

### SUMMARY OF SCIENTIFIC/TECHNICAL PAPERS IN THIS ISSUE

#### **An Equivalent Input Noise Level Criterion For Hearing Aids.**

John H. Macrae, PhD and Harvey Dillon, PhD (*p. 355*)

**Purpose of the Work.** A hearing aid emits noise generated within the aid itself even when no external sound enters its microphone. The aim of an internal noise criterion for hearing aids is to ensure that, as far as possible, the internal noise emitted by hearing aids is inaudible to users. The purpose of the project was to establish maximum acceptable internal noise levels for hearing aids. **Subjects/Procedures.** The data used in the investigation were 700 audiograms obtained from the case records of adults who had been provided with hearing aids. The project determined whether a previously established internal noise criterion could be relaxed as the gain of the hearing aid increases. The internal noise criterion can be relaxed whenever it results in the internal noise at the output of the hearing aid not exceeding the threshold of the user of the aid. **Results.** It was found that the internal noise criterion can be relaxed for higher gain hearing aids, as a function of the gain of the aid. The relationship between relaxation of the criterion and the gain of the hearing aid is complex and differs at different frequencies. **Relevance to Veteran Population.** The internal noise criterion can be used by the Department of Veterans Affairs to specify the maximum acceptable internal noise for various types of hearing aids and can also be used in testing individual hearing aids during the process of repair or maintenance in order to ensure that the internal noise output of the aid will not be heard by, or will not be objectionable to, the veteran.

*John H. Macrae, PhD*

#### **Gain, Frequency Response, And Maximum Output Requirements For Hearing Aids.**

John H. Macrae, PhD and Harvey Dillon, PhD (*p. 363*)

**Purpose of the Work.** The purpose of this work was to determine performance specifications for hearing aids. Hearing aid designers need to know what performance

is required of hearing aids if those hearing aids are to provide adequate gain, frequency response, and maximum output levels to clients. **Subjects/Procedures.** The hearing aid gain, frequency response, and maximum output selection procedures currently recommended by the National Acoustic Laboratories (NAL) of Australia were applied to the audiograms of a representative group of hearing aid clients and the distributions of requirements were determined for the group. **Results.** Required frequency response variations, which are provided by tone controls, were determined from the distribution of gain requirements and the required range of gain-maximum output combinations was determined for different types of hearing aids (behind-the-ear, in-the-ear, in-the-canal, completely-in-the-canal, and body-level hearing aids). **Relevance to Veteran Population.** The Department of Veterans Affairs can use these results to specify the performance required of different types of hearing aids in order to ensure that the aids will provide appropriate gain, frequency response, and maximum output levels for those veterans who require them.

*John H. Macrae, PhD*

#### **Comparative Effectiveness of Videothermography, Contact Thermography, and Infrared Beam Thermography for Scanning Relative Skin Temperature.**

Richard A. Sherman, PhD; Allyn L. Woerman, MMSc, PT; Kent W. Karstetter, DPM (*p. 377*)

**Purpose of the Work.** We compared the effectiveness of three devices for recording the heat of the skin (videothermography, infrared beam thermography, and contact thermography) that are used in diagnostic procedures. **Subjects/Procedures.** Using each device, the skin of both lower limbs was imaged sequentially for 139 male and 15 female patients reporting lower limb pain. Images were also made of an electronic heat producer to determine accuracy. **Results.** The contact thermograph was unable to image many areas accurately and was unable to produce accurate recordings under several common conditions. The videothermograph and infrared thermometer were simple to use and very accurate. **Relevance to Veteran Population.**

Incorrect results can be avoided by not using a device that is too inaccurate for many applications. Savings can be achieved by using the infrared thermometer (less than \$200) instead of the videothermograph (about \$70,000).

*Richard A. Sherman, PhD*

### **Obesity and Metabolic Disorders in Adults with Lower Limb Amputation.**

Sergey F. Kurdibaylo, MD (*p. 387*)

**Purpose of the Work.** To investigate the features of obesity progression and disorders of metabolism in adults with lower limb amputation, and to develop aids for exercise training and balanced nutrition to maintain a person's ambulatory status with a prosthetic limb.

**Subjects/Procedures.** Ninety-four subjects with various levels of lower limb amputation were studied. To determine body mass, 68 subjects were measured with a caliper at the skin folds on various parts of their bodies. Biochemical research of cholesterol metabolism was conducted on 26 subjects. **Results.** Measurements of body fat and biochemical research revealed changes in subjects with lower limb amputation. This progression of obesity directly depends on the level of amputation and the degree of activity decrease and nutritional increase. This was detrimental to prosthetic fit and comfort and contributed to a sedentary lifestyle. Based on this research and on clinical observation, consistent physical exercise and reduction of caloric intake are recommended in order to achieve complete medical and social rehabilitation of subjects with lower limb amputation. **Relevance to Veteran Population.** Obesity and a sedentary lifestyle in adults with lower limb amputation can hinder retention of prosthetic fit; thus decreasing the ability to ambulate while wearing a prosthesis. This could restrict a person to wheelchair activities and accelerate atherosclerotic disease unnecessarily.

*The Editor, for and in the absence of, the author.*

### **Relationships of the Vibromyogram to the Surface Electromyogram of the Human Rectus Femoris Muscle During Voluntary Isometric Contraction.**

Yuan-ting Zhang, PhD; Cyril B. Frank, MD; Rangaraj M. Rangayyan, PhD; Gordon D. Bell, MD (*p. 395*)

**Purpose of the Work.** Vibromyographic (VMG) signals (sometimes called muscle sounds) are vibration signals associated with muscle contraction. The purpose of this work was to understand VMG signals and study

their relationship to the surface electromyographic (EMG) signals recorded simultaneously during voluntary contractions. **Subjects/Procedures.** Four non-disabled, adult, male subjects were studied. VMG and EMG measurements were performed on the rectus femoris muscle during 20–80 percent of voluntary isometric contractions at three knee joint flexion angles.

**Results.** For the rectus femoris, there seems to be a linear VMG versus EMG relationship during the four discrete levels of isometric contractions. **Relevance to Veteran Population.** The VMG may be used as an aid in the retraining of limb movements using biofeedback, and may also be useful in the automatic control of powered prostheses.

*Yuan-ting Zhang, PhD*

### **Factors Associated with Life Satisfaction Among A Sample of Persons with Neurotrauma.**

Lee Warren, MA; J. Michael Wrigley, PhD; William C. Yoels, PhD; Philip R. Fine, PhD (*p. 404*)

**Purpose of the Work.** This study examines the effects of social and clinical factors on life satisfaction. **Subjects/Procedures.** A telephone interview of 175 persons, between 18 and 64 years old, with Traumatic Brain Injury (TBI) or Spinal Cord Injury (SCI) was conducted one year after discharge from the hospital.

**Results.** Findings show persons with TBI or SCI are two distinct groups with regard to factors affecting life satisfaction. The factors increasing life satisfaction for persons with TBI were: satisfaction with one's family, being employed, being married, blaming oneself for the injury, and having memory and bowel independence. For persons with SCI, satisfaction with one's family and blaming oneself for the injury were the only factors increasing life satisfaction. **Relevance to Veteran Population.** There are many veterans with TBI or SCI and these findings may help increase their life satisfaction.

*J. Michael Wrigley, PhD*

### **Chair Rise Strategy in the Functionally Impaired Elderly.**

Michael A. Hughes, MS and Margaret L. Schenkman, PhD, PT (*p. 409*)

**Purpose of the Work.** The purpose of this work was to examine how older people who have difficulty rising from a chair change what they do in order to be able to stand up. **Subjects/Procedures.** Eighteen subjects who

had difficulty rising from a chair allowed us to videotape them while they rose from a lower chair (more difficult) and a higher chair (less difficult).

**Results.** The results showed that in rising from the lower chair, the people in this group placed their feet closer to the body, increased how fast they bent

forward, and took longer to rise. **Relevance to Veteran Population.** People with difficulty rising from a chair change their strategy when they rise from a low chair. These changes are a mix of tactics that result in an inefficient method of rising.

*Michael A. Hughes, MS*

