

# **Electromyographic and ultrasound results of masticatory function of masseter muscles in patients with the odontogenic phlegmons**

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**Abstract.** This article shows the significance of odontogenic purulent infections of maxillofacial area and reveals the physiotherapeutic methods of rehabilitation of masseter muscles. The aim of research is to study the effectiveness of electrovibromassage in patients with odontogenic phlegmons of maxillofacial area and evaluate the functional state of masticatory muscles. The material of research were 54 patients with phlegmon of maxillofacial area who were treated in the maxillofacial surgery department of the Osh Interregional Joint Clinical Hospital during the period from 2019 to 2020. Most of the patients 62,9% had phlegmons localized under the masticatory 21 (38.9%), wing-mandibular 33 (61.1%) facial cervical spaces. All patients were divided into two groups: comparison (24 patients) and main (30 patients), in both groups were held similar algorithm of surgical and therapeutical treatment, but in main group in addition was used electrovibromassage, myogymnastics and mechanotherapy of affected area in order to boost rehabilitation process. The results of research, according to electromyographic and ultrasound diagnostics show that proposed method of treatment-rehabilitation complex increases the effectiveness of rehabilitation.

**Key words:** odontogenic phlegmons, rehabilitation, electrovibromassage

## **Introduction**

The significance of the problem is a rapid increase in the number of patients with purulent inflammatory diseases of the maxilla-facial region, violation of the balance of reactive mechanisms of the body, the specificity of the microflora of purulent wounds, sensitization of the body and reducing the effectiveness of antibiotic therapy. One of the most common disorders

in odontogenic purulent diseases is a violation of masticatory function. Inadequate function of the masticatory apparatus leads to disorders of the gastrointestinal tract, carbohydrate, nitrogen, water metabolism, reduces the performance of the entire neuromuscular apparatus of the body as a whole, causing psycho-emotional discomfort. All of the above changes lead to the need for rehabilitation at different stages of the disease, taking into account the individual characteristics of each patient. Stages and continuity are of great importance in the solution of the tasks. Rehabilitation measures should be carried out taking into account the peculiarities of the clinical course and the degree of disease prevalence. One of the important symptoms of odontogenic phlegmon is inflammatory contracture of the masticatory muscles of varying severity, which makes adjustments in rehabilitation. In case of maxillofacial phlegmon, the central mechanisms of regulation of the masticatory function are complicated and therefore the most effective, and sometimes the only way to strengthen and restore the nervous connections and also to create the functional system in new conditions is electro-stimulation. However, the available literature does not sufficiently cover the issues of functional state of masticatory muscles in patients with odontogenic phlegmons, the complex of treatment and rehabilitation measures for full recovery of masticatory function is not developed, electrophysiological substantiation of masticatory muscles electrostimulation in this type of pathology is absent.

### **Objective of the study**

To study the effectiveness of electrovibromassage in patients with odontogenic phlegmons of maxillofacial area and evaluate the functional state of masticatory muscles.

### **Materials and methods of research**

We have observed 54 patients with phlegmon of maxillofacial area who were treated in the maxillofacial surgery department of the Osh Interregional Joint Clinical Hospital during the period from 2019 to 2020. There were 34 male (62.9%) and 20 female (37.1%) patients. In the highest percentage of cases were patients of young age from 16 to 40 years (41 persons - 75.9%). The sources of odontogenic infectious inflammatory process were wisdom teeth in the first place (37.3%), followed by 36 and 46 teeth (28.1%), 37 and 47 teeth in the third place (18.9%), and 15.7% were diseases of other dental groups (). We chose only phlegmons localized under the masticatory 21 (38.9%), wing-mandibular 33 (61.1%) facial cervical spaces. The majority of patients came to the in-patient treatment at late terms: in 5 days and more from the disease beginning - 46 (85,1%) patients and only 8 patients (14,8%) addressed after 3 days of the pathological process beginning. Clinical examination of the patients consisted of a detailed analysis of complaints, medical and life history, traditional dental examination, laboratory tests, and consultations with relevant specialists.

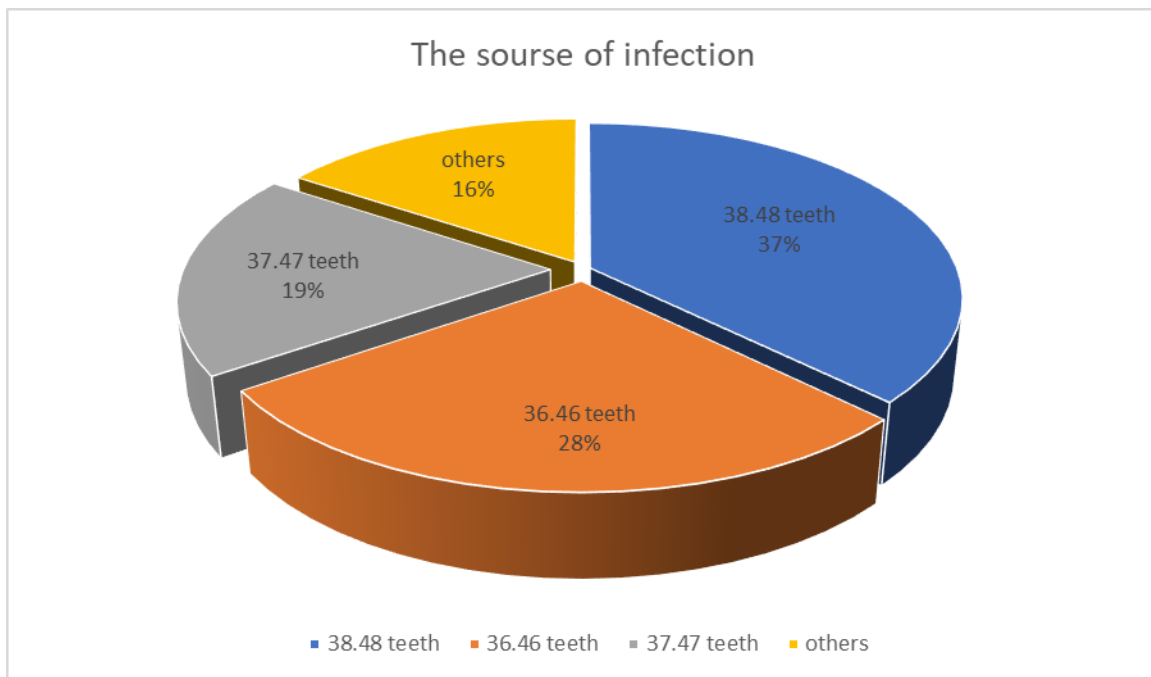


Fig.1. The percentage of teeth that caused the odontogenic infection

All patients were divided into two groups: comparison (24 patients) and main (30 patients). General principles of patient management were the same in both groups: on the day of hospitalization after preoperative preparation under general or combined anesthesia we performed adequate surgical treatment of the purulent wound, removed the "guilty" tooth, prescribed antibacterial, desensitizing, infusion, detoxifying and symptomatic therapy if indicated. All patients were dressed daily: after antiseptic treatment and drainage of the wound an aseptic gauze dressing moistened with 10% sodium chloride solution was applied; as the wound process passed to the second phase, the wound was dressed under an ointment dressing or early secondary sutures were applied.

Group I patients (comparison) underwent physiotherapeutic treatment of the pus wound with low-frequency magnetic therapy. Mechanotherapy was performed by the patients in this group independently using improvised means without time and dynamic observation. Patients of the II group received the suggested medical-rehabilitation complex: besides the conventional treatment, electrostimulation of the masticatory muscles with the apparatus of "Electrovibromassage", the total duration of one session was 10-15 minutes, 2 times a day and therapeutic myogymnastics according to V.A. Sokolov's method. As well as mechanotherapy. The proposed treatment-rehabilitation complex in patients with odontogenic phlegmon with the use of masticatory muscles myostimulation, mechanotherapy of the lower jaw and myogymnastics has a direct relation to the practical medicine and can be used in the conditions of hospital and polyclinic. The obtained data of the positive effect of the suggested treatment of

patients with odontogenic phlegmon on clinical and electromyographic data allow to substantiate extensive indications for the use of the complex of rehabilitation measures both at the hospital stage of treatment and in the conditions of the daytime hospital and in the rehabilitation room and are the method of choice in treating inflammatory diseases of the maxillofacial region soft tissues. Economic availability of "Electrovibromassage" apparatus, simplicity of its use, mobility, safety, allow using it at any stage of rehabilitation. Cheapness of materials and availability of the apparatus outside the factory conditions allow its use both in a physiotherapy room and in a dentist's workplace in a polyclinic. Therapeutic myogymnastics was carried out by the patients during the first 2 days under the guidance of a doctor and then was carried out independently if each patient had a reminder.

A set of exercises for myogymnastics of mimic and masticatory muscles was carried out as follows:

- Opening and closing the mouth 5-7 times, 2 minutes;
- Inflating the cheeks and relaxing 3-4 times, 2 minutes;
- Biting the upper lip with the lower teeth 4-5 times, 2 minutes;
- Lateral movements of the lower jaw 3-4 times, 1.5 minutes;
- Extending the lower jaw forward 3-4 times 2 minutes;
- Retracting the neck 5-6 times, 2 minutes;
- Moving the mouth corners to the side 5-6 times 1.5 minutes;
- Moving the lips into a tube 5-6 times, 2 minutes;
- Massaging the mucous membrane of the mouth with the tongue 3-4 times, 2 minutes.

The specified task was achieved by measuring the degree of mouth opening produced by the optimal load on the masticatory apparatus, with the load being equal at any value. The electrokymographic study examined the condition of the masticatory muscles in 54 patients both involved in the pathological process and clinically unaffected muscles of the opposite side in the dynamics. A total of 108 studies were carried out. For this purpose, we used "Keypoint™ Software version 1.1" computer program on the basis of "Dantec" electrokymographic complex. Duration and amplitude, polyphase of motor unit potentials were determined. Bioelectrical activity was studied in two states: full relaxation to reveal spontaneous activity and during voluntary muscle tension. Study of masticatory muscles condition in odontogenic phlegmonas was carried out with ultrasound analyzer "SIM 7000 CFM Challenge". Measurements were taken on the healthy side and the side involved in the inflammatory process in the state of physiological rest and at arbitrary load. The structure of masticatory muscles, their echogenic density, and the presence of pathological inclusions were analyzed in the course of the study.

Materials of the study were subjected to mathematical processing with the help of statistical software packages Excel 2000, Statistica for Windows 5.0.

### **Results of the study and their discussion**

Our observations showed that the magnitude of the mouth opening in patients with the phlegmon of the lid-mandibular space is  $1,3 \pm 0,2$  cm; submasseteric  $-1,0 \pm 0,3$  cm, which indicates the presence of inflammatory contracture of the mandible. In phlegmonas of the wing-mandibular and submandibular spaces, contracture of grade III is determined. At ultrasound examination of masticatory muscles of practically healthy persons the greatest thickness at rest is observed in m. masseter ( $14,1 \pm 0,2$  mm), m. pterygoideus medialis ( $11,8 \pm 0,3$  mm). The thickness of masticatory muscles at rest was almost the same in patients with odontogenic phlegmons and healthy individuals. On loading, there is a considerable increase of these muscles thickness in healthy people, whereas in patients with odontogenic phlegmon these indexes are considerably less.

Comparative estimation of masticatory muscles thickness in odontogenic phlegmonas showed that in the resting state it prevails on the affected side. In the phlegmon of the submasseteric space -  $15,4 \pm 0,2$  mm (against  $14,1 \pm 0,2$  mm), at the phlegmon of the wing-lumbar space, the thickness of m. pterygoideus medialis practically did not change ( $11,8 \pm 0,3$  mm against  $11,7 \pm 0,3$  mm), which can be explained by the anatomico-topographic features of this cellular space. Submasseter space in norm  $14,1 \pm 0,2$  mm in phlegmons  $15,4 \pm 0,2$  mm, in load  $18,4 \pm 0,2$  mm, at rest  $15,7 \pm 0,2$  mm. The pterygoideus medialis in norm  $11,7 \pm 0,3$  mm, in phlegmon  $11,8 \pm 0,3$  mm, in load  $14,9 \pm 0,3$  mm, at rest  $13,1 \pm 0,3$  mm. The contractility of the masticatory muscles in odontogenic phlegmons of the submandibular and wing mandibular spaces. Submaxillary space in normal  $30,4 \pm 0,2$ , in phlegmons  $9,4 \pm 0,2$ , wing mandibular space in normal  $27,3 \pm 0,2$ , in phlegmons  $11,0 \pm 0,2$ . The contractile ability of the masticatory muscles on the affected side was significantly lower than on the opposite side, especially in phlegmonic submasseteral space - by 3 times, the winglet-mandibular space contractile ability was lower by 2 times ( $p < 0,005$ ). Thus, ultrasound examination in 96% of patients, regardless of age, showed foci of fibrosis in the form of longitudinal transverse lines along its entire length in the muscle. Electromyographic studies showed that the average amplitude of the motor unit potential of the muscles in patients on the healthy side was within normal values, while on the side of the affected muscle there was a significant decrease in the indicators in patients before treatment. Thus, the amplitude of action potentials of m. pterygoideus medialis on the inflamed side was  $116,3 \pm 0,5$   $\mu$ V (versus  $210,3 \pm 0,5$   $\mu$ V of the healthy side). These figures were significantly lower in the study of m.masseter ( $102,3 \pm 0,5$  vs.  $210,3 \pm 0,5$ ). The main (30 people) group of patients applied electrovibromassage and mimic exercises after 10 days, which indicates an increase in the density of muscle fibers

and response to impulse stimuli with a higher stimulus threshold. Electromyographic studies at the end of treatment in the main group showed m. pterygoideus medialis  $183.5 \pm 0.5 \mu\text{V}$ , m. masseter  $168.3 \pm 0.5$ . After application of the complex of therapeutic and rehabilitation measures, a significant decrease of the contracture in the main group of patients was registered, which was manifested in the improvement of the mouth opening, by the 3rd-5th day soft tissue swelling, discomfort and tension in the masticatory muscles significantly decreased, the mouth opening increased daily by 3-4 mm and reached 4.0-4.5 cm in 93% of patients by the end of treatment, and 7% of patients had a slight inflammatory contracture of degree I. In the comparison group (24 patients) the electromyographic indices remained reduced m. pterygoideus medialis  $125.2 \pm 0.5 \mu\text{V}$ , m. masseter  $110.3 \pm 0.5$  at the end of treatment. In the comparison group, inflammatory contracture of the lower jaw of I and II degree remained pronounced in 100% of cases. Mouth opening at the end of treatment in the main group was  $4.3 \pm 0.2$  cm, but in the comparison group these indexes were  $2.8 \pm 0.5$  cm. Thus, the use of myostimulation electrovibromassage with contratubex gel, and myogymnastics in the complex treatment of patients with odontogenic phlegmon leads to a more rapid recovery of chewing function, reduction of postoperative complications in the form of scar deformities and contractures.

Thus, ultrasound examination in odontogenic phlegmon showed that the thickness of masticatory muscles on the unaffected side at rest was almost the same as in healthy conditions. When loaded, the contractility of masticatory muscles on the side of inflammation was 2-7 times lower than on the opposite side, especially in phlegmonic sub-masseteral, wing-mandibular space. Foci of fibrosis in the form of longitudinal transverse lines along the muscle length of various sizes and shapes were observed in 96% of patients. Clinical evaluation of the results of treatment of patients with the proposed therapeutic-rehabilitation complex showed the formation of flat, inconspicuous scars in the area of the postoperative wound, absence of scar contracture and complete restoration of masticatory muscle function.

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