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Radiological Note

Temporomandibular Joint of the Healthy Persons Upon Magnetic Resonance Imaging

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ABOUT ARTICLE

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ABSTRACT

Purpose.
To present the anatomy of the temporomandibular joint of healthy people based on the results of the magnetic resonance imaging.
Patients and methods.
31 patients without the pathology of the temporomandibular joint were examined.
Results.
Based on the results of magnetic resonance imaging in patients without the pathology of temporomandibular joint anatomy of the temporomandibular complex was presented. Two methods of temporomandibular joint examination were compared: CT and MRI. Indications and contraindications (absolute and relative) for MRI were presented.
Conclusions.
Using the magnetic resonance imaging makes it possible to effectively diagnose degenerative, inflammatory and neoplastic diseases of joints and surrounding soft tissues as it was proved by the performed examination of the temporomandibular joint of healthy people.

Currently, one of the most common pathologies in the maxillofacial area are diseases of temporomandibular joints (TMJ). The pathology of the TMJ, among the diseases of the dento-jaw system, takes the third place after caries and periodontal disease (Sysoljatin P., Il'in A, Dergilev A., 2001; Pisarevsky Y., et al., 2003; Tymofieiev O.O., 2007, 2010, 2012; Ivasenko P. et al., 2009, et al.) [1-10]. Difficulties in revealing structural disorders in diseases of the TMJ are due to the anatomical features of these joints (Ryabokon E., 2004, 2006) [11, 12]. The TMJ is divided by an articular disc, fixed intraarticular ligaments, into two floors (cavities). The posterior intraarticular ligaments, together with the vessels and nerves between them, and the connective tissue form the bilaminar zone. The bilamar zone of the TMJ is located behind the articular disc. Two ligaments connect the disc to the temporal bone and to the condyle of the lower jaw. They are separated by the venous plexus (Zenker's cushion pad). The upper ligament, attached to the posterior margin of the fossa, is made of an elastic fibrous tissue, whereas the lower ligament, made of inelastic fibrous tissue, is attached to the posterior surface of the condylar process of the lower jaw. The inner surface of the TMJ cavities in the anterior part of the bilaminar zone is covered by endothelial cells, which form the synovial lining with the production of synovial fluid.

Among this pathology, the following diseases are common: dysfunction of the TMJ, arthritis and arthrosis. At the same time, we often have to meet with ankylosis, subluxations and neoplasms.

If a patient needs to be examined for a TMJ trauma or a fractured condylar process of the jaw is suspected, the best way to diagnose is computed tomography (CT). Computed tomography clearly visualizes the compact substance of bones and cavities filled with liquid (blood). To obtain images by a computer tomograph, X-rays are used. A computer tomograph is a special X-ray machine that rotates around the subject's body and takes pictures at different angles. CT is used to diagnose bone pathology, post-traumatic injury (violation of bone integrity), and also clearly visualize hemorrhages.

Magnetic resonance imaging (MRI) is a modern, universal, non-invasive and safe method for examining a patient, which is based on the magnetic properties of human tissues and allows diagnosing various joint diseases. To obtain an image when performing magnetic

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resonance imaging, X-ray radiation is not used, since the subject is placed in a strong magnetic field and this leads to the fact that all the hydrogen atoms in the patient's body are aligned parallel to the direction of the magnetic field. At this point, the device sends an electromagnetic signal perpendicular to the main magnetic field. Hydrogen atoms, having the same frequency as the signal, get «excited» and generate their own signal, which is picked up by a tomograph. It is known that different types of tissues (bones, muscles, vessels, etc.) have a different number of hydrogen atoms and therefore they generate a signal with different characteristics. The main value that is recorded in a magnetic resonance study is the response of magnetic nuclei to the action of an alternating magnetic field, which depends on the density of nuclei and other parameters specific for each part of the human body. A magnetic resonance tomograph recognizes these signals, deciphers them and builds an image (Hamada Y. et al. 2000, et al.) [13, 14]. The clinical application of the MRI method is to study the spatial distribution of hydrogen nuclei and some other elements in the human body.

The difference between MRI and CT is that with MRI, the measured value is the magnetization of certain types of nuclei in the isolated volume element, while for CT, the coefficient of X-ray absorption by various biological tissues. MRI does not have any harmful effects on the patient.

With MRI, bone tissue is clearly visible, but more soft tissue is captured. Magnetic resonance imaging is the main method in modern diagnostics of degenerative, inflammatory and tumor diseases of joints and surrounding soft tissues. MRI allows a non-invasive way to visualize the soft tissue component of the joint (tendons, ligaments, articular disc, cartilage, periarticular bag). This method makes it possible to obtain thin sections in different planes with the subsequent setting of a three-dimensional image of the joint, which allows to establish accurately the presence or absence of pathological changes in the TMJ and / or surrounding soft tissues, and to establish their localization and timely and correctly choose the treatment tactics.

Absolute contraindication to MRI is the presence of a pacemaker or metallic foreign bodies in the area under investigation, because rough artifacts appear on the images, as well as in the presence of metal non-removable dentures in the oral cavity (for examining the maxillofacial region), i.e. the presence of foreign metal bodies causes the risk of their displacement by a magnetic field. Relative contraindication is pregnancy in the early term (the first 3 months) and claustrophobia.

Indications for MRI of the TMJ are: musculo-articular dysfunction, inflammatory-dystrophic diseases (arthritis, arthrosis), post-traumatic injuries, ankylosis, pain in the temporal region with movements of the lower jaw, clicks when moving (opening and closing the mouth) of the lower jaw, Opening of the mouth with movements of the lower jaw, defects of the lower jaw when planning reconstructive operations, planning orthodontic treatment, etc.

When planning a magnetic resonance imaging of the TMJ, they make marks (localizers), which are displayed on the images obtained (Figs 1, 2). The localizer in the axial projection (in the transverse plane of the body) shows the course and orientation of the slices in the planning of the parasagital (Fig 1) and paracoronal projection (Fig 2).

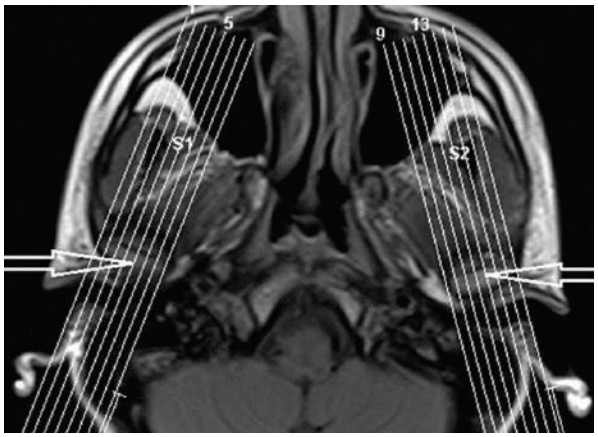

FIGURE 1. Localizer in axial projection. Shows the course and orientation of the slices when planning the parasagital projection (condylar heads are indicated by *arrows*). The ordinal numbers of the figures with the closed mouth correspond to the ordinal numbers of the slices on the localizer.

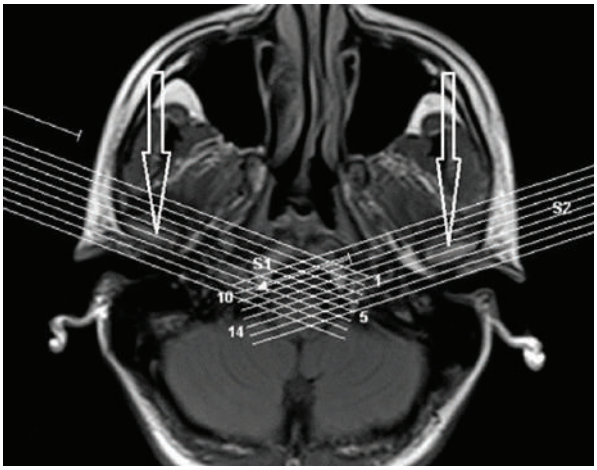

FIGURE 2. Localizer in axial projection that shows the course and orientation of the slices in the planning of the paracoronary projection (condylar heads are indicated by *arrows*). The ordinal numbers of the figures with the closed mouth correspond to the ordinal numbers of the slices on the localizer.

Now we will show the images of the TMJ made in different planes (Figs 3-16).

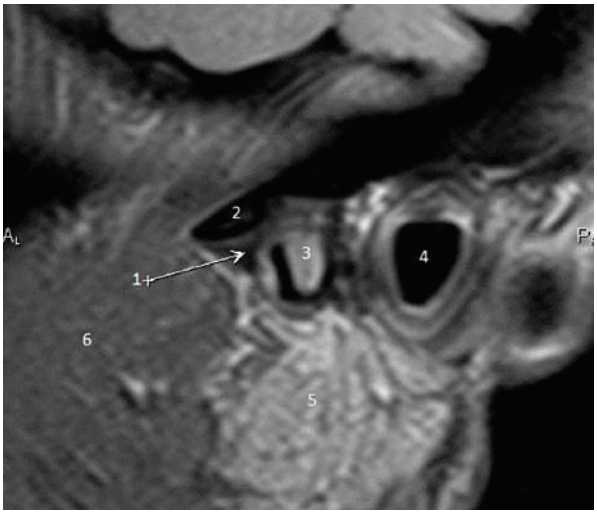

FIGURE 3. TMJ slice in the sagittal plane shows: 1 – TMJ disc, 2 – articular tubercle, 3 – the head of the condylar process of the mandible, 4 – the external auditory meatus, 5 – the parotid gland, 6 – the temporal muscle.

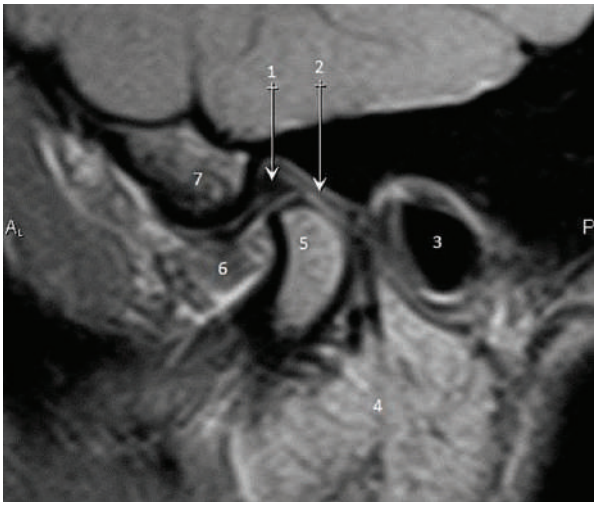

FIGURE 4. TMJ slice in the sagittal plane shows: 1 – TMJ disc, 2 – bilaminar zone, 3 – external auditory meatus, 4 – parotid salivary gland, 5 – head of condylar process of mandible, 6 – lateral pterygoid muscle, 7 – articular tubercle.

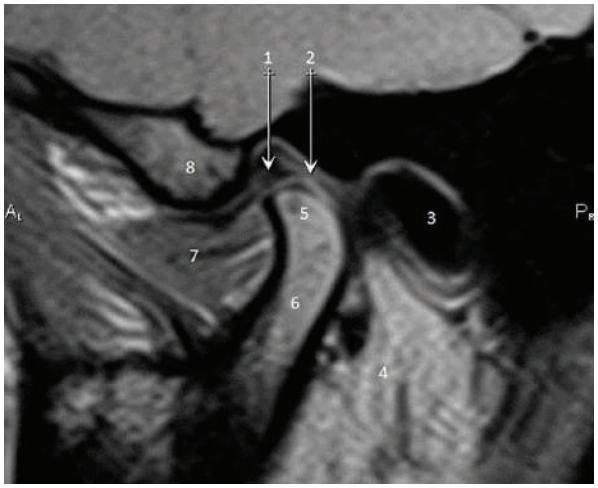

FIGURE 5. TMJ slice in the sagittal plane shows: 1 – TMJ disc, 2 – bilaminar zone, 3 – external auditory meatus 4 – parotid gland, 5 – head of condylar process of the mandible, 6 – ramus of the mandible, 7 – lateral pterygoid muscle, 8 – articular tubercle.

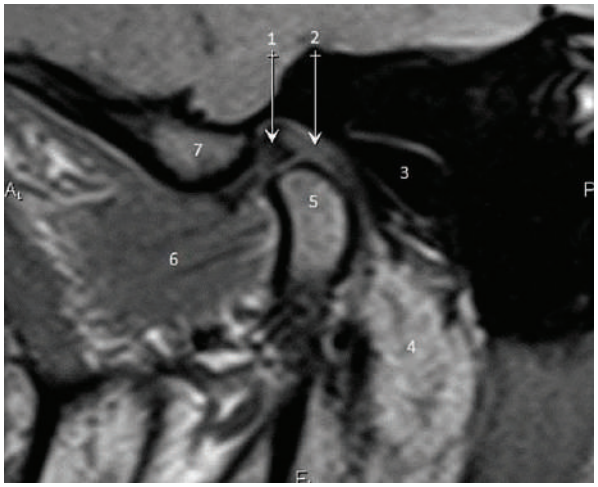

FIGURE 6. TMJ slice in the sagittal plane shows: 1 – TMJ disc, 2 – bilaminar zone, 3 – external auditory meatus, 4 – parotid salivary gland, 5 – condylar process of mandible, 6 – lateral pterygoid muscle, 7 – articular tubercle.

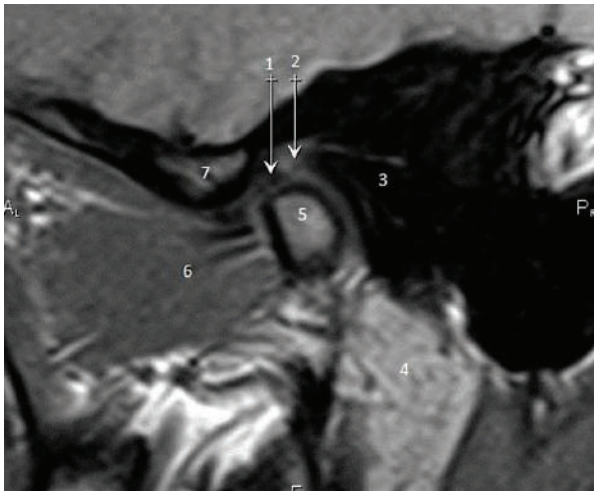

FIGURE 7. TMJ slice in the sagittal plane shows: 1 – TMJ disc, 2 – bilaminar zone, 3 – external auditory meatus, 4 – parotid salivary gland, 5 – condylar process of mandible, 6 – lateral pterygoid muscle, 7 – articular tubercle.

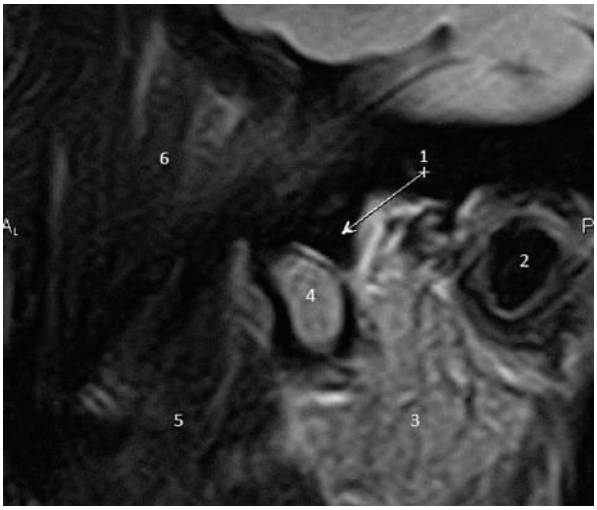

FIGURE 8. TMJ slice in the sagittal plane with an open mouth: 1 – TMJ disc, 2 – external auditory meatus, 3 – parotid salivary gland, 4 – condylar process of mandible, 5 – medial pterygoid muscle, 6 – temporal muscle.

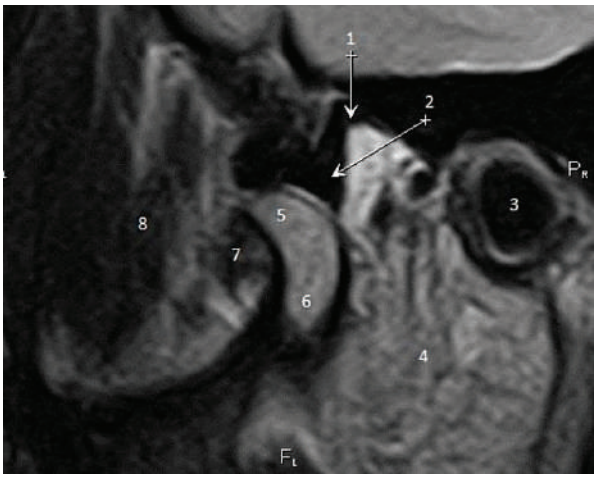

FIGURE 9. TMJ slice made in the sagittal plane with an open mouth shows: 1 – bilaminar zone, 2 – TMJ disc, 3 – external auditory meatus, 4 – parotid salivary gland, 5 – condylar process of mandible, 6 – ramus of the mandible, 7 – lateral pterygoid muscle, 8 – temporal muscle.

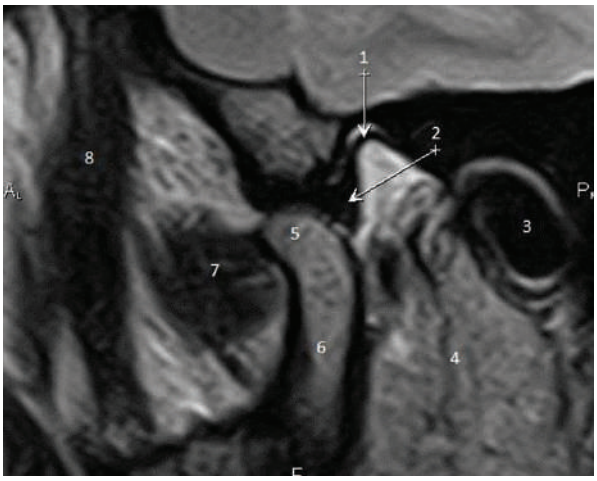

FIGURE 10. TMJ slice made in the sagittal plane with an open mouth: 1 – bilaminar zone, 2 – TMJ disc, 3 – external auditory meatus, 4 – parotid gland, 5 – condylar process of mandible, 6 – ramus of the mandible, 7 – lateral pterygoid muscle, 8 – temporal muscle.

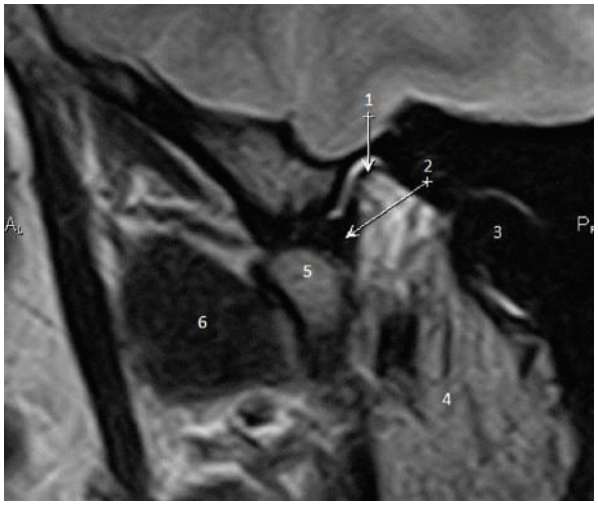

FIGURE 11. TMJ slice made in the sagittal plane with an open mouth shows: 1 – bilaminar zone, 2 – TMJ disc, 3 – external auditory meatus, 4 – parotid salivary gland, 5 – condylar process of mandible, 6 – lateral pterygoid muscle.

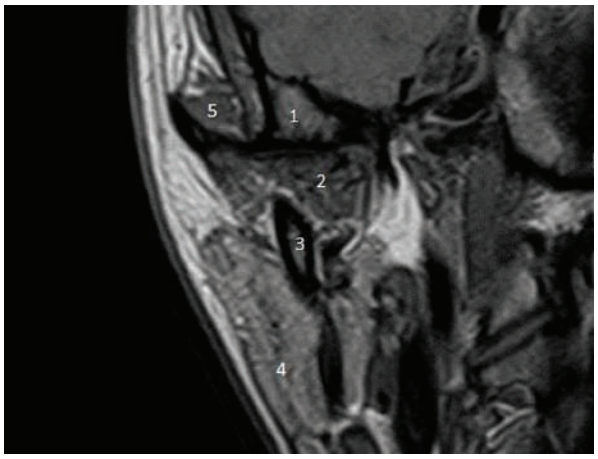

FIGURE 12. TMJ slice in the coronary (frontal) plane shows: 1 – articular fossa, 2 – lateral pterygoid muscle, 3 – ramus of the mandible, 4 – parotid salivary gland, 5 – temporal muscle.

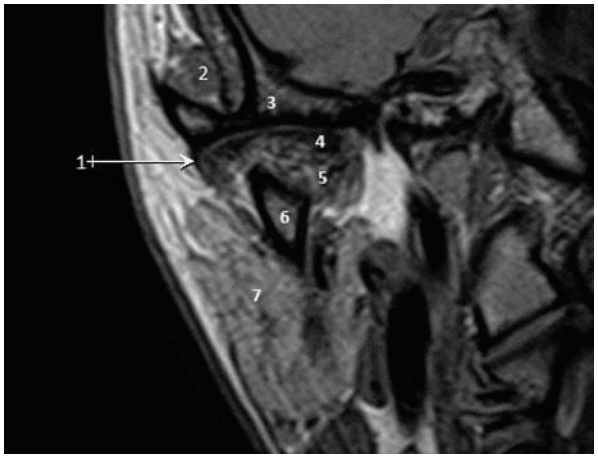

FIGURE 13. TMJ slice in the coronary (frontal) plane shows: 1 – articular capsule, 2 – temporal muscle, 3 – articular fossa, 4 – TMJ disc, 5 – lateral pterygoid muscle, 6 – ramus of the mandible, 7 – parotid gland.

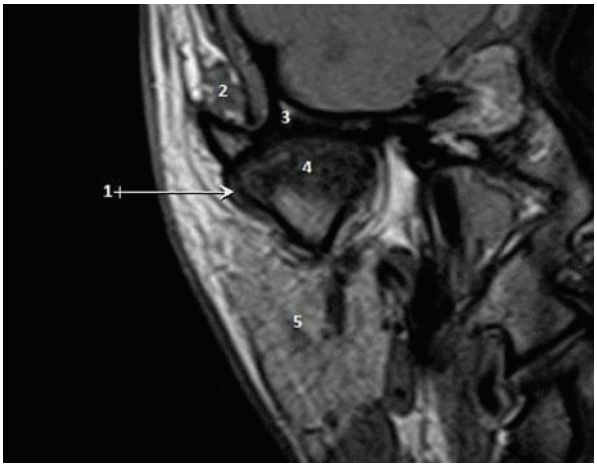

FIGURE 14. TMJ slice in the coronary (frontal) plane shows: 1 – articular capsule, 2 – temporal muscle, 3 – articular fossa, 4 – condylar process of mandible, 5 – parotid gland.

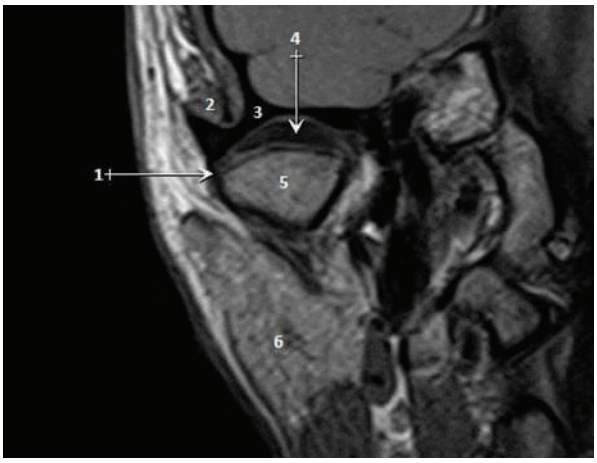

FIGURE 15. TMJ slice in the coronary (frontal) plane: 1 – articular capsule, 2 – temporal muscle, 3 – articular fossa, 4 – TMJ disc, 5 – condylar process of mandible, 6 – parotid gland.

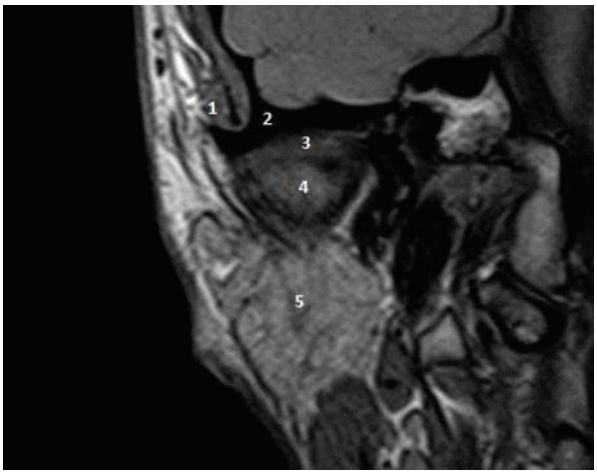

FIGURE 16. TMJ slice in the coronary (frontal) plane: 1 – temporal muscle, 2 – articular fossa, 3 – TMJ disc, 4 – condylar process of mandible, 5 – parotid gland.

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Conflict of Interests

The authors declare no conflict of interest.

Role of Author and Co-authors

Oleksii O. Tymofieiev (concept of the paper and writing). Sergii V. Maksymcha (material collection).

Ethical Approval

Approval was obtained from the Medical Ethics Committee of the Shupyk National Medical Academy of Postgraduate Education, Kyiv, Ukraine.

Patient Consent

Not required.

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Скронево-нижньощелепний суглоб здорової людини при проведенні магнітно-резонансної томографії

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ПРО СТАТТЮ

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Магнітно-резонансна томографія (МРТ)
Комп'ютерна томографія (КТ)
Диск скоренево-нижньощелепного суглобу
Біламінарна зона СНЩС

РЕЗЮМЕ

Мета. Представити анатомію скоренево-нижньощелепного суглобу здорових людей на підставі результатів проведеної магнітно-резонансної томографії.
Пацієнти та методи. Проведено обстеження 31 пацієнта без патології скоренево-нижньощелепного суглобу.
Результати. На підставі результатів проведеної магнітно-резонансної томографії у пацієнтів без патології скоренево-нижньощелепного суглобу представлена анатомія скоренево-нижньощелепного комплексу. Проведена порівняльна характеристика двох методів обстеження СНЩС: комп'ютерної томографії і магнітно-резонансної томографії. Представлені показання і противопоказання (абсолютні і відносні) до проведення МРТ.
Висновки. Проведеними обстеженнями скоренево-нижньощелепного суглобу у здорових людей встановлено, що застосування магнітно-резонансної томографії дозволяє більш ефективно проводити сучасну діагностику дегенеративних, запальних і пухлинних захворювань суглобів і оточуючих м'яких тканин.

Височно-нижнечелюстной сустав здорового человека при проведении магнитно-резонансной томографии

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О СТАТЬЕ

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Височно-нижнечелюстной сустав (ВНЧС)
Магнитно-резонансная томография (МРТ)
Компьютерная томография (КТ)
Диск височно-нижнечелюстного сустава
Биламинарная зона ВНЧС

РЕЗЮМЕ

Цель. Представить анатомию височно-нижнечелюстного сустава здоровых людей на основании результатов проведенной магнитно-резонансной томографии.
Пациенти и методы. Проведено обследование 31 пациента без патологии височно-нижнечелюстного сустава.
Результаты. На основании результатов проведенной магнитно-резонансной томографии у пациентов без патологии височно-нижнечелюстного сустава представлена анатомия височно-нижнечелюстного комплекса. Проведена сравнительная характеристика двух методов обследования ВНЧС: компьютерной томографии и магнитно-резонансной томографии. Представлены показания и противопоказания (абсолютные и относительные) к проведению МРТ.
Выводы. Проведенными обследованиями височно-нижнечелюстного сустава у здоровых людей, установлено, что применение магнитно-резонансной томографии позволяет более эффективно проводить современную диагностику дегенеративных, воспалительных и опухолевых заболеваний суставов и окружающих мягких тканей.