

Clinical Relevance for the Veteran

SUMMARY OF SCIENTIFIC/TECHNICAL PAPERS IN THIS ISSUE

Adaptive Gait Responses to Plantar Heel Pain.

Anthony D. Levins, MD; Harry B. Skinner, MD, PhD;
Vince J. Caiozzo, PhD. (p. 289)

Purpose of the work. This study evaluates the adaptive gait responses to pain in the nonimpaired individual. This information is useful in evaluating future techniques in pressure reduction about the foot in populations at risk to develop pressure ulcers. **Subjects/Procedures.** The gaits of 18 subjects were studied with a foot switch gait analyzer with and without stimuli in the form of a 2-mm, 3.3-mm, or 4.6-mm bead placed below the heel. **Results.** Subjects compensated by reducing the single limb support duration at the 3.3-mm and 4.6-mm bead sizes. The swing phase and single limb support were reduced as a percentage of the gait cycle at the 4.6-mm bead size only. **Relevance to the Veteran Population.** Neuropathic foot ulcers are common among veterans. A better understanding of gait adaptation to painful stimuli in normal individuals may indicate another possible avenue in the assessment of programs aimed at prevention and treatment of the diabetic foot ulcer in addition to pressure redistribution.
Anthony D. Levins, MD

Automatic Tuning of Myoelectric Prostheses.

Claudio Bonivento, Prof, PhD; Angelo Davalli, MS;
Cesare Fantuzzi, PhD; Rinaldo Sacchetti, MS;
Sabina Terenzi, MS. (p. 294)

Purpose of the Work. The purpose of this work is to give both technicians and persons with amputation an instrument for setting and monitoring a myoelectric upper limb prosthesis. All the operations may be done locally or remotely. **Subjects/Procedures.** The system is designed for both technicians and prosthesis users. The former can diagnose problems and set the prosthetic parameters very easily, the latter are capable of customizing the prosthesis by themselves on some occasions. The system works with a new type of

myoelectric upper limb prostheses that uses a microprocessor to control the artificial arm. For remote tuning, a PC-based video-communication system is used via ISDN telephone lines. **Results.** The clinical trials of automatic tuning of the prosthesis have highlighted a good correspondence between the parameters found with manual tuning and the ones calculated automatically. We have obtained positive results in the use of remote modality. **Relevance to the Veteran Population.** This tool, in conjunction with the MCA prosthetic system, can save veterans with artificial arms much time and trouble in maintaining proper adjustments of their prostheses.

Claudio Bonivento, Prof, PhD

Wrist Motion in Handrim Wheelchair Propulsion.

DirkJan (H.E.J.) Veeger, PhD; Liduin S. Meershoek,
MSc; Luc H. V. van der Woude, PhD;
Jessica M. Langenhoff, MSc. (p. 305)

Purpose of the work. Among wheelchair users, carpal tunnel syndrome (CTS) is a regularly occurring phenomenon. The purpose of the work was to identify whether CTS is related to extreme wrist motions during handrim wheelchair propulsion, possibly in combination with wrist flexor activity. **Subjects/Procedures.** Nine subjects (four wheelchair users, five controls) participated in a movement analysis study on a treadmill. **Results.** The peak values for ulnar and radial deviation were close to generally reported maximal range of motion (ROM) values. Peak extension was approximately 50% of ROM. The peak angles with concurrent activity of the wrist flexors were only slightly less. These large angles are serious risk factors for CTS. **Relevance to the Veteran Population.** These findings support the hypothesis that wrist motion during handrim wheelchair propulsion is likely to be an important cause in the high occurrence of CTS and underline the usefulness of alternative propulsion systems and the need for the evaluation of different handrim grips.
H.E.J.(DirkJan) Veeger, PhD

Measurement of Impaired Muscle Function of the Gastrocnemius, Soleus, and Tibialis Anterior Muscles in Spastic Hemiplegia: A Preliminary Study.

Jules G. Becher, MD; Jaap Harlaar, MSc; Gustaaf J. Lankhorst, MD, PhD; Tanneke W. Vogelaar, PT.
(p. 314)

Purpose of the Work. In spastic hemiplegia, muscle dysfunction can be classified as impairment of activation, increased stiffness, and shortening. The purpose of this study is to measure the muscle dysfunction of three ankle muscles. **Subjects/Procedures.** Ten subjects with spastic hemiplegia were measured for active and passive movements of the ankle before and after local anesthesia of the Tibial Nerve. Surface EMG, angle, and torque level were recorded. **Results.** Marked differences in muscle dysfunction were found; five subjects showed spasticity, five had increased stiffness without EMG-activity, loss of EMG output varied between 9 and 74%, nine had shortening of the Gastrocnemius, eight had shortening of the Soleus Muscle. Local anesthesia did reduce spasticity, but did not reduce stiffness. **Relevance to the Veteran Population.** The proposed classification can be used to determine the choice of therapy for functional problems related to impaired function of muscles of the ankle.

Jules G. Becher, MD

Mathematical Modeling of Normal Pharyngeal Bolus Transport: A Preliminary Study.

Michael W. Chang, MD, PhD;
Brigitte Rosendall, MS; Bruce A. Finlayson, PhD.
(p. 327)

Purpose of the Work. Dysphagia (difficulty in swallowing) is a common clinical symptom that can cause life-threatening pulmonary complications, such as choking and aspiration pneumonia. It is important to advance the persons with dysphagia toward oral feeding in a timely fashion to enhance the recovery of swallowing function and preserve the quality of life. Current clinical assessments are limited in providing safe guidelines for oral feeding. We propose to use mathematical modeling to supplement clinical assessments for dysphagia management. **Subjects/Procedures.** A mathematical model employing pharyngeal bolus fluid mechanics was constructed using finite element analysis. This model

incorporated literature-reported, normal, anatomical data with time-dependent pharyngeal/upper esophageal sphincter wall motion obtained from videofluorography (VFG). This time-dependent wall motion was implemented as a moving boundary condition in the model. **Results.** The preliminary model demonstrated feasibility of modeling pharyngeal bolus transport. This model also addressed the need and the potential for computational fluid dynamics in understanding physiology and pathophysiology of the pharyngeal phase of swallowing. **Relevance to the Veteran Population.** Dysphagia is common in all populations, including veterans. Safe oral feeding for those with dysphagia requires a thorough understanding of pharyngeal bolus fluid mechanics. This preliminary model demonstrated the need for this kind of model and its potential clinical applications.

Michael W. Chang, MD, PhD

Incidence of Peripheral Neuropathy in the Contralateral Limb of Persons with Unilateral Amputation Due to Diabetes.

Patrick J. Potter, MD, FRCPC;
Oleh Maryniak, MD, FRCPC; Ray Yaworski, RT;
Ian C. Jones, B.Math, MA. (p. 335)

Purpose of the Work. This study was designed to determine the extent of peripheral neuropathy present in the intact limb of persons with first-time nontraumatic amputations, given our clinical impression that this population has a significant incidence of neuropathy, even in those not affected by diabetes mellitus. **Subjects/Procedures.** Eighty subjects with first-time, nontraumatic amputation were examined with regard to determining the extent of peripheral neuropathy present in the intact limb. Subjects were categorized as those with and without diabetes mellitus (DM). Clinical examination for peripheral neuropathy, nerve conduction velocities and electromyographic sampling were used to determine the extent of peripheral neuropathy. A scale combining these examination points was used to approximate the severity of the peripheral neuropathy. **Results.** Eighty percent had evidence of peripheral neuropathy. Twenty-eight out of 42 who did not have DM had evidence of peripheral neuropathy. Only 1 of the 38 subjects who had confirmed DM had no evidence of peripheral neuropathy. **Relevance to the Veteran Population.** The finding of a high incidence of peripheral nerve compromised is important to take into

consideration when treating persons with peripheral vascular disease as there is risk of compromise to the limb, not only due to the peripheral vascular disease, but also due to potential neuropathy. Earlier use of preventive measures with regard to better foot care, education, and appropriate foot care have been shown to

reduce the incidence of amputation in a population of persons with DM. Such strategies could potentially be applied to all persons at risk for nontraumatic amputation.

Patrick J. Potter, MD, FRCPC