

Chapter 6

Neuroprostheses as an Element of an Eclectic Approach to Intervention in Neurorehabilitation

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ABSTRACT

Improvements in the effectiveness of contemporary neurorehabilitation emphasize the need for a shift from a specific approach to intervention to an eclectic approach to intervention. The novel strategies of brain-computer interfaces' and neuroprostheses' application in an eclectic approach to intervention may be regarded as leading the way in clinical practice development. There is a limited amount of evidence both in the areas of theoretical principles and clinical applications, but it seems the application of various rehabilitation methods and techniques may effectively support the outcomes of the BCI's and NP's use. The author aims investigate the extent to which the available opportunities are being exploited, including current and potential future applications of neuroprostheses within an eclectic approach to intervention in neurorehabilitation.

INTRODUCTION

Recent progress in the area of brain-computer interfaces (BCIs) and neuroprostheses (NPs) may offer another breakthrough in neurorehabilitation, especially as an element of an eclectic approach to intervention (Mikołajewska & Mikołajewski, 2012; Mikołajewska, 2012). The number of disabled, severely ill, and elderly people requiring the aforementioned devices may significantly increase

in the years to come. No doubt independence, increased quality of life, community participation and integration are considered the primary goals of contemporary holistic neurorehabilitation based on the biopsychosocial approach to health care (Mikołajewska, 2012). The diverse and complex set of patients, activities, deficits and settings may significantly influence the choice of possible forms of therapy. Moreover, the possible types of interventions (sets of interventions), degrees of

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clinical support and models of intervention within holistic neurorehabilitation programs may need further definition; current approaches may need redefinition, novel models, programs, classifications and methodologies as well as comparisons. But integration of the best scientifically supported methodologies within an eclectic holistic neurorehabilitation model is not easy. Attempts to provide an easy-to-learn model to patients with neurological deficits, their families/caregivers and medical staff (including rehabilitation professionals) make this efforts hard to achieve. An eclectic/mixed approach to intervention and associated methodologies is intended to offer a coherent framework for hypothesis generation, clinical decision-making, evaluation of treatment outcomes and direction of future research (Martelli et al., 2012; Jones et al., 2008). Eclectic therapy is not a purely innovative therapeutic idea (DeGangi & Royeen, 1994). It seems to be unconsciously, intuitively used by experienced therapists (Tyson & Selley, 2007; Jette et al., 2005), but was not quite defined previously. An eclectic approach is the synthesis of classical intervention methods, techniques, and tools, and requires the design and evaluation of experimental research studies of its efficacy. An eclectic/mixed approach stimulates change and advancement, and allows for a flexible transition from a traditional approach to a patient-tailored therapy. Advanced clinical practice requires using an individual and problem-solving approach, and advanced skills in the therapy of patients with complex dysfunctions. An eclectic approach may be regarded as a natural form of neurological rehabilitation in adults since there is no particular method (techniques, tool) in neurorehabilitation which may be perceived as more predominant over others.

This article aims at investigating the extent to which the available opportunities are being exploited, including current and potential future applications of neuroprostheses within an eclectic approach to intervention in neurorehabilitation.

Background

The general aim of the neurorehabilitation is to achieve, in the shortest time, the best outcomes available within the current health status of the patient. Neurorehabilitation is closely connected with the methods used (techniques, tools) for treatment. It is necessary to combine medical, social and psychological rehabilitation. But due to the variety of deficits, patient characteristics, and many more medical, psychological, and social factors, the application of detailed schemes in neurorehabilitation is considered difficult. An eclectic approach responds to this problem by offering a modern individual approach to the patient with neurological deficits. The restoration of function in patients after nervous system damage can be based on:

- Functional recovery (thanks to preserved neural connections, neural plasticity, etc.) through intensive repetitive exercises,
- Function supplementation and support,
- Function replacement by assistive technology, BCIs, and NPs (Table 1).

There are at least several key issues concerning the rehabilitation process:

- The implantation/installation of the BCI/NP is the beginning of the therapeutic process,
- Successful treatment requires patient approval, joint goal-setting, and objective evaluation of the therapy results,
- BCI/NP training is performed as a part of the rehabilitation schedule,
- The number of erroneous trials decreases during the training period,
- The training process is finished when required features of control (e.g. speed, precision, etc.) are achieved,

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