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Modern views on the treatment and preventions of muscular-articulation dysfunction of the TMJ in patients with fractures of mandible in different localization

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Abstract
An increase in the number of injuries in the young able-bodied population is one of the main medical and social problems. Fractures of the bones of the face are characterized by a significant frequency, and the leading place is fractures of the mandible, ranging from 45 to 95%. The main attention in domestic and foreign literature was directed at the study of internal disorders in the TMJ, due to fractures of the processus frontalis. Questions of the treatment of musculo – joint disorders caused by fractures of the mandible of other localizations, as a rule, were not addressed promptly and, accordingly, not resolved. This explains the relevance of the study.

Keywords: Fracture of the mandible, TMJ, occlusive disorders, muscle disorders, joint disorder

1. Introduction
The growth of traumatism in the young able-bodied population is one of the major medical and social problems. Fractures of the facial bones are characterized by a considerable frequency, and the leading place is occupied by fractures of the mandible, which make up from 45 to 95% [1, 8].

Issues of optimization of treatment and medical rehabilitation of patients with mandibular fractures have important socio-economic importance. This is confirmed by the large number of works devoted to the study of injuries of the bones of the facial skeleton and, in particular, the mandible, concerning the improvement of methods of complex treatment of fractures [2, 11].

The main attention in the domestic and foreign literature was directed to the study of internal disorders in the TMJ caused by fractures of the processus condylaris [3, 9]. The issue of treatment of musculoskeletal disorders of the TMJ caused by fractures of the mandible of other locations, as a rule, was not asked in a timely manner and, accordingly, was not resolved. This explains the relevance of the study.

The lack of purposeful early comprehensive treatment of musculoskeletal disorders of the TMJ caused by fractures of the mandible of different localization, led to misdiagnosis and their underestimation by all dental specialists (surgeons, therapists, orthopedists, orthodontists, etc.).

Numerous publications concerning musculoskeletal dysfunction of the TMJ are devoted to the etiology, pathogenesis, morphology, clinic, diagnosis and treatment of this multifactorial disease [4].

In some works the distant consequences of fractures of the mandible were reflected as a possible cause of musculoskeletal dysfunction of the TMJ [5, 12].

Therefore, the problem of comprehensive study of the pathogenetic mechanisms of development of musculo-articular dysfunction of the TMJ, the improvement of the quality of its early diagnosis, as well as the implementation of differentiated purposeful correction of the revealed disorders and prevention of possible complications in patients with musculo-articular dysfunction of the TMJ with mandibular fractures of different localization, are currently relevant. [6, 10].

2. The purpose of the study
Was to conduct a literature review of the modern methods of the treatment and prevention of muscular-articulation TMJ dysfunction in patients with fractures of mandible in different localization.

3. Results and their Discussion

There are many ways to treat mandibular fractures. These include splinting with dental tires, osteosynthesis of fragments in various ways, immobilization of mandibular fragments, etc. All treatments can be divided into surgical and conservative. Conservative, in turn, is divided into functional and symptomatic [2]. Due to the fact that musculoskeletal dysfunction of the TMJ caused by fractures of the lower jaw, was studied, mainly, when localized in the area of the processus condylaris, then treatment methods were aimed at eliminating these disorders [3].

The literature often attention is paid on the surgical treatment of fractures of the processus condylaris as a preventive measure of post-traumatic dysfunction, ankylosis [4].

Surgical intervention on the processus condylaris was performed by a number of authors with fresh trauma. Auto-, allografts, implants, etc. were used to achieve these goals. [5].

In the extra-articular fracture of the mandible, damage to the structural elements of the TMJ is also noted. Thus, S.Takaku *et al*. (2011) investigated pre- and postoperative condition of the TMJ after open repositioning of fractures of the mandible in the area of the base and head of the processus. The authors, after late surgery (more than 9 days) in all surveyed individuals found dislocation of the intra-articular disc, although the disks were not displaced during preoperative examination.

H.C.J. Kerstein *et al*. (2001) observed atrophy of the processus after bilateral osteotomy. The authors explained the progressive osteoarthrosis of the mandibular heads by changing the ratio of the articular surfaces and the position of the articular disc.

A separate issue in the literature is the treatment of intra-articular disorders of the TMJ. Most of the intra-articular disorders in the TMJ occurred, according to some authors, as a result of micro- and macro-injuries. Damage to the TMJ was caused by a fresh fracture of the mandible at its intra-articular localization [6].

G.E.Anastassov (1996), comparing physiotheraputic and surgical methods of treating intra-articular fractures, noted that conservative methods are outdated and should be disposed of. He suggested at the intra-articular fractures, to conduct the resection of the processus head.

Several authors claimed that only 5% of patients with abnormalities in the TMJ needed surgical treatment. These were patients with juvenile disorders, recurrent dislocations of the intra-articular disc, tumors, ankylosis of the TMJ [7]. In addition, T.K.Ong *et al*. (1996) noted that after surgery on the sprouts in the early period, pain persisted in 94% of the surveyed persons. In the late postoperative period, the pain disappeared, improvement was only in 23% of patients.

According to VA Semkin *et al*. (2000) surgical interventions on the elements of the TMJ are rarely used. For dysfunctions caused by violation occlusion, the authors recommended their gradual removal under radiological control. The main, in their opinion, should be methods aimed at eliminating pain and muscle overload (physiotherapy procedures, prescribing sedatives with relaxing action, massage, myo-gymnastics, acupuncture, blockade of the lateral pterygoid muscle).

One of the probable causes of disorders of the functional state of chewing muscles in the distant period was the presence of post-traumatic changes in the structure of the surrounding articular soft tissues [1, 4, 7]. In addition, all fractures were accompanied by abnormalities of the trophics TMJ and the articular tissues, the response of damaged soft tissues by trauma [8]. Disruption of the muscle fiber trophism led to the development of connective tissue, the manifestation of which was the formation of contractures in the chewing muscles, the emergence and progression of muscle dysfunctions, arthritis of the TMJ.

However, it is well known that in a state of physiological rest the distance between the teeth should be 2-4 mm. Therefore, when using Tigerstedt tires, the position when the teeth of the upper and lower jaws are closed is forced. In response, there was a chewing muscles reaction - reflex spasm [5, 6]. To set the teeth in a bite in a state of physiological rest were offered interdental gaskets. The obstacle to the implementation of the described method of treatment was the subjectivity of the patient's feelings - the impossibility in all cases (due to adentia, displacement of fragments and damage of soft tissues) to accurately determine the distance between the teeth on the upper and lower jaws, characterizing physiological rest.

Extraoral osteosynthesis of bone fragments good restored the anatomical shape, but the surgery damaged the chewing muscles, the periosteum, which subsequently led to the development of connective tissue [8]. In addition, during the operations used not always compatible with the human body foreign objects (wire, spokes, plates, brackets, screws, etc.), which, in some cases, had to be removed. This circumstance limited the indication for using of fixing materials

In addition to orthopedic, surgical methods of treatment, as an adjunctive method, used drug therapy and physical methods in the form of UHF, Ca, P electrophoresis, etc. [9].

In addition to antibacterial therapy, fractures of the mandible were widely used factors of non-specific resistance of the body, steroid and non-steroidal anabolic drugs, immunomodulators, antnoxdants and vitamins [1, 2].

The phenomena of dysfunction of the TMJ of different etiology, as believed PM Egorov, (1986), are accompanied by emotional disturbance or stress. Stress, in their opinion, causes the hypertonus of the chewing muscles and, as a consequence, the limitation of the mobility of the mandible. Since fracture of the mandible is always accompanied by stress, a number of authors have recommended the internal use of tranquilizers, analgesics, muscle relaxants, sedatives with relaxing action [7, 11]. In the presence of pain syndrome novocaine blockade according to Bershe-Dubov, according to Egorov, superficial anesthesia with chloroethyl.

The disadvantage of the work on the treatment of fractures of the mandible is the lack of methods of complex treatment and prevention of musculoskeletal disorders of TMJ in fractures of the mandible of different localization [5].

The use of vascular drugs in the treatment of acute injury to the mandible is noteworthy. For example, LI Voloshna (2005) recommended nootropics (piracetam, cerebrocrust) to improve repair processes.

Physical factors are widely and successfully used at all stages in the treatment of both fractures of the mandible and dysfunctions of different etiology [9]. However, in the available literature, there are no techniques for the simultaneous treatment of physical factors of the fractures of the mandible and musculoskeletal disorders of TMJ, and those that are developed often contradict each other.

From the standpoint of the general theory of physiotherapy therapeutic physical factors are physico-chemical stimuli that bring energy into the body and can cause changes in its external and internal environment in the form of three characteristic stages - physical, physical-chemical and

biological [4].

Depending on the tasks that need to be solved, both low-frequency and high-frequency physiotherapy, a number of phototherapy methods, ultrasound and others are used OI Efanov *et al*. (2002) describe many methods and techniques for treating mandibular fractures and subsequent post-traumatic complications. The main methods recommended by them for the injury of soft tissues and jaws were the electric field of UHF, microwave therapy, UV rays on the damaged area, with pain - electrophoresis of novocaine. 2 weeks after fracture of the jaw it was proposed to use calcium and phosphorus electrophoresis, ultrasound. However, the authors themselves did not deny that in violations in the chewing muscles caused by arthrosis of the TMJ, complete recovery of neuromuscular conduction did not occur.

High-frequency electrotherapy causes effects at the cellular and subcellular levels in the body. In the mechanism of physiological and therapeutic action there are two related effects: thermal and oscillatory. Thermal action occurs as a result of overcoming friction in the tissues due to the vibrational motion of charged particles and the increase in the vibrations of the side chains, proteins and other molecules caused by the resonance of their natural frequency with the frequency of a given field. The nature of the oscillatory effect is not fully understood and discussed.

At the same time, there are certain limitations in the use of UHF therapy: malignancies, blood diseases, cardiovascular pathology, etc. Narrowing of indications for the purpose of patients with fractures of the mandible of the electric field of UHF occurs due to the pronounced thermal effect, which increases the probability of hematoma suppuration.

VI Vakulenko *et al*. (2013) for diseases of the TMJ of different etiology used oxygen therapy to improve blood supply to the joint. To relieve the effects of pain, inflammation, swelling, and improved membrane permeability, the authors irradiated the joint with a helium-neon laser. This procedure had a potential effect on nerve trunks and trophic effect on tissues due to the expansion of arterioles.

The mechanism of action of galvanization (continuous direct current of low voltage and low force) on the body is the directional movement of ions and other charged particles, resulting in a change in electrical properties, the ionic conjuncture of tissues and intercellular matter. This affects the functional activity of cells, their colloidal state and reactivity, the level of cellular and tissue metabolism, the rate of reparative processes [7, 19]. OI Efanov *et al*. (2007) characterized galvanization as a potent stimulator of neuromuscular conduction. They believed that the conductivity of electric current in organs and tissues directly depended on the hydrophilicity of the tissues and the location of the electrodes. Under the influence of direct current, there was an increase in blood and lymph circulation, increased permeability of histogematological barriers and tissue resorptive activity, normalized the ratio of major nervous processes, decreased pain [2, 9, 12].

Studies of low frequency pulse currents by some researchers have shown that their effect on human cells and tissues causes changes in electrical parameters, and the resulting periodic changes are similar to the natural processes of electrical excitation of nerves and muscles [10]. The authors believed that these periodic changes, in turn, excite nerve receptors, motor activity of muscle fibers, and proprioceptors. In their opinion, a feature of the physiological action of low frequency pulse currents is the ability of low frequency pulse currents to reduce the activity of the sympathetic part of the autonomic nervous system, to produce an anti-adrenergic effect.

In the mechanisms of therapeutic action of low-frequency pulse currents, their ability to normalize the functional state of the central nervous system and its regulatory effect on various organs and systems of the body are distinguished; produce anesthetic, anti-edema and antispasmodic effect, improve blood supply, repair processes, etc. [16].

Sinusoidal modulated currents (SMC), according to research by OI Efanov *et al*. (1980) have a more calming effect. As a result of the influence of the alternating sinusoidal current, modulated in amplitude, the bioelectric activity of the neuromuscular apparatus and vascular tone was normalized, and peripheral circulation was improved. However, the application of this method for fractures of the mandible before their consolidation, the authors did not recommend, as they believed that the formation of bone marrow.

A number of authors have reported satisfactory results in the treatment of arthritis, arthrosis and dysfunction by sinusoidal modulated currents. The appointment of SMC in combination with ultrasound after surgery of the allograft of the TMJ caused improvement of all indicators [1, 2, 3]. The authors noted the recovery of the electrical activity of all the muscles under study, both in the near and long terms, which reduced the duration of rehabilitation by 2 times.

In clinical physiotherapy and balneology, low-frequency impulse currents, including SMC, are attributed to methods that provide central analgesic, antistress (anti-adrenergic), antihypertensive, "vascular" effects in transcerebral and transthoracic effects. 1990; ON Razdilskaya, (2000). At the same time, they are used for electrical stimulation of the striated and smooth muscles (NI Strelkova, 1991).

However, to date, the use of SMC in combination with pathogenetic methods of treatment in dentistry in general and in fractures of the mandible in particular is not substantiated. There are no promising studies on the comparative effectiveness of different methods of physiotherapy in this category of patients.

The method of electroneurostimulation through the skin, used for diseases of the TMJ, allowed to remove the painful symptom, which contributed to the early restoration of the functional activity of the joints and chewing muscles [14]. UR Mnzakulova (1989) conducted electroneurostimulation in the complex treatment of fractures of the mandible. She suggested placing the electrodes: the first on the spine, the second on the bone or skin in the fracture area. The author noted a decrease of 10% of the number of patients with complications in the form of suppuration, improvement of the reographic indexes of blood supply, accelerated recovery of electromyographic activity of chewing and temporal muscles.

Simultaneous symptomatic treatment included the simultaneous use of physical factors with medication. Most often, electrophoresis with various drugs was used for fractures of the mandible and musculoskeletal dysfunctions.

RN Serova and TFZanagova (2009) treated juvenile arthropathy by electrophoresis zinc copper [10].

The data of the literature analysis on the use of hydrocortisone electrophoresis and its injections into the cavity of the temporomandibular joint in chronic arthritis, arthrosis, dysfunctional conditions are controversial [11]. Some authors noted good effect, elimination of inflammation, etc. [12]. Other studies have shown that after the introduction of hydrocortisone in the TMJ, deformation of the articular

surfaces, up to the development of arthrosis, was observed . In the treatment of chronic diseases of the TMJ with steroid drugs, some authors of the positive effect were not observed [13,14].

The contentious issue is the timing and indications for the use of lidase and ronidase in disorders of the TMJ in the joint cavity or by electrophoresis. VI Burgonskaya (2011) suggested intra-articular introduction of lidase in acute and chronic traumatic arthritis of the TMJ. AA Timofeev (1998) did not recommend the introduction of drugs into the joint cavity, due to the frequent complications of their introduction. In case of acute traumatic arthritis, it was suggested to use analgin, amidopyrin, and externally - a compress of ronidase [14]. Daily bile compresses were used for a month during the transition period from arthritis to arthrosis. In the transition from acute to chronic arthritis, external rubbing of verapin was used. The use of compresses and ointments provided for orthopedic correction of the bite [2, 15]. MD Mashkovsky (2007) noted satisfactory results when using lidase in contractions of chewing muscles, hematomas, tendencies to ankylosis, rheumatic arthritis. He considered fresh hemorrhage a contraindication to the use of this drug. However, the method of classical drug electrophoresis involves about 90% loss of the amount of the drug from its single dose. This circumstance significantly limits the use of pharmacological drugs that require strict dosing (antibacterials, hormones, anticoagulants, sedatives, etc.).

Despite the many proposed and implemented methods for conservative treatment of fractures of the mandible, a number of authors note that after the fracture is the formation of a "new bite" [16]. The authors note that disorders of central occlusion with no muscle adaptation cause musculoskeletal disorders of TMJ. The problem of adaptation to the new bite in the available literature has not been addressed. The frequency and clinical features of lower jaw fractures in individuals with muscular and joint dysfunction of the TMJ who preceded trauma were not covered.

Orthopedic dentistry describes a number of ways to restore central occlusion disorders (due to adentia, irrational prosthetics, etc.), to eliminate factors that prevent the restoration of maximal contact between the teeth of the upper and lower jaw. Bite plates, occlusal linings, stabilizing and relaxing tires, caps, etc. are used. [3, 17]. However, in the treatment of disorders of central occlusion after fractures of the mandible, they are not widespread.

Some orthopedists-dentists in the presence of supercontacts, premature contacts, traumatic nodes, absence of fissure-tubercular contacts of the teeth of the upper and lower jaw of non-traumatic origin used selective grinding of teeth by Jenkelson with direct and open bite [11, 18].

If you do not follow the rules of grinding are observed complications in the form of reduction of alveolar height (height of the central occlusion), hyperesthesia of hard tissues of teeth, excessive loading on a periodontal after grinding of humps of teeth, withdrawal from contacts some of teeth and an overload of other teeth [4,19].

VA Khvatova (2008) warned that the method of selective grinding of teeth should be approached with caution. If it is not possible to create stable occlusion in this way, it is necessary to use others (tires, gaskets, etc.).

Some authors noted that occlusion disorders in patients with myofascial pain syndrome can develop for the second time as a result of spasm or hyperfunction of chewing muscles. He suggested to eliminate traumatic knots by grinding the leading dental contacts, which are revealed by means of copy paper.

YB Zolotareva (2015) successfully applied the described method in persons with non-traumatic malocclusion. She suggested that after this manipulation, she should polish her teeth, cover them at all stages with a fluoro-lacquer or gel to prevent hyperesthesia and prevent caries. In addition, following a certain sequence, the author noted the restoration of harmonious occlusion, a favorable relationship between the joint heads and pits, the normalization of the tone of the chewing muscles. The procedure of eliminating traumatic nodes prevented, according to the author's observations, the development of deep periodontal pockets, exposing the necks and roots of the teeth. Thus, the proposed method of selective grinding was a measure of prevention in the prevention and development of periodontal diseases and hard tissues of the teeth.

The above indicates that the condition of the TMJ, in the treatment of fractures of the mandible of different localization has received a little bit attention. Mainly attention was paid to musculoskeletal disorders in fractures of the processus condylaris. Surgical methods of treatment of post-traumatic intra-articular disorders in the form of a dislocation of a disk are difficult and ineffective [20].

Most of the physical treatments used in the clinic are symptomatic and. aimed at eliminating pain and accelerating the healing of the fracture of the mandible. Medications are also prescribed to prevent purulent complications. Purposeful pathogenetic treatment was carried out only by individual authors, and was aimed at eliminating muscle tension in chewing muscles in the treatment of fracture [21].

Existing medication treatments for mandibular fractures, physical factors, and treatments for disorders of the TMJ are often mutually contradictory. Preventive measures designed to prevent the development of post-traumatic musculoskeletal form of dysfunction of the TMJ are insufficiently effective. In the available literature there is no work on the comparative effectiveness of the use of various physical factors in the treatment and prevention, musculoskeletal disorders caused by fractures of the mandible. There is no research on the combined use of physical factors with drugs that would effectively eliminate musculoskeletal disorders by relieving pain and spasms, improving blood supply and restoring the nerve conduction of the articular tissues. As muscular and joint dysfunction in fractures of the mandible of different localization has been studied is not enough, the methods of treatment aimed at elimination of disorders that have arisen after trauma in the TMJ and around the articular tissues have not been adequately improved. Selective grinding of the teeth to restore central occlusion and maximal hump contact - the method is effective, but in violation of the bite, due to inaccurate comparison of fragments of the mandible, was not used.

Thus, there is not found mechanism of occurrence of functional musculoskeletal disorders in fractures of the mandible of different localization, the diagnostic methods used do not have full information and require improvement. Posttraumatic musculoskeletal dysfunctions are not isolated in a separate nosological form and are considered as a syndrome of pathology of the temporomandibular joint or other musculoskeletal system elements. There are no treatment regimens for musculoskeletal disorders caused by fractures of the mandible of different localization, depending on the clinical course, the terms preceding the violation in the temporomandibular joint. Therefore, the problem of

improving the existing ones and developing new pathogenetically conditioned methods of treatment and rehabilitation for patients with fractures of the mandible, until complete recovery, is very relevant and timely. As the frequency of fractures does not tend to decrease and according to the data of domestic scientists up to 95% of all injuries of the face, as a rule, in people of young working age.

4. Conclusions

The complex treatment of muscular-articulation TMJ dysfunction in patients with fractures of mandible involves the use of the most modern pharmaceutical drugs in combination with orthopedic and surgical methods that further allow to obtain a stable positive result. The generalization of literary data and the results of these studies allow to confirm the high efficiency and the significance of surgical techniques for the treatment and prevention of postoperative complications, as a preparatory stage of orthopedic rehabilitation of patients with of muscular-articulation TMJ dysfunction with the fractures of mandible, whose role in complex rehabilitation of patients is underestimated, which requires the optimization of their use and further research.

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