BULLETIN OF STOMATOLOGY AND MAXILLO-FACIAL SURGERY OF
Vol. 19, No. 1

DOI: 10.58240/1829006X-2023.19.1-31

ORIGINAL ARTICLE

TRETAMENT INJURY OF THE INFERIOR ALVEOLAR NERVE DURING IMPLANT PLACEMENT USING MAGNETIC-LASER THERAPY

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Received: Nov. 26, 2022; **Accepted:** Dec. 27, 2022; **Published:** Jan. 15, 2023

Abstract

Objective: The aim of this study was to assess the effectiveness of magnetic-laser therapy in complex treatment of neuropathy after dental implantation

Materials and methods: The present study is based on the results of the analysis of clinical, instrumental and radiation studies of 27 patients, with post-traumatic neuropathy inferior alveolar nerve. Diagnosis of damage to the inferior alveolar nerve was based on the clinical manifestations of neuropathy (pain, paresthesia, loss of sensation, etc.). The study of the sensitivity of the skin of the lower lip and chin in the segment of the inferior alveolar nerve dysfunction and in the symmetrical segment performed using sensory tests. Conservative treatment included: Anti-infl ammatory, analgesics, antioxidants, B complex of the vitamins group. Magnetic-laser therapy included in a conservative treatment complex for patients. To conduct a comparative analysis of effectiveness of magnetic-laser therapy, two groups were formed:

Patients fi rst group (n= 14), whose treatment complex included magnetic- laser therapy,

Patients second group (n= 13), whose treatment complex did not include magnetic-laser therapy.

Results: Most patients after implant placement complained of pain of varying degrees, a decrease or lack of sensitivity of the lower lip, chin skin, and the mucous membrane of the alveolar process of the lower jaw, paresthesia or hyperesthesia. Some patients did not have pain, however noted that sensitivity disorders have a negative effect on general well-being and interfere with work. When comparing 2 group the best pain relief was patients first group. The average area of skins sensory impairment in patients was mean 9.4cm^2. Patients first group complete recovered function of inferior alveolar nerve within mild 1 month, patients in the second group, whose treatment complex did not include magnetic laser therapy, fully recovered function of inferior alveolar nerve within mild 2 months.

Conclusion: Thus, the inclusion of magnetic laser therapy in the post-implantation traumatic neuropathy treatment shows the biostimulation effect, complex allows to reduce the recovery time of functional disorders of the inferior alveolar nerve, to reduce the area of skins sensory impairment and increase the effectiveness of treatment.

Keywords: *injury of the inferior alveolar, implant, magnetic-laser therapy*

Hakobyan G.V. et al. (2023). Tretament injury of the inferior alveolar nerve during implant placement using magnetic-laser therapy. Bulletin of Stomatology and Maxillofacial Surgery. Vol. 19 N1, 31-39.
DOI: 10.58240/1829006X-2023.19.1-31

Introduction

Dental implantation, which is now widely used, is a fairly popular type of orthopedic care with partial or complete adentia. At the same time, it is known that 5%-26% of patients after dental implantation develop complications, accompanied by a complex of functional and structural disorders [1-6].

One of the surgical complications of dental implantation is damage to the mandibular canal during the dental implant site osteotomy or placement and postoperative indirect trauma due to hematoma, secondary ischemia and thermal stimuli [7-10]. According to various authors, the frequency of implant related Inferior Alveolar Nerve (IAN) injuries varies from 3 to 26% [11-13]. It is manifested by post-traumatic neuropathy, a characteristic clinic of pain syndrome, from mild paresthesia to complete anaesthesia, accompanied by emotional-stress disorders, and signifi cantly worsens the patient's quality of life. The most common result of nerve damage is loss of lip, chin sensitivity [14-16]. As a result of nerve injury, many functions disturbance, such as speech, eating, and drinking, etc.

Different degrees of nerve injury are available. For assessment of the severity of inferior alveolar nerve injury, Jalbout and Tabourian classifi ed three categories of neurosensory alterations during the implant placement (neuropraxia, axonotmesis and neurotmes) based on the dynamics of time and the completeness of restoration of sensitivity [17]. Diagnosis of IAN sensory disturbances are based on subjective clinical sensory testing and objective sensory tests. The loss sensation of the lip and chin can be measured by clinical testing [18]. Various methods of testing are used to assessneurosensory function: from patient questioning to high-tech tests, however, the patient's report is the most sensitive indicator of sensory disturbances [19, 22].

Clinical sensory testing is still the most popular in everyday practice based upon the stimulated through cutaneous contact and includes pin tactile discrimination and thermal discrimination (war, cold). Currently there are different treatment methods inferior alveolar nerve injury, the use of medication (vitamins B, steroidal anti-infl ammatory substances), acupuncture, local physiotherapy [23-27]. However, there is no universal therapy that contributes to the full normalization of the function of damaged nerve. An integral part of physiotherapy includes transcutaneous electric nerve stimulation, acupuncture, low level laser therapy, magneto therapy, diadynamic currents [28-31].

Magnetic therapy is considered a relatively safe alternative, without signifi can't side effects. There are few scientific publications that evaluate the effects of magnetic-laser therapy for treatment neuropathy after implant surgery. Therefore, the effectiveness of magnetic-laser therapy in the treatment of neuropathy needs to be studied.

The aim of this study was to assess the effectiveness of magnetic-laser therapy in complex treatment of traumatic neuropathy after dental implantation.

Materials and methods

The work is based on the results of the analysis of clinical, instrumental and radiation studies of 27 patients (16 women and 11 men, The average age was 41.7 years), with post-traumatic neuropathy inferior alveolar nerve (axonotmesis) [17]. Diagnostic methods include objective and subjective methods, including neurosensory testing. Diagnosis of damage to the lower alveolar nerve was based on the clinical manifestations of neuropathy (pain, paresthesia, loss of sensation, etc.). During patient data collection, changes in the sensitivity of the skin of the lips and chin, of the oral mucosa were evaluated. To establish a diagnosis, radiographic examination was performed to clarify for localization implant.

The final diagnosis is based on patient complaints, the results of neurosensory and Computed Tomography (CT) studies (figure 1).

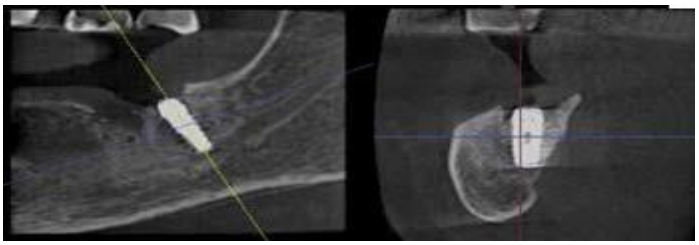

Figure 1: CT scan after surgery, nerve pressure with left distal implant

Pain levels were obtained using a visual analogue scale (VAS) (score 0-10) [32]. The VAS is presented as a 10-cm line, anchored by verbal descriptors, usually 'no pain' and 'worst pain'. The VAS is a validated, subjective measure for pain. The values can be used

to track pain for a patient or to compare pain between patients with similar conditions.

Patients who presented with a complaint of pain were asked to record pain scores via a paper VAS to indicate pain intensity. Patients were instructed that a score of 1 to 3was indicative of mild pain, 4 to 6 was indicative of moderate pain, and 7 to 10 was indicative of severe pain (figure 2).

The study of the sensitivity of the skin of the lower lip and chin in the segment of the mandibular nerve dysfunction and in the symmetrical segment performed using sensory tests.

Figure 2: Pain levels visual analogue scale (VAS)

The nature, location, prevalence, intensity, duration and frequency of pain were evaluated. The response to pain (needle puncture), thermal (hot water tube) was assessed, quantitative assessment of the area of paresthesia of the skin (figures 3,4). For monitoring of the IAN sensory function recovery neurosensory disorder surface area was mapping and Nphotographing to compare with the dynamics of treatment (figure 5 A, B).

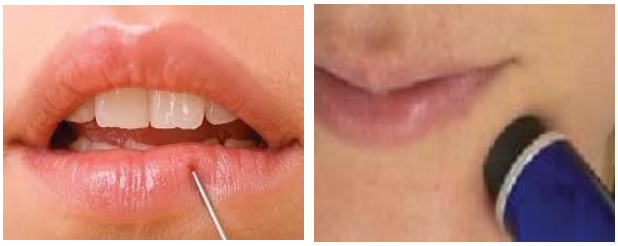

Figure 3, 4: The sensitivity of the skin of the lower lip and chin performed using needle puncture and thermal (hot water tube) sensory tests

Figure 5: Sensitivity surface area was mapping and photographing (A), surface decreased after 14 days treatment compare with treatment start (B)

Factors have been identifi ed that exacerbate or weaken the expression of sensory disturbances or pain syndrome. All patients carried out skin sensory tests. As a result of the analysis of sensory test indicators, the degree of damage of inferior alveolar nerve and the treatment strategy were determined.

The complex of post-traumatic neuropathy treatment measures included:

- elimination of nerve compression and inflammatory processes
- restoration of nerve trophism
- stimulation of regeneration

The inclusion criteria for including patients in this study were post-implantation neuropathy associated with postoperative indirect trauma due to hematoma or secondary ischemia.

The exclusion criteria for patients in this study were postimplant neuropathy associated with damage to the mandibular canal during osteotomy at the site of the dental implant or implant placement.

To conduct a comparative analysis of effectiveness of magnetic laser therapy, patients were randomly assigned into two groups:

Patients first group (n= 14), patients received irradiation of a Magneto-Laser therapy,

Patients second group (n= 13), whose treatment complex did not include magnetic-laser therapy.

Mean pain scores VAS scale and the mean area of sensory skin were obtained 1, 2, 3, 4, 5, 6 weeks after surgery and were compared in the dynamics of treatment between the two groups.

Conservative treatment included: anti-infl ammatory, analgesics, antioxidants, B complex of the vitamins group. For internal use is prescribed neurorubine (B1, B6, B12) once a day for 3 weeks, ibuprofen 600 mg three times a day for 3 weeks, Oral dexamethasone 4 mg 2 tablets AM for 3 days and 1 tablet AM for next 3 days, in case of pain, Ketonal Forte 100 mg of to take 1–2 tablets per day.

Magnetic-laser therapy included in a conservative treatment complex for patients. Magnetic-laser

therapy was performed using the Milta F-8-01 device (Space Equipment GAM, Russia, fig. 6).

Figure 6: Milta F-8-01 device

The Milta-F-8-01 device includes low-intensity pulse lasers, a magnetic fi eld generator, low-intensity laser radiation, and a combined physiotherapeutic effect of the magnetic field. The following parameters were selected for the treatment: pulsed wave frequency 80 Hz, wavelength 0.89 μm, radiation power 1.2-5 mW/cm^2, magnetic fi eld is 5-10 mTl, for 5 minutes. Magnetic-laser therapy was carried out for 10-14 days, intraoral and extraoral method in the projection of the inferior alveolar nerve and mental foramen (Figures 7, 8). The irradiation points were established following the protocol recommended at the Special Laboratory of Lasers in Dentistry (LELO).

Figure 7, 8: Extraoral and intraoral magnetic-laser therapy in the projection of the inferior alveolar nerve

Results

Most patients after implant placement complained of pain of varying degrees, a decrease or lack of sensitivity of the lower lip, chin skin, and the mucous membrane of the alveolar process of the lower jaw, paresthesia or hyperesthesia. 9 patients (5 patients first group, 4 patients second group) did not have pain, however noted that sensitivity disorders have a negative effect on general well-being and interfere with work. Patients with pain syndrome noted a signifi cant change in quality of life and irritability.

The relation of distribution of pain has shown that 11 patients (6 patients fi rst group, 5 patients second group) reported mild pain (1 to 3 score), and 7 patients (3 patients fi rst group, 4 patients second group) reported moderate pain (4 to 6 score) scores VAS. In 6 patients fi rst group with mild pain (1 to 3 VAS score) 8,2 day, in 3 patients fi rst group, with moderate pain (4 to 6 VAS score) 12,4 day. In 5 patients second group with mild pain (1 to 3 VAS score) pain decreased and disappeared after mean 13,6 day, in 4 patients second group, with moderate pain (4 to 6 VAS score) pain decreased and disappeared after mean 18,3 day. When comparing 2 group the best pain relief was patients first group.

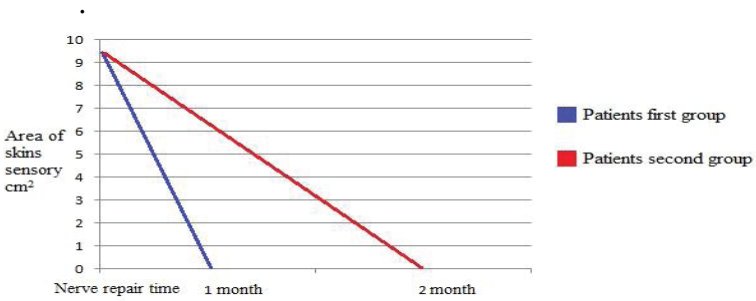

Figure 9: The mean timing of the restoration of sensitivity patients first and second group

Discussions

The Inferior Alveolar Nerve (IAN) carries general sensation for the mouth, teeth, lip and chin and serve important function for oral health and general functions such as eating, chewing, tasting, and phonation[33].Inferior alveolar nerve damage can occur during various dental surgical procedures (wisdom tooth extraction, reconstructive surgery on the lower jaw, orthognathic surgery, surgical removal of cysts, inferior alveolar nerve lateralization, dental implant placement) [33-38].

The development of these complications can be an important factor in reducing the quality of life. One of the problems dental implantology is prevention complications, development of effective methods complications.

During implant insertion different function of the inferior alveolar nerve degree disorders are caused by: direct perforation of the inferior alveolar canal, intraosseous hematoma or nerve pressure with implant. Due to a hematoma, minor injury to the IAN may develop, edema will develop later, and the injury will worsen. In cases where the patient reports permanent numbness on the side of implant placement, including the lower lip and chin (3 hours

after surgery when the effect of local anesthesia weakens), this will be the fi rst sign of nerve damage[12]. Patient with post-traumatic trigeminal neuropathy can manifest as neuropathic pain, anesthesia, hypesthesia or hyperesthesia and the resulting stress disorder [39]. There are many possible assessment tools that are used for the assessment of nerve injury severity [40, 41].

Clinical neurosensory tests (pinprick sensation, thermal sensation) were the most common reported diagnostic tests undertaken. Any damage (penetration or compression), as well as hemorrhages in the mandibular canal led to intraoperative pain of the neuralgic type. Ischemia itself, even without direct damage to the nerve, will cause suffi cient infl ammation and damage to the nerve, which can lead to permanent damage to the nerve. The degree of pain relief is individual and depends on each patient. The issue of regeneration of nerve tissue and pathomorphological changes in the nerve fi ber when it is damaged during dental implantation is discussed in research publications. The variety of proposed treatment methods and the lack of universal tactics indicate the need to develop new methods of treatment post-traumatic neuropathy of inferior alveolar nerve. The conservative therapies for Inferior Alveolar Nerve (IAN) neuropathy include the use of corticosteroids and nonsteroidal anti-infl ammatories [41].

In the absence of effective methods to resolve post-traumatic neuropathy inferior alveolar nerve has been a recommended alternative treatment method, including physiotherapy [42-48].

Magneto-laser therapy is among the methods of physiotherapy accelerates the healing and regeneration of tissues after damage, eliminates pain and swelling. Magnetolaser field act on the molecules of cell structures, to activate the processes of metabolism of cells and thactivity of enzymatic systems, stimulation of nerve cell and lymphocyte respiration. At the tissue level, there is observed: improved microcirculation, accelerated revascularization and reinnervation, decreased intracellular and intercellular edema, increased blood oxygen saturation at the microcirculatory level. The early diagnosis and treatment of this pathology, which causes suffering to patients, seems to be an important task in implantology, in connection with the foregoing, the further development of treatment methods is reasonable and relevant. Based on this, for the treatment of 27 patients with postimplantation neuropathy inferior alveolar nerve (axonotmesis) we included magnetic-laser therapy in the treatment complex and evaluated the results of treatment. The Visual Snalogue Scale (VAS) pain scores for each group at each time were analyzed. Results from the study indicate that pain was reduced in both treatment groups. A reduction in the duration of pain and the terms of the restored function of the lower alveolar nerve in patients of the fi rst group compared to patients second group shows the effectiveness of magneticlaser therapy. Effectiveness of magnetic-laser therapy on pain reduction can be explained by the fact that laser light absorbed by nociceptors, exert an inhibitory effect on A and C pain fi bers, which slows conduction velocity, and suppresses neurogenic infl ammation.

The results of the treatment showed that, complex treatment using magnetic-laser therapy reduced the time of restoration of sensitivity of the lips and skin of the chin also facilitated pain sensitivity and decreases increase the effectiveness of treatment. Magnetic-laser therapy promote to increase blood fl ow by vasodilation and also reduces edema. Thus, the inclusion of magnetic-laser therapy in the post-implantation traumatic neuropathy treatment complex allows to reduce the recovery time of functional disorders of the inferior alveolar nerve, to reduce the area of skins sensory impairment. If the nerve is damaged, evaluation and treatment should be started immediately after the damage to get a good prognosis.

Conclusions

Magnetic-laser therapy can be recommended as a non-pharmacological alternative in patients presenting with mild to moderate pain on the day after nerve injury, the effects related to the degree of nerve injury.

Based on the developed data, it can be concluded that magnetic-laser therapy can have a positive effect on the restoration of disorders of the sensitivity of the lower alveolar nerve, accelerating the improvement of the regeneration of the affected nerves after dental implantation, increase the effectiveness of treatment.

Declarations

Conflict of interest and financial disclosure: The author declares that he has no confl ict of interest and there was no external source of funding for the present study. None of the authors have any relevant financial relationship(s) with a commercial interest.

Funding: This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Ethics approval and consent to participate: This protocol was approved by the Clinical Research Ethics Committee Yerevan State Medical University after M. Heratsi (protocol N16 14.05.18) and in accordance with those of the World Medical Association and the Helsinki Declaration.

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[3] Երևանի Մ. Հերացու անվ. պետական բժշկական համալսարանի բերանի խոռոչի և դիմածնոտային վիրաբուժության ամբիոնի դասախոս, Հայաստան

Ամփոփում

Նպատակը: Այս հետազոտության նպատակն էր գնահատել մագնիսա-լազերային թերապիայի արդյունավետությունը ատամների իմպլանտացիայից հետո նյարդի վնասվածքի բուժման ժամանակ:

Նյութեր և մեթոդներ: Սույն ուսումնասիրությունը հիմնված է 27 հիվանդների կլինիկական, գործիքային և ճառագայթային հետազոտությունների վերլուծության արդյունքների վրա, որոնք ունեն ստորին ատամնաբնային նյարդի վնասվածքային ներդոպաթիա: Ստորին ալվեոլային նյարդի վնասվածքի ախտորոշումը հիմնված էր նյարդաբանության կլինիկական դրսևորումների վրա (ցավ, պարեստեզիա, զգայունության կորուստ և այլն): Ստորին շրթունքի և կզակի մաշկի զգայունության ուսումնասիրությունը ստորադաս ալվեոլային նյարդի դիսֆունկցիայի հատվածում և սիմետրիկ հատվածում իրականացվել է զգայական թեստերի միջոցով: Կոնսերվատիվ բուժումը ներառում էր՝ հակաբորբոքային, ցավազրկողներ, հակաօքսիդանտներ, վիտամինների խմբի B կոմպլեքս, մագնիսական-լազերային թերապիան: Մագնիսական-լազերային թերապիայի արդյունավետության համեմատական վերլուծություն իրականացնելու համար ձևավորվել է հիվանդների երկու խումբ.

Առաջին խմբի հիվանդներ (n= 14), որոնց բուժման համալիրը ներառում էր մագնիսական-լազերային թերապիա,

Երկրորդ խումբ հիվանդներ՝ (n=13), որոնց բուժման համալիրը չի ներառել մագնիսա-լազերային թերապիա:

Արդյունքները: Իմպլանտների տեղադրումից հետո հիվանդների մեծ մասը դժգոհում էր տարբեր աստիճանի ցավից, ստորին շրթունքի, կզակի մաշկի և ստորին ծնոտի ալվեոլային լորձաթաղանթի զգայունության նվազումից կամ բացակայությունից, պարեսթեզիայից կամ հիպերեսթեզիայից: Որոշ հիվանդներ ցավ չեն ունեցել, սակայն նշել են, որ զգայունության խանգարումները բացասաբար են ազդում

ընդհանուր ինքնազգացողության վրա և խանգարում աշխատանքին: 1-ին խմբի հիվանդների մոտ նյարդի ֆունկցիան լիովին վերականգնվել է 1 ամսվա ընթացքում, երկրորդ խմբի հիվանդների մոտ, որոնց բուժման համալիրը չի ներառել մագնիսական լազերային թերապիա, նյարդի ֆունկցիան ամբողջությամբ վերականգնվել է 2 ամսվա ընթացքում: Մաշկի զգայական խանգարումների միջին մակերեսը հիվանդների մոտ եղել է միջինը 9,4 սմ^2:

Եզրակացություն: Այսպիսով, մագնիսալազերային թերապիայի ներառումը հետիմպլանտացիոն վնասվածքային նեյրոպաթիայի համալիր բուժման մեջ ցույց է տալիս կենսախթանման ազդեցություն, թույլ է տալիս նվազեցնել նյարդի ֆունկցիոնալ խանգարումների վերականգնման ժամանակը, նվազեցնել մաշկի զգայական խանգարումների տարածքը և մեծացնել բուժման արդյունավետությունը:

ЛЕЧЕНИЕ ПОВРЕЖДЕНИЯ НИЖНЕАЛЬВЕОЛЯРНОГО НЕРВА ПРИ ИМПЛАНТАЦИИ С ИСПОЛЬЗОВАНИЕМ МАГНИТОЛАЗЕРНОЙ ТЕРАПИИ

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Резюме

Цель: Целью данного исследования была оценка эффективности магнитолазерной терапии в комплексном лечении невропатии после дентальной имплантации.

Материалы и методы: Настоящее исследование основано на результатах анализа клинических, инструментальных и лучевых исследований 27 больных с посттравматической нейропатией нижнего альвеолярного нерва. Диагноз повреждения нижнеальвеолярного нерва ставился на основании клинических проявлений невропатии (боли, парестезии, потеря чувствительности и др.). Исследование чувствительности кожи нижней губы и подбородка в сегменте дисфункции нижнеальвеолярного нерва и в симметричном сегменте проводили с помощью сенсорных тестов. Консервативное лечение включало: противовоспалительные, анальгетики, антиоксиданты, комплекс витаминов группы В. Магнитолазерная терапия включена в комплекс консервативного лечения больных. Для проведения сравнительного анализа эффективности магнитолазерной терапии были сформированы две группы:

Пациенты 1-й группы (n=14), в комплекс лечения которых входила магнитолазерная терапия,

Больные второй группы (n=13), у которых в комплекс лечения не входила магнитолазерная терапия.

Результаты: Большинство пациентов после установки имплантатов предъявляли жалобы на боли различной степени, снижение или отсутствие чувствительности нижней губы, кожи подбородка, слизистой оболочки альвеолярного отростка нижней челюсти, парестезии или гиперестезии. У части больных боли отсутствовали, однако отмечалось, что нарушения чувствительности отрицательно сказываются на общем самочувствии и мешают работе. При сравнении двух групп, наилучшее обезболивание наблюдалось у пациентов 1-й группы.Средняя площадь нарушений чувствительности кожи у больных составила в среднем 9,4 см2. У больных 1-й группы функция нижнеальвеолярного нерва полностью восстановилась в течение 1 месяца, у больных второй группы, у которых в комплекс лечения не входила магнитолазерная терапия, функция нижнеальвеолярного нерва полностью восстановилась в течение 2-х месяцев легкой степени тяжести.

Заключение: Таким образом, включение магнитолазеротерапии в комплексное лечение постимплантационной травматической невропатии оказывает биостимулирующее действие, комплекс позволяет сократить сроки восстановления функциональных нарушений нижнеальвеолярного нерва, уменьшить площадь кожно-чувствительных нарушений и увеличить эффективность лечения.

Hakobyan G.V. et al. (2023). Tretament injury of the inferior alveolar nerve during implant placement using magnetic-laser therapy. Bulletin of Stomatology and Maxillofacial Surgery. Vol. 19 N1, 31-39.
DOI: 10.58240/1829006X-2023.19.1-31