

## MAGNETIC RESONANCE TOMOGRAPHY OF THE TEMPOROMANDIBULAR JOINTS IN AMBULATORY PRACTICE



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### АМБУЛАТОРИЯ АМАЛИЁТИДА ЧАККА-ПАСТКИ ЖАҒ БЎҒИМИНИНГ МАГНИТ - РЕЗОНАНС ТОМОГРАФИЯСИ

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### МАГНИТНО-РЕЗОНАНСНАЯ ТОМОГРАФИЯ ВИСОЧНО-НИЖНЕЧЕЛЮСТНЫХ СУСТАВОВ В АМБУЛАТОРНОЙ ПРАКТИКЕ

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**Резюме.** Стоматологларнинг кўрсатмаси билан амбулатория шароитида магнит-резонанс томография (МРТ) учун мурожаат қилган беморларнинг чекка-пастки жағ бўғимлари (ЧПЖ) билан касалланиш тузилиши ўрганилди. Ҳитачидан АПЕРТО МРТ сканерида 50 та беморда 100 та чекка-пастки жағ бўғимлари махсус спирал ёрдамида 0,4 Т магнит майдон кучланишида текширилди. Тадқиқот протоколига T1-, Pd- ва T2 \* вазнли тасвирларни қийиш ва қиялик коронар текисликларида олишга эришилди. Барча беморлар функционал тадқиқотлар ўтказдилар. Текширилган бўғимларнинг 90 (90%) қисмида турли хил ички бузилишлар аниқланди - 23 бўғимдаги камайтириладиган силжиш, 30 бўғимдаги бошқарилмайдиган силжиш, 37 бўғимдаги артроз билан бошқарилмайдиган силжиш. 1 та яхши сифатли ўсма аниқланди. 9 та бўғимларда патологик ўзгаришлар аниқланмади. Аниқланган ЧПЖ патологияси таркибида артикуляр дискнинг иккиламчи артроз билан назоратиз силжиши шаклида ички бузилишлари устун келди. МРТ суяк ва бўғимнинг юмшоқ тўқималарининг тузилишидаги морфологик ўзгаришлар диагностикасини уларнинг функционал ҳолатини баҳолаш билан аниқланади.

**Калит сўзлар:** магнит-резонанс томография (МРТ), чекка-пастки жағ (ЧПЖ), ички бузилишлар.

**Abstract:** The structure of morbidity of temporomandibular joints (TMJ) of patients who applied for magnetic resonance imaging (MRI) on an outpatient basis under the direction of dentists was studied. Investigated 100 temporomandibular joint in 50 patients on an APERTO MRI scanner from Hitachi with a magnetic field strength of 0.4 T using a specialized coil. The study protocol included obtaining T1-, Pd- and T2 - weighted images in the oblique and oblique coronary planes. All patients underwent a functional study. In 90 (90%) of the examined joints, various types of internal disorders were identified - reducible displacement in 23 joints, non-controlled displacement in 30 joints, non-controlled displacement with osteoarthritis in 37 joints. 1 benign tumor was diagnosed. No pathological changes were revealed in 9 joints. In the structure of the revealed TMJ pathology, internal disorders prevailed in the form of an uncontrolled displacement of the articular disc with secondary osteoarthritis. MRI provided the diagnosis of morphological changes in the bone and soft tissue structures of the joint with an assessment of their functional state.

**Key words:** magnetic resonance imaging (MRI), temporomandibular joint (TMJ), internal disorders.

**Introduction.** The relationship between dental health and quality of life has been proven in numerous foreign studies. Dental health affects both the physical and psychological state of a person, and on his social well-being. Today, the prevalence of diseases of the temporomandibular joints (TMJ) in the population is quite high. Based on the results of in-depth dispenser examinations of boys and girls aged 1625 years, studying in universities and colleges in

Moscow, TMJ pathology was revealed in 12% of students [2]. According to J. Ault (2009), up to 75% of US residents experience problems with TMJ throughout their life, but only 5-10% of them are diagnosed with joint diseases that meet the TMD criteria (Temporo-mandibular dysfunction / disorder).

A syndrome characterized by pain in the parotid region, ringing in the ears, hearing loss, dizziness, headache, burning sensation in the tongue, pain when

chewing, was first described in 1934 by J. Costen, who explained the appearance of these symptoms by the loss of lateral teeth with a subsequent decrease the height of the lower part of the face and the upper-posterior displacement of the heads of the lower jaw, which squeeze the external auditory canal, neurovascular structures. Most foreign and some domestic authors use the term "internal derangement". The collective term "internal disorders of the TMJ" (TMJ TM) corresponds to conditions including pathological displacements of the articular disc (subluxation, habitual and chronic dislocation), its structural disorders (partial and complete violation of integrity, dystrophic changes, adhesion), as well as violations of the biomechanics of the head of the lower jaw caused by the pathology of the soft tissue components of the joint (intra-articular ligaments, capsules). In the works of many domestic and a number of foreign authors it is noted that the leading etiological factor in the development of TMJ dysfunctions, which largely contributes to their progression, are occlusive disorders caused by various types of anomalies of the dento-jaw system and partial or complete adentia.

During psychodiagnostic studies in 40-93.5% of patients with nontraumatic TMJ lesions, various disorders of the psychoemotional sphere were revealed, which indicates a significant role of pathocharacterological personality traits in the pathogenesis of TMJ dysfunctions. An important etiological significance in the development of TMJ dysfunction syndrome belongs to the traumatic factor. The relationship of intra-articular pathological changes with a previous automobile or motorcycle injury, accompanied by re-flexion of the neck (whiplash) and leading to a disruption in the atlanto-occipital junction with subsequent changes in the tone of the muscles of the face and neck, has been proven.

In numerous works of domestic and foreign authors on the study of the TMJ VL, it has been proved that long-term disorders of the biomechanics of the joint, the most uncontrollable displacement of the articular disc, contribute to the development of secondary osteoarthritis with subsequent remodeling of the head of the mandible and the articular tubercle.

American Academy of Orofacial Pain (AAOP) distinguishes two groups in the structure of TMD: myogenous TMD, i.e. associated with muscle pathology, and arthroogenous TMD due to various pathologies of joint elements. The greatest prevalence of TMJ diseases and, above all, internal disorders in all studies was noted in women aged 16-39 years. It is generally accepted that MRI is the only non-invasive method for diagnosing pathological changes in the soft tissue elements of the TMJ. Taking into account the fact that most joint diseases are caused by damage to the articular disc and intra-articular ligaments, MRI becomes a necessary and often sufficient method for obtaining diagnostically significant infor-

mation and is accepted throughout the world as the "gold standard" of TMJ study.

It is difficult to overestimate the capabilities of multidetector computed tomography (MDCT) with 3d reconstruction in the diagnosis of mechanical damage to the facial skeleton, but its use in non-traumatic TMJ lesions is significantly limited by the lack of reliable visualization of the soft tissue elements of the joint. Precise diagnostics of changes in the bone structures of the joint during the development of secondary osteoarthritis, volumetric visualization of congenital and acquired deformities of the dento-jaw system as an etiopathogenetic basis for the development of VL, assessment of the degree of involvement of the bone elements of the joint in primary and secondary tumors are possible only when using MDCT with all variants postprocessing processing. The aim of the work was to study the structure of TMJ morbidity in patients who applied for an MRI scan at the Integrated Medicine Center in the direction of dentists and presented complaints of the same type: a variety of pain sensations and noise phenomena in the joint accompanying varying degrees of severity of restriction of mouth opening.

**Material and methods.** The MRI method was used to examine 50 patients - 43 women and 7 men aged from 13 to 72 years (average age - 29 years), In all patients, both joints were examined, thus, the state of 100 TMJs was studied.

MRI was performed on a Hitachi APERTO tomograph with a magnetic field strength of 0.4 T and using a specialized coil. The research protocol included obtaining T1-, Pd- and T2\* - weighted images in the oblique and oblique coronary planes with a slice thickness of 3 mm. All patients underwent a functional study, including scans. The study protocol included an assessment of the position of the disc in relation to the mandibular head. On MRI scans in oblique planes, the articular disc has the shape of a biconcave lens located between the head of the lower jaw and the posterior slope of the articular tubercle. The criterion for the correct position of the articular disc is the localization of its posterior edge in relation to the head of the lower jaw at the 12 o'clock position of the conventional dial relative to the full circumference of the head of the lower jaw. In this case, the anterior edge of the disc is located between the head of the lower jaw and the posterior slope of the articular tubercle. Variations in the position of the posterior edge of the disc within 11-13 o'clock are admissible and are not a sign of its dislocation. On MRI scans in the oblique coronary planes, the articular disc has the shape of a crescent, located above the articular surface of the head of the lower jaw. Also, on MRI scans in both planes, the shape, size, structure of the cancellous substance and the thickness of the cortical layer of the head of the mandible, its position in the man-

dibular fossa of the temporal bone, and the state of the lateral pterygoid muscles were assessed.

Functional MRI examined the displacement of the heads of the mandible and the articular disc when opening the mouth, the integrity of the intra-articular ligaments and the structure of the bilaminar zone. In 12 (24%) cases, the patients had the results of a previous X-ray examination in the form of orthopantomograms, linear tomograms, and TMJ radiographs according to Parma.

Subsequently, 3 patients underwent MDCT in other medical institutions of the city to clarify the nature of morphological changes in the condylar processes and the body of the lower jaw (in cases of retro-, macrognathia and benign tumors).

**Results.** Of the patients included in the study, 43 (86%) complained of headaches, 48 (96%) complained of pain norm and internal disorders in tumor when opening the mouth and 39 (78%) for pain with lateral movements of the lower jaw. Various noise phenomena during movements of the lower jaw in the form of clicks and crunching were noted by 34 (68%) and 22 (44%) patients, respectively. Restriction of mouth opening of varying degrees was noted by 38 (76%) patients. In the history of the disease, 7 (14%) patients indicated trauma, 11 (22%) - diseases of the peripheral joints. 5 patients were previously diagnosed with compound dysplasia heel fabric. The dentition was preserved in 36 (72%) patients, in 12 (24%) patients there was secondary partial adentia, and two (4%) patients used dentures. Anomalies of the structure of the dentition were diagnosed in 11 (22%) patients. The relationship between the onset of symptoms or their aggravation with prolonged dental procedures was noted by 6 (12%) patients.

Pathological changes in the bone and soft tissue elements of the TMJ were diagnosed in 91 joints. In 5 patients, structural abnormalities were detected only in one joint, in 2 patients, no pathological changes in the joints were found. When performing functional MRI in 60 joints with mouth opening, the upper edge of the mandible head was visualized at the apex of the articular tubercle. In 23 joints, the limitation of the displacement of the head of the lower jaw was determined, which, when opening the mouth, did not reach the apex of the articular tubercle and was localized at its posterior clivus. Signs of hypermobility were revealed in 17 joints - the head of the lower jaw with maximum opening of the mouth was visualized at the anterior slope of the articular tubercle.

On MRI scans in the oblique planes in 18 joints, the posterior pole of the disc was located in the range of 11-13 hours, the location of the anterior edge of the disc is variable and depends not only on the degree of its dislocation, but also on the size of the disc and the severity of its deformation. Anterior disc displacement was detected in 81 joints - its posterior pole was located in the range of 9-10 hours. With an-

terior displacement of the disc, its partial medial dislocation was determined in 17 joints, and partial lateral dislocation in 15 joints. No signs of disc displacement were detected in the coronal plane in 59 joints. In 9 cases, we observed an isolated lateral dislocation of the disc without its anterior displacement.

During functional MRI, a reducible disc displacement with its complete reduction was found in 23 joints. With the usual occlusion, the disc was in the position of anterior or anterolateral displacement; when the mouth was opened, the central part of the disc was located between the head of the lower jaw and the articular tubercle

An uncontrolled displacement of the articular disc was found in 30 joints; the disc was visualized in the anterior or anterolateral (lateral or medial) position at the anterior surface of the mandibular head in the position of the usual occlusion and with the maximum abduction of the mandible. This condition was due to the fact that the posterior intra-articular ligaments, due to mechanical damage or dystrophic changes, lost the ability to return the disc posteriorly, and the position of the disc was regulated only by the upper head of the lateral pterygoid muscle.

Pathological changes in the bilaminar zone in the form of its thinning and volume decrease, violations of the integrity of the intra-articular ligaments were detected in 25 joints, changes in the form of an increase in volume and inhomogeneous structure in all types of images were detected in 18 joints.

Synovitis was diagnosed in 21 joints - in one or both of its parts, an excessive amount of joint fluid was visualized in the form of a substrate with a signal that was hyperintense on T2 \* and Pb-weighted images. At the same time, reducible displacement of the articular disc was accompanied by synovitis in 5 cases, and uncontrolled displacement - in 16 cases.

In 11 patients with various anomalies of the dental-jaw system, hypoplasia of the mandibular head was diagnosed, which was accompanied by various types of dislocation of the articular disc and early formation of osteoarthritis in the contralateral joint.

Long-term disorders of the biomechanics of the joint in the absence of adequate treatment in the joint lead to the development of secondary osteoarthritis, manifested by deformation of the articular surface of the lower jaw head, subchondral sclerosis and other changes in the cancellous substance of the lower jaw head and articular tubercle (cystic restructuring, fatty degeneration, bone marrow edema). Pathological changes in the bone structure are localized mainly along the anterior-upper surface of the head of the lower jaw, which to the greatest extent bears the functional load during movements in the joint. In addition, similar changes are quite often detected in the outer part of the articular surface of the head of the lower jaw, where, due to the displacement of the articular disc, a local increase in mechanical load oc-

curs. A later sign of osteoarthritis is a change in the shape of the head of the lower jaw, flattening or enlargement of the articular tubercle due to adaptive remodeling.

Signs of secondary osteoarthritis were found in 37 joints. Fibrous changes in the lateral pterygoid muscles (to the greatest extent in the upper bundle) in the form of linear sections of a reduced signal on T1-, T2\* - and Pb-vzhang images were identified in 16 joints.

**Conclusion.** In the structure of the revealed TMJ pathology, whether internal disorders in the form of uncontrolled displacement of the articular disc with secondary osteoarthritis. MRI provided the diagnosis of morphological changes in bone and, which is of the greatest clinical significance, soft tissue structures of the joint with an assessment of their functional state.

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#### **МАГНИТНО-РЕЗОНАНСНАЯ ТОМОГРАФИЯ ВИСОЧНО-НИЖНЕЧЕЛЮСТНЫХ СУСТАВОВ В АМБУЛАТОРНОЙ ПРАКТИКЕ**

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**Резюме.** Исследованы 100 височно-нижнечелюстных суставов у 50 пациентов на МРТ-сканере APERTO от Hitachi с напряженностью магнитного поля 0,4 Тл с использованием специализированной катушки. Протокол исследования включал получение T1-, Pd- и T2 -взвешенных изображений в косяк и наклонной коронарных плоскостях. В 90 (90%) обследованных суставах выявлены различные типы внутренних нарушений - уменьшаемое смещение в 23 суставах, неконтролируемое смещение в 30 суставах, неконтролируемое смещение при остеоартрозе в 37 суставах. Была диагностирована 1 доброкачественная опухоль. В 9 суставах патологических изменений не выявлено. В структуре выявленной патологии ВНЧС преобладали внутренние нарушения в виде неконтролируемого смещения суставного диска при вторичном остеоартрозе. МРТ позволила диагностировать морфологические изменения костных и мягкотканых структур сустава с оценкой их функционального состояния.

**Ключевые слова:** магнитно-резонансная томография (МРТ), височно-нижнечелюстной сустав (ВНЧС), внутренние нарушения.