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Guest Editorial

Nonsurgical Laser Treatment (NSLT) of Central and Peripheral Nervous System Injuries

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The lasers used in nonsurgical procedures have biomodulatory effects on all human tissues and have been demonstrated on experimental animals and humans at a cellular level, having a measurable effect on almost all cell and tissue types, including the central and peripheral nervous system. Detailed information now exists on the anti-inflammatory, analgesic, and regenerative effects that have been proven in many tissue types, including neurons in culture in both animals and humans, and biomodulatory effects on the muscle tone of voluntary muscles.[1–4]

In 1979, Judith Walker underlined the analgesic and anti-inflammatory effects of nonsurgical lasers on neuromas associated with lower limb amputation. In 1975, V.M. Inyushin and P.R. Chekurov underlined the anti-inflammatory effects of laser on bone–joint–muscle–tendon diseases; J. Goldman, on blood parameters of rheumatoid arthritis; in 1971, R. Fork, on the regeneration of peripheral nerves in animal models. Many other authors have studied and are studying the possible effects of laser on the regeneration of the central and peripheral nervous system.[2–6]

In our institute, in common with Japanese authors, we began to treat subjects with lesions of the central nervous system (CNS) using low incident laser energy, trying to exploit the power of these systems at the anti-inflammatory, regenerative, and analgesic levels. From 2003, we started to treat subjects with traumatic spinal cord injuries (SCIs) and brain injuries (BIs), and others with central nerve degenerative lesions (multiple sclerosis, amyotrophic lateral sclerosis, demyelinating leukodystrophy, and syndromes of the lower motor neurons). Indeed, before we started, Prof. Yoshimi Asagai[1] in Japan routinely treated children with hereditary spastic cerebral palsy with low-level laser therapy (LLLT), reporting excellent results, as well as many other Japanese authors.

At a clinical level, one big problem is that each traumatic CNS injury is always different, regarding both the loss of function and the selection of the most appropriate treatment. For this reason, statistical criteria are less valid, because many variable parameters are involved concomitantly. However, some international criteria based on international scales of clinical evaluation are followed by the scientific community, such as the American Spinal Cord Injuries Association (ASIA) Impairment Scale (AIS) for the subjective evaluation of sensor and motor function, Ashworth Scale, for the evaluation of muscle tone, the Franklin Scale, the Glasgow Coma Scale, and others.

In contrast, in medicine and biology, any clinical trial must always follow three fundamental criteria: the precepts of the Helsinki Declaration and European Community (EC) Guidelines; Virchow's approach: ''At first we study the facts, then the causes of facts''; and the WHO approach.'' We must study and verify each substance, energy, and tool, which modify a physiological process of the human body.

From 2004 until 2015, we enrolled 289 patients with traumatic spinal cord injuries (TSCI), which had occurred at least 1 year before laser treatment and documented each case with computed tomography (CT), nuclear magnetic resonance (NMR), evoked somato-sensory potential (ESSP), and evoked somato-motor potential (ESMP), rather than the clinical international scales. All patients had total and/or subtotal sensory and motor paralysis under a lesion level classified as AIS A. The lasers used were 808, 10,600, and 1064 nm, applied with a first cycle of 20 sessions, 4 a day. We used more wavelengths concomitantly because each wavelength has different penetration depths, targets, and absorption characteristics in the tissue. We use the laser for different goals, namely anti-inflammatory, regenerative, and influencing muscle tone. From 2013, before laser treatment under the level of the lesion, muscle activity was tested also with a surface electromyography (sEMG) system. Clinical evaluations always included examination and assessment of superficial and deep tactile and thermal sensory levels under the level of the lesion.

A therapy protocol was used according to the clinical conditions of each patient. Dosage was adjusted following the clinical results. The same clinical evaluations and sEMG examinations were repeated at the end of each cycle of treatment. The cycles of treatment were replicated in average every 2 months. A group of patients stopped the therapy for a longer time interval for practical reasons, such as diseases that overlapped, support from a family member or other third party was impossible, and more.

Results were regarded as positive if the sensory sensibility increased by a minimum of two metamers under the level of the lesion. sEMG showed modifications in CNS–muscle conduction spikes, under the same level. Regarding the state of the TSCI, after each cycle of 20 sessions, patients showed improvements in motor function and voluntary command.

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