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Non-invasive neuromodulatory therapies applied in trigeminal neuralgia

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Abstract: *Background:* Estimates reveal that about 1 in 15,000 patients suffer from pain impulses from trigeminal neuralgia. Annually there are 5-6 new cases registered per 100,000 inhabitants, with an increased frequency in women with a ratio of 3/2:W/M. It is revealed that the first manifestations appear at the ages between 40 and 60, but in recent decades cases have appeared at younger ages, starting even with 21. Given the high intensity of pain in the trigeminal pathology, significantly disabling pain for long periods of time, effective noninvasive approaches are required to reduce pain, reduce the frequency of exac-erbations and bring patients to a functioning state as close as possible to the physiological limit. *Material and method:* A low frequency pulsatile magnetic field is a non-pharmacological and non-invasive method which is widely used in a multitude of medi-cal conditions by medical and paramedical professionals for the management of chronic or acute pain. This original research aims to provide an insight view into the review of evi-dence available for the analgesic non-invasive therapy uses of the pulsed magnetic field. The before and after examinations the therapy have included a general assessment of the functional status, an assessment of pain severity. *Result:* With this study we hope to demonstrate the increased efficiency of the non-invasive rehabilitation methods with ap-plication in trigeminal neuralgia pathology that qualitatively affects the daily life of the pa-tients experiencing trigeminal neuralgia. *Conclusion:* Non-invasive rehabilitation in trigem-inal neuralgia registers remarkable results, similar to drug approaches, the major benefit being the absence of adverse effects both during treatment and late, in the long term. It in-creases the quality of life of patients, the frequency of relapses and the intensity of the pain-ful stimulus from the first treatment sessions..

Keywords: trigeminal, neuromodulation, pain, neuralgia, magnetotherapy, non-invasive

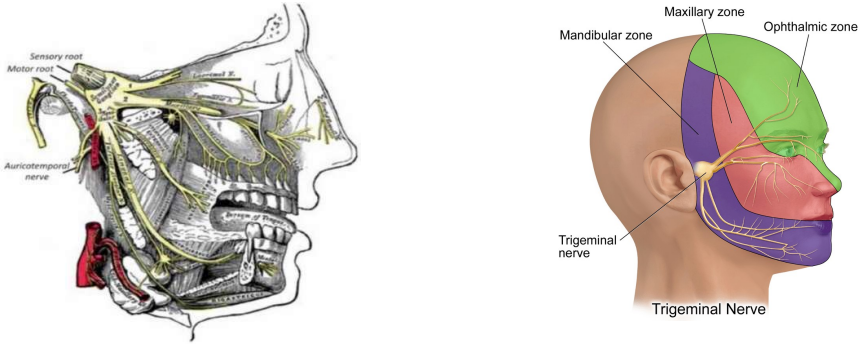
1. Introduction

Also known as tic Douloureaux, prosopalgia, suicidal disease or Fothergill's disease, trigeminal neuralgia is also known as "the great trigeminal drama, in three acts" (Sicard) because of the symptoms it produces: pain, facial hemispasms and vegetative phenomena. The clinical manifestation of damage to the cranial trigeminal nerve, is considered one of the most violent facial neuralgia. Pathology is due to the dysfunction of the trigeminal nerve with its three branches. It may suffer from mechanical compressions (artery, vein, tumor, etc.), trauma, various sufferings of the central nervous system at different levels, etc.

The classification of trigeminal neuralgia was made based on symptoms: type 1: sudden, violent pain that can last between a few seconds to 2 minutes followed by periods of calming. The pain-analgesia cycle can repeat for up to several hours. Type 2: constant

continuous pain of reasonable intensity, bearable, like a burning or sharp, of long duration [1,2].

The two types can overlap and coexist in the same individual. Symptoms manifest themselves on the area of innervation of the trigeminal nerve. Triggers of an episode: any kind of mechanical stress on the area, trigger stimuli - touch, vibration, mastication, etc. or can occur spontaneously. Primary trigeminal neuralgia occurs mainly in the 6th decade of life, but can occur at any age, while secondary trigeminal neuralgia occurs predominantly in young patients.



(a) (b)

Figure 1. (a) The area innervated by the branches of the trigeminal nerve and the functions performed (sensory, motor) [1]. (b) Painful areas in trigeminal neuralgia: ophthalmic, maxillary, mandibular [2].

The trigeminal nerve with its three terminal branches: ophthalmic, maxillary, mandibular controls tactile, motor and painful sensations from the brain to the facial area, masticatory and mimico-gestual, salivary and lacrimal muscles [1,2]. Penetrating pain with intensity similar to an electroshock with random appearance and localization is the dominant symptom, manifestations can occur after seemingly harmless actions such as brushing teeth, shaving, talking. According to the Institute of Neurological Disorders and Stroke, 12 Americans out of 100,000 experience trigeminal neuralgia annually [3]. An abnormality of blood vessels, hypertension and multiple sclerosis are among the main causes of this pathology [2,3].

The pain caused by trigeminal neuralgia is usually localized on one side of the face, cheeks, jaw, gums, lips, eyes, forehead and lasts a few seconds or minutes, but there are cases in which it can persist up to several days or months, with short periods of remission. Particular to trigeminal neuralgia is an intense pain with burning sensation or electroshock that occurs spontaneously or can be caused by certain stimuli, such as mastication, breathing, swallowing, cold air current, brushing teeth, washing face, etc.

Trigeminal neuralgia can be caused by the most harmless actions: laughing that contracts the muscles of the face, usual mimicry, touching the face, chewing, brushing teeth, talking, applying makeup, the breeze blowing in the face, smiling, washing the face, etc.

The frequency and intensity of symptoms can induce other related pathologies: anxiety (fear of certain gestures and touches that would trigger or intensify pain), facial spasms (painful tics), excessive tearing, rhinorrhea, swelling of the face, excessive sweating, headache, neck or shoulder pain. Obviously, early diagnosis streamlines treatment and reduces the risk of relapse of pain or occurrence of associated pathologies. Usually, patients consider that the pain is caused by a dental abscess, but the reality is that trigeminal neuralgia is caused by completely other health issues: pressure exerted by an abnormal blood vessel on the trigeminal nerve, hardening of blood vessels and, implicitly, damage to the trigeminal nerve, multiple sclerosis (damage to the myelin sheath), overuse

or previous trauma, inflammation/dysfunction of the temporomandibular joint, strokes, tumors, etc. There are also dental diseases that can mimic the specific symptoms of trigeminal neuralgia: pulpitis, incorrect canal treatments, postextractional alveolitis, bacterial infections, periodontitis, osteitis, etc., with the danger of confusion. The diagnosis of trigeminal neuralgia is usually established based on several investigations, which include anamnesis, physical examination, patient history and, possibly, imaging analyzes [3]. Maagnetic resonance imaging (MRI) is useful to see it there is a blood vessel, tumor, multiple sclerosis or other abnormalities involving trigeminal nerve. The differential diagnosis of trigeminal neuralgia versus temporomandibular joint is based on differences in symptoms: in trigeminal neuralgia we have stabbing sensation or electrical impulse on the face, jaw or cheek, pain in the front of the ear, numbness and needles on the face, irritating dental pain while in temporomandibular joint we encounter pain in the jaw muscles that sometimes extends to the neck and shoulder area, limitation of jaw mobility or even jaw blockage, uncomfortable alignment of jaw bones and cracks on the temporomandibular joint [3].

Painful paroxysms and the insecurity of the possibility of returning disabling symptoms make the patient access many medical services, consultations in various specialties: family doctor, dentists, clinical specialties - ENT, neurologist, neurosurgeon, rheumatologist, etc. to consume large amounts of anti-inflammatory and antalgic drugs with already known side effects and without a satisfactory result.

The treatment of trigeminal neuralgia aims to relieve symptoms but will it also aim to treat the cause, not the consequence, namely trigeminal neuralgia. In other words, following the results offered by medical investigations, the doctor will decide which is the most appropriate therapeutic method, so that the patient can enjoy an improvement of symptoms, but also a possible cure of the condition causing trigeminal neuralgia.

The treatment of trigeminal neuralgia is a special one. Abuse of pain relievers, anti-inflammatories and opioids does not lead to pain remissions [4,5]. A drug treatment is required to raise the nociceptive threshold, and this is represented by first-line medication: antiepileptics and tricyclic antidepressants.

But the administration of anticonvulsants, antidepressants, antispasmodics may also present side effects, such as dizziness, confusion, lethargy, nausea, etc. Individuals who have a history of kidney, liver or haematological disease should be closely monitored during such treatment as there is an increased risk of toxicity. Trigeminal neuralgia cannot be cured, which is a good reason to find alternative therapies to the usual invasive ones [6].

2. Results

2.1. Characteristics of the patients (age, gender, environment)

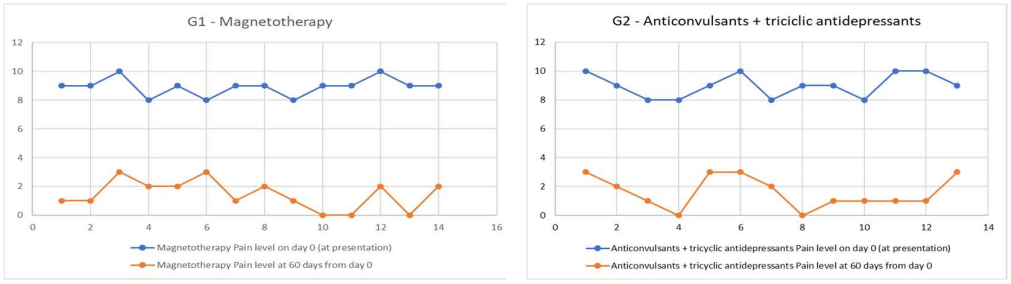
Table 1. Characteristics of the patients in the study group

	No.	**Percentage (%)**	**Min/Max age (years)**	**MD±DS**
Gender (M/F)	8 men 19 women	70.37 % 29.63 %		
Age (years)			25 - 42	35.03 ± 5.33 %
Environment (U/R)	21 urban 6 rural	77.77 % 22.23 %		
Acut	9	33.33 %		
Chronic	18	66.67 %		

2.2. Results obtained after using the treatment

Figures 2 (a) and (b) reveal relatively similar significant reductions in pain and discomfort levels reported with both magnetic therapy in the G1 group and anticonvulsant and tricyclic antidepressants in G2 compared to baseline assessment values in both G1 and G2. The level of pain and discomfort was measured in both the G1 and G2 groups at first, on the day before the start of the therapy and at the end 60 days after the first day of treatment. More specifically, on day 0 and day 60 of treatment for each patient in the study.

Therefore, in both types of applied treatments (non-invasive/magnetotherapeutic and pharmacological) patients reported marked, significant decrease in specific disabling pain (electric shock type) and discomfort. From the perspective of the adverse effects of the two types of therapies, obviously, the balance tilts towards the non-invasive electromagnetic therapy, drug therapy having multiple known adverse effects, as specified in the package leaflet.



(a) (b)

Figure 2. The involution of pain level: (a) Group G1 - Magnetoterapy; (b) Group G2 – Anticonvulsants + Tricyclic antidepressants

3. Discussion

Magnetic therapy is one of the physiotherapy procedures commonly used as a therapy with long-lasting therapeutic effects in the chronic pain of vertebrogenic etiology or common degenerative diseases, even in situations where other methods of therapy have failed. Generically called magnetotherapy, the therapy itself is divided into static magnetic fields and dynamic magnetic fields, those changing in time [7].

The dynamic magnetic fields distinguished different categories of are based on parameters such as intensity, frequency and actual use [8, 9, 10]. The magnetic therapy is a non-thermal method, it is safe and rarely causes negative effects [10]. Magnetic field therapy uses magnetic fields with densities of flux between 0.1 mT and 30 mT. Magnetic field pulses can be rectangular, triangular, trapezoidal, sinusoidal, and zig-zag shaped. The frequency of these pulses is less than 100 Hz, usually in the range of 5 to 50 Hz [11,12,13]. Significantly higher magnetic field induction values for transcranial stimulation in patients with depression [12,13].

At the same time, the benefit of using static magnetic field in acute flare-ups was revealed, while pulsatile magnetic therapy registers palpable benefits in chronic pathologies. To have a relative comparison perspective, we mention the strength of the Earth's magnetic field measured at 0.05 mT. The BTL-5000 operates with magnetic fields whose intensity can be up to 1000 times higher. Application requires special attention, especially from the perspective of the fact that man does not have specific receptors for the magnetic field and thus does not perceive it directly unlike, for example, the electric current. The application of magnetic therapy is always based on a detailed analysis of the medical history and an objective clinical examination of the patient.

Both, static and pulsed magnetic fields are used successively. The main difference is that pulsed magnetic fields induce small currents (Faraday) in the tissue due to the changing magnetic flux [13]. These currents are hypothesized to represent the purported analgesic mechanisms associated with PMFT (pulsed magnetic field therapy). It has also been suggested that they cause modification of the inflammatory process, reduction of oedema, induces vasodilatation, and enhanced tissue repair [13,14,15,16]. Others have suggested a direct effect on nerve transmission [16]. It is certain that magnetic therapy has proven its effects: analgesic, anti-inflammatory, trophic (accelerating healing and growth), myorelaxation and spasmolytic effect, vasodilator and edema reduction [17].

Recent studies reveal that the therapy performed by means of pulse electromagnetic field is up to 100 times more effective than the application of a static magnetic field [15,16]. This is why pulse magnetic therapy is becoming nowadays one of the most widespread methods of physiotherapy, especially with addressability on pain and inflammation [18,19,20]. Negative magnetic fields have a beneficial effect on living organisms, while positive magnetic fields have an altering effect [21,22]. At the same time, the biological value of oxygen is increased under the influence of a negative electromagnetic field, thus causing the attraction of oxygen from the blood into the cell under the influence of negatively charged DNA. The negative electromagnetic field does not affect the pH balance in any way, maintaining alkaline balance which in turn stimulates an increase in the amount of oxygen in the body. It is also known that static magnetic fields (CMS) can alter ion flux, membrane potential, membrane configuration, ion pump activity, or neurotransmitter release. The multitude of biological phenomena associated with CMS of 1000-4000 G alters the structure of proteins and enzymes and the kinetics of reactions involving free radicals [22,23,24]. After MSC application, reductions in neuron action potential from experimental studies and changes in permeability in synthetic liposome vesicles were observed [24].

The continuous application form is usually used for sedative effect. It is especially indicated in anxious neuroses[24]. These are mental disorders recorded in people who are not on record with mental illness but can occur in response to significant stress in their lives. It also finds use in various neurovegetative disorders (menopausal women or adolescents with such disorders). In the cervical region, magnetic therapy is applied for the sedative effect it has on tense muscles or dysfunctions of neurological origin. The interrupted form of application, whatever type, has a clear general stimulating effect. This is the motivation for use in people suffering from prolonged depressive states, in those with hypotension or disturbing clinical manifestations: vertigo, intense headaches, frequent fainting or fainting [23].

Magnetodiaflux is a procedure that uses electromagnetic fields generated by low frequency currents (50-100Hz), using the therapeutic effects of the magnetic field in local or general tissue applications aimed at diminishing the articular and abarticular inflammatory process, muscle contractures and increasing the cortical threshold to pain. The uniform magnetic field is applied through a large circular coil (thoracic, lumbar area, etc.) or smaller (cervical area, upper limb, lower limb). The analgesic effect of magnetodiaflux is the result of various biological interventions on tissues leading to the creation of natural-physiological anti-inflammatories, produced in the tissue of the human body. Magnetic therapy relaxes muscles, locally stimulates blood cuirculation, thus relaxing muscles in the vicinity of blood vessels which, in turn, relax, dilate. In this way, the trophicity of tissues is stimulated, streamlining the exchange of substances [25,26]. The release of endorphins works by eliminating pain, and hyperemia and increased blood flow bring anti-inflammatory benefit. The complexity of the effects of the magnetic field on the human body is complex enough, acting to accelerate the exchange of intercellular substances, on metabolism, endocrine effects but also on the autonomic nervous system [25,26]. Under the action of the magnetic field, favorable effects are produced that lead to the acceleration of wound healing processes, callus, fractures, necrosis and wound healing, regardless of etiology [27,28]. At the same time, magnetodiaflux registers marked

systematic effects in stress, chronic fatigue, orthopedic medical rehabilitation (post fracture status) [15,16,17,20]. From the perspective of the situation that each device has power and frequency characteristics, as an additional precaution, the therapy must be personalized, adapted to each patient, giving importance to side effects, assessing the optimal balance between beneficial effects and unwanted side effects, thus avoiding running unnecessary or uncontrollable risks.

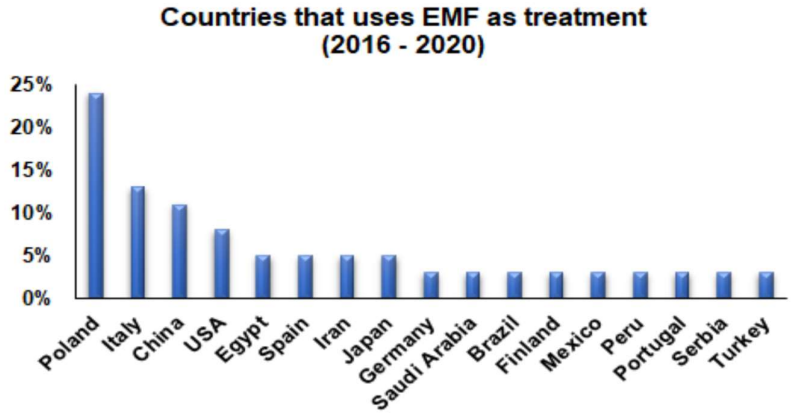


Figure 3. Countries where magnetic stimulation has been used as a non-therapy to treat musculoskeletal diseases [10,19].

Figure 3 shows the reports from the countries where the study was conducted, listing those with the lowest and highest contributions. Among the technologies used to generate and apply magnetic stimulation, PEMF (pulsed electromagnetic fields), MF (magnetic fields) and EMF (electromagnetic fields) account for 54%, 25% and 21% respectively. The most common signals used by these devices are sine, pulse, triangle and sawtooth waves, capable of varying field strength, frequency and duty cycle [10, 19, 24]. Applications for different types of signals include sine waves for nerves and muscles, pulse waves for bone disorders, and triangle waves for cartilage, tendons, and similar dysfunctions. [10,19,24].

Contraindications to the magnetic therapy are minor in number: cardiac pacemaker wearers, metal prosthesis holders, individuals with serious blood diseases (anemia, leukosis, thrombopenias), hemorrhagic states, active infectious diseases, febrile states, malignant tumors, decompensated liver failure, decompensated renal failure, serious, decompensated or advanced endocrine syndromes with complications (acromegaly, Basedow, Cushing, Addison's diseases), active tuberculosis, psychosis decompensated, pregnancy.

Phychiatric approach. In many cases, trigeminal neuralgia shows a positive response to a number of medications, but their use can cause unpleasant side effects for the patients concerned. Traditionalist pharmacological administration is considered the first-line treatment for trigeminal neuralgia. [29] In spite of the fact that there are an impressive number of drugs that can be utilized to treat this condition, therapeutic administration remains a challenge for healthcare experts. Carbamazepine and oxcarbazepine (as suggested everyday measurements, 0.4–1.2 g and 0.9–1.8 g, respectively) are considered first-line operators in treatment for torment administration [29,30,32]. The foremost commonly detailed side impacts of these drugs are laziness, vertigo, sickness, diplopia and decreased neuromuscular control, as well as cognitive issues. These unfavorable impacts were watched particularly in ladies. Hoisted transaminase levels and hyponatremia are commonly recorded in patients accepting these drugs in tall dosages [29,30]. The event of these side effects has driven to investigate into unused restorative procedures that seem demonstrate useful for patients with trigeminal neuralgia.

A meta-analysis of randomized controlled trials including a add up to of 1331 patients detailed comparable viability of gabapentin to carbamazepine, with less antagonistic reactions recorded. Gabapentin might be considered a second-line sedate and utilized as refractory therapy for patients with trigeminal inclusion. It had a better quality of life fulfillment list than carbamazepine and was related with less antagonistic effects, particularly hepatic. In any case, the adequacy of gabapentinoids for the treatment of trigeminal neuralgia has not however been adequately assessed [30,32,33,35].

Gabapentin related with ropivacaine infusions into foreordained anatomical locales progressed torment administration and quality of life, whereas pregabalin was appeared to be useful in patients with trigeminal neuropathy after one year of follow-up [34,35]. Hu et al. conducted a precise audit of the helpful viability and security of botulinum poison sort A (BTX-A) infusions for trigeminal neuralgia and found a reaction in roughly 70-100% of patients, with a cruel torment limit concentrated and recurrence decreased by around 60-80%. No major unfavorable occasions were re-ported for patients within the ponder [29,31,32,36].

Lamotrigine and baclofen may be considered second-line drugs in patients who don't react to first-line drugs or who encounter terrible side impacts. Carbamazepine can be combined with medications tried in later a long time, such as gabapentin, ropivacaine, tizanidine or pimozide, to realize predominant or proportionate comes about, individually, to make strides treatment resilience. Intravenous lidocaine can be utilized to treat intense torment, whereas botulinum poison A can be utilized as headstrong treatment [29,32,34].

A number of other drugs have been tried to treat trigeminal neuralgia, such as intravenous phenytoin and phenytoin, phosphenytoin, clonazepam, valproic corrosive, misoprostol, tocainide, topical capsaicin cream, intranasal lidocaine, tizanidine, sumatriptan and amitriptyline, with constrained advantage [29,34].

Surgical mediations are saved for the quiet with debilitating side effects of trigeminal neuralgia, in whom at slightest 3 drugs in adequate measurements did not cause an enhancement in side effects or in the event that the drugs caused unfavorable impacts terrible by the understanding. Backslide of indications is another reason why masters choose surgical treatment. It is assessed that up to 50% of NT patients will require a few frames of surgery sooner or afterward. Agreeing to parameters said by European and American hone rules, microvascular decompression, percutaneous rhizotomy on the Gasserian ganglion and gamma radiosurgery (GKRS) (gamma cut radiosurgery) may be successful within the treatment of trigeminal neuralgia, whereas prove for fringe neurectomy is still uncertain [31,32].

4. Materials and Methods

The research was carried out in *Domenico Medical Center* of Iasi, from January 1 to December 31, 2018. It included 27 patients with definite diagnosis of trigeminal neuralgia, 9 at the primary appearances, another 18 displaying for intense repetitive (constant) flare-ups. This is often a 12-month Pilot Ponder. This is a 12-month Pilot Study.

The twenty-seven patients ranged in age from 25 to 42 years, presented themselves to the rehabilitation center complaining of significant burning and/or electroshock pain and functional impotence at various levels: temporo-mandibular, facial, masticatory, etc. Patients received clinical evaluation, assessment of pain levels, and diagnostic confusion was excluded. Trigeminal neuralgia is predominantly a clinical diagnosis. Patients benefited from specific clinical consultation both in the dental clinic (dentist) and in the recovery clinic (recovery doctor).

The diagnosis was made based on the description of the pain: type of pain (sudden, intense, boring, similar to electric shock, usually short-lived), location of pain (the affected facial region shows us if the trigeminal nerve can be blamed), triggering factors (light touching of the cheeks, mastication, speech, presence of air currents), medical history of the patient, neurological examination to detect other possible pathologies. Imaging investigations (MRI) can also be done for edification and differentiated diagnosis.

The inclusion criteria: patients diagnosed with trigeminal neuralgia associated or not with inflammation or ATM dysfunction.

The exclusion criteria: patients with other diseases: dental, occlusal, tumor, pulpitis, alveolitis, periodontitis, osteitis, etc. patients with various implants (plates, rods, pacemaker, stent), benign tumor diagnosis.

All people gave their informed consent prior to their inclusion in the study and agreed for the study to be published. The study was approved by IRB no.10 of 11.12.2017.

(a) (b)

Figure 3. (a) Magnetodiaflux BTL-5000 SWT POWER device, BTL Industries Ltd. UK, 2015 (b) Coil magnetotherapy bed

This report aimed to assess the currative effect of non-invasive neuromodulation therapy on acute pain of trigeminal neuralgia. The main objective of the study was to measure the effectiveness of non-invasive electromagnetic therapy for 15 sessions applied every other day (total application 30 days) compared to medication administration for an administration period of 60 days. Measurements were made of the level of pain and discomfort at presentation and 60 days after the first day of treatment administered for both the G1 and G2 groups, regardless of treatment. This study is a plea for the widespread use of magnetic therapy in trigeminal neuralgia, but also with prospects for use in dolorific pathologies of neuropathic nature, thus avoiding the administration of medication that usually has many adverse effects.

The objectives pursued within the applied treatment were pain relief, segmental and total relaxation of patients, reduction of anxiety and depression, improvement of quality of life of patients affected by trigeminal neuralgia.

The somatic nervous system allows voluntary control of muscle activity. The magnetic therapy using continuous magnetic field is currently used in pathologies requiring sedation. The magnetic therapy with pulsatile magnetic field inhibits the nociceptive activity of neurons in the central nervous system. Pain relief is achieved by increasing the pulse amplitude magnetic pulse to induce a non-painful paranesthesia beneath the magnetic coil. The electromagnetic sedation technique is based on modulating nerve impulses that go to the peripheral nerve pathways involved. Magnetic therapy is a non-pharmacological, non-invasive, non-surgical method used by medical and paramedical professionals for acute and chronic pain management in various pathological conditions. Similarly, it is used for segmental pain management and in various conditions affecting maxillofacial region.

For lasting effects, retard type, magnetic field therapy is required to be applied in cures of 15 sessions for 30 minutes every two days with resumption of the cure every 6 months. At the same time, magnetic therapy through inhibitory action on pain facilitates the execution of associated oral kinetotherapy, allowing execution at physiological limits of exercises intended for the orofacial area with stimulation of mirror oroneuroproprioception. Magnetic therapy and associated kinetotherapy must be correlated with dietary and hygienic regimen such as adapting activities that overload the temporomandibular joint, muscles involved in mastication, swallowing and speech,

temporary adoption of a fluid diet that does not require mastication, activities that daily overload the temporomandibular joint exerting pressure on the trigeminal nerve and, possibly, wearing a mouth guard both at night to avoid bruxism, as well as throughout the day, thus avoiding potentially dolorific activities and actions.

For assessments of pain levels in the two groups created, the VAS pain rating scale shown in Figure 4 was used.

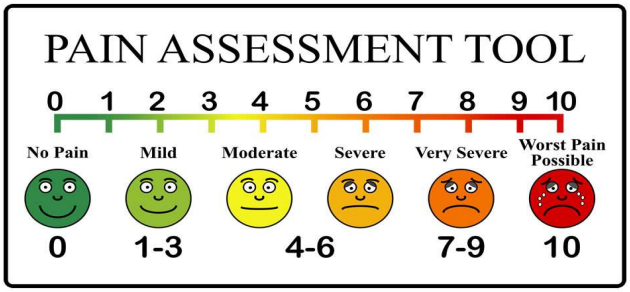


Figure 4. Visual-analog scale

This is a medical rehabilitation pilot study, constituting itself to be a preliminary test aiming to assess the feasibility thereof and to identify any potential issues and aspects before conducting a wider study on the physiotherapeutic noninvasive treatment used in the trigemen nevralgy.

For this research, the statistic analysis was carried out by using Microsoft Office 2021 version.

A search of the PubMed/Medline electronic database was performed for dates up to April 2024. The search terms used included "trigeminal nevralgy", "facial pain" or "non-invasive treatment on trigeminal nevralgy" or "conservative management" or "drug treatment" or "behavioral therapy" or "physical therapy". Several studies on physiology, pathology, clinical diagnostics, therapeutic approaches from dental, pharmacological and surgical perspectives were found, and several articles addressing TENS (Transcutaneous Electrical Nerve Stimulation) therapy, the last one published in 2020. No approach to magnetotherapeutic treatment in trigeminal neuralgia.

Further studies were chosen on the basis of manual searches of reference lists and review papers and from meetings of the National Institutes of Health (NIH) PubMed, European Academy of Neurology guideline on trigeminal neuralgia, The Trigeminal Neuralgia Association Australia which promotes the use of static and/or low frequency magnetic field in alleviating disabling pain and electromagnetic functional stimulation in some neurological pathologies. The FDA also approved TMS (Transcranial magnetic stimulation) for obsessive-compulsive disorder (OCD), migraines and to help people stop smoking when standard treatments haven't worked well. Research continues into other potential uses for TMS, including epilepsy. The repetitive magnetic stimulation has been shown to elicit analgesic effect in several craniofacial pain sindromes including trigeminal neuralgia.

5. Conclusions

Trigeminal neuralgia is a temporarily disabling pathology. The electric shock pain experienced by affected patients drastically limits the daily activity, resulting in an important impairment of their quality of life. Common drug therapies, including anticonvulsants and tricyclic antidepressants, include numerous and consistent adverse effects, balancing the success of administration. Non-invasive neuromodulatory therapy such as magnetic therapy through the absence of adverse effects and thin limitation of contraindications must be used with similar resounding results in the therapy of trigeminal neuralgia, successfully replacing long-term pharmacological therapy, situation demonstrated and supported by the present pilot study. From a pain relief perspective, magnetic stimulation therapy uses magnetic pulses to stimulate specific areas of the brain and nerve, including the prefrontal cortex, which is involved in pain perception and

modulation. By targeting these important regions, magnetic stimulation therapy help to significantly reduce the intensity and frequency of facial pain associated with trigeminal neuralgia.

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Institutional Review Board Statement: The study was conducted under the Declaration of Helsinki, and approved by the Ethics Committee of CENTRU MEDICAL DOMENICO (from 15.11.2017), for studies involving humans.

Informed Consent Statement: Informed consent was received from all subjects involved in the study. The patient(s) has(have) given their written informed consent for this paper to be published.
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