neuroprosthesis recipients. **Results.** All implant recipients noted improvement in health, incidence of pressure sores,

leg spasms, and urinary tract infections. Subjects were moderately to very satisfied with system performance and were unanimously willing to repeat the surgery and rehabilitation to obtain similar clinical outcomes. All implant recipients reported the system to be safe, reliable, and easy to use. **Relevance to the Veteran Population.** The implanted standing neuroprosthesis appears to be clinically acceptable and effective for providing options for exercise, standing, and transferring to individuals with paraplegia or low tetraplegia. Veterans with SCI may benefit from such assistive technologies.

Sanjeev Agarwal, MD

Reliability of computer-automated hearing thresholds in cochlear-impaired listeners using ER-4B Canal Phone™ earphones

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Purpose of the Work. This study was conducted to document test-retest reliability of hearing thresholds in cochlear-impaired listeners using our computer-automated tinnitus-matching technique and Etymotic Research (ER)-4B Canal Phone™ insert earphones. The study replicated a previous study in which we tested subjects with normal-hearing sensitivity. **Subjects and Procedures.** Repeated thresholds were obtained, within and between sessions, to the nearest 1 dB at one-third octave frequencies from 500 Hz to 16,000 Hz. Testing also evaluated for effects of ear-tip reinsertion at the octave frequencies. Twenty individuals with cochlear hearing loss were evaluated with the use of our fully automated protocol. **Results.** The previous group of normal-hearing subjects and the present group of hearing-impaired subjects both showed overall good threshold reliability, with observable differences between groups. First, repeated testing resulted in improved hearing thresholds for the normal-hearing group, but not for the cochlear-loss group. Second, the normal-hearing group showed overall better response reliability, both within and between sessions, than the cochlear hearing-loss group. These differences were small but consistent. **Relevance to the Veteran Population.** These two studies have demonstrated that reliable threshold responses can be obtained using our automated testing technique. This technique has particular application for tinnitus testing and for ototoxicity monitoring and is intended for eventual clinical use in Veterans

Affairs audiology clinics. The ER-4B insert earphones offer an important advantage over other types of earphones, both insert and supra-aural, in that they can be used to test both conventional and high-frequencies (up to 16,000 Hz). The ER-4B earphones could be used with any audiometric testing system.

James A. Henry, PhD

Telemedicine and the delivery of health services to veterans with multiple sclerosis

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Purpose of the Work. Telemedicine has the potential to reduce costs, improve access to healthcare, and improve the quality of care for those with disabilities. It is important to properly evaluate the effectiveness of telemedicine in the environment in which it will be applied. A possible exception to this is when the individual issues relevant to the application of telemedicine to a particular population have already been studied. This paper reviews the medical literature in support of this premise that the fundamental issues and approaches to the care of the veteran with multiple sclerosis (MS) using telemedicine have already been studied in other populations. The current state of the telemedicine literature is discussed, as well as the use of telemedicine in the Veterans Health Administration (VHA). **Procedures.** Review of the medical literature. **Results.** The application of telemedicine to the care of the veteran with MS has support in the medical literature. **Relevance to the Veteran Population.** The VHA has a rich telemedicine network. Telemedicine may increase access to veterans in remote areas and to those who live in urban areas and have mobility impairments and may

increase home-care options. While telemedicine is being used presently, its capacity has only begun to be tapped. Veterans increasingly are being cared for by variations of telemedicine technology in the VHA. The actual use of telemedicine by individual facilities and clinicians varies. Increasing knowledge and comfort with this technology will allow more clinicians to take advantage of the improvements in access, quality, and cost-effectiveness that telemedicine potentially provides.

Michael Hatzakis, Jr., MD

A comparison of cutaneous vascular responses to transient pressure loading in smokers and nonsmokers

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Purpose of the Work. This study investigated whether smoking, known to be a risk factor in the development of pressure ulcers, has an effect on vascular responsiveness in the skin. **Subjects and Procedures.** The increase in blood flow following removal of a pressure load (reactive hyperaemia) was measured in the skin above the sacrum in healthy female smokers and their matched nonsmoker controls. **Results.** The total response was significantly attenuated in the smokers, mainly because of a failure to maintain the increased blood flow response. **Relevance to the Veteran Population.** This study has shown that differences in vascular responsiveness can be measured at skin sites at risk of pressure damage in an "at risk" group. These preliminary studies may allow the development of an objective measurement of risk as well as the further investigation of the factors associated with pressure ulcer development.

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