

SUMMARY OF SCIENTIFIC/TECHNICAL PAPERS IN THIS ISSUE

Design of a Controlled-Energy-Dissipation Orthosis (CEDO) for Functional Suppression of Intention Tremors.

Michael J. Rosen, PhD; Allison S. Arnold, MS; Ivan J. Baiges, MS; Mindy L. Aisen, MD; Sheila R. Eglowstein, BS (*p. 1*)

Purpose of the Work. This design project was meant to produce a device that will allow people with arm tremors to undertake manual tasks with greater independence. The CEDO supports the user's arm and smoothes its motions much the way the suspension of a car reduces its bouncing. **Subjects/Procedures.** Evaluations were performed by subjects with tremors due to multiple sclerosis or traumatic head injury. Quality of movement was studied during functional activities and laboratory testing. **Results.** The outcome of the work is a prototype tremor-damping brace that mounts to a table or wheelchair frame and allows motion of the user's arm in a plane (e.g., over a desk). Useful reductions in tremor with little resistance to intended motions were observed for most subjects. **Relevance to Veteran Population.** A product based on this work could expand educational and vocational capabilities for veterans whose control over their limbs is impaired by tremor.

Michael J. Rosen, PhD

An EMG-Controlled Grasping System for Tetraplegics.

Shalini Saxena, MS; Slavica Nikolić, BS; Dejan Popović, PhD (*p. 17*)

Purpose of the Work. Due to a spinal cord injury (SCI), humans find themselves totally dependent on other people or devices for even the simplest tasks that are normally taken for granted. The device designed enhances grasping and other simple daily activities. Subjects with complete SCI at the C6 and C7 level, along with humans injured at higher cervical cord levels, who have retained wrist extension but have paralyzed fingers and thumb flexors, can benefit from this development. **Subjects.** Six. **Results.** Initial clinical tests showed that simple daily activities can be accomplished or improved when using the device compared to attempts without the assistive system. **Relevance**

to Veteran Population. There are a fair number of veterans who suffered spinal cord injury at a high cervical level who may directly benefit from this approach, which, in general, can be further developed and used for other assistive systems.

Dejan Popović, PhD

Gait Parameters following Stroke: A Practical Assessment.

Herbert P. von Schroeder, MD; Richard D. Coutts, MD; Patrick D. Lyden, MD; Edmund Billings, Jr., MD; Vernon L. Nickel, MD (*p. 25*)

Purpose of the Work. To analyze the walking patterns (gait) of stroke patients using an electronic gait analyzer and to assess the changes with time. **Subjects/Procedures.** Forty-nine stroke patients and 24 control subjects were analyzed. **Results.** Stroke patients walked slower than controls; they took fewer steps per minute and spent more time with both legs on the ground at the same time. Patients' affected hemiplegic legs spent less time on the ground and more time swinging compared to their unaffected legs. Gait measurements improved with time following stroke, mostly in the first 12 months, but the unequal pattern of gait did not change over time. **Relevance to Veteran Population.** Abnormal walking was due to difficulty in moving the body over a weaker, less stable leg. Gait analysis can be important for documenting abnormalities and determining the effects of therapy after a stroke.

Herbert P. von Schroeder, MD

Establishment of Consistent Gait after Fitting of New Components.

Rowan D. English, DAppSc (P/O); Wendy A. Hubbard, BAppSc (PT), MAppSc (HM); G. Keith McElroy, MEd (*p. 32*)

Purpose of the Work. This project was undertaken to give an indication of the length of time required for a person with an amputation to become re-familiarized with an artificial limb following the substitution of a component or a number of components. **Subjects/Procedures.** A single subject, a man with a through-knee amputation, was assessed using a test prosthesis with two different knee mechanisms. Several parameters were measured and analyzed to determine when his gait had stabilized so that a decision could be made about the suitability of the knee mechanisms. **Results.** For the clinical situation, it was

found that at least 1 week of acclimatization was required before a decision could be made about the suitability of the knee component. For the purposes of research, however, it was deemed preferable for the subject to use a knee mechanism for at least 3 weeks to be sure the relevant gait parameters had stabilized. **Relevance to Veteran Population.** This study helps the prosthetist in clinical practice establish the length of time required for trial of new components in an artificial limb. It also indicates to the researcher that an altered prosthesis needs to be used for a reasonable length of time before detailed measurements can be taken. Also, this assists in the further testing of prosthetic components and the subsequent development of objective prescription criteria. This directly benefits the prosthetists and their clients.

Rowan English, DAppSc (P/O)

Conventional 4-Bar Linkage Knee Mechanisms: A Strength-Weakness Analysis.

J. de Vries, MD, Dsc (p. 36)

Purpose of the Work. The objective of the study done is to trace the relevant factors of 4-bar linkage knees which influence function, comfort, and cosmetics of the prosthesis. **Subjects.** None. **Procedures.** Using clinical and biomechanical research data, a strength-weakness analysis of eight 4-bar linkage knees has been carried out. **Results.** At the stance phase, five of the eight knees are intrinsically stable, meaning without extension of residual limb force. The 0° center of rotation of these knees is behind the femur-heel line. Each knee has its own collection of instantaneous centers of rotation (a trajectory) which begins with the 0° center of rotation. When bending the knee, the hip flexion-torque required is smaller when the 0° center of rotation is closer to the femur head-toe line and is dependent on the measure of the axial load. On average, a comparatively large amount of energy is still necessary. During the swing phase, the maximal axial stump load, the maximal hip-moment, and the energy required are approximately the same within the eight knees in relation to walking speed. Friction influences the swing characteristics of the prosthetic lower leg considerably. **Relevance to Veteran Population.** With the help of objective

clinical and biomechanical features of 4-bar linkage knee mechanisms, the correct knee can be chosen for the individual patient.

J. de Vries, MD, Dsc

Waking Effectiveness of Visual Alerting Signals.

*Sherry K. Bowman, MCISc; Donald G. Jamieson, PhD;
Robert D. Ogilvie, PhD (p. 43)*

Purpose of the Work. People who are unable to hear acoustic alarm signals because they have a complete or partial hearing loss must rely on visual or tactile signals to warn them in the event of an emergency. However, there is debate as to whether personal smoke detector devices that provide a visual alarm can be relied upon to wake a person safely. We studied the alerting effects of visual alarm devices when people were in the deepest stages of sleep—slow wave sleep (SWS) and random eye movement (REM) sleep—and related our results to the physical (optical) characteristics of devices available to consumers. **Subjects/Procedures.** The brain activity of individual sleepers was monitored electrophysiologically over the course of a night's sleep. A calibrated visual alerting (strobe light) signal was provided after subjects were confirmed to be in a specified stage of deep sleep. The strobe was allowed to run until the subject awoke, or a maximum of 5 minutes elapsed. Twenty healthy, young adult women were tested repeatedly in this way. All reported that they were good sleepers, and had normal hearing and vision. None was taking medication. **Results.** Even under the favorable pharmacological (medication-free) and optical (smoke-free) conditions of the present study, sleepers did not wake consistently under the most intense testing conditions. We conclude that currently available devices of this type cannot be relied upon to wake a sleeping person safely, in the event of a fire. **Relevance to the Veteran.** Even with the most intense light signal tested, sleepers woke safely only about half the time. Deaf and hard-of-hearing veterans should, therefore, know that they cannot rely on devices of this type to wake them safely in the event of a fire.

Donald G. Jamieson, PhD