


NEUROTECHNOLOGY
Advances in Neurotechnology for Persons with
Spinal Cord Injury

Contemporary Forums
★ Boston, MA ★ May 12, 2010 ★

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Helping people regain life through neurotechnology



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Objectives

- Identify four categories of neurotechnology devices and applications specific to SCI population.
- Describe the implementation of FES exercise program along with the rehabilitative and physiological impact to persons with spinal cord injury.
- Assess the applications of and potential patient outcomes of neurotechnology devices in the areas of neural prosthesis, adaptive neural systems and FES.
- Evaluate information resources available to rehabilitation professionals to enhance clinical practice for persons with SCI.

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Agenda


- **Introduction and Overview of Neurotechnology**
Jennifer French, MBA
- **FES Cycling Program in Practice: One Center's Experience**
Kelly Root, MSPT
- **FES Rowing for Exercise**
J. Andrew Taylor, PhD
- Refreshment Break
- **Adaptations in the FES Device and in the Nervous System**
James J. Abbas, PhD
- **FES Applications for Spinal Cord Injury**
P. Hunter Peckham, PhD
- **Questions and Discussion**

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Sponsors *for this course*

- NEC Foundation of America
- The Craig H. Neilsen Foundation
- Restorative Therapies
- Cleveland FES Center
- Neurotech Reports

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Neurotech Network is a 501 (c)(3) non-profit organization dedicated to improve the education of and the advocacy to access neurotechnology devices, therapies and treatments for persons with neurological impairments, care givers and the medical professionals who care for them.

Neurotech Network, The Society to Increase Mobility, Inc. and its representatives do not rate, endorse, recommend, sell, distribute or prescribe any products, procedures or services. We provide resources to help make informed health decisions.


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What is Neurotechnology?

Definition: The application of medical electronics and engineering to restore or improve the function of the human nervous system.

Health and Economic Impact:

- Reduced long term care costs
- Increased independence
- Accelerate rehabilitation
- Improve quality of life
- Increase feelings of self-worth
- *Impact varies depending on device, therapy or treatment and specific user circumstances.*



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Variety of Applications

- Eyelid droop
- Epilepsy
- Shoulder Subluxation
- Sleep apnea
- Muscle atrophy
- Arm/hand rehab
- Cardiac assist
- Cough
- Pressure Ulcers
- Spasticity
- Bladder/Bowel
- Chronic Pain
- Gait rehabilitation
- Foot drop
- Parkinson's disease
- Depression
- Vertigo
- Dysphasia
- FES Exercise
- Smart Prosthesis
- Arthritis
- Nerve Repair
- Nerve Regrowth
- And many more to come

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Evolution of Neurotechnology

- 1950-1960 • Age of Prosthetics
- 1969 • NIH Neural Prosthesis Program
- 1976 • FDA regulate implants
- 1980 • Advances in technology
- 1990 • Labs to Marketplace
- 2000 & beyond • Device sustainability

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Categories of Neurotechnology

- Neuromodulation
- Neural Prosthesis
- Neural Rehabilitation
- NeuroSensing & NeuroDiagnostics

**There are variation of these main categories*

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Neuromodulation

- Spinal Cord Stimulation
- Surface Stimulation
- Implanted Drug Delivery Systems
- Sacral Nerve Stimulation
- Tibial Nerve Stimulation
- Transcranial Magnetic Stimulation

Spinal Cord Stimulation - Pain

TENS for pain

Sacral Nerve Stimulation - Overactive Bladder

Picture Sources: Medtronic, Empt

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Neural Prostheses

- Lower extremity
- Upper extremity
- Dysphasia
- Bladder Stimulator
- Breathing and Cough Assistance

Hand and wrist stimulation

Drop Foot Stimulation - Gait

Implanted breathing system

External stimulation - Dysphasia

Picture sources: Biometrics, Chattanooga Group, Innovative Neurotechnics, Synapse Biomedical

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Neural Rehabilitation

- Neuromuscular Electrical Stimulators
- Neural Reeducation Systems
- NeuroRobotics

FES Cycling

Robotic assisted interventions

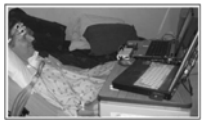
EMG & NMES

Picture Sources: Restorative Therapies, Rehabmedica, Zynex Medical, Repose Unit-Allerta


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NeuroSensing & Diagnostics


- EEG & EMG Sensing
- Brain Computer Interface
- Peripheral Nerve Sensing



Brain Computer Interface



Peripheral Nerve Sensing






EMG Movement Sensing

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Emerging Devices and Therapies


- New Electrode Designs:
 - BION
 - FINE
 - Spiral Cuff
- Pudendal Nerve Stimulation
- Wound Healing
- Implanted Drop Foot Stimulation
- Nerve Blocking
- Exoskeleton & Robotics

Picture Source: APT Center/FELIS Center, AMF

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Available Resources

- Website – www.NeurotechNetwork.org
- Fact Sheet with NSCIA: Neurotechnology for Traumatic Spinal Cord Injury
- Free Resources: Newsletters and User Experiences
- Central Database of Neurotechnology
- Advocacy for funding and reimbursement

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