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Abstract:

The purpose of this literature review was to show the connection between the postural and dental-maxillary system, also to consecrate the pathogenesis of pathologies that occur when there is a violation in one of the systems, methods of diagnosis and treatment of these disorders. We have given articles both proving this connection and denying it. The accuracy of the postural system is realized due to proprioceptive sensitivity, which is carried out by proprioceptors located in almost all organs, but in different proportions. Including these receptors are located in the temporomandibular joint and the sacroiliac joints, and their number in these anatomical structures compared to other parts of the postural system is the greatest. In case of imbalance in one of the systems, a compensatory reflex neuromuscular response occurs, which is expressed in the form of hyper tone. There are descending and ascending information currents in the postural system. Diagnosis of disorders in the posture affects the further treatment, therefore it is very important. Diagnostics, as well as therapy for the above disorders, include manual and instrumental methods. Therapy should be comprehensive and, in addition to dental treatment, should include a course of manual therapy to prevent the recurrence of the disease and improve the quality of life of the patient. The review describes the methods of TENS-, splint-, ultrasound-, manual-, ALF-, therapy of postural disorders. Based on the literature analyzed by us, it can be said that it is impossible to deny the connection between the postural system and intercuspatation.

Key words: postural system, position of the mandible, manual therapy, TMJ.

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INTRODUCTION:

The human body space of a closed kinematic chain, the movement of one of its components leads to a compensatory response of another structure, which obeys the law of the postural system. The orofacial area is part of it, therefore, for quality dental care, a specialist needs to understand the mechanism of interaction of the components of this system.

MATERIAL AND METHODS:

An analysis of 70 sources of Russian and foreign literature in electronic databases of publications eLibrary, ScienceDirect, Scopus, etc. for the period from 1961 to 2019. As part of the research, modern methods for the diagnosis and treatment of postural disorders were studied.

RESULTS AND DISCUSSION:

The postural system functions thanks to the presence of inputs and outputs. According to some scientists, the way out of balance. Inputs are usually divided into

endo- and exo-inputs. Inner ear and foot. Adequate operation of the above structural highways 2 endo-

inputs: oculomotor and proprioception of the heads, trunk and lower extremities. They allow determining the position of the eyes in order to integrate visual and vestibular information, as well as establish cephalic and plantar information [1, 2, 3].

Proprioception requires special receptors that provide postural resistance and postural orientation. As soon as the balance is disturbed, a reflex neuromuscular reaction occurs that occurs through proprioception. The works of T. Fukuda (1961, 1983), P.M. Gagey, B. Weber (1995) showed that with impaired impulse and the threat of imbalance functional state of the dentition in patients can lead to impaired postural balance (the descending path), while at the same time, disorders in other parts of the postural control (head joints, spine, feet, etc.) can adversely affect the functional state of the temporomandibular joint (TMJ) and be the cause of its dysfunction (ascending path).

One of the factors affecting TMJ is the state of the maxillary complex (MC). The upper jaw is connected to the frontal, ethmoid, zygomatic, lacrimal, palatine bones, lower nasal concha, opener, as well as the upper jaw of the opposite side, which greatly affects cranial movements and afferent impulse. The lower jaw (LJ) is almost completely formed by the age of 12, while the LJ continues to grow up to 20 years or more, thus, after the completion of its development, the MC begins to limit in front and on the sides of the LJ. Therefore, any deformations of the MC prevent the achievement of the optimal size of the NPs, which leads to malocclusion, a change in the position of the articular heads relative to the temporal bones and soft tissues, which is recorded by proprioceptors and leads to changes in the underlying structures [4-6]. The existence of a downward path for the development of postural disorders is confirmed by an article published in 2005 in the journal *Cranio* by Italian researchers. The experiment involved 30 experimental rats, 15 of which for a week wore a seal made of heliocomposite material on the upper right first molar. The following week, the same rats, in addition to the first, wore a second seal on the left first molar to balance occlusion. In 83% of the experimental rats, the shape of the spine recovered with proper occlusion [7]. A study by M. Paya-Argoud, in which 22 patients participated, showed that ortho-facial muscle harmonization after orthognathic surgery improves head orientation and postural stabilization in static conditions after 2.5 months. The improvement in posture after surgery, confirmed by stabilometry, is explained by the weight ratio of sensory signals, which is more important for proprioceptive information from low frequencies, moreover, the positive effects of surgery on postural stabilization are most pronounced in the absence of tooth contact, which indicates that proprioceptive signals emanating from the muscles of the LJ and joints, are more actively involved in postural changes [8].

Travel and Rothbart have conclusively established the existence of upward informational currents. Researchers have shown how Morton's foot affects the stability of the sacroiliac joint [4]. Sonesen L. drew attention to the fact that joint disorders in the zones of the cervical vertebrae, sacrum and coccyx, the attachment sites of the dura mater, lead to twisting and tension of the meninges. The adaptation of the first cervical vertebra and compensation of the position due to the TMJ occurs. There is also evidence in the literature that the horizontal and vertical dimensions of the first cervical vertebra have a relationship with the position of the head, the angle of inclination of the

base of the skull, the shape of the LJ and growth. Also, the position of the head and neck affect craniofacial morphology, including the base of the skull, airways of the maxillary sinuses, disorders of the TMJ and occlusion [9].

Effective treatment of posturological problems depends on the quality of diagnosis. The main and most common diagnostic method in posturology is considered to be stabilometry, with the help of which fluctuations of the center of gravity of the whole body are reflected and, at the same time, the force exerted by the researcher to maintain his balance in an upright position [10-12]. When conducting a stabilometric study, the following basic provisions are observed: exclusion of external extraneous influences on the patient, standardization of the conditions for conducting the study, compliance with the natural vertical position of the subject. Most often, a force plate is recorded in the Romberg position: "eyes open, lower jaw in free position"; "Eyes are open, teeth are closed." Some authors additionally perform stabilometry in the free-standing position with the calm position of the LJ, and then with tightly closed teeth [13].

A statistically significant deterioration of the parameters characterizing postural resistance in patients with TMJ dysfunction was established. So, with an upward path of development of postural disorders in patients with joint pathology, tooth closure led to an improvement in stabilometric parameters, which is an important differential diagnostic sign of the type of postural syndrome. In the group of patients with a descending pathway of the development of postural disorders and TMJ dysfunction during the test with closing of the teeth, on the contrary, there was a significant deterioration in the stabilometric indices. A number of studies indicate the need for stabilometry in a moving object for reliability [8, 14].

Raster stereography also allows you to evaluate the correlation between craniofacial morphology and body position, while the method does not contain x-ray radiation, which allows it to be widely used. This technology is based on photogrammetry. A "4D" image is created that includes the time component, in addition to the three-dimensional space [7]. Known data on the use of optoelectronic stereophotogrammetric analysis [15]. This stereophotogrammetric system automatically digitizes the video signals received from the infrared camera detectors, and develops data to restore the position of

the control points previously placed on the anatomical landmarks of the subject.

Diagnosis of occlusion must also include the study of cephalometric parameters, which allows the method of teleroentgenogram [16].

To date, electromyography is an integral method for the diagnosis of patients with posturological disorders. This method allows you to record the total fluctuations in potentials that occur when impulses from the central nervous system arrive [17, 18].

Such multidagnostic computer systems, such as a myograph, an TMJ vibration analyzer, a device for analyzing the movements of the lower jaw, a neurostimulator, a T-scan, also greatly facilitate the tasks of a dentist [19].

Osteopathic diagnosis includes many clinical posturological tests that differ in different osteopathic schools. The doctor, using a series of active, passive, load tests of an axial nature, tensile tests, determination of craniosacral rhythm, estimates the range of motion in the joints, reveals spasmodic muscle areas. Due to the growing interest in this field of medicine, diagnostic methods have received a big leap in recent years.

Diagnosis and further treatment require a palpator of high palpation sensitivity, which is not acquired immediately and requires many years of training [20]. The direction of all methods of manual therapy is determined by the pathogenesis of the disease. As already mentioned, in the posture there are ascending and descending information currents, so all the treatment methods described below will also affect the state of the dentofacial system, including the TMJ. Before manual therapy, the organic cause of the disease must be eliminated.

Therapy of posturological disorders is based on the laws distinguished in this discipline: the law of channels, the law of cross chains when walking, the law of plantar baroreceptors [2]. The course of manual treatment in each case is individually selected by the osteopathic doctor. But manual therapy alone is not always enough, it is worth considering the fact that proprioceptive afferent impulse from the dentoalveolar system has a negative effect on posture [21]. Cranial manual therapy and osteopathic correction techniques, the release of soft tissue of the pterygopalatine fossa, and mobilization of the TMJ are used as applied kinesiological therapy for downward

currents. Other methods of treating pathological downward information currents are indicated in the fundamental work "Craniodontia". In his book, Giuseppe Stefanelli separately highlights the chapter on the treatment of postural skull lesions, which describes various methods of treating a particular pathology using methods of applied kinesiology [20].

To achieve the best result in the treatment of postural disorders, it is better to combine manual techniques, orthodontic and orthopedic dental treatment. So, in the above-mentioned work "Craniodontia," the author outlines the chapter on the treatment of postural disorders with the advanced lightwire functionals (ALF) apparatus, which acts on the posture through dentoalveolar system. The main goals of wearing the ALF apparatus are: the development of the incisal bone, the release of the anterior segment, the solution of the problem of crowding of the teeth. The effects of wearing this apparatus on the bones of the skull are described, in particular: the palatine process of the maxillary bone, the mastoid process of the temporal bone, the zygomatic, sphenoid, maxillary bones. Due to the effect on the sphenoid bone, the sphenofasilar joint normalizes with lateral strain [22].

The therapeutic position of the LJ must be restored before orthodontic or orthopedic treatment, as any violation of the LJ position leads to a compensatory change in the position of the head, cervical spine and shoulder girdle [23]. To bring LJ into the correct position, transcutaneous electrical nerve stimulation (TENS) has been widely used recently. The principle of operation of this device is to apply electrical impulses to the electrodes located on the symmetrical parts of the face, with an interval of 1 time in 1.5 seconds. Analysis of the literature showed that the authors use ULF-TENS (ultra-low frequency transcutaneous electrical nerve stimulation) or Neuromuscular TENS frequency, which is up to <4 Hz. High-frequency (> 50 Hz) and low-intensity (1–2 mA), or low-frequency (1–5 Hz) / high-intensity (15–20 mA) devices [24] are distinguished. In addition to the muscle-relaxing ability of TENS, they indicate the analgesic ability that both types of TENS devices can cause by stimulating well myelinated afferent fibers of large diameter, which leads to the excitation of a gelatinous substance, due to which the "gate control" of pain is triggered, pain impulse to the overlying sections decreases central nervous system. This mechanism was called the "pain gate control theory" proposed by Melzak and Wall. In addition, TENS increases the content of endogenous morphine-like substances (endorphins and enkephalins) in plasma

and cerebrospinal fluid due to electrical stimulation of the near-water gray matter of the midbrain region. It is important to note that the analgesic effect of TENS was not reduced after administration of naloxone [25]. In the articles, the recommended time of electroneurostimulation in cases of persistent tonic tension of the masticatory muscles as a treatment procedure with a course of 7-10 sessions lasting 40 minutes [26, 27]. There are devices that allow the patient to independently adjust the amplitude of the current, comfortable for him. TENS makes it possible for the dentist to determine the optimal, therapeutic position of the LJ due to muscle relaxation of the muscles innervated by the trigeminal, facial nerves [24]. There is evidence that ULF-TENS does not affect the definition of centric relation [28].

The literature describes techniques for applying TENS electrodes to the sites of the most superficial passage above these nerves [29, 30]. The use of this device goes beyond dentistry, for example, TENS is used in neurology and sports medicine [31-34]. Transcutaneous electroneurostimulation is one of the stages in the treatment of patients with posturological and dental disorders. Most authors point to a significant decrease in the tone of the temporal, chewing, sternocleidomastoid, biparticular, lateral and medial pterygoid muscles, and muscles straining the palatine curtain after TENS therapy. It is noted that muscles in a state of hypertonicity give the most pronounced picture of changes in electromyographic activity [24, 35]. TENS-therapy has proven itself well and shows positive clinical results, but the mechanism of action of the method has not been studied enough.

A good therapeutic effect in balancing the cranio-mandibular balance is achieved by using the TENS apparatus in conjunction with splint therapy. Splint therapy is a complex of therapeutic measures aimed at normalizing the functioning of the musculoligamentary component of the masticatory apparatus and the ratio of the TMJ structures by means of an occlusal splint (R spl) [36, 37]. The splint itself is made of quick-hardening plastic immediately after TENS-therapy [21]. Also, some authors describe the methods of using splint therapy without using TENS, but using botulinum toxin for muscle relaxation [38, 39]. The physiological position of the LJ in such works is determined by means of condilography, axiography, then, after wearing the splint and deprogramming the muscles to the physiological position of the LJ and its articular head, permanent prosthetics are performed [40, 41]. Also described are cases where the correction

of cranio-mandibular disorders was carried out with the participation of an osteopath [42].

There are articles in the foreign literature describing the use of ultrasound therapy for temporomandibular dysfunction, which also causes hypertonicity. Parameters of using this treatment method are indicated — frequency 8 W / cm², pulse mode, procedure time 7 minutes [43, 44]. Ultrasound exposure improves local blood circulation and causes muscle relaxation [45].

CONCLUSION:

Based on the analyzed domestic and foreign literature, we can say that it is impossible to deny the connection between the postural system and intercuspitation. Diagnostics due to computer systems becomes faster without loss of quality. Manual therapy, which has been developing for centuries, is important and sometimes decisive in the treatment of both postural and cranio-mandibular disorders. The treatment of posture pathologies associated with intercuspitation disorders is represented by many different options, but the treatment of TENS and splint therapy gives the best clinical results and is characterized by a more predictable outcome. It is worth noting the absence in the domestic literature of data on ultrasound therapy of postural system disorders associated with intercuspitation.

TENS- transcutaneous electrical nerve stimulation
 TMJ- temporomandibular joint
 MC- maxillary complex
 LJ- lower jaw
 ALF- advanced lightwire functionals

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