

Modern Concepts of Functional Electrical Stimulation

FUNCTIONAL ELECTRICAL STIMULATION (FES) may cause paralyzed muscles to contract in some clinical circumstances. In general, FES is a valuable tool in activating any muscle paralyzed as a result of upper motor neuron (UMN) damage. In contrast, electrical stimulation cannot be used to stimulate muscle contraction in lower motor neuron (LMN) damage. A clinician can determine the extent of LMN damage by relatively simple diagnostic tests. In this issue of the *Journal of Long-Term Effects of Medical Implants*, we have enlisted the help of leading clinical authorities in completing collective reviews on modern concepts of FES.

Dr. Robert P. Wilder, Assistant Professor of Physical Medicine and Rehabilitation at the University of Virginia Health System, has coordinated the completion of a collective review on FES for dropped foot.¹ In his excellent review, he describes the techniques, use, methods, and clinical results of FES applied to the peroneal nerve in the treatment of dropped foot. In another report, Dr. Wilder describes the use of FES cycle ergometers to reverse the dramatic systemic and life-threatening effects of spinal cord injury.² His collective review demonstrates that two FES cycle ergometers offer promise in reversing the devastating consequences of spinal cord injury.

Dr. Gregory G. Degnan, Associate Professor of Orthopedic Surgery at the University of Virginia Health System, has been a leading authority in microvascular surgery, including free-tissue transfer, complex thumb reconstruction, and replantation of amputated parts, for the last two decades. Reinforced by his experience, Dr. Degnan has completed a collective review on the use of FES in tetraplegic patients to restore hand function.³ This unique technology has been devised to produce lateral pinch and palmar grasp in persons with C5 and C6 motor-level spinal cord injuries.

In two separate collective reviews, we recruited internationally recognized urologists who have been catalysts for innovations in urology throughout their academic careers. Dr. William D. Steers, Chairman, Department of Urology at the University of Virginia Health System and the Jay Y. Gillenwater Professor of Urology, completed a comprehensive collective review on FES of bladder and bowel in spinal cord injuries.⁴ This review focuses on the Finetech-Brindley bladder system, which enhances voiding through stimulation via electrodes implanted around the ventral sacral roots. Dr. Stuart S. Howards, Professor of Urology, Molecular Physiology, and Biological Physics at the University of Virginia Health System, completed a collective review on FES for ejaculation.⁵ This important review discusses the technique and effectiveness of rectal-probe ejaculation in conjunction with various assistive reproductive modalities. This technology is considered the best approach in patients with spinal cord injury levels below T-10 or those in which penile-vibratory stimulation fails.

As the reader gathers pertinent information from these superb collective reviews, the imprint of four individuals who contributed significantly in finalizing these comprehensive scientific endeavors will be evident. Elizabeth Jones, a fourth-year undergraduate in systems engineering at the University of Virginia, proved to be a valuable resource as a thoughtful and gifted writer who contributed to each of the collective reviews. Tyler Wind, a second-year medical student at the University of Virginia School of Medicine, actively collaborated with the talented physicians as they prepared their reviews. He became so inspired by his experiences in orthopedic surgery and rehabilitation medicine that he plans to pursue a career in orthopedic sports medicine. Our administrative assistant, Brenda Crider, put her heart and soul into this endeavor as she searched

the literature for pertinent scientific publications. Because Brenda displayed critical insight into the treatment of dropped foot, she was included in this collective review. Finally, William Randall played a vital role in selecting clinical topics involving FES. His expertise in conducting clinical trials, understanding contract research protocols, and using medical-based computer information systems allowed us to select valuable FES products that will clinically benefit a well defined patient population.

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