SCIENTIFIC AND CLINICAL EVIDENCE NON-INVASIVE NEUROMODULATION NESA

nesa® non invasive neuromodulation microcurrents

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Content

1. INTRODUCTION

The information processing system of the body includes three subsystems (brain-nervous system, endocrine system and the immune system) fully coordinated due to the optimal functioning of the human body. A disease state is more than the abnormal functioning of the electrical and chemical information processing. In many cases, involves an interactive electrophysiological excitation or inhibition of the brain-nervous system.

Nesa non-invasive neuromodulation is based on a superficial treatment with electrical microcurrent (generated by the device called Xsignal), which is governed by Wilder's law and the concept of hormesis (Diazguerrero et al., 2013). This technology produce imperceptible sensations through low impedance zones. The effect of the electric current is multiplied due to the fact multiple routes structurally cover the entire body, by the electrodes of the extremities and the guide.

NESA technology was developed based on the basic principle of electrical neuromodulation for pain control and the autonomic nervous system, that is, electrical stimulation that can produce changes or modulations in neural electrical shoots. It was created thanks to a team of Japanese scientists and engineers. Through trial and error studies, over 10 years, they established the low impedance input nerve pathways, which corresponds to currents electrode locations. In addition, they registered and designed the electrical sequences of each program with their records of effects produced and objectives. The objective is achieving results through the use of a minimum current for the body's information processing system. In this sense, the NESA microcurrent generator allows the input of the electrical signal and creates the possibility of modulating the nervous system through a current without polar effects. It is also imperceptible, however it may stimulate or modulate small caliber fibers.

Non-invasive neuromodulation NESA therefore, occupies an independent position, separate from conventional electrotherapy. Thanks to its characteristics, it can be applicable to different clinical scenarios, such as symptoms secondary to the excitement and tension of musculoskeletal, visceral and / or vascular systems. NESA could improve conditions that need the restoration in cases where there are several complications with psychosomatic consequences and imbalances or affectation of the autonomic nervous system.

NESA is a technology that extends among various health fields: nursing, neurology, dentistry, psychiatry, dermatology, obstetrics and gynecology, pediatrics, sports medicine, rehabilitation, home treatment, preventive medicine and physiotherapy in all its variants. It is also a growing technology and scientific advance that may open a future frontier.

2. NESA NON-INVASIVE NEUROMODULATION APPLICATION

The effect of the electric NESA microcurrent is multiplied thanks to its supply by multiple routes that structurally cover the entire body.

2.1 Circuit structure and electric current

Non-invasive NESA neuromodulation is produced thanks to the XSIGNAL device, which generates a microcurrent through the 24 semi-electrodes located on the wrists and ankles. Along them and the directing electrode added, close the electrical circuit through the body (in total there are 4 electrodes divided into semi-electrodes and a fifth called directing electrode). It is a symmetric biphasic microcurrent, with low frequency and limited intensity.

It is necessary to have specialized training about how to located correctly the semi-electrodes in the 24 hand and foot positions, as well as the programs applied. As an instrument to facilitate its application, highly elastic gloves and anklets are used. They have the semi-electrodes installed corresponding to the exact nerve place, determined by the low impedance areas.

Once the electrodes are placed, a potential runs gradually following the afferent and efferent senses of the nerve transmission (low caliber and low speed fibers). In sequence, within each specific program, the system of twenty-four semi-electrodes oscillates automatically producing sequences in negative or positive polarity. These activation sequences depend on each program's characteristics and the objectives planed.

Thanks to current studies such as clinical case reports, pilot studies and randomized clinical trials, the application objectives are being defined with greater precision. They have also provided evidence about the effectiveness in different health fields namely: Vagal Neurology and Neuromodulation, Rehabilitation, Sports Physiotherapy, Urology and Gynecology, Pain Management, Sleep Medicine, and Pulmonology and Respiratory Physiotherapy.

2.2 Physical characteristics

Each program is designed with sequences of different intensities, frequencies and voltage. At some exactly moment in the stimulus process, some sequences of the different programs register single-phase low-frequency currents (the design of the sequences is determined by the patent).

Frequency

The frequency is minimal. As a microcurrent, the determined frequency may be from 1.12 to 14.28 Hertz. The frequency varies depending on the programs design, which it can be static or oscillate between scales.

Intensity and voltage

The amperage is from 0.1 to 0.9 mA. The voltage or potential difference is set to 3 or 6 volts. The potential difference generated is very weak, therefore, although Ohm's law is applied, no differences are developed harmful potentials to produce polar and adverse effects.

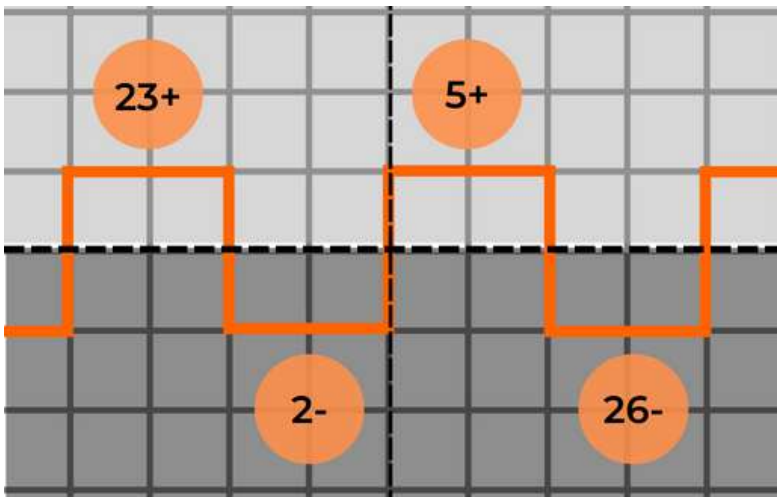


Figure 1. In the following figures, it is shown the location of the semi-electrodes in their corresponding wrist and ankle brace. It is represented, as well, their numbering (figures 2, 3 and 4).

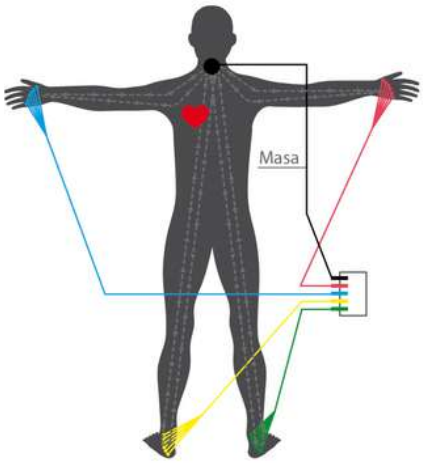


Figure 2. Body diagram of the locations of the 4 electrodes and the targeting electrode. The division into semi-electrodes is further appreciated.

The XSIGNAL® current transmitter introduces its signals through 24 electrodes located at the ends of both hands and both feet, as shown in the picture. The directional electrode acts as a grounding electrode, concentrating the impulses on specific areas. These areas are explained below under types of application. For the application of gloves and anklets, it is necessary to remove metal objects from the patient, and to clean the skin where the electrodes are placed. Attention should be paid to the size required for each patient, in order to match the electrodes to the prescribed locations and to achieve good contact of the metal with the skin.

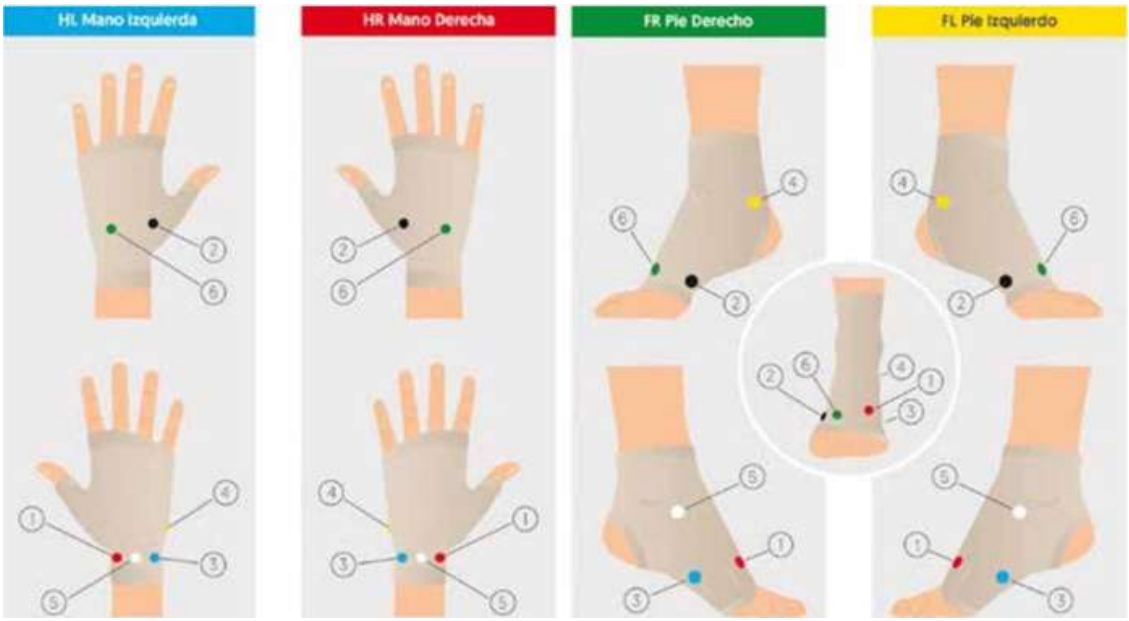


Figure 5 . Color clasification of electrodes.

Wrist	Ankle
1.Radial nerve (anterior branch)	1.superficial peroneal nerve
2.Radial nerve (posterior branch)	2. Saphenous nerve
3. Ulnar nerve (anterior branch)	3. Sural sensitive nerve
4. Ulnar nerve (cutaneous branch)	4. Tibial nerve (calcaneal branches)
5. Median nerve (palm branch)	5. Superficial peroneal nerve
6. Ulnar nerve (dorsal branch)	6. Deep peroneal nerve

Figure 6. Nerves description bay semi-electrode.

2.3 Installation of non-invasive neuromodulation NESA

The following indications must be taken into account for its application.

- Preferably, remove metal objects from the patient: watches, bracelets, rings, etc.
- Lay the patient supine on a stretcher. If possible, place it with a cushion and with the popliteal area relaxed with a roller. If you cannot be accommodated on a stretcher, treat him comfortably seated.
- Clean the patient's skin with alcohol before place the gloves / anklets. Electrolyte cream is not needed.
- Install the gloves and anklets correctly in the front, back, right and left. Check the position of the electrodes on the screen of the treatment section.
- Ensure effective contact of the electrodes with the skin. After installing the gloves, connect the connections from the power supply device to the connectors on the gloves.
- Place the directing electrode (if there is abundant hair in the area of skin concerned, it is preferable to shave the area).
- Program the treatments to apply on the device.
- Start with the treatment.
- Remove, disinfect and save.

Figure 7. Graphic representation of the placement of the electrodes on the patient, in a passive application modality. The Xsignal device is appreciated on its table adapted for easy placement.

3. SCIENTIFIC EVIDENCE AND CLINICAL ADVANCES

3.1 CLINICAL AND SCIENTIFIC ADVANCES IN NEUROLOGY

3.1.1. Implications in neurology

The physioelectric characteristics of the NESA microcurrents allow the neuromodulation of the ANS at the systemic level. It produces modulations in the autonomic neuronal cascade and promote the normalization of electrically dysfunctional or pathological systems (R. Becker, 1998). As explained above, the propagation of current facilitates its transmission through the B fibers responsible for the preganglionic connection of the autonomic nervous system and the unmyelinated C fibers.

Special consideration should be given to the complete activation of the sympathetic system concept. It is produced by very intense emotional or painful stimuli that produce an activation of the sympathetic system throughout the organism through the hypothalamus. We can call this profile sympathetic-activated patients, and we can identify them thanks to the anamnesis at the first consultation. (McCorry, 2007). Nesa neuromodulation can help decrease the activation described. As is known, the role played by the autonomic nervous system in the generation and maintenance of certain painful states is significant (Knudsen et al., 2019). Thus, after certain injuries (Mischkowski et al., 2018), some changes can be observed as a consequence of the important modulation of this kind of systems. Moreover, those systems which involves central sensitization pain mechanisms and ANS (Drewes et al., 2020).

Some preliminary studies in the field of neurology are showing improvements in diseases such as complex regional syndrome (Molina et al., 2020), trigeminal neuralgia (Lledó-Amat, ancho-Francés, et al., 2021); changes in the patient's quality of life of with Multiple Sclerosis (Contreras & Medina-Ramírez, 2021) and in patients with cerebrovascular accidents (Lledó-Amat, et al., 2021).

In pediatric neurology, a double-blind randomized clinical trial with a control group (trial code: CEIC HUGCDN: 2019-474-1) is being developed with the aim of determining the effectiveness of superficial neurostimulation in children with neurodevelopmental disorders for improvement of constipation and quality of sleep (San Juan de Dios Hospital, Las Palmas de Gran Canaria, Spain) (Báez-Suárez et al., 2020).

Nowadays, a new line in geriatrics has been started with the objectives; to evaluate and improve the quality of sleep, stress and anxiety in people residing in Spanish health centers.

3.1.2 Implications for Vagus neuromodulation

The vagus nerve plays a crucial role in redirecting nerve impulses when ANS is neuromolating or systemic body. The mechanism of action of the NESA microcurrents in the neuromodulation of the Vagus can be multifactorial for the CNS; neuromodulating propagated cortical depression and inhibiting posterior trigeminal vascular nociceptive pathways (Chen et al., 2016), acting on the trigeminal-cervical complex (Akerman et al., 2017) and parasympathetic pathways (Möller et al., 2018). For this reason, it is an important ally in migraine and headaches, especially in cluster headaches (CR).

As it is global neuromodulation, the Vagus also plays an important role in the transmission of cascade modulation (Capitán Maestrando, 2013) through its vast network reaching the solar plexus and mesenteric nervous system, where sympathetic and parasympathetic fibers are combined. (Bouchet, 1979) allowing clinical results in pathologies that affect this area.

A physiological study has recently been started where it is expected to measure changes in the evoked potentials of both Median Nerves, Tibial Nerves, and Vagus Nerves, as well as to measure the somatosensory cortex corresponding to each one, before and after performing the 10 sessions. The objective of programming, therefore, will be firstly not to generate adverse effects on the patient; secondly, to enhance the effects on the nervous system that the device can generate, in a homogeneous way; and thirdly, to focus the action on the nerves. Peripherals and the cranial nerve being measured.

Figure 8. 3D details of the extension of the vagus nerve and mesenteric plexus.

3.1.3 Implications for neuromodulation of the cardiovascular system

Non-invasive neuromodulation NESA can produce changes in cardiac variability related to the ANS, although possible studies related to the parameter of cardiac variability in pathologies or optimization of sports training are still under development.

3.2 CLINICAL AND SCIENTIFIC ADVANCES IN REHABILITATION

3.2.1 Implications for sports rehabilitation and physiotherapy

Anxiety and concentration can be variables that affect sports performance, the first defined as an organism's response to external and internal stimuli, and the second as a psychic process that includes reasoning in terms of achieving a specific goal.
The need to find new and ecological variables focused on training adaptations and the recovery process in team sports players during training and competitive matches has increased in recent years (Coutts et al., 2017). Impellizzeri et al. defined internal load as a set of athlete responses in the presence of predominant physiological, psychological and biomechanical stressors due to external load during training sessions and matches (Impellizzeri et al., 2019). Heart rate variability (HRV), enzyme activity (for example, CK or cortisol or testosterone concentrations), or subjective perceptions (RPE, well-being, or DOMS) are indicators of adaptation and recovery or variables of indirect effects of internal load, instead of internal load variables (Kellmann et al., 2018; Vanrenterghem et al., 2017).

Non-invasive neuromodulation can act against all conditions that cause excitement and tension in the cerebral nervous, osteoarticular muscular, and visceral vascular systems, as well as improve the concentration levels of the players. It is currently applied in sports treatments, in soccer, badminton, runners and basketball.

Preliminary studies in soccer players have shown improvements in the experimental groups with significant differences (p-value = 0.041) for the quality of sleep with the application of NESA, compared to placebo groups. Recently, a double-blind randomized clinical trial (006 / CEICGC / 2021) is finishing the objective of which was to improve neural efficiency (improve performance and stress, improve coordination in the field, improve sleep quality, improve well-being of the athlete and reduce fatigue) and the performance of basketball players through a post-training NESA treatment. Preliminary results show significant differences (pvalue = 0.007; pvalue = 0.000; pvalue = 0.000) for the improvement of the quality of sleep (duration, REM and total sleep time) related to the biomarkers indicative of muscle damage and the loads applied in the intervention group. Both studies are in the publication phase.

Figure 9. Athletes with the application of non-invasive neuromodulation NESA and its portable versatility.

3.2.2 Implications for trauma rehabilitation

The implication of the neuromodulation of the autonomic nervous system in the improvement of injuries of a traumatic nature is also being widely studied. The application objectives are based on the improvement of pain, quality of life, functionality, acceleration of recovery and therefore to generate more effective and efficient units in the treatment of patients.

A study was carried out in patients diagnosed with whiplash occurring while traveling, thanks to the collaboration of a mutual organization, where the results showed a correlation in the improvement of pain and mobility. (see annex of studies).

Currently, a double-blind randomized clinical trial with a control group is active (CHUNSC_2020_97 PRONES Study) where it is intended to demonstrate that treatment with non-invasive neuromodulation NESA compared with usual treatment reduces pain, improves quality of life and functionality, both in the early postoperative phase, as well as in the medium and long term in postoperative patients undergoing total knee replacement. (see annex of studies).

Another of the current studies is the randomized double-blind clinical trial with a control group in patients undergoing ACL surgery (CPMP / ICH / 135/95), where its objective is focused on accelerating the patient's recovery process after ACL surgery and reduce the associated economic costs.

Figure 10. 3D representation of the application of non-invasive NESA neuromodulation showing the wrist half-electrodes and the directional electrode in a focal treatment, with determined localization.

3.3 CLINICAL AND SCIENTIFIC ADVANCES IN UROLOGY AND GYNECOLOGY

3.3.1 Implications in Overactive Bladder

Urinary Incontinence is a condition that causes involuntary urine leakage. There are two types of incontinence, that associated with efforts and the striated muscles of the pelvic floor, incontinence associated with the sensation of urgent urination not related to efforts. This last type of incontinence is associated with Overactive Bladder Syndrome. The International Continence Society (ICS) defined in 2002 the Overactive Bladder Syndrome (OAB) as a syndrome characterized by the presence of urinary urgency isolated or in combination with other symptoms, such as Urge Urinary Incontinence (UUI), generally associated with an increase in the frequency of voiding and nocturia, in the absence of another demonstrable disease (Alcántara Montero, 2016).

Men and women with OAB symptoms report low levels of quality of life related to health and work productivity, as well as high levels of anxiety and depression compared to those who have no symptoms or with minimal symptoms (Coyne et al., 2011). In Spain a population study was carried out to measure the incidence of OAB. The prevalence of the general population> 40 years is 21.5%, being higher in women (25.6%) than in men (17.4%). Only 28.4% of the subjects with compatible symptoms had been diagnosed with HIV and only 16.7% were receiving treatment (Castro et al., 2005).

OAB presents a multifactorial etiopathogenesis, being possible a neurogenic, urothelial, myogenic or idiopathic origin. Any of these mechanisms can produce symptoms associated with OAB. The increased contractility of the overactive detrusor is due to hypersensitivity of the muscarinic receptors (M2 or M3). Acetylcholine released in the sympathetic nervous system pathways causes the activation of M3 receptors, responsible for bladder contraction (Wein Alan J. & Rackley Raymond R., 2006).

The treatment of OAB is staggered, goes through a process of bladder reeducation, pelvic floor exercises, changes in lifestyle and pharmacology. Neurostimulation is part of the recommended therapeutic algorithm in cases that are resistant to initial treatment. In this sense, NESA microcurrents are presented as an alternative whose purpose directly affects some of the possible known etiologies of OAB, such as neurogenic origin, detrusor hyperactivity and the release of acetylcholine by the autonomic nervous system.

A double-blind randomized clinical trial with a control group is currently active to verify the efficacy of NESA neuromodulation in women with OAB (Clinical Trials Code NCT04120545). The objective is to verify the decrease in the voiding diary and the improvement in the quality of life compared to a placebo group, in 10 sessions distributed twice a week. The pilot study carried out previously had satisfactory results that lasted over time, in such a way that the current trial aims to reaffirm and disseminate the results previously obtained.

3.3.2 Implications in Erectile Dysfunction

Male erection depends on involuntary reflexes from the parasympathetic nervous system, which trigger vasodilation, located in the sacral segments of S2-S4 and the central nervous system, specifically the midbrain and the limbic cortex. The somatic pathway also plays an important role in erection. When activated, corpuscular receptors and free endings located in the penis send signals that travel through the dorsal nerve of the penis, a branch of the pudendal nerve, until reaching the posterior horn of the spinal cord at the S2-S4 level. From here they ascend the spinothalamic and spinoreticular pathways to sensory perception in the somatosensory cortex and the thalamus in the central nervous system. Once the information is processed, a response is produced in the ONUF nuclei of S2-S4, causing the contraction of the ischiocavernosus muscles through the pudendal nerve (Ceballos et al., 2015).
The parasympathetic nervous system triggers the peripheral neurotransmitter response, the main one being acetylcholine, which is released by inhibition of noradrenergic presynaptic release and by stimulation thanks to the release of endothelial nitrous oxide. At the central level, the erection is associated with dopamine, which produces an erection without sexual stimulation, with serotonin and oxytocin, which increases the blood concentration during sexual intercourse.
The etiology of ED can have an organic component, such as vascular, neurogenic, anatomical or endocrinological, or on the other hand a psychogenic cause (Ceballos et al., 2015). In those cases where dysfunction depends on neurogenic factors or psychological factors associated with anxiety or depression, a clinical improvement in erectile dysfunction has been observed, thanks to the modulation by the NESA microcurrents of the autonomic nervous system. In those cases where the main etiological component is the vascular factor, no progress has been observed. The comfort in the application of the treatment, its innocuousness, and its ease to compare it with the placebo opens a path of investigation in which to justify the results observed in the clinic.

3.3.3 Implications in Gynecology

In gynecology, pathologies associated with long-lasting pain processes are sometimes observed, either due to neuropathies derived from surgical processes, neuropathies associated to psychogenic causes (pudendal nerve neuropathy), or complex pain such as those that can derive from endometriosis.
The evolution of pain is variable depending on the etiology. In pain with a nociceptive component, where the tissue registers damage, the pain sensation on the part of the patient decreases as the tissue heals and remodels. In those cases of long-standing pain, where the perception of pain exceeds the natural history of tissue healing, and no other justified causes are found, the pain can be considered neuropathic, even when neurophysiological tests do not register it.
The nervous system plays a major role in the registration, transport and interpretation of the pain signal, in such a way that the psychosocial components of the patient influence its perception to an excessive extent (Gifford & Butler, 1997). The efficacy of NESA technology in relieving neuropathic pain has been observed in the clinic (Molina et al., 2020), even in long-standing cases. The application of resonance therapy with adequate clinical reasoning, and a number of sessions in proportion to the time of evolution of the affliction, results in a comfortable and effective treatment for the patient. It will be necessary to develop both its use and the research that concerns it, in order to be able to solve situations of uncertain prognosis, such as those observed in most neuropathies that exceed the sixth month of evolution (Costigan et al., 2009).

3.4. CLINICAL AND SCIENTIFIC ADVANCES IN THE TREATMENT OF PAIN

The NESA microcurrents favor the physiological orthodromic flow of the bioelectricity of the nervous system, especially in those areas where it has been altered by some dysfunction (R. Becker, 1998). Pain manifests as an electrical signal within the metabolism, which is registered, transported to higher centers, interpreted and from which a response is generated (Gifford & Butler, 1997). When pain is maintained over time or certain injuries occur (Mischkowski 2018), changes are observed in the pain perception and modulation system, pattern-generating neurons are activated, turning a symptom into a pathology in itself. Pain sensitization that occurs centrally is believed to be largely maintained by the autonomic nervous system (Knudsen et al. 2019).

The psychosocial implications and the impact on the quality of life that is generated in patients with chronic pain are invalidating. It is necessary to adopt effective and less invasive strategies for this sector of the population, which is estimated to be 17% in Spain, and to solve the current deficiency in the management of chronic pain (Torralba et al., 2014).

The influence generated by global neuromodulation NESA on the nervous system, restores by repetition of electrical patterns, including the ANS-dependent pain modulation system, marking the physiological rhythms that should predominate in a healthy individual. It is therefore to be understood that those patients with long-term and highly affected painful pathologies will need a longer exposure to the microcurrent than those patients with milder characteristics and a closer evolution.

In this way, with the application of the NESA X Signar microcurrent device, for example, the decrease in pain by 8 points on the VAS scale of a complex regional syndrome of upper limb of 2 years of evolution in 13 sessions has been observed, spread over 5 weeks (Molina et al., 2020).

The treatment of fibromyalgia, complex pain or central sensitization syndromes, involves understanding, in the first instance, its etiology. Understanding the functioning of the nervous system as a whole, and the succession of events that lead a person to suffer from fluctuating and incessant pain for years, without the tissues being involved, is something that puzzles both clinicians and patients. The multidisciplinary approach and the socio-family support is essential, but innovation, the development of technologies and the implementation of these within the reach of users is even more essential at this time. Improvements in sleep quality, fatigue and pain reduction have been observed clinically in patients with fibromyalgia of more than 10 years of evolution, after performing between 3 and 10 months of treatment with the NESA microcurrents, times in line with the duration of the evolution of each case.

The treatment of headaches, especially of some migraine syndromes, is possible with the application of this technology, in a high percentage observed in the clinic, sometimes with the resolution of the crisis, at the end of the application of the device. These observations should be demonstrated in the future through clinical trials, and would mean a change in the understanding of the etiology of certain conditions, as well as an improvement in the quality of life of the patients involved.

3.5. IMPLICATIONS AND ADVANCES IN SLEEP MEDICINE

Insufficient sleep or sleep disorders are directly related to cardiovascular disease, diabetes, being overweight, obesity, stress, accidents, and importantly with immune and neurocognitive dysfunction. As scientific studies show. Complementing the above, the analysis of studies carried out to date reveals that the quality of sleep and the immune response have a strong relationship and in turn with the autonomic nervous system. Sleep deprivation results in poor immune function: it decreases the production of antibodies by vaccines, the number and activity of NK cells, as well as the production of IL-2 and induces an increase in the circulation of pro-inflammatory markers IL-6, TNF-α and C-reactive protein. ultimately resulting in alterations of the vegetative nervous system and sympathetic-parasympathetic regulation.

Therefore, given the current situation in which we live, we need to increase strategies that facilitate the consolidation and quality of sleep. Within the therapeutic arsenal, we consider that the use of Non-Invasive Neuromodulation, through the NESA XSIGNAL device, can contribute to this factor and, therefore, to the improvement of the immune system response.

Figure 11. 3D graphic drawing representing the production of melatonin and its secretion to the blood vessels of the brain.

6.1 Implications in sleep treatment

In order to improve the quality of sleep, taking into account the diversity of etiologies of sleep dysfunctions, a new opportunity is presented to include, as an adjunct, non-invasive neuromodulation NESA to current sleep treatment methods. Due to the non-invasive and painless application of neuromodulation, NESA is a complementary treatment to the rest available in patients with alterations in the quality of sleep.
The diverse origin of sleep disorders makes their treatment and diagnosis complex, however, preliminary studies have shown an improvement in the quality of sleep in soccer athletes by applying NESA non-invasive neuromodulation sessions three times a week for 15 sessions. post-training. Applying program 7 for 100% of the time between 45 and 90 minutes, after one or two sessions with previous preparation programs (P1 50% of the time, P7 50% remaining), will allow the autonomic nervous system to be modulated, but it will have an impact different depending on the location of the directing electrode. The main recommended location is C6-C7, with a higher incidence in the reticular formation of the medulla oblongata, after the cases registered in the clinic and in preliminary studies.

In the last clinical trial carried out on professional basketball players, characterized by stressful situations that alter the quality of sleep, preliminary results with significant differences (p-value = 0.007; p-value = 0.000; p-value = 0.000) show for the improvement of the quality of sleep. (duration, REM and total sleep time) related to biomarkers indicative of muscle damage and applied loads in the intervention group. Correlations are currently being studied, in addition, with cortisol and creatine kinase levels.

For future lines and taking into account the potential of melatonin as well as the improvement in the quality of sleep through the regulation of circadian rhythms as agents to counteract the consequences of the COVID-19 pandemic, the non-invasive application and painless neuromodulation NESA can be a complementary treatment to the rest available in post-covid patients from the point of view of respiratory physiotherapy and electrotherapy focused on the autonomic nervous system.

Taking into account the direct evidence of the application of respiratory physiotherapy in ICU units and the reduction in hospital stay, a complementary treatment to these physiotherapy techniques, such as non-invasive neuromodulation, can generate advances in the evolution of these patients. The first cases that are being studied are revealing an acceleration in the recovery of post-covid patients both in their symptoms and in the quality of sleep, envisioning a promising future in helping to treat patients with sequelae caused by the affectation of the COVID-19.

Figure 12. Left: Image with the cervical location of the targeting electrode, in central treatment. Right: Saliva cortisol level meter with collector and buffer.

4. DEVELOPMENT AND CLINICAL RESEARCH IN NON-INVASIVE NEUROMODULATION NESA

This section aims to expose the reader to the different lines of research that have been and are being developed by different working groups that we will now proceed to describe:

4.1 FINISHED STUDIES

"Efficacy of treatment with the NESA Xsignal® electrostimulator in patients with post-traumatic neck pain"
Institution: Service of Rehabilitation ACTIVA Mutua Madrid-Barcelona-Córdoba.

Abstract: 21 patients with the diagnosis Whiplash have been evaluated (grade I-II cervical injury qualification, following the Foreman and Croft Classification). Said evaluation has been carried out with the biomechanical analysis system "Biomek" (Movement analysis is carried out using three-dimensional videophotogrammetry - motion capture using several infrared light emitting cameras) at the beginning of the protocolized rehabilitation treatment and after 14 days. The physiotherapy protocol consists of the application of an electrostimulator (NESA XSIGNAL®) combined with active exercise for 14 days in patients diagnosed with post-traumatic neck pain as a result of an on-the-road traffic accident. Cervical pain and disability questionnaires are also carried out at the beginning and after 14 days.

Results: Good correlation between the decrease in cervical mobility restriction and the manifestation of pain and disability in 14 days. Statistically analyzed mobility data (initial assessment vs. evolutionary control) shows a significant increase in mobility in the 4 movements: flexion, extension, lateral flexion and rotation. In relation to the values of the questionnaires, a decrease in cervical pain and disability is obtained with respect to the initial values.

Conclusions: Our study shows the usefulness of the biomechanical test to determine the degree of cervical affectation and to monitor the rehabilitation treatment in order to establish the protocols and apply the new physical procedures. "

"Superficial neurostimulation aplication electroencephalographic and psychological changes". Institution: University of Alcalá de Henares.

Summary: 15 subjects (7 women and 8 men), aged between 18 and 88, who showed mild or moderate anxiety, hostility, and obsessive symptoms (but for a case with severe symptoms), underwent 20 one-hour sessions each one, at least twice a week and a maximum of 4 times. Program number 7 was applied to them. They could not receive psychotherapeutic treatment during the study period. The only exclusion criteria applied were pregnancy, recent myocardial infarction or implanted pacemaker.

Results:
- Most of the subjects had their scores reduced on different scales, in some cases up to 50%. Subjects who do not go beyond the threshold or whose anxiety, irritability, and obsessive symptoms are at a minimum also improved as shown on the scales. Neurostimulation could be responsible for an increase in the effects of psychopharmacology; however, more specific studies are required to confirm this hypothesis.
- The most satisfactory clinical results have been achieved in a frequency range of 7.8 Hz. The most plausible explanation is based on the Schumann resonances, which would have that as the basic frequency and what would be the high precision external time base used by the body to control circadian rhythms.

"Comparative study of the frontal EGG activity after superficial neuro-stimulation application, mindfulness and other attentional techniques." Institution: University of Alcalá de Henares.

Subsequently, the same authors designed a study with the onektivop, with the aim of comparing the electrical changes observed after the use of non-invasive neuromodulation NESA with other mental concentration techniques: Mindfulness (mental attention without judgment) and a technique based on emission of a sound. The application of NESA microcurrents was used and it was evaluated through digital encephalogram; Faraday cage.

Results The Mindfulness and SNSA techniques show similarities with respect to the frequency of the alpha rhythm in the frontal regions (Figures 1 and 2) compared to a different mental concentration technology. nickel (figure 3). However, scalable studies are needed to determine more generalizable results.

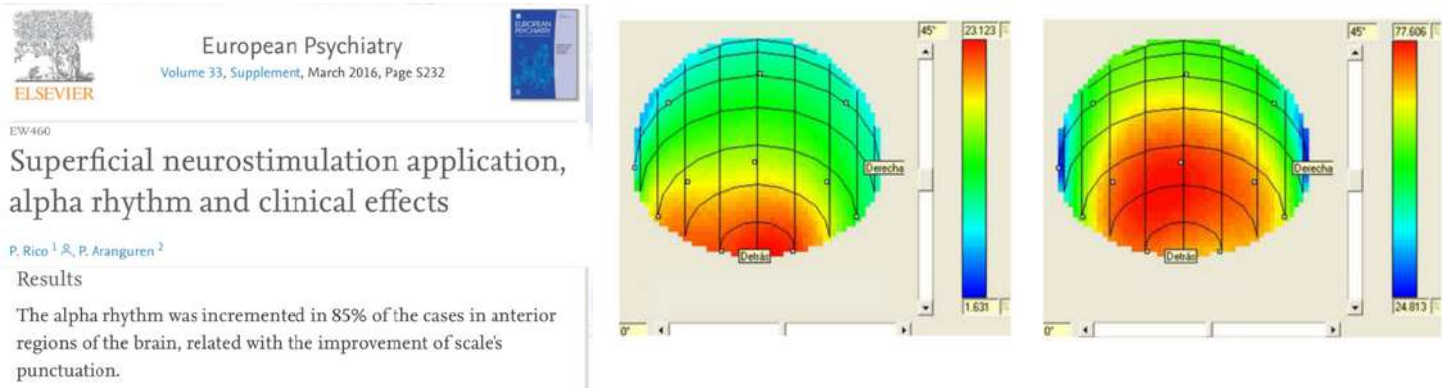


Figure 13. Left: Study published in the European Psychiatry Journal. Right: Before and after the application of NESA in the concentrations of the alpha waves represented in a digital encephalogram.

"Efficacy of non-invasive neuromodulation NESA in improving the quality of sleep and well-being in soccer players; viability study"
Institution: Alfonso X el Sabio University, Madrid. Spain
Authors: Aparicio, P. Jean, Antonin

Objective: To verify the effectiveness of the application of non-invasive neuromodulation NESA in improving the quality of sleep and well-being of soccer players of a professional team.

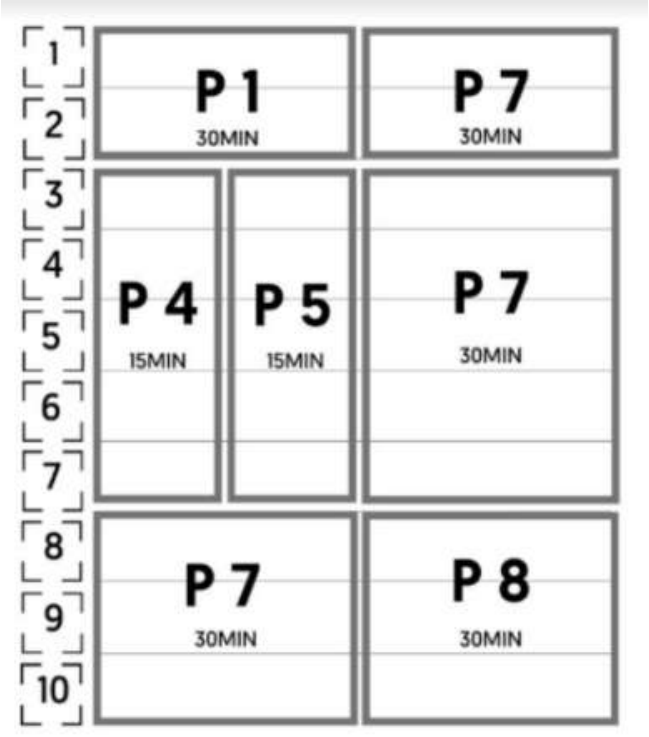
o Determine improvement in sleep quality
o Assess changes in cortisol concentrations related to sleep and stress.
o Check the feasibility of the study for a subsequent clinical trial

Type of Study: Final Degree Project. Prospective intervention feasibility study in two groups of professional soccer sports subjects (intervention and placebo).

Subjects: Healthy soccer players without previous injuries.

Intervention: 10 sessions, 2 times a week. Applying a central protocol combining P1, P7, P5. P4 and P8.

Results: After analyzing the results, a significant difference was obtained for the improvement of sleep quality (pvalue = 0.041) post intervention in the experimental group. And although no differences were obtained for cortisol levels, a significant Pearson correlation (p-value = 0.009) was observed between the decrease in post-treatment cortisol and the improvement in sleep quality.



UNIVERSIDAD ALFONSO X EL SABIO

Figura 14. Left: Chart with details of programs applied, time and week of application. Right: Salivary cortisol meter.

"Efficacy of non-invasive neuromodulation NESA in neuroefficiency in basketball players on the field"
Institution: FC Barcelona, basketball team.
Authors: F. García, D. Fernández, J. Vázquez-Guerrero, R. Font, B. Moreno-Planas, D. Álamo Arce, R. Medina-Ramírez and M. Mallol-Soler

The competitive calendars of team sports are increasingly compressed, generating changes in the effort-recovery cycle. Given this new situation, it seems necessary to analyze how it affects semi-professional players at a physiological and performance level, as well as how to observe if the non-invasive neuromodulation technique NESA helps the neuroefficiency and concentration values of said players.

MAIN OBJECTIVE: Improve the neuroefficiency and performance of basketball players through a post-training NESA treatment. Likewise, to observe the possible associations between parameters of both external and internal load and responses after training and games with non-invasive neuromodulation.

o Improve performance and stress
o Improve coordination in the field
o Improve the quality of sleep.
o Improve the well-being of the athlete
o Reduce fatigue

PROGRAM	TIME	DIRECTIONAL ELECTRODE	MODE
P5	15MIN	C7	LOW
P7	30MIN	C7	LOW

Figure 15. NESA protocol

METHODS: Randomized clinical trial. For this, a double-blind capture system will be available (neither the specialist nor those responsible for recovery will know which patients enter the complementary treatment). At the end of the study, the results obtained between the different groups of patients will be able to be compared; those additionally treated with a device, those treated with a placebo device and those in the standard rehabilitation procedure without a device.

RESULTS:
The sample of male basketball players (20.9 (SD 2.4) years; 196.7 (SD 11.5) cm; 89.0 (SD 21.2) kg) was analyzed for the first phase on sleep, a significant difference was obtained (pvalue = <0.001; 0.007 ; <0.001; <0.001) for the improvement of the variables duration, REM and total sleep, in the post intervention in the experimental group. Showing a maintenance of the quality of sleep of the experimental sample, especially in the last two weeks where they entered the playoffs. The rest of the results are currently being processed.


CLINICAL TRIAL article

Front. Physiol., 22 November 2022
Sec. Exercise Physiology
https://doi.org/10.3389/fphys.2022.1032020

This article is part of the Research Topic
Physical Stimulus-Performance-Adaptation : Understanding the physiological relationship
View all 6 Articles

Recovery of the physiological status in professional basketball players using NESA neuromodulation treatment during different types of microcycles in season: A preliminary randomized clinical trial

F. García[1,2], D. Fernández[1,2], J. Vázquez-Guerrero[1,2], R. Font[1,2], B. Moreno-Planas[3], D. Álamo-Arce[4], R. Medina-Ramírez[4]* and M. Mallol-Soler[1,2]

[1] Sports Performance Area, Futbol Club Barcelona, Barcelona, Spain
[2] Barça Innovation Hub, Futbol Club Barcelona, Barcelona, Spain
[3] Physical Therapy, University Francisco de Vitoria, Pozuelo de Alarcón, Spain
[4] SocDig Research Group, University of Las Palmas de Gran Canaria, Las Palmas, Spain

Figure 16. Paper publication in Frontiers in Physiology journal.

"Efficacy of the NESA treatment on sleep quality, pain and incontinence in patients with Multiple Sclerosis. Prospective study"
Insitution: Sinapsis Fisioterapia (Mallorca, Spain) and University of Las Palmas de Gran Canaria
Authors: Contreras, M. Medina, R.

Objective:
The main objective of this study is to improve the sleep quality of patients with Multiple Sclerosis. The secondary objective was to improve pain perception, control of urinary bladder incontinence neurogena and the differences between two treatment groups.

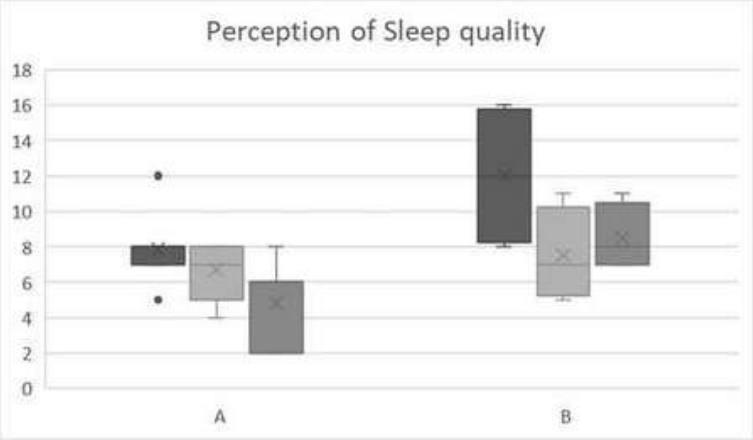
Subjects
Patients of a local Multiple Sclerosis association. After an online meeting, the
Potential patients were openly invited. (n=14).

Design
The treatment was for 3 weeks with 15 sessions (one session per day). All participants attended to an initial visit with an experimental physical therapist to verify the inclusion criteria.
Once the participants were accepted, the sample divided into two groups was randomized through digital software:

- Group A: with NESA microcurrent treatment based on program 2 + program 3 (with electrode directional electrode located in L1-L3) and program 5 + program 7 (with directional electrode located in C7). Each program for 15 min.
- Group B: with microcurrent NESA treatment based on program 2 + program 6 + program 5 + program 7 (with directional electrode located at C7). Each program for 15 min.
- Outcome measurements were assessed at baseline (before week 1), session 7 (week 2), and after of session 15 (end of week 3).

Results
Fourteen participants were invited and randomized into group A (n=7) and group B (n=7). After the first week, we lost three patients to group B (n = 4) due to covid infection. In the analysis of weekday sleep quality in each group, we found a significant difference in group A (p value = 0.19) and for group B (p value = 0.30) between the mean of the score of the Pittsburgh scale. In group A, the Pittsburgh score started with a mean of 7.85 points, 6.71 points in the second week and 4.85 in the last week.

For evaluation of incontinence we found significant differences between weeks in the CACU test in the area of symptoms (pvalue = .008) and area of discomfort (pvalue = .086) exclusively for the group A, with positive improvement over 3 weeks of treatment. In addition, in ICIQ_SF test results were observed significant differences between weeks of treatment only for group A (pvalue= .13) with a positive improvement. I don't know found significant differences for group b.
Finally, for the assessment of pain only significant differences were observed in group A between weeks (p-value = 0.022), being lower at the end of treatment.



Graph 1. The results obtained in each group with respect to the Pittsburgh test are represented in a boxplot. The results for group A are statistically significant.

"Efficacy and safety of the NXSignal® device for the treatment of overactive bladder in urology. Randomized controlled clinical trial ".
Institution: Maternal-infant Insular University Hospital Complex of Las Palmas de Gran Canaria and Hospiten Bellevue (Santa Cruz de Tenerife).
Authors: Conde, G. Matín, A. Medina, R. Baez, A.

Objective: To evaluate the efficacy and safety of the application of NXSignal technology in the treatment of patients with overactive bladder to improve the mechanism of regulation of bladder function, and, therefore, of symptoms and quality of life of patients. the patients.
Type of Study: Randomized, open, parallel and controlled clinical trial.

Methods:
The patients will be recruited from the gynecology consultation (pelvic floor) of the Insular-Maternal-Infant Hospital Complex on the island of Gran Canaria and from the functional urology consultation of the Hospiten Rambla hospital on the island of Tenerife. At the time of recruitment, the specialist involved in this study will indicate whether they wish to follow the treatment algorithm proposed by the Spanish Association of Urology or the one proposed in this study by applying the NXSignal device. A protocol were used during 10 sessions of 60 minutes, twice a week.

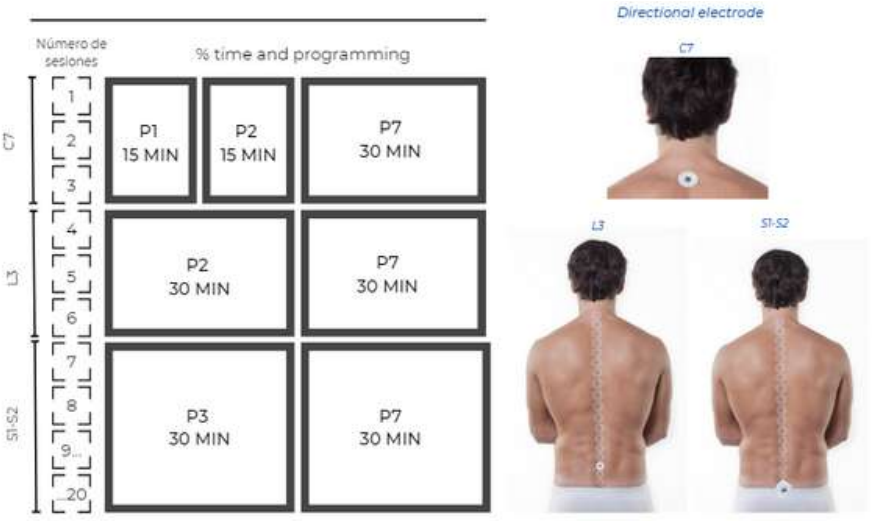


Figure 17. Detail of the programs foreseen in the protocol in the session blocks. The time and location of the directing electrode are also specified.

Results
Comparing the clinical outcomes of patients using the Spanish version of the Overactive Bladder Control Self-Assessment Questionnaire (CACV), significant differences were obtained for the intervention group over time for CACV symtoms (p-value=0.04) and CACV discomfort (p-value=0.003). In addition, significant differences were found for the incontinence questionnaire (ICQF) over time showing a more rapid improvement in the NESA group. (p-value=0.007). In terms of sleep, significant differences were found in the intervention group over time, improving by +- 1 point on the Pittsburgh test. No significant differences were found for either group for the insomnia questionnaire. The intervention group presented a 15% decrease in nocturia and urge incontinence episodes. However, no differences were obtained between groups, due to the sample size. In future studies it is recommended to replicate this methodology with a larger sample.

Conclusion
NESA non-invasive neuromodulation is a treatment that encourages being an ally in urology or pelvic floor treatment as it shows its potential by demonstrating improvements in sleep, incontinence and overactive bladder related discomfort.

"Effectiveness of surface neurostimulation in children with neurodevelopmental disorders for improvement of constipation and sleep quality. Randomized clinical trial."
Institution: Hospital San Juan de Dios, Las Palmas de Gran Canaria.
Authors: Baez, A. Padrón, I. Medina, R

Institution: Ciudad San Juan de Dios, Las Palmas de Gran Canaria.

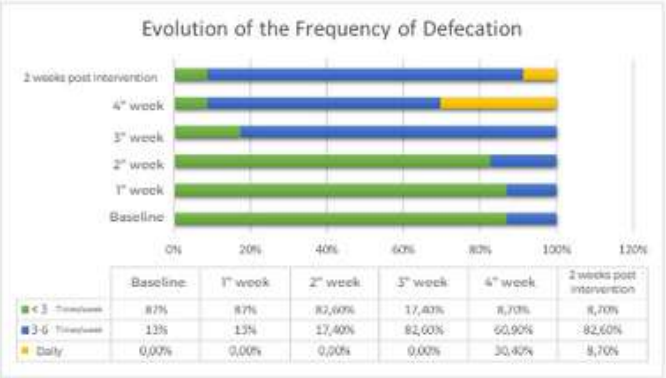
Objective: To evaluate the effectiveness of the NXSignal device applied in people with neurodevelopmental disorders, in relation to constipation problems and sleep consolidation.

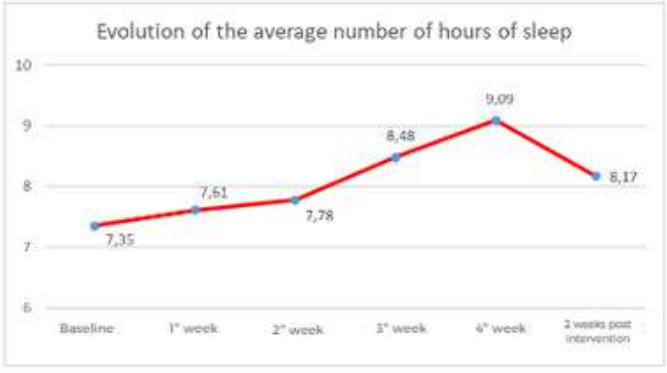
Study: Randomized double-blind clinical trial with control group and intervention group (CEIC HUGCDN: 2019-474-1).

Subjects: Children attending school at the Ciudad San Juan de Dios Center in Las Palmas de Gran Canaria with neurodevelopmental disorders.

Intervention: 10 sessions, 3 times per week. A schedule of P2 + P7 (for 60 min) was used throughout the sessions.

Results: The intervention group showed a significant improvement in the frequency of defecation, going from less than 3 times per week to more than 4 times per week in 80% of the sample. There was also an improvement in the number of hours of sleep and a decrease in nighttime awakenings in the intervention group (see graphs).





Graphs 2 and 3. Left: Evolution of the frequency of defecations results. Right: Evolution of the sleep hours.

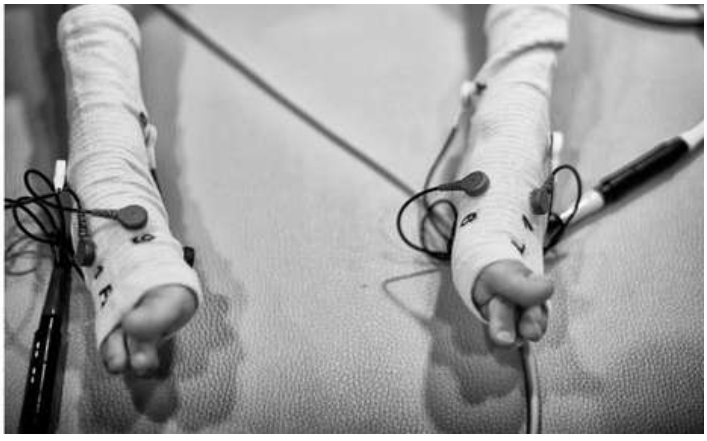


Figure 18. Patiens images from the stuty. All patients signed the inform consent to participate and take photos.

"Efficacy of non-invasive neuromodulation treatment in patients with dementia to improve quality of life, sleep and general functional status".
Doctoral Thesis of the University of Murcia.
Authors: Teruel, E. Conesa, C. Medina, R.

Objectives:
Know the effectiveness of an adapted therapeutic exercise program and its comparison with non-invasive neuromodulation through NESA, and both treatments with a control group; to improve sleep disturbances in patients with dementia.

Type of Study: Randomized, multicenter clinical trial

Methods

This is a randomized, multicenter clinical trial consisting of 30 patients diagnosed with dementia who belong to two Alzheimer's and other dementia associations in the Region of Murcia (AFADE and AFAMUR). The participants in this study were divided into three treatment groups (GC: control group; GEET: experimental group of 52 therapeutic exercise sessions; GENM: experimental group of 20 non-invasive neuromodulation sessions with the Nesa device). The variables of sleep quality and cognitive ability were measured at 4 different moments of the study using various rating scales. the study.

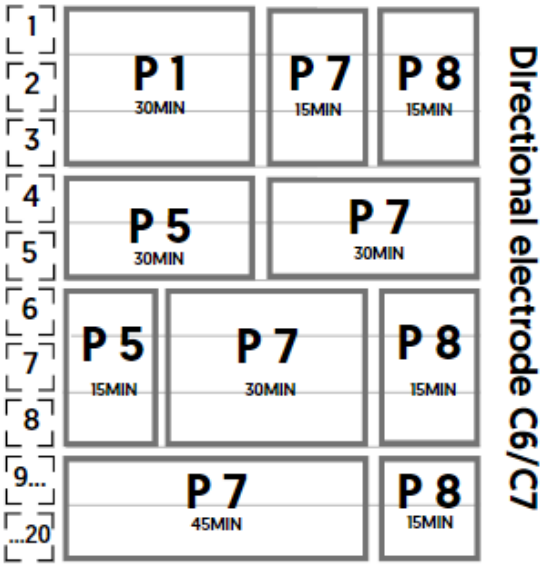


Figure 19. Detail of the programs foreseen in the protocol in the session blocks. The time and location of the directing electrode are also specified.

Result
Analysis of the results obtained on the sleep quality variable reveals favorable and significant data for both experimental treatments after two months. Regarding the follow-up we found a higher score and, therefore, greater efficacy for sleep disorders with the NESA treatment.

Statistically significant differences (p=0.002) are found between the three groups, however, the Nesa group obtains a higher score on the Lob's Mec scale, which means that patients in the Nesa group present less cognitive impairment in the post-test, at follow-up 1 and follow-up 2.

Group	Pretest	Postest	Follow-up1	Follow-up2
NESA	22.7 (3.27)	28.4 (4.48)	29.5 (4.01)	30.7 (3.50)
Exercise	23.9 (3.60)	24.7 (3.13)	26.3 (2.83)	27.5 (2.92)
Control	18.6 (5.10)	19.7 (4.83)	19.2 (4.87)	18.3 (4.27)
X^2(gl)	7.84 (2)	12.20 (2)	15.89 (2)	20.14 (2)
p	0.020	0.002	< 0.001	< 0.001
ε^2	0.270	0.421	0.548	0.694

Table 2. Detail of the statistics results for the variable LOBO (Mini Mental State Examination) in all groups.

Conclusions

Non-invasive stimulation through the Nesa device and therapeutic exercise are two effective and non-pharmacological treatments that provide benefits in sleep disturbance and cognitive functions in patients with dementia.

"Qualitative study of effectiveness, safety and Functioning of the NESA xsignal device".
Institution: Hospital Quiron Sevilla.

Abstract: 10 patients with relative homogeneity in symptoms were evaluated, as well as variables anthropometric. In all cases, clinically relevant results were recorded in relation to the pain relief. In most of the registered cases, said improvement was reported before the fifth session of intervention with the NXsignal device .

"Evaluation of the impact on cognitive performance and inflammatory response parameters in relation to high intensity exercise in highly trained athletes (CrossFit) for the application of superficial neurostimulation".
Institution: Sant Cugat High Performance Center.

Abstract: Pilot study in which they intervene for 3 months with athletes who practice CrossFit. In a first phase, a standard resistance strength work session is established. The initial sample was of 20 individuals of age (21-35 years), who underwent a medical check-up, with analysis blood test and maximal stress test to rule out inflammatory pathology, discriminate the risk cardiovascular and characterize level of aerobic fitness. After the first 30 minutes of training, a new blood draw was performed, which will be repeated 2 hours and 30 minutes after the end of the exercise.

On the other hand, once the treatment with NESA Xsignal was completed (90 minutes post-training), the battery of neurocognitive tests that were developed during the first medical visit and, in relation to the strength tests, 10 minutes after the end of the exercise, fatigue tests were carried out, similar to the phase prior to training and at 2 hours and 10 minutes (after blood extraction and post intervention with NESA Xsignal).

Results:
- The sample was homogeneous.
- There is a tendency to better recover the group with NESA Xsignal , which in turn loses less speed in the immediate post-exercise.
- The group operated on with the device showed less presence of inflammatory response (level of cytokines).
- Both groups improved neurocognitive response. The NESA Xsignal group presented a tendency to improvement of the successes in the tests.

4.2 ACTIVE STUDIES:

"Efficacy of the NXSignal device for the treatment of Anterior Cruciate Ligament injuries. Randomized controlled clinical trial. "
Institution: Sant Josep-Althaia Clinic; Manresa, Barcelona.

Objective: Accelerate the patient's recovery process after ACL surgery and reduce the associated financial costs.
-Improved functionality, stability and joint strength.
-Facilitate a decrease in pain during the rehabilitation process.
-Reduce the number of injuries generated after the first 6 months post-surgery.

Type of Study: Randomized double-blind clinical trial with a control group.
Subjects: Patients who are going to have an ACL tear operation, those who undergo the same ACL surgical technique, operated by the same surgeon, will be chosen.
Analysis: Functional tests (IKDC and LSI), VAS, edema, quality of life (SF-12), encephalography will be evaluated.
Intervention: 36 sessions, 3 times a week. Phase 1 . 1 time per week phase 2. 1 time every 2 weeks Phase 3.

PROGRAM	TIME	DIRECTIONAL ELECTRODE	MODE
P6	30MIN	popliteal zone	HIGH
P7	30MIN	popliteal zone	LOW

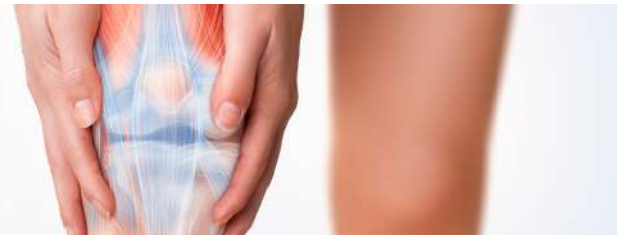


Figure 20. NESA protocol detailed. We used high mode due to the health conditions of the subjets, elite sporters.

PRONES study: "Influence of NESA technology in post-operative knee recovery".
Institution: Hospital San Juan de Dios de Tenerife.
Authors: Castillo Rodríguez, JC. Afonso, T. Barrio, MA. Dominguez, B. Alvarez, S. Fierro, I. Gil, N. Rodríguez, Y. Lugo, J. Medrano, R. García, L. Medrano, R. García, L. Fierro J.

Objective: To demonstrate that the treatment with Applied Superficial Neurostimulation compared to the usual treatment reduces pain, improves quality of life and functionality, both in the early postoperative phase, as well as in the medium and long term.

Study Type: Double-blind randomized clinical trial with control group

Subjects: People who underwent total knee replacement.

Intervention: 10 sessions of 60 minutes, three times a week. The protocol to be followed will consist of applying program 6 for 30 minutes, followed by program 7 for the remaining 45 minutes

"Physiotherapy for Persistent COVID Function through Non-Invasive Neuromodulation NESA".
Institution: UPSA, URJC, UFV y ULPGC
Authors: Melian, A. Laguarta, S. Medina, R.

Objective:
Main objective:

- Analyze the effects on the quality of life and sleep through the application of the superficial neuromodulation NESA vs. placebo in women with LC.
- To analyze if there is a correlation in the improvement of the perception of the quality of life related to health.
- Assessment of mechanical sensitivity to pain by evaluating the Pain Threshold at
- Pressure (UDP).
- Analyze the presence of heart rate variability and cortisol values before and after treatment.

Design
This is a triple-blind randomized controlled clinical trial that will be developed in the facilities of the future University Clinic of the Faculty of Nursing and Physiotherapy Salus Infirmorum of the Pontifical University of Salamanca. This sample will be divided as follows manner: 30 women who will receive experimental treatment with NESA Superficial Neuromodulation and 30 women who will do it with a placebo machine of the same model.

The following are established as selection criteria:
Inclusion criteria
1) Women who have suffered from CP symptoms for more than one year.
2) Present signs of central sensitization.

Exclusion criteria
Age over 60 or under 18.; Male sex (due to hormonal differences that influence the analysis of pain and the higher prevalence of the disease in females; Previous treatment with surgery.; Prior spinal trauma; Whiplash; Pregnancy status; Musculoskeletal disease previous (rheumatoid arthritis, reflex sympathetic dystrophy, fibromyalgia); Pacemaker; electric pump drug dispenser; ; Changes in skin sensitivity; Pharmacological treatment analgesic or anxiolytic during the study.

Study variables
1. Quality of sleep and quality of life: questionnaires Pittsburgh, SF-36, and PROMIS Global Health.
2. Cardiac variability: digital blood pressure monitor (ADC Cuff+ Navy Adult Cuff 23- 40cm BP-9005-11AN-1MB), pulse oximeter (Quirumed. OXYM4100) and portable electrocardiogram device and APP weCardio HC.
3. Central sensitization by assessing the Pressure Pain Threshold (PDU): algometer Baseline 12-0300 MMT at cervical level C5-C6, dorsal D5-D6 and tibialis anterior muscle.
4. Demographic variables: age and group of intervention.
5. Salivary cortisol

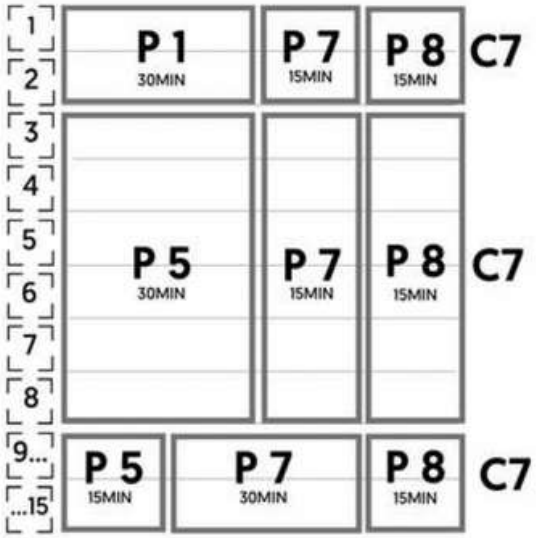


Figure 21. Detail of the programs foreseen in the protocol in the session blocks. The time and location of the directing electrode are also specified.

""Efficacy of noninvasive NESA neuromodulation in fibromyalgia: a randomized, triple-blind clinical trial."
Institution: Clinicas CIN, UCLM, ULPGC (Spain)
Authors: Gómez, H. Mordillo, L. Dileone, M. ELvira, M. Medina, R. Báez, A.

MAIN OBJECTIVE
To improve the overall level of pain and fatigue in patients diagnosed with fibromyalgia through NESA noninvasive neuromodulation treatment.
SECONDARY OBJECTIVES
- Improve sleep quality
- Improve stress and anxiety
- Improve quality of life.

Design
Randomized clinical trial. The general configuration of the study consists of recruiting patients with a previous diagnosis of fibromyalgia. For this purpose, there will be a triple-blind recruitment system (neither the specialist nor the treatment managers will know which patients enter the complementary treatment) and two NESA XSIGNAL® devices operating in triple-blind (due to the imperceptibility of the stimulation performed, there will be a placebo machine and another one applying the treatment).

Sample:
- Patients over 18 years of age
- Diagnosis of Fibromyalgia meeting ACR 1990/20101,2 criteria, made by a physician, documented by clinical report.
- Diagnosis of Fibromyalgia made at least 12 months ago
- Stable baseline treatment in the month prior to inclusion in the study

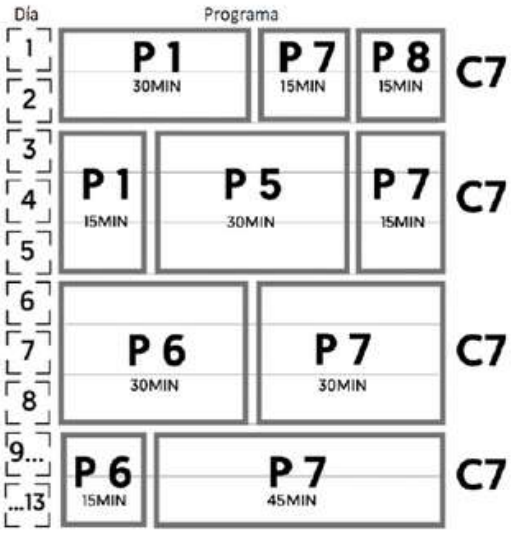


Figure 22. Detail of the programs foreseen in the protocol in the session blocks. The time and location of the directing electrode are also specified.

ESTUDY VARIABLES
Patients will be evaluated in the first session and after treatment (pre- and post-treatment):
1. Pain: Visual Analog Scale (VAS) 2.
2. Pain Algometry (18 trigger points in fibromyalgia).
3. Perceived sleep quality: through a validated questionnaire of perception of sleep quality, Pittsburgh questionnaire (Zúñiga-Vera, 2021).
4. Quality of life: FIQ scale
5. Brief Symptom Listing Test: LSB-50.
6. Polysomnography: looking for correlations with the Pittsburgh questionnaire.

These results are intended to reduce the need to resort to medication with a consequent reduction in the number of visits to doctors' offices and a final reduction in social and health care costs.
In addition, the simultaneous study of pain and sleep disorders will make it possible in the future to delineate in greater detail the profile of these patients, allowing for possible new research aimed at improving the quality of life of patients with this limiting pathology.

"Efficacy and safety of NXSignal applied surface neurostimulation technology for the treatment of complex regional pain syndrome (CRPS) type I".
Institution: Hospital MAZ de Zaragoza
Authors: Dr. Roque, Báez, A.

Aims: To evaluate the patient's recovery process and pain modulation, shortening the recovery time and economic costs associated with complex regional pain syndrome type I.
Type of Study: Randomized, open, parallel and controlled clinical trial.

Subjects: For this type of pathology, although it can be presented by people without a traumatic history, in general they are more frequent after trauma or surgery to the hand or foot. The bibliography cites an affectation between 0.05% and 35% of these patients. To this, it must be added that only 20-30% of patients regain their previous functionality and 30-40% of patients achieve a greater or lesser degree of disability.

Although it can occur at any age, it is more common between the ages of 40 and 50, and is much more common in women than in men; it is also more frequent in the upper limb than in the lower one; and its highest incidence occurs after a distal radius fracture (especially if it is comminuted and articular), especially if it is treated by plaster immobilization.

Intervention: 20 sessions of 60 minutes with a frequency of 4-5 times a week.

Sesión	Direccionador	Tiempo de los Programas por sesión de 60 minutos		
1	C6 y C7	P1 15 min.	P6 15 min.	P7 30 min.
2	C6 y C7	P1 15 min.	P6 15 min.	P7 30 min.
3	C6 y C7	P4 15 min.	P6 15 min.	P7 30 min.
4	C6 y C7	P4 15 min.	P6 15 min.	P7 30 min.
5-19	C6 y C7	P4 15 min.	P6 15 min.	P7 30 min.
20	C6 y C7	P4 15 min.	P6 15 min.	P7 30 min.

Figure 23. Detail of the programs foreseen in the protocol in the session blocks. The time and location of the directing electrode are also specified.

"Efficacy of non-invasive neuromodulation NESA through somatosensory evoked potentials and sympathetic-cutaneous responses in healthy subjects: feasibility study in physiotherapy"
Institution: University of Las Palmas de Gran Canaria, M Clinic, Physiotherapy Daniel Reig (Jaén)

Somatosensory evoked potentials are crucial in determining the physiological changes of potentials in nerve pathways. Although their main function is diagnostic, they have recently been used as a physiological test to determine physioelectric changes in healthy subjects to study applied stimuli, such as laser, pain or electrotherapy.

Aims

The objective of this study is to determine if there are changes in the somatosensory evoked potentials of the ulnar, median, tibial, peroneal and vagus nerves when applying non-invasive neuromodulation NESA, which is used as a physiotherapy treatment for objectives such as pain. , vegetative affectations and sleep dysfunctions.

Study

The general configuration of the study consists of a study before and after the block of sessions to be determined, and differences of all the variables measured before and after NESA therapy will be compared through the mechanisms of somatosensory evocations.

Methods

During the 10 sessions of the treatment, the programming will evolve to optimize the response. The treatment will be carried out centrally to cover the nervous system in a general way, and with low intensity in order to avoid adverse effects. The proposal includes 3 programming phases. A first phase of preparation of 3 sessions, a second phase of empowerment and a last phase that aims to generate changes at the level of the peripheral nervous system, specifically the peripheral nerves (N.Mediano and N.Tibial), in addition to perpetuating the others objectives established in the previous phases.

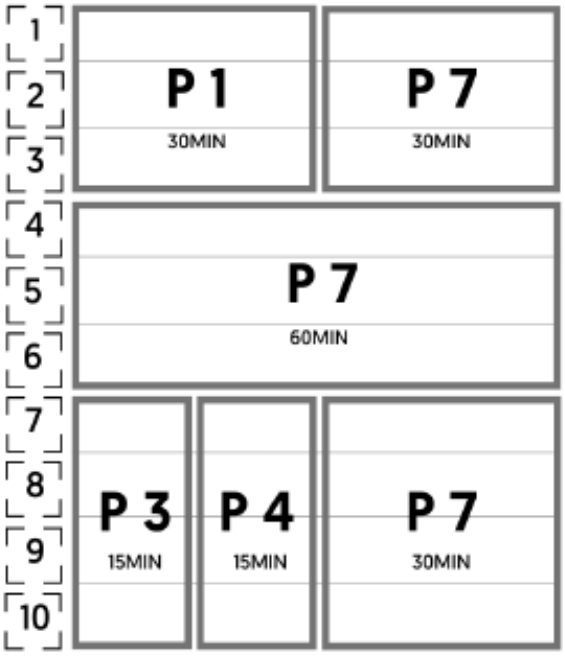
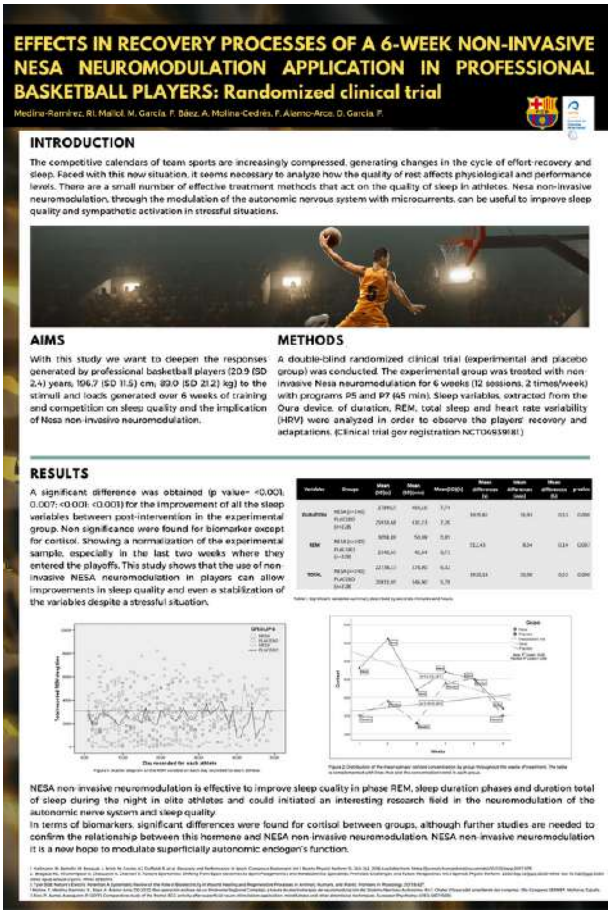


Figure 23. Detail of the programs foreseen in the protocol in the session blocks. The time and location of the directing electrode are also specified.

POSTERS



NEUROMODULACIÓN NO INVASIVA - NESA

Bruxismo y dolor orofacial, un caso clínico

TONI ROMAN ARIAS (COlFICat 4543) Y RAQUEL MEDINA (Col 1780)
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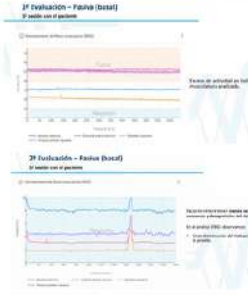
FisioSomnia

INTRODUCCIÓN-BRUXISMO

Actualmente entendemos el bruxismo como una parasomnia [1] caracterizada por un movimiento rítmico mandibular (MRM) que tiene su etiología primaria en una alteración del generador central de patrones masticatorios (GCP's) de nuestro SNC [2] [3]. El bruxismo puede ser de vigilia o de sueño, con dolor orofacial o sin dolor orofacial, con desgaste dental o sin desgaste dental. La etiología secundaria del bruxismo está relacionada en gran medida, con los aspectos epigenéticos del individuo. [4]
Todas estas características del bruxismo hacen que tanto su valoración, como su abordaje en Fisioterapia, a día de hoy, sea más de carácter paliativo, en relación a su sintomatología, que no propiamente un tratamiento sobre la etiología primaria en sí.

RESULTADOS EMG DE SUPERFÍCIE



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CASO CLÍNICO

La Paciente de 30 años acude a clínica con dolor orofacial de caracter mixgeno en el lado izquierdo, afectación odontocervical referida con puntos gatillo en masetero superficial y sensación de cansancio así como alteraciones del sueño que le dificultan su descanso.

Evaluación
Realizamos evaluación de la actividad muscular mediante EMG y de las alteraciones del sueño mediante test de Pittsburg.
La evaluación mediante EMG ha tenido dos apartados, uno en situación basal y otro en carga máxima con rubro posterior en molares. La EMG la realizamos con la paciente estirada en la camilla con el fin de representar al máximo la posición de descanso en la cama y evitar compensaciones musculares características de la acción gravitatoria.

Tratamiento
El tratamiento aplicado ha sido a modo experimental mediante Neuromodulación No Invasiva Aplicada (NESA), hecha valorando un tratamiento pasivo, sin ningún otro tipo de tratamiento complementario. El objetivo era observar si sólo con este tratamiento pasivo mejoraba el dolor orofacial así como las alteraciones del sueño de la paciente.

Protocolo de tratamiento
El tratamiento consistió en: cinco sesiones.

Sesión 1, 2 y 3: P3(15'), P6(5'), P7(5') direccionador en P1 y P7 central y en P6 en masetero izquierdo.

Sesión 4 y 5: P1(15'), P7(10') PF (15') direccionador en P1 y P7 central y en P7 en ATM izquierda.

Evolución EMG y del dolor

En Una primera valoración EMG basal del paciente observamos niveles superiormente altos de actividad muscular bilateralmente, por encima del 20%. También observamos que existe mayor actividad muscular derecha 58%. La afectación miofascial del lado izquierdo (EVA 7) puede estar relacionado con una menor capacidad de la musculatura izquierda a soportar cargas máximas o submáximas en las fases triturgicas.
En la evaluación post tratamiento observamos un cambio drásticos en la actividad muscular disminuyendo por debajo del 10% aspecto relevante que tiene su correspondencia en la evaluación del dolor con una EVA de 2

Evolución trastornos del sueño

En Una primera valoración del test de Pittsburg observamos que desde que entramos en la cama tarda aproximadamente 30 minutos en dormirse. Acostumbra a despertarse en mitad de la noche tres o más veces durante la semana y comenta que tiene una calidad del sueño bastante mala, acostumbra a tomar medicación para dormir.
En la Evaluación post tratamiento dada que sitúa en la cama tarda aproximadamente 10 minutos en dormirse. Acostumbra a despertarse en mitad de la noche menos de una vez durante la semana. Comenta una calidad del sueño bastante buena, no ha tenido que tomar medicación para dormir.

Afiliación: Universidad de las Palmas de Gran Canaria ULPGC

TRATAMIENTO DE LA NEURALGIA DEL TRIGÉMINO CON NEUROMODULACIÓN NO INVASIVA NESA®. A PROPÓSITO DE UN CASO.

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INTRODUCCIÓN

*La **neuralgia del trigémino** se define como un **trastorno caracterizado por un dolor recurrente unilateral, breve y parecido a una descarga eléctrica** de inicio y terminación abruptos. El dolor se limita a la **distribución de una o más divisiones del nervio trigémino***

Los estudios basados en la población estiman una prevalencia que varía del 0,03% a 0,3%. Siendo una de las pocas condiciones de dolor neuropático para las que se encuentran disponibles múltiples terapias, incluidas las médicas y quirúrgicas, aún no se ha identificado la mejor opción de tratamiento de los síntomas.

*La **neuromodulación** implica la **modificación de la actividad de circuitos neuronales específicos** con el objetivo de estimular una red neuronal mediante la aplicación de una corriente eléctrica.*

*Las **microcorrientes NESA** trabajan con **neuromodulación no invasiva** de **baja frecuencia** (entre 1 y 14 Hz).La tecnología NESA ha sido estudiada en el tratamiento de otros síndromes neurológicos y en otros campos como la psiquiatría y la parálisis cerebral infantil.*

OBJETIVO

Estudiar los efectos de la neuromodulación NESA® en el tratamiento de un paciente con Neuralgia del trigémino.

RESULTADOS

Tras el tratamiento inicial la paciente presenta un 8/10 en la escala EVA que no persiste mas de 45'.
Con tratamiento NESA:
5ª sesión.: 0/10 (momento puntual 4/10)
Desde 8ª sesión: 0/10 que persiste hasta la actualidad.
Actualmente acude a tratamiento 1 vez al mes como mantenimiento, en momentos puntuales de estrés o durante la menstruación refiere un 4/10 de intensidad de dolor como valor máximo.

MATERIAL Y MÉTODOS

Mujer 28 años → Neuralgia del trigémino 1 año de evolución → Sin tratamiento de fisioterapia previo

Presenta fuerte alteración del nervio trigémino izquierdo, con irradiación del dolor en las 3 ramas del trigémino (10/10 en escala EVA de dolor), no mejora con medicación y el especialista maxilofacial propone intervención quirúrgica.
Presenta bruxismo, agravada por stress y ansiedad; hipomovilidad del cóndilo mandibular derecha, hipermovilidad del cóndilo mandibular izquierda, rigidez cervical y rigidez en la musculatura suboccipital.

Tratamiento inicial: terapia manual + movilización fascial profunda mediante presión negativa + radiofrecuencia.

Protocolo de tratamiento con NESA X-Signal: 20 sesiones (2/semana) + Conductores NESA (protocolo para la regulación del sueño).

CONCLUSIONES

Las microcorrientes NESA son eficaces en el tratamiento del dolor de la paciente con Neuralgia del Trigémino debido a la disminución en la puntuación de la escala EVA para el dolor.

CASO CLÍNICO DE NEUROMODULACIÓN SUPERFICIAL APLICADA (NESA) EN PACIENTE CON ESCLEROSIS MÚLTIPLE

Marina Contreras Polo (COFIB Col.: 1520) y Raquel Medina - Ramírez (COFC Col. 1780)

AEQUUS

INTRODUCCIÓN

La Neuromodulación Superficial Aplicada (NESA) ayuda a regular el Sistema Nervioso parasimpático.
Es electroterapia no invasiva e indolora para el paciente, basada en microcorrientes de baja frecuencia. Estudios previos indican que permite aliviar el dolor mediante el suministro de señales eléctricas imperceptibles y lentas que neuromodulan de los sistemas alterados eléctricamente, normalizando sus funciones.
La esclerosis múltiple (EM) es una enfermedad autoinmune inflamatoria desmielinizante de causa desconocida y curso crónico causada por el daño a la mielina. Al dañarse la mielina se genera una alteración en la capacidad de los nervios para conducir impulsos eléctricos desde y hacia el cerebro y esto produce los diversos síntomas, entre ellos espasticidad, fatiga, dolor neuropático y/o incontinencia urinaria.
Todos estos factores influyen directamente en la calidad de vida del paciente, empeorando cada vez que aparece un brote de esta patología.
Debido al carácter invalidez de la EM cualquier mejora de la sintomatología lo será también en la calidad de vida y en el estado de salud del paciente.

OBJETIVOS

Los objetivos son mejorar el estado de salud y la calidad de vida gracias al control de incontinencia urinaria a causa de la vejiga neurógena.

CASO CLÍNICO

Paciente de 48 años con EM secundaria progresiva y que cursa con espasticidad, fatiga, dolor neuropático e incontinencia urinaria a cause de la vejiga neurógena.

EVALUACIÓN

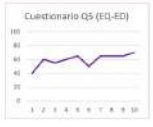
Se realizan 3 mediciones: al inicio, sesión 5 y tras la sesión 10.

- Cuestionario QS (EQ-5D Cuestionario de Salud.
- Cuestionario de autoevaluación del control de vejiga (CACU) y el Cuestionario de Incontinencia Urinaria (ICIQ-SF).
- Evolución diaria de las sesiones se pasa la escala visual de estado de salud de 0 a 100 del Cuestionario QS.

TRATAMIENTO

10 Sesiones de tratamiento pasivo con NESA XSignal.

- 5 sesiones de modulación del SNA (P1 (15') + P5 (15') + P7 (15') con direccionador en C7).
- 5 (1+1) sesiones de modulación Modulación vejiga neurógena y SNA.
  - P1 (15') direccionador en C7 + (P2 (15') + P5 (15') + P7 (15')) con direccionador en L3.
  - P1 (15') direccionador en C7 + (P2 (15') + P5 (15') + P7 (15')) con direccionador en S1-S2.



RESULTADOS

El paciente al inicio del tratamiento evalua su estado de salud en la escala visual de 0-100 del EQ-5D en un 40, terminando las sesiones al 68 de su mejor estado de salud deseado.
En el CACU, sobre el control de la vejiga, la sintomatología inicial era de 5/12 con una molestia de 6/10 y al final del tratamiento 2/10 y 3/10 respectivamente.
En el ICIQ-SF la puntuación inicial es de 14/21 terminando el tratamiento con una puntuación de 2/21.

CONCLUSIONES

Gracias a la Neuromodulación Superficial Aplicada (NESA) el paciente ha conseguido mejorar el control de la incontinencia urinaria, mejorando así el impacto de esta en su calidad de vida, ya que en el ICIQ-SF se reduce a la mitad.
El estado de salud del paciente también mejora considerablemente.

BIBLIOGRAFÍA

EFECTOS DE LA NEUROMODULACIÓN NO INVASIVA NESA® EN EL TRATAMIENTO DE SECUELAS DE ICTUS. A PROPÓSITO DE UN CASO.

Lledó-Amat, M. Medina-Ramírez, R. Alamo-Arce, D. Arteaga-Ortiz, R.
Afiliación: Universidad de las Palmas de Gran Canaria ULPGC

INTRODUCCIÓN

El **Ictus** es la segunda causa principal de muerte en todo el mundo y la **principal causa de discapacidad neurológica** en adultos (Li et al. 2020), los pacientes que sobreviven suelen sufrir **secuelas físicas** relacionadas con la movilidad, la visión o el habla, así como trastornos del ánimo, cognitivos y de personalidad, **afectando a su funcionalidad y calidad de vida** (Crichton et al. 2016).

La **neuromodulación** implica la **modificación de la actividad de circuitos neuronales específicos** con el objetivo de estimular una red neuronal mediante la aplicación de una corriente eléctrica, controlando la **frecuencia**, **amplitud** y ancho de pulso (Andrés et al. 2015).

Las **microcorrientes NESA** trabajan con **neuromodulación no invasiva** de **baja frecuencia, entre 1 y 14 Hz**. La tecnología NESA ha sido estudiada en otros campos como el tratamiento de síndromes neurálgicos, en psiquiatría y en parálisis cerebral infantil (Molina et al. 2020; Báez et al.2020).

MATERIAL Y MÉTODOS

61 años
Ictus en 2008
Hemiplejia izquierda

Ítems valorados inicialmente, a las 5 y 10 sesiones, valoración a los 15 días de finalizar el tratamiento.
Espasticidad - E. Modificada de Asworth (MS 3; MI 2/4)
Dolor - EVA (0/10)
Equilibrio - E. Equilibrio de Berg (40/56)
Independencia AVD - Índice de Barthel (90/100)
Calidad de Vida - E. ECVI-38 (70/100)

10 sesiones con NESA X-Signal
1 hora
2 días/semana

OBJETIVO

Estudiar los efectos de la neuromodulación superficial aplicada NESA® en el tratamiento de las secuelas de pacientes de Ictus.

RESULTADOS

Las variables de dolor, independencia en la realización de las AVD y calidad de vida no presentaron cambios. El paciente nos trasmite, percibir mejoría en su calidad de vida con el tratamiento pese a no observarse cambios en algunos de los ítems estudiados.
Resultados respecto a la espasticidad:

CONCLUSIONES

Las microcorrientes NESA producen cambios en las secuelas del tono muscular del paciente después del tratamiento planteado de 10 sesiones, sin embargo no se observan cambios en los ítems de dolor, equilibrio, independencia de las AVD y en la calidad de vida.

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ORAL PRESENTATIONS

OP119

EFFECTIVENESS OF NON-INVASIVE NEUROMODULATION IN CHILDREN WITH NEURODEVELOPMENTAL DISORDERS TO IMPROVE CONSTIPATION AND SLEEP QUALITY. A preliminary study

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Introduction: Children with neurodevelopmental disorders have a delay in acquiring the skills that are assumed taking into account the phases of typical psychomotor development. Added to this difficulty and main element of concern on the part of their families, there are another series of signs that appear with some frequency and that, despite being unnoticed against other major problems represent basic and fundamental factors in the correct development and performance such as constipation problems and sleep disorders

Objective: To evaluate the effectiveness and safety of the non-invasive neuromodulation device applied in people with neurodevelopmental disorders, in relation to constipation problems and in the quality of sleep.

Methods: A prospective observational study was conducted. Children with neurodevelopmental disorders were selected that met the established inclusion criteria, and to whom the non-invasive neuromodulation device (NESA XSignal) was applied, based on the use of microcurrents during 12 sessions of 60 minutes of treatment (alternate days). The type and frequency of bowel movements was evaluated as well as the hours and quality of sleep. The participants in the study continued to receive the routine of care already prescribed as usual.

Results: 20 participants with neurodevelopmental disorders were selected in our hospital to evaluate the viability of this initiative. The quality sleep results did not statistically significant change was seen, but deposition results were better. No incidence was recorded in participants derived from the use of the electrotherapy device

Conclusions: The use of non-invasive neuromodulation can improve the quality of life in children with neurodevelopmental disorders. More studies are necessary for statistically significant results.

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Casos clínicos

Título: Recuperación exitosa de un Síndrome Regional Complejo a través de electroterapia de neuromodulación del Sistema Nervioso Autónomo

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Coautor 2: Aníbal Báez Suárez **Coautor 3:** Daniel David Álamo Arce

Centro de Trabajo: Universidad de Las Palmas de Gran Canaria. Sapiens Fisioterapia-Icod de los Vinos - Tenerife

Introducción

Paciente femenina (43 años), acude a consulta en octubre de 2019 con diagnóstico de Síndrome Regional Complejo en mano derecha, con dolor 10 (EVA) en la zona cubital (2 años de evolución). Limitación extensión activa de muñeca (goniometría 20º). Tratamiento farmacológico (Tramadol, Gabapentina y Prazosina). Antecedentes de accidente de tráfico en octubre de 2017 con traumatismo en brazo derecho, cirugía de liberación del Nervio Cubital en marzo de 2018, 2 años de rehabilitación, bloqueo del Ganglio Estrellado en diciembre de 2018 sin mejoría y programación para la implantación de neuroestimulador.

Observación clínica

Observamos hiperhidrosis, vello en la zona cubital del codo y la mano. Refiere dolor urente lancinante (EVA=10) constante en la muñeca y sensación de pesadez. Programamos sesiones (13) de microcorrientes bifásica simétrica de aplicación topológica (electroterapia NESA), de muy baja frecuencia e intensidad, moduladora del Sistema Nervioso Autónomo. En la 5ª sesión desaparece la sensación de pesadez. En la 8ª sesión disminuye el dolor urente (EVA=2) y la sensación lancinante se vuelve intermitente. El médico suspende la medicación al inicio de tratamiento. Posteriormente, se combina el tratamiento eléctrico con neurodinamia y el rango articular evoluciona de 25º hasta 55º de extensión activa de muñeca. Desaparece hiperhidrosis y el vello.

Conclusiones

La rapidez de la evolución de la paciente muestra resultados sorprendentes con este nuevo tipo de electroterapia de microcorrientes neuromoduladoras del SNA, que permite recuperar un Síndrome Regional Complejo devolviendo a la paciente la funcionalidad y calidad de vida de su mano dominante.

CASO CLÍNICO DE NEUROMODULACIÓN SUPERFICIAL APLICADA (NESA) FIBROMIALGIA Y DEPRESIÓN

Monica Torrents Reynés (COFIB Col.1713), Álvaro Palomino Herrero (COFIB Col. 1832) y Erola Griño Seguí (COFIB Col. 392)

INTRODUCCIÓN

La fibromialgia (FM) es un padecimiento caracterizado por dolor generalizado, con respuestas aumentadas a estímulos percibidos como nociceptivos y síntomas somáticos; el dolor es crónico, asociado o no a rigidez articular, habitualmente a fatiga, trastornos de sueño, disfunción cognitiva y depresión.

Al margen de la importancia de mejorar la sintomatología y funcionalidad de estos pacientes, no hay ningún tratamiento específico para la F.M. Las intervenciones no farmacológicas que han demostrado mayor beneficio son estimulación eléctrico nerviosa transcutáneo y el ejercicio físico. La mayoría de los estudios han observado una disminución del dolor tras la aplicación del TENS en personas con FM. Con el presente estudio, se pretende analizar la efectividad de un tratamiento basado en NESA como alternativa a los abordajes no farmacológicos habituales.

La Neuromodulación Superficial Aplicada (NESA) facilita una regulación del Sistema Nervioso parasimpático. Su aplicación consiste en electroterapia no invasiva e indolora, basada en microcorrientes de baja frecuencia. Existen estudios que indican que se consigue aliviar el dolor mediante el suministro de señales eléctricas imperceptibles y lentas que neuromodulan de los sistemas alterados eléctricamente, normalizando sus funciones.

CASO CLÍNICO

Paciente de 53 años de edad, diagnosticada de fibromialgia desde hace más de 15 años. Padece de artrosis generalizada, parestesias en las manos, dolor sacro, costal derecho y hombro homolateral. Antecedente de cáncer de mama, operada sin extirpación. Trastornos de sueño, ansiedad y depresión. Estos síntomas hacen que tenga dificultad para llevar a cabo sus actividades de la vida diaria.

OBJETIVOS:

Los principales objetivos son regular su calidad de sueño y disminuir el dolor y la ansiedad mejorando así su percepción de calidad de vida.

EVALUACION

Se realizan 3 mediciones: al inicio, a la 5ªsesion y al finalizar el tratamiento.

- Cuestionario EQ-eD de calidad de vida.
- Cuestionario Pittsburgh de calidad de sueño.
- Cuestionario Hamilton de ansiedad.

TRATAMIENTO

10 Sesiones de tratamiento pasivo con NESA XSignal.

- 3 sesiones de modulación del SNA (P1 (30') + P7 (30')) con direccionador en C7).
- 7 sesiones de modulación (P1 (15') + P6 (15') + P8 (15') + P7 (15') con direccionador en C7)

RESULTADOS

Al iniciar el tratamiento su percepción subjetiva respecto a su estado de salud (cuestionario Q5) era de 4/10 mientras que al finalizar el tratamiento se observa una mejoría de 5/10.

En cuanto a la ansiedad según el test de Hamilton , todos los parámetros han disminuido, en especial la ansiedad somática. El valor total pasa de 41 a 29.

En la escala Pittsburgh se puede observar una mejoría notable en cuanto a calidad de sueño desde la quinta sesión, pasando de un valor 14 a un valor 10.

CONCLUSIONES

El abordaje de tratamiento basado en la Neuromodulación Superficial Aplicada (NESA), puede ayudar a mejorar algunos síntomas asociados a la fibromialgia, como puede ser su percepción subjetiva de su estado de salud, así como los síntomas de ansiedad, tanto somática como psíquica, según se aprecia en la evolución de las respuestas que el paciente remite a los cuestionarios aplicados. También se observan mejoras respecto a su calidad de sueño.

Se observa una mejoría con respecto al estado inicial, y un impacto más significativo tras las primeras sesiones, pudiendo ser interesante observar la evolución del paciente a largo plazo, tras un mayor número de sesiones.

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TRATAMIENTO A TRAVÉS DE NEUROMODULACIÓN NO INVASIVA EN TENDINOSIS AQUILEA

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INTRODUCCIÓN

La tendinopatía aquílea es una patología muy frecuente cuya etiología es una tensión excesiva y/o repetitiva sobre el tendón, produciendo que este se debilite e inflame ante el incremento de tracción. Este uso excesivo no incluye únicamente a las personas deportistas, un 26% de los pacientes que presentan tendinopatía aquílea no practican ejercicio regular. El paciente suele referirnos a su dolor como una molestia que aparece ante la carga inicial, que desaparece con la actividad continuada. Si el proceso se hace crónico el dolor puede llegar a ser persistente, provocando claudicación y cese de la actividad del paciente.

La **tendinosis** se caracteriza por dolor, hinchazón y deterioro funcional, debido a un proceso degenerativo no inflamatorio, con una estructura del colágeno desorganizada. Sin embargo, algunos estudios demuestran que hasta un 34% de los tendones asintomáticos presentan cambios histopatológicos, por lo que estos pueden no ser la causa directa del dolor. Se considera que el uso excesivo del tendón induce a la patología, sin embargo la etiología y la patogenia no es bien aclarada, como tampoco la fuente del dolor y el trastorno de su mecanismo.

OBSERVACIONES CLÍNICAS

Paciente mujer de 53 años con antecedente de dolor lumbo-pélvico de carácter crónico. Sufre desde junio de 2020 tendinosis aquílea en pie izquierdo, asociada a dolor en la marcha y episodios de impotencia funcional, así como un gran edema. Tras haber recibido diferentes tratamientos de fisioterapia como Epi, punción seca, terapia manual y ejercicio terapéutico no se consigue una disminución de la sintomatología, por ello se decide un abordaje diferente y aplicar tratamiento de neuromodulación no-invasiva a través de NESA.

TRATAMIENTO

La neuromodulación no invasiva es una tecnología mediante la cual se emiten impulsos eléctricos que mejoran el funcionamiento del sistema nervioso. Estos impulsos se utilizan para mitigar el dolor, recuperar la movilidad y el tono muscular. Además, mejora la calidad del sueño y obtiene resultados que se mantienen en el tiempo. Se trata de una técnica indolora en la que se pueden programar diversos tratamientos. En este caso, se plantean P1, P3, y P7, siendo estos pertenecientes a equilibrio neurovegetativo, cadena cinética posterior y estimulación parasimpática respectivamente, con el electrodo central colocado en C7.

Antes de comenzar el tratamiento se realizó a la paciente una ecografía del tendón, en la que se midió tanto el grosor como la vascularización, y la homogeneidad. También se midió el dolor percibido por la paciente según la escala EVA obteniendo un resultado de 7/10 y la calidad del sueño según el cuestionario Pittsburg con un resultado de 17/21.

Se realizaron 11 sesiones de tratamiento con una cronología de 2 sesiones por semana y se volvieron a evaluar los mismos parámetros.

RESULTADOS

En la última medición la paciente refiere una mejoría del dolor de 5 puntos en la escala EVA, y una mejora de la calidad del sueño de 12 puntos. Además, la vascularización del tendón se reduce, dando paso a la fase de remodelación, no apreciándose en este periodo una reducción del diámetro del tendón sin embargo se observan cambios ecográficos como un mayor patrón de alineación fibrilar y una aminoración de las áreas hipoecóicas intratendinosas.

Además, la paciente informa de una reducción de la inflamación general y local en las articulaciones interfalángicas de las manos, y un descenso del nivel de estrés en su vida diaria.

EVA

$$\frac{7}{10} \rightarrow \frac{2}{10}$$

PITTSBURG

$$\frac{17}{21} \rightarrow \frac{5}{21}$$

DISCUSIÓN

Se estima que entre un 50-70% de los pacientes con dolor moderado-intenso sufren trastornos del sueño, asociados a despertares nocturnos por dolor, dificultad para quedarse dormido y sueño no reparador. Estos trastornos del sueño presentan una relación directa y recíproca con la intensidad de dolor que sufre el paciente.

La relación entre dolor y sueño está ya confirmada, por ejemplo se ha demostrado una disminución de los umbrales del dolor cuando se reduce el tiempo de sueño y una disminución de la pensibilidad al dolor cuando se aumenta el tiempo de sueño. Todo esto puede deberse a que la información aferente también se lleva a cabo a nivel del tronco encefálico y espinal, núcleos sensibles del trigémino, núcleo del tracto solitario y cuernos posteriores de la médula espinal. Esto confirma mediante la evaluación de los componentes del reflejo flexor nociceptivo durante la transición de la vigilia al sueño.

CONCLUSIONES

Basándonos en los resultados obtenidos en este caso, la Neuromodulación Superficial Aplicada (NESA) se puede considerar un abordaje terapéutico útil y confiable para el tratamiento de las tendinopatías aquíleas dentro de una perspectiva multifactorial. NESA es una técnica que se puede aplicar sin causar dolor; la que aumenta su seguridad.

La calidad del sueño como un factor crítico e independiente del resto de comorbilidades asociadas al dolor, es de fundamental importancia a la hora de evaluar el enfoque satisfactorio del tratamiento del paciente con dolor crónico.

A pesar de los buenos resultados, se necesitan estudios controlados para probar su eficacia terapéutica a medio-largo plazo, con un mayor número de casos y la realización de ensayos clínicos en este campo.

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CASO CLÍNICO DE NEUROMODULACIÓN SUPERFICIAL APLICADA (NESA) COMO TRATAMIENTO PARA LA ANSIEDAD

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INTRODUCCIÓN

La Neuromodulación Superficial Aplicada (NESA) ayuda a regular el Sistema Nervioso parasimpático.
Se trata de ondas microcorrientes de baja frecuencia, no invasiva e indolora para el paciente. Los estudios realizados demuestran el alivio del dolor mediante el suministro de señales eléctricas imperceptible y lentas que neuromodulan los sistemas alterados eléctricamente, normalizando sus funciones.

La ansiedad es un mecanismo adaptativo natural que nos permite ponernos alerta ante sucesos comprometidos, sin embargo en ocasiones el sistema de respuesta a la ansiedad se ve desbordado y funciona incorrectamente, pudiendo provocar que el paciente quede paralizado, con sentimiento multiformes. Los síntomas se manifiestan tanto a nivel emocional como físico, preocupación constante, agitación, problemas de sueño, taquicardia, dificultad para respirar o dolor de cabeza.

OBJETIVOS

El objetivo es aumentar la calidad de vida la salud mental de la paciente, y por consecuente la salud física causada por el estrés y la ansiedad.

CASO CLÍNICO

Mujer con 23 años, desarrolla episodios de ansiedad con regularidad, siuna dolor de cabeza constante, pesadez y estado de ánimo deprimido.

EVALUACIÓN

Se realizan tres mediciones: Al inicio, a la 5 y tras la sesión 10.

- *Cuestionario State Anxiety Inventory (STAI).*
- *Escala de ansiedad de Hamilton.*
- *Se pasa la escala visual del 0-100 del QS y se añaden comentarios subjetivos del paciente.*

TRATAMIENTO

10 sesiones de tratamiento pasivo con NESA XSignal.
- 3 sesiones iniciales de modulación del SNA (P1 (30') + P7 (30') en C7.
-2 sesiones con los programas P2 (15') + P7 (30') + P8 (15') en C7.
-5 últimas sesiones P2 (15') + P7 (45') en el nacimiento del esternón.

RESULTADOS

El paciente al inicio del tratamiento evalúa su estado de salud en la escala visual del 0-100 del EQ-5D en un 60%, en la decima sesión evalúa su estado de salud con un 80%.
En el State Trait Anxiety Inventor (STAI), sobre la ansiedad, la puntuación inicial fue de 25/60 y al final del tratamiento fue de 32/60.
Por último en la escala de Hamilton obtenemos inicialmente una puntuación de ansiedad psíquica de 6/28 y de ansiedad somática de 8/28. En la última sesión primera abtenemos 5/28 y 5/28.

CONCLUSIONES

Gracias a la Neuromodulación Superficial Aplicada (NESA) la paciente ha conseguido mejorar su estado de salud general en un 20%.
Por otro lado, en los tests de ansiedad se observa mejora al final del tratamiento pero se propone realizar más sesiones para conseguir un resultado más concluyente.

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RESOUCES AND LINKS

MORE INFORMATION:

¿What is NESA non-invasive neuromodulation?

How does NESA's non-invasive neuromodulation work? 3D

How to start with NESA technology?

UNIVERSITY RESEARCH AGREEMENTS

Alfonso X el Sabio University, NESA® Electrophysiology Laboratory. Scientific investigation.

Research and academic development agreement with the Pontifical University of Salamanca. NESA®

Research agreement University of Alcala de Henares. Pain Institute. Feat. NESA WORLD®

Research agreement University of Castilla La Mancha. UDALI. Feat. NESA WORLD®

NESA CLINICAL TRIALS

Efficacy of non-invasive neuromodulation NESA® in the neuroefficiency of basketball players. 2022

Clinical Trial: Recovery of the Anterior Cruciate Ligament with NESA - Clinica Sant Josep Manresa.

Clinical trial: Peristalsis and sleep in children with cerebral palsy. NESA-Hospital San Juan De Dios

Clinical Trial: Postoperative knee prosthesis NESA - San Juan De Dios Hospital. 2021

Clinical Trial: Overactive Bladder with NESA. HOSPITEN Have. and Gran Canaria Maternal and Child Hospital.

Clinical Trial / Chronic pain in Complex I regional syndrome. Hospital MAZ Zaragoza and the ULPGC.