



УДК 616.716.3-001.5-08-06:616.742.71 – 616.724
DOI 10.24144/1998-6475.2020.50.18-24

METHODS FOR DETERMINING THE POSITION OF MOTOR AND TRIGGER POINTS OF THE CHEWING MUSCLES IN DYSFUNCTION OF THE TEMPOROMANDIBULAR JOINT

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Abstract. *Introduction.* According to various publications, from 40 to 60% of the population has various diseases of the temporomandibular joint (TMJ), most of them - functional disorders. A special place in the violation of the temporomandibular joint belongs to the increase in the tone of the masticatory muscles and their dysfunction.

The aim of the study. To develop a method for diagnosing the condition of the masticatory muscles in TMJ dysfunction and assess its clinical effectiveness.

Materials and methods. During 2018–2019, 35 people with dysfunctional TMJ were under observation. Patients were divided into three groups: I – neuromuscular (20 people), II – occlusal-articulatory (10 people), III – mixed type (5 people). Clinical examination was conducted using a device, designed to provide effective electromyographic examination of the masticatory muscles.

Results. It was found that MP AMM on the side of TMJ pathology is shifted upwards compared to MP symmetrical side, with the greatest shift was observed in patients with occlusal-articulatory and mixed pathologies, which indicates prolonged muscle spasm and the need for further rehabilitation.

Three weeks after orthopedic and conservative treatment, it was found that the MPs were shifted down and inwards of the AMM relative to the initial one, and after 3 months the MPs on the pathology side were at the same level as the MPs of the symmetrical side. This fact of our observation may indicate muscle relaxation and positive dynamics of intramuscular adjustment. These results of inspection can testify to a long spastic condition of AMM and confirm efficiency of complex treatment of this group of patients.

Conclusions. Thus, with the help of the developed diagnostic device not only the initial position of MP and TP muscle was investigated, but also the estimated dynamics of intramuscular adjustment during treatment.

Key words: temporomandibular joint, dysfunction, actually masticatory muscle, motor point, trigger point, diagnosis.

Методи визначення положення моторних та тригерних точок жувальних м'язів при дисфункції скронево-нижньощелепного суглоба

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Резюме. *Вступ.* За даними різноманітних публікацій, від 40 до 60% населення мають різні захворювання скронево-нижньощелепного суглоба (СНЩС), більшість із них – функціональні розлади. Особливе місце при порушенні скронево-нижньощелепного суглоба належить підвищенню тону жувальних м'язів та їх дисфункції.

Мета дослідження. Розробити метод діагностики стану жувальних м'язів при дисфункції СНЩС та оцінити його клінічну ефективність.

Матеріали та методи. Протягом 2018–2019 років під спостереженням знаходилося 35 осіб із дисфункцією СНЩС. Пацієнти були розподілені на три групи: I – нервово-м'язовий (20 осіб), II – оклюзійно-артикуляційний (10 осіб), III – змішаний тип дисфункції (5 осіб). Клінічне обстеження проводилося за допомогою приладу, призначеного для забезпечення ефективного електроміографічного дослідження жувальних м'язів.

Результати досліджень. Було встановлено, що моторні точки жувальних м'язів на стороні патології СНЩС зміщуються вгору порівняно з симетричною стороною моторних точок. Найбільший зсув спостерігався у пацієнтів з оклюзійно-артикуляційним та змішаним типом дисфункції, що свідчить про тривалий м'язовий спазм та необхідність подальшої реабілітації.

Через три тижні після ортопедичного та консервативного лікування було встановлено, що моторні точки були зміщені вниз і всередину відносно початкового положення, а через 3 місяці були на тому

ж рівні, що і моторні точки симетричної сторони. Цей факт нашого спостереження може свідчити про розслаблення м'язів та позитивну динаміку внутрішньом'язової перебудови. Результати обстеження можуть свідчити про тривалий спастичний стан власне жувальних м'язів та підтверджують ефективність комплексного лікування цієї групи пацієнтів.

Висновки. Таким чином, за допомогою розробленого діагностичного приладу було досліджено не тільки початкове положення моторних та тригерних точок жувальних м'язів, але й оцінена динаміка внутрішньом'язової корекції під час лікування.

Ключові слова: скронево-нижньощелепний суглоб, дисфункція, власне жувальний м'яз, рухова точка, тригерна точка, діагностика.

Introduction

According to various publications, from 40 to 60% of the population has various diseases of the temporomandibular joint (TMJ), most of them - functional disorders. A special place in the violation of the temporomandibular joint belongs to the increase in the tone of the masticatory muscles and their dysfunction. It is impossible not to take into account in the pathogenesis of diseases of the temporo-mandibular joint and the role of disorders of occlusal relationships. The correct diagnostic process is hindered by the lack of a single classification of joint diseases.

Literature data and clinical observations indicate that in the etiology and pathogenesis of diseases of the temporomandibular joint, the above reasons are important. It is necessary to emphasize the interdependence of all these etiological factors. Back in 1996, Yu. Petrosov proposed a working classification, according to which functional disorders and diseases of the temporomandibular joint are divided into 5 groups. One of the groups was dysfunctional conditions of the joint:

- neuromuscular dysfunctional syndrome;
- occlusal-articulatory syndrome;
- habitual dislocations and subdislocations of the lower jaw;
- dislocations of the intra-articular disc;
- parafunction of masticatory, mimic muscles and muscles of the tongue.

In TMJ diseases, especially dysfunctional conditions of unknown origin, there is a tonic muscle tension (muscle protective spasm) in response to a painful impulse that develops during functional load or involuntarily. In turn, muscle spasm leads to increased stimulation of their pain receptors and there is a vicious circle: pain - muscle spasm - increased pain - painful muscle spasm. In this case, this condition is a secondary reflex reaction of the muscles in the form of their tonic response [1, 2].

Skeletal muscle spasm leads to the development of characteristic tissue processes, which are accompanied by swelling, pain and decreased

muscle strength. These processes are associated with the development of inflammation and changes in the microcirculation (local blood and lymph circulation, exudation), activation of pain receptors and secondary damage to muscle fibers. The onset of inflammation of muscle tissue is associated with a constant spastic state of muscle fibers, extracellular matrix structures and blood capillaries and the direct contact of these structures with each other and with blood plasma [2, 3, 5].

The motor points (MP) of the actually masticatory muscles (AMM) correspond to the entry of the motor nerve into the muscle. MPs are usually formed inside the muscle (at the synapses) and cause spasm of the entire muscle. One type of MP is trigger points (TP), which form anywhere in a muscle, both inside and at the edges where the muscle attaches to the bone, and cause local spasm in the area of muscle. In some cases, TP are localized near MP. These points are also called trigger points because they cause pain when pressed. On palpation, these are ligaments or seals or lumps in the muscles. They are formed mainly from muscle strain, neurological diseases and after injury.

TP not only causes pain, but can also lead to dysfunction of the corresponding muscle. Such muscles get tired quickly. TP also causes headaches, numbness, tingling in the muscles, and other muscular or myofascial disorders. Can cause itching for no apparent reason, especially from hot, such as when washed under a stream of hot water [2, 3, 4].

Insufficient muscle relaxation leads to the formation of local hypertension. The spasm of muscle fibers changes perfusion and hypoxia occurs, which is accompanied by the release of inflammatory mediators and activation of pain receptors. Over time, in areas of local hypertension, special TPs are formed that contain multiple loci of sensitization and include one or more sensitized nerve endings. There are active and latent TP. Latent TP is painful only on palpation, active is manifested in spontaneous



pain at rest or during movement. Active TP can also cause painless phenomena. The most common autonomic symptoms: local vascular spasm, local hyperhidrosis, pilomotor activity. Paresthesia's can be the equivalent of pain phenomena in the area of injury [4, 6].

The aim of the study

To develop a method for diagnosing the condition of the masticatory muscles

in TMJ dysfunction and assess its clinical effectiveness.

Materials and methods

During 2018–2019, 35 people with dysfunctional TMJ were under observation. Patients were divided into three groups: I – neuromuscular (20 people), II – occlusal-articulatory (10 people), III – mixed type (5 people) (table 1).

Table 1

General characteristics of the patients

№	Clinical group	Total patients, n	Men, n	Women, n	Average age, years	
					m	f
A	I	20	10	10	40	27
B	II	10	6	4	32	38
C	III	5	2	3	26	52
	Total	35	18	17		

All patients were palpated to determine local hypertonia of the masticatory muscles, pain and tension or relaxation in the muscles, the degree and nature of muscle damage, the state of MP, the presence of TP.

The following criteria were used to clinically assess the condition of the masticatory muscles (their motor and trigger points):

Grade I - with a slight muscle damage: the muscles are soft, elastic, resilient. MPs are soft, small in size. There is muscle tension in some areas and TP. Patients do not complain of severe pain, it appears only when pressing on the point during its inactivation and palpation.

Grade II was characterized by stronger muscle tension, palpation revealed severe muscle spasm in large areas. MP is dense, larger. There are many active TP, when touched the patient feels pain. Dense seals, strands are defined. There are neuromuscular changes, pronounced myofascial syndrome.

Grade III - palpation reveals severe muscle tension and spasticity. Large and very compacted MP in the form of strands. Quite painful TPs are located almost throughout the muscle. The pain arises even at rest. At finger carrying out multiple firm consolidations, fibrosis on multiple sites were defined. Expressed neuro-dystrophic myofascial syndrome.

To determine the MP, the patient clenched his teeth as much as possible. As a result of a TMJ dysfunction, the position of the MP may

change, which, in turn, indicates the dynamics of intramuscular changes.

Palpation was performed by “rolling” the muscle between the thumb on the outside and the index finger on the inside (the index finger was inserted into the mouth).

Diagnostic criteria for the condition of MP and TP of the masticatory muscles are as follows:

I. “Major” criteria (all five are required):

- 1) complaints of local or regional pain;
- 2) limiting the range of motion of the lower jaw;
- 3) palpation of a “tight” cord in the damaged muscle;
- 4) area of hypersensitivity within the “tight” strand (trigger point);
- 5) area of reflected pain characteristic of this damaged muscle.

II. “Minor” criteria (one of three is required):

- 1) appearance of pain on trigger points stimulation;
- 2) tremor on palpation of the trigger point of the injured muscle;
- 3) reduction of pain when stretching the damaged muscle.

Clinical examination was conducted using a device, designed to provide effective electromyographic examination of the masticatory muscles as their initial state and the dynamics of changes in the masticatory muscles during treatment of the patient by improving the fixation of the device on the patient's face and the introduction

of a better spatial system coordinates for mathematical calculation of the position of the motor (or trigger) point of the masticatory muscle (Declarative patent of Ukraine № 26484).

The device has two rigid frames, connected by screws and equipped with sliding rulers,

graduated according to the type of spatial coordinate system, nasal stop, ear clips and dental maxillary cap with released occlusal surface of the teeth, which improves the quality of diagnostic assessment of the patient's MP and prevents errors, fig. 1:

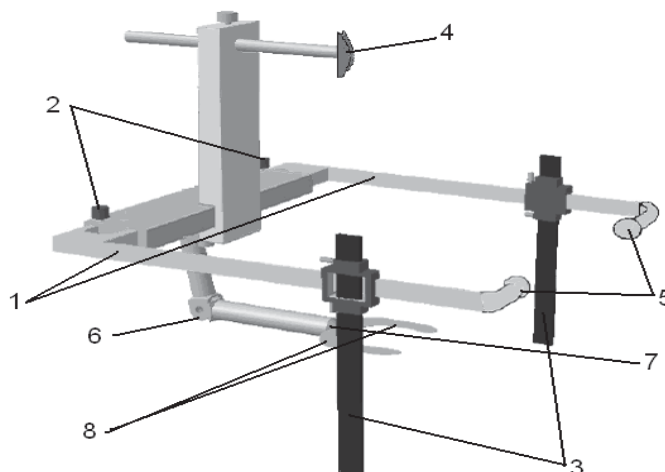


Fig. 1. Graphic representation of the device for estimating the position of motor points

The device for positioning the diagnostic equipment on the patient's face was used as follows: the patient was fixed on the upper jaw an individual plastic cap with a released occlusal surface, then fixed the upper part of the device by tightly fitting the frame to the patient's cheekbones, nasal stop and earplugs. Then, using an adapter, the upper part of the device was combined with a maxillary cap containing a groove for the adapter.

Thus a rigid fixation of the device has been achieved on the patient's face. Rulers with a surface-graded coordinate system were moved along the frame to the desired point, which is a cutaneous projection of the motor point of the masticatory muscle; the rulers were rigidly fixed to the frame with fixing screws. Then the position of the MP or TP of the masticatory muscle was evaluated according to the mathematical

coordinate system and the data were entered into the patient's medical history.

After these measurements, an electrode for electromyographic examination was placed on the determined and fixed location of the MP muscle. Patients were examined before and in the dynamics of treatment according to the method developed by us, which included relaxation of the actual masticatory muscle, orthopedic treatment and subsequent drug therapy [3, 4].

Results

After palpation to determine the location of MP and TP, or only MP (if TP was not detected), the device was placed on the face and their dimensions in diameter were measured according to the mathematical coordinates of the location of MP and TP relative to the masticatory muscle (table 2.).



Table 2

The results of the diagnosis of the position of the motor and trigger points of the actual masticatory muscles in patients with TMJ dysfunction before and after treatment

Type	Group		
	I – neuro-muscular disorders (n = 20)	II – occlusal- articulation (n = 10)	III – mixed (n = 5)
Primary (blue)	The diameter of the MP is 0.5–0.75 cm, the MP is displaced upwards by 0.1–0.15 cm relative to the MP of the AMM of the undamaged side. TP are absent. On the healthy side - no change	The diameter of the MP is 0.5–0.75 cm, the MP is displaced upwards by 0.15–0.25 cm relative to the MP of the AMM of the undamaged side. TP – 1-2, diameter - 0.2-0.7 cm, located on the posterior edge of the AMM, clinically: large criteria (all 5), small are absent. On the healthy side - no change	The diameter of the MP is 0.5–0.75 cm, the MP is shifted upwards by 0.25–0.45 cm relative to the MP of the AMM of the undamaged side. TP – 2-4, diameter - 0.3– 1.0 cm in diameter, located on the posterior edge and near the MP AMM, clinically: large criteria (all 5), small - 1-2. On the healthy side – MP without changes. There is one or two TP, with a diameter of 0.1-0.3 cm
3 weeks after treatment (red)	The dimensions of the MP are unchanged, shifted by 0.05–0.08 cm downwards and inwards. TP are absent. On the healthy side – no change	The dimensions of the MP are unchanged, shifted by 0.05–0.075 cm downwards and inwards. TP - 1 or not, diameter - 0.2-0.3 cm, located on the posterior edge of the AMM, clinically: 2-3 large criteria, small are absent. On the healthy side – no change	The dimensions of the MP are unchanged, shifted by 0.03–0.05 cm downwards and inwards. TP - 1-2, diameter - 0.2-0.5 cm, located on the posterior AMM, clinically: large criteria (all 5), small are absent. On the healthy side – MP without changes, TP are absent
3 months after treatment (green)	The dimensions of the MP are unchanged, shifted by 0.75–0.1 cm downwards and inwards from the initial one. TP are absent. On the healthy side - no change	The dimensions of the MP are unchanged, shifted by 0.5–0.7 cm downwards and inwards from the initial one. TP - 1 or not, diameter - 0.1-0.17 cm, located on the posterior edge of the AMM, clinically: 1-2 large criteria, small missing. On the healthy side – no change	The dimensions of the MP are unchanged, shifted by 0.2–0.5 cm downwards and inwards from the initial one. TP - 1-2, dimensions - 0.2-0.3 cm in diameter, located on the posterior edge of the AMM, clinically: 1-2 large criteria, small are absent. On the healthy side – MP without changes, TP are absent

As can be seen from table. 2, MP is a relatively static value in patients of all clinical groups, their size is unchanged and the diameter varies within 0.5–0.75 cm on both the injured and the healthy side. Only their position relative to the eponymous muscle points of the opposite side changes, which is obviously due to the spastic state of the AMM, resulting in a shortening of its muscle fibers. It was found that MP AMM on the side of TMJ pathology is shifted upwards compared to MP symmetrical side, with the greatest shift was observed in patients with occlusal-articulatory and mixed

pathologies, which indicates prolonged muscle spasm and the need for further rehabilitation.

Three weeks after orthopedic and conservative treatment, it was found that the MPs were shifted down and inwards of the AMM relative to the initial one, and after 3 months the MPs on the pathology side were at the same level as the MPs of the symmetrical side.

This fact of our observation may indicate muscle relaxation and positive dynamics of intramuscular adjustment, which was confirmed by clinical criteria for the effectiveness of treatment, fig. 2:

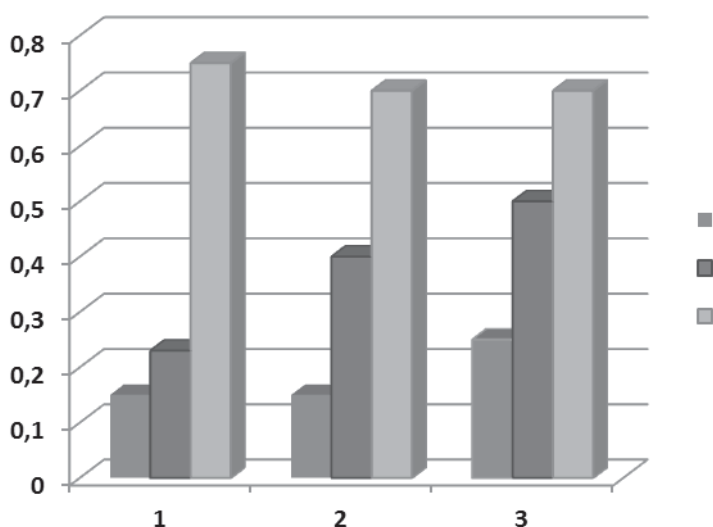


Fig. 2. Graphic representation of the dynamics of the position of the motor points of the masticatory muscle in patients of different clinical groups

Regarding TP, the data obtained were different: in patients with neuromuscular disorders, TP was determined only. In group II, one or two TPs were observed, which were clinically manifested as latent TPs and after 3 months were no longer detected. In patients with mixed pathology, the clinical picture was the worst: 2–4 TP at the time of primary observation, some were active and had both large and small evaluation criteria. Even in 3 months after treatment 1 or 2 TP remained, but already in the form of latent strands. All TPs were located on the rear edge of the AMM. On symmetrical intact AMM TP were not determined or were defined as latent in isolated cases.

These results of inspection can testify to a long spastic condition of AMM and confirm

efficiency of complex treatment of this group of patients.

Conclusions

Thus, with the help of the developed diagnostic device to ensure effective electromyographic examination of the masticatory muscles, which creates a stable fixation on the patient's face and allows to assess the position of MP and TP of the masticatory muscles in terms of mathematical coordinate system, not only the initial position of MP and TP muscle was investigated, but also the estimated dynamics of intramuscular adjustment during treatment.

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Отримано 03.12.2020 р.