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Editorial

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Non-invasive neuromodulation as a physiotherapeutic resource in the treatment of neurological and musculoskeletal dysfunctions

Neuromodulação não invasiva como recurso fisioterapêutico no tratamento das disfunções neurológicas e musculoesqueléticas

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Neuromodulation techniques include a variety of procedures designed to modulate activity of the human nervous system and improve various health conditions. The use of noninvasive clinical neuromodulation (NIN) was initially developed through its application in cases of psychiatric illness, and then applied for other purposes, such as in the control of chronic pain, movement disorders, epilepsy, tinnitus and rehabilitation after stroke[1,2]. Recently, studies have shown that the use of NIN associated with active therapies has potentiated effects. Evidence shows a stronger effect when NIN is associated with occupational therapy[3], assisted upper limb robotic training[4], and cognitive behavioral therapy for depression[5], language therapy for aphasia[6], among others. Iosa and co-authors[7] point to NIN among the seven most promising technologies for the future of rehabilitation.

Physiotherapy is a profession that aims to treat movement dysfunctions with the help of physical resources. Electric and electromagnetic currents therefore make up the arsenal of resources used by these professionals. Among the techniques most used with neuromodulatory purposes are repetitive transcranial magnetic stimulation (rTMS), transcranial Direct Current Stimulation (tDCS), and the various Peripheral Electrical Stimulation techniques (PES). These techniques generally act by increasing or decreasing the excitability of the cerebral or cerebellar cortices, causing neurons and neuronal networks to change their functioning states. Its use makes sense especially when functioning in the central nervous system is altered in terms of excitability and / or connectivity, characterizing pathological states of functioning.

tDCS is a painless noninvasive cortical modulation technique that, by applying low intensity direct current to the cranial scalp, is able to alter cortical excitability and thus interfere with the performance of different functions. Thus, it can influence motor and sensory functions[8]. Its effects depends mainly on the applied current polarity, its intensity, the application time, the stimulated area and the current density[8,9]. Under the anodic electrode, most of the time, increased excitability is observed; while under the cathodic, a cortical inhibition is observed.

rTMS is based on the principle of electromagnetic induction, generated from a high power alternating electric current applied to a coil with coiled copper wires. The constant change in the orientation of the electric current within the coil is capable of generating a magnetic field through the skin and

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bones. When this field is applied over the cranial scalp, it is able to modulate the activity of the cerebral cortex[10]. During rTMS application, electrical currents are induced in cortical areas that can depolarize neurons and generate action potentials, promoting inhibition or increase of cortical excitability in specific areas. These induced changes in neuronal activity may influence neural networks, promoting plasticity in the central nervous system[11,12]. These characteristics make TMS an arguably useful tool also for assessing brain activity, plasticity, muscle representation, and excitatory or inhibitory brain functions[13]. In addition, it is an excellent resource to be associated with other active modalities of therapeutic exercises that can be applied at pulse train intervals[14].

It has recently been revealed that PES also has effects on brain behavior and plasticity. The application of PES causing peripheral muscle contractions may increase cortical excitability, such as anodic tDCS or high frequency rTMS[15,16]. With this it is possible to selectively promote plasticity in the representation of muscles in the cerebral cortex, inhibiting or facilitating its activity. Other modalities of neuromodulation are less well known, but they have also shown promising results leading us to believe that in the near future they will also be incorporated into routine physiotherapeutic practices. Among these, we highlight the transcranial Alternating Current Stimulation (tACS), transcranial Random Noise Stimulation (tRNS),transcutaneous Vagus Nerve Stimulation (tVNS), and transpinal Direct Current Stimulation (TsDCS), among others.

The main concern related to the explicit use of NIN is the adverse effects, however, severe adverse effects are very rare. Hence, safety care in applying the techniques should be part of the routine of care and research services[17]. Still, they are equivalent or smaller than any other modalities already consolidated and used by physiotherapy. In Brazil, the Federal Council of Physical and Occupational Therapy (COFFITO) ensured through Resolution No. 434/2013 the use of both rTMS and tDCS techniques in the clinical practice of the physioterapists. The application of the techniques is only allowed in clinical conditions where there is already a level of scientific evidence that justifies their therapeutic indication, as stated in COFFITO Judgment No. 378/2014. Physiotherapists are required to be accredited to the Regional Council for Physical and Occupational Therapy (CREFITO) in their jurisdiction to use NIN techniques. For accreditation, the professional must present proof of practical first aid knowledge and proof of training course or in-service training with a minimum of 30 hours for tDCS, 60 hours for assessment TMS, and 60 hours for rTMS. Also, 60% of the content must be from practical activities. Certification must be made by a higher education institution or professional association.

It is hoped that this panel helps clinical physiotherapists to be interested in NIN techniques, which may be very helpful to alleviate the suffering of those who seek improvement of movement dysfunctions, reason for being of our profession.

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