



Neurotechnology for Paralysis: a satellite conference for the health care professional population

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Abstract Statement

Neurotechnology, the application of medical electronics and engineering to the human nervous system, is an expanding field of science. To further scientific development there is a need for discussion between consumers, clinicians and investigators. This satellite conference session may serve as a model replicated for various other health care disciplines providing a mechanism to update clinicians. It may also encourage feedback to investigators guiding future development of novel, consumer friendly, effective neurotechnology devices and therapies. Focused on paralysis and targeted toward the physical therapy profession, the session consisted of presentations and demonstrations of devices, active discussion and collaboration and measurement of key barriers of acceptance. Final results suggest a main barrier to the acceptance of neurotechnology is awareness and education. Further emulation of this model will require targeted matching of audience with applicable technology, more involvement of practicing clinicians in the selected profession and further inquiry of the clinical acceptance barriers.

Keywords: neurotechnology, paralysis, clinical application, physical therapy, barriers of acceptance.

Neurotechnology is defined by Neurotech Reports and Neurotech Network as the application of medical electronics and engineering to the human nervous system. Neurotechnology devices provide a unique avenue for promoting health, wellness and prevention for people with paralysis. "From consumers' perspectives, the focus of research, designed to restore function, ought to be based on their needs and desires and not just on the scientifically intriguing aspects of a particular technology." (Kilgore, KL, et al)¹. Information on the practical use of neurotechnology in non-laboratory environments is scarce. Moreover, the availability of new neurotechnology devices is rapidly growing. According to the "The Market of Neurotechnology: 2008-2012" published by Neurotech Reports², the FDA approved approximately sixteen new devices in the past three years. *There is a distinct need for a link between consumers, clinicians and investigators to further scientific development of neurotechnology devices in the treatment of neurological disorders.* This event was an attempt to bring together consumers and investigators in an interactive session with clinicians from the physical therapy profession.

Objectives

This project had four objectives in the context of a conference session targeting the health care professional population:

1. To provide a forum for the presentation and demonstration of the recent scientific and clinical findings in neurotechnology among health care professionals involved in treating people with paralysis.

2. To foster discussion and collaboration between health care providers who work with people with paralysis and investigators engaged in neurotechnology development to further translational and clinical applications of neurotechnology.
3. To measure the effectiveness of this conference and identify key barriers of acceptance among the targeted population.
4. To disseminate conference proceedings through the world-wide-web.

The Society to Increase Mobility, dba, Neurotech Network, was the organizer of this satellite conference session. As a non-profit organization, its focus is to disseminate information about neurotechnology devices to persons with impairments, their caregivers and health care professionals and to encourage the growth and direction of developments in the neurotechnology industry. The following description addresses each of the above objectives.

Objective 1: Presentation & Demonstrations

To provide a forum for the presentation and demonstration of the most recent scientific and clinical findings in neurotechnology among health care professionals involved in treating paralysis. This satellite conference session delivered an overview of neurotechnology and demonstrations provided by professionals directly involved with a sample device and by a user with a neurological disorder. This objective was established to encourage an exchange of ideas and practices as well as provide a base of scientific knowledge and the evolutionary industry sustainability regarding neurotechnology devices.

Objective 2: Discussion & Collaboration

To foster discussion and collaboration between health care providers and investigators engaged in neurotechnology development to further translational and clinical applications. This discussion focused on technological applications best suited for the treatment of persons with paralysis. This included currently available devices for clinical and home use and those being developed in the research environment. Interaction between health care professionals and the investigators developing the devices for scientific inquiry may foster development of practical applications.

Objective 3: Measure and Identify

To measure the effectiveness of this conference session and identify key barriers to acceptance among the attending physical therapy professionals. This was achieved by query of the session attendees. More importantly the query was used to identify attending practitioners' concerns toward the practical use of neurotechnologies and key barriers to acceptance. This information may help guide new scientific developments.

Objective 4: Disseminate

To disseminate conference proceedings through world-wide-web access. To help advance scientific knowledge, the conference session gathered feedback regarding clinicians' concerns. This information will be disseminated to the neurotechnology research community by posting this conference report on the Neurotech Network website.

The satellite conference session was held through a well-established gathering of physical therapist professionals in the United States, the 2008 American Physical Therapy Association Annual Conference in San Antonio, Texas. The physical therapy discipline was chosen since this profession has a high level of direct patient interaction and the increasing use of novel technologies by physical therapists to treat people with

paralysis. The session agenda and presenters are provided in the following section. An additional component to this session was to understand the concerns of clinicians regarding neurotechnology and the barriers to its use in the treatment of their patients. In the long term, this satellite conference session may serve as a model which could be replicated for various other health care disciplines; such as rehabilitation medicine, occupational therapy, nursing and case management. As a model session, it may be used as a mechanism to update clinicians on developments in the field of neurotechnology and to provide feedback to investigators regarding the future development of novel, consumer friendly, effective neurotechnology devices.

Session Proceedings

As the field grows, where can rehabilitation professionals find the resources to stay abreast of the latest developments in order to provide the best possible care for their clients? This session provided presentations, discussion and demonstrations of recent scientific and clinical findings in the field of neurotechnology for treating people with paralysis. An introductory presentation to the field of neurotechnology covered fundamentals of the technology, principles of electrical stimulation, growth of applications in practices and categorical areas of the field. The four categorical areas of neurotechnology were reviewed as Neural Prostheses, Neuromodulation, NeuroRehabilitation and NeuroSensing & Diagnostics. This was followed by an interactive question and answer session with demonstrations by people who use neurotechnology devices in their daily lives along with practitioner testimonials and experiences. Specific demonstrations were respiratory therapy, neural prosthetics, and neural rehabilitative exercise. This was followed by presentations by three neurotechnology investigators discussing the latest neurotechnologies being transitioned from the laboratory to the clinic. These presentations were preceded by a scheduled open discussion between the audience and panel of presenters to assess key acceptance barriers in the clinical setting. The session closed with the dissemination of resources that provided contact information about specific neurotechnology applications for practice and clients.

Presenters in this session were as follows (in alphabetical order):

- 1) Stephanie Copeland, electrical stimulation exercise user and person with spinal cord injury
- 2) Jennifer French, Executive Director, Neurotech Network
- 3) George Fulk, PT, PhD, Assistant Professor, Clarkson University
- 4) David Hankin, Chief Executive Officer, Alfred E. Mann Foundation
- 5) Lorrie Hemerly, drop foot stimulation user and person with multiple sclerosis
- 6) Patrick Jacobs, PhD, Associate Professor, Florida Atlantic University
- 7) Wendy Smith McBrayer, BS, RRT, Clinical Specialist, Synapse Biomedical
- 8) Keith McBride, MPT, DPT, Adjunct Instructor, University of Maryland and Director of Consumer Education and Support for Bioness
- 9) Laszlo Nagy, diaphragm pacing system user and person with spinal cord injury
- 10) Beverly Walters, MD, MSc, FRCSC, FACS, Consulting Medical Director, Cyberkinetics Neurotechnology Systems
- 11) Paul Yoo, PhD, Research Associate, Neural Prosthesis Laboratory, Duke University

Advisory Committee Members

- James Abbas, PhD, University of Arizona
- Anne Bryden, OTR/L

- Warren Grill, PhD, Duke University
- P. Hunter Peckham, Case Western Reserve University
- Mary Bucket, Neurotech Network
- James Cavuoto, Neurotech Reports
- Jan Dobbs, Advisor
- Laszlo Nagy, Advisor

The presenters were gathered together for the session on June 14, 2008 in San Antonio, Texas. The session agenda was as follows:

Agenda

Introduction to Neurotechnology: Presented by Jennifer French & George Fulk.

Description: This session provided an overview of neurotechnology, developments from the past to the present, categories and application of available devices and therapies.

User Demonstration and Practitioner Testimonials: Presented by those listed below.

Description: This session offered demonstrations of select devices, user experiences and the explanation of the physiology and application of the device.

Respiratory Therapy – Wendy Smith McBrayer and Laszlo Nagy

Neural Protheses - Keith McBride and Lorrie Hemerly

NeuroRehabilitation Exercise – Patrick Jacobs and Stephanie Copeland

Future Developments in Devices: Presented by those listed below. *Description: This session provided three examples of devices that are in various stages of development*

Restoring Urinary Tract Function using Nerve Cuff Electrodes – Dr. Paul Yoo.

Oscillating Frequency Stimulation for Acute Spinal Cord Injury- Dr. Beverly Walters, MD

Implantable Microstimulator System - David Hankin

Discussion – Barriers for Acceptance: *Description: This session engaged discussion and exchange of ideas focusing on practical application of devices, barriers to access and delivery, in addition to how future scientific developments may be improved.*

Resources for your practice and patients: *Description: Distribution of a practical guide listing neurotechnology devices and therapies and contact information related to persons with paralysis.*

The persons attending this conference session were also attendees of the three day American Physical Therapy Association (APTA) Annual Conference and Exposition. Each attendee pursued the session from the conference brochure guide. Listed as “Neurotechnology Fundamentals and Emerging Devices for Persons with Paralysis”, the session overview and education credits were made available through the [APTA](#)

[conference website](#), listed in the conference brochure, daily newsletter and provided on daily poster course listings in the main convention hall. Handouts from the session presentations are available to attendees also through the conference website. Venue and presentation electronics were provided by APTA.

Observations for Future Sessions

There were several observations of this session and suggestions for future improvements.

Targeted Attendance

The first observation was the lower than expected attendance. Potential rationale for the attendance may be, for instance, the day of the week, the title and description of the session, the chosen conference or the perception of neurotechnology as practical application. The session was conducted on a weekend day and the last day of the conference. With an overall attendance of nearly 3000 physical therapists, this session attracted only a fraction of this number. Attendance may be higher if presented earlier in the conference and not on a weekend day. The annual conference venue may have been the wrong APTA venue for this session. This venue typically attracts students and administrators in the physical therapy profession. As a session focused on applications to patients, this session may be more appropriate for a conference with an attraction of clinicians with more direct patient contact. The title of the session and the description used the term “neurotechnology”. This project was created under the premise of the lack of awareness epidemic of neurotechnology in the clinician population. Particular for the physical therapy profession, the wide exposure in practice is limited to such areas as pain management or muscle strengthening after surgery or injury. With this in mind, the description of the session was inappropriately focusing on the technology rather than the applications. Future sessions should be titled and have accompanying descriptions to focus on the practical application for the audience. From these attendance observations future session may be targeted to the appropriate audience, scheduled advantageously and described and titled to more effectively communicate to the targeted audience.

Session Structure

There are three areas of session structure; agenda content, time management and presentations. Content in the agenda was relevant for this targeted audience. It progressed from an introduction of what is available to a sampling of future technologies. The organizers encouraged a broad overview of neurotechnologies; however, we believe in the future tools related specifically to the physical therapy profession would invoke a better response. The conference session was scheduled for a three hour period. This proved to be either too much content for the time allotted or not enough time for the constructed content. The current structure allowed little time for in-depth question and answer or discussion. Finally, the presentations in the current structure were well prepared and delivered. To attract more attendance in the solicitations prior to the event, it may be helpful to provide more practicing clinicians and physical therapist researchers to be involved in the presentations. With these points considered, future events should be cognizant to the agenda content specific to the audience profession, time constraints and involvement of more practicing professionals.

Feedback

Near the end of the session, a questionnaire was distributed to the audience participants. This tool queried them on 3 main areas of concern: Safety and Training, Insurance Reimbursement and Finance, and Awareness and Education. Only twelve

participants completed the questionnaire. Potential errors from any conclusions drawn include too small a sample size, self-selection of respondents and group influence.

The respondents were nearly split in half between their primary roles as a physical therapists and students of the profession. They were also split in half between those who never have used neurotechnologies as defined in the session to those who have. However, there are no correlations between primary role and past use. Finally, those that have used neurotechnologies in the past, the majority reported occasional or some use in their practices. Respondents were asked to respond to statements on a five point Likert scale. The statements were a mixture from the three main categories. The responses to the insurance reimbursement and financial access statements were universally responded with no opinion. Therefore no inferences may be drawn in this category.

The others do not have this issue. In the area of Safety and Training, two statements receive strong response shown with low standard deviations. The first was a strong agreement among the respondents to the perception of neurotechnology devices as complicated to use and recommend. The second is the expressed need to have information to pass on to patients. The final significant correlated response was in regard to the concern for patient safety. There was a low level of concern that using neurotechnologies may cause the patient more harm than good. The final category was Awareness and Education which showed the most areas of correlation amongst responses. A need for training opportunities and a means to stay updated on neurotechnology were expressed in this area. There was some correlation between the responses in these two areas but it is not significant. Another highlight of this category was the high response (58%) to the acknowledgement that neurotechnologies are applicable to their physical therapy practices. This may provide an opportunity for more satellite conference sessions with the need for exposure, relevance to the profession of physical therapy and the expressed desire for more learning.

The results of the questionnaire showed that the main barriers to the acceptance of neurotechnology were awareness and education. Despite the limitations associated with this data, it provided a brief glimpse of the perceived barriers by physical therapists that, in turn, suggested the need for further inquiry to expand on these conclusions. As these sessions are crafted in the future, it may be helpful to discover the kinds of neurotechnology driven tools physical therapy professionals would like or need in order to better treat their patients and to make their practices more attractive to potential clients.

Summary

In the long term, this satellite conference session may serve as a model which could then be replicated for other various disciplines in health care; such as rehabilitation medicine, pain management, or case management. This satellite conference and its successors may be used as a mechanism to update the clinicians on the developments in the field of neurotechnology. There is also an additional component to advance the scientific design and development of neurotechnology devices, namely understanding the concerns of clinicians regarding neurotechnology and the barriers to its use in the treatment of their patients. Additional inquiry is needed of the physical therapy profession to truly understand the barriers to acceptance. Furthermore, open discussions to gather qualitative information is needed to supplement a quantitative query. It is asserted that the outcome from this project will provide a model conference

tailored toward the need to communicate neurotechnology applications and advances to rehabilitation professionals and that will provide a feedback mechanism to the research and industry communities to assist in future advances in the field.

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