

Neurorehabilitation and Noninvasive Brain Stimulation: The Dawn of a Relationship and the Importance of their Understanding

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“The process of recovery is obviously of vast importance for our consideration in regard to rational treatment of some cases of very serious brain disease; for if recovery be spontaneous, we may err in attributing it to the effects of our remedies, and thus our opinions on therapeutics become untrustworthy”

Sir Hughlings Jackson, 1888

It wasn't long ago when patients suffering from neurological or neuropsychiatric conditions were left in institutions because their pathologies disrupted their cognitive or physical functioning. Having neither much scientific foundation nor evidence of efficacy, hopes faded away in the eyes of patients, relatives, and treating physicians. Usually, professionals in the field of rehabilitation found themselves in front of complex cases, where the basic understanding of the neuro-cognitive deficits and how to promote recovery were just abstract ideas supported only by speculations. Fortunately, as in the case of any other medical specialties, science helped develop a new discipline that was supported by rigorous research methodologies and advancements in biomedical technology, boosting the growing field of rehabilitation. Thus, neurorehabilitation was born, and came in a time where patients affected by life-threatening conditions were beginning to survive more than before. Those with chronic illness saw an increase in their life expectancy, and these epidemiological changes in the neurological population geared medicine and related disciplines to promote research based in the necessity to improve quality of life, but also to facilitate the reinsertion of these patients into productive environments.

Neurorehabilitation is in a process of maturation, the sophistication of its applications relies on the gained knowledge coming from neurosciences, medicine and bioengineering. Hence technology is now being adapted for a better anatomical and physiological interface with its human component, and pharmacological treatments are better used thanks to the understanding of the processes involved in the natural recovery and the plastic changes occurring at central and peripheral level. Furthermore, we are combining treatment modalities in order to optimize clinical outcomes but also to facilitate the functionality of those patients suffering from disabilities.

Noninvasive brain stimulation (NIBS) is one of the techniques that have the potential for clinical applications in neurorehabilitation. Neuromodulation by electrical fields either by direct currents or

induced by magnetic pulses is becoming an attractive option to facilitate neurological restoration. Thanks to the mechanisms involved in promoting plastic changes, NIBS can be coupled with other forms of therapeutic approaches, enhancing processes of learning that can be utilized for rehabilitation purposes. The technological design of most devices, favors its use in the clinical settings and with previously generated knowledge, we are now able to train patients within a period of time where the effects of the stimulation can have long-lasting effects by enhancing long term potentiation (LTP) or long term depression (LTD), which can be used to compensate deficits or inhibit circuits due to maladaptive plasticity. However, we still in the need to gain better understanding of how physical forces interact with biological tissue, and this is what needs to be promoted among researchers if we want to get NIBS accepted as treatment option in neurorehabilitation. Basic and translational research should be endorsed and this is one of the premises for the International Journal of Neurorehabilitation.

We should benefit from the momentum offered by the media attention and lay curiosity, now *plasticity* is on fashion and we have the responsibility to guide these inquiries and also those individuals with misconceptions about how to recover from neurological insults. We have also reached a point where clinicians and researchers working in this arena have the duty to educate, transform, and build the field of NIBS supported by strong scientific foundations, with the purpose to provide better care to the incoming wave of patients that will need our assistance. And for this we should start with the professionals in formation, neurorehabilitation and NIBS needs to be thought in universities and rehabilitation centers to sensitize these young professionals in an environment where medicine, mechanics, physics, engineering, and computer sciences blend with the intention to offer a pathway of wellness.

The International Journal of Neurorehabilitation has the compromise to disseminate knowledge among the clinical and scientific community, and is our compromise to expose the readers to high quality manuscripts that reach standards of excellence in diverse areas of neurorehabilitation. Because this is the only way, that our patients will receive the real benefits from science and technology. This is why we want you to be optimistic, but also critical about the work presented in the first issue of the International Journal of Neurorehabilitation.

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