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Alterations in Masseter Muscle Tones after Treatment with Different Obturators

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Surgical treatment of maxillary cancer causes serious disorders in the chewing and eating functions of patients. As a result of the concomitant radiotherapy, the tone of masticatory muscles is changed which restricts mouth opening and mandibular mobility. The aim of the study is to analyse the alterations in m. masseter after maxillary resection and prosthetic treatment with different obturators. Electromyography is used to record the changes in muscle tones and action potentials regarding the muscles contractions of the resected and healthy sides. Research findings demonstrate normal action potentials with 350-500 μV and 150-300 μV amplitudes on the healthy side and the operation area, respectively, after the end of treatment. It is shown that the prosthetic treatment after maxillary resection improves the condition of masticatory muscles regardless the type of applied obturators. Irrespectively of the treatment method, the amplitude values of m.masseter on the resected side remain lower in comparison to the normal one.

Key words: m. masseter, maxillary resection, maxillary defect, obturator, electromyography.

Introduction

The electromyography (EMG) is a contemporary method for registration and evaluation of muscle activity with broad application in medicine [7]. In dentistry, EMG is used for activity assessment of masticatory muscles while treating and diagnosing some parafunctions and different diseases of temporomandibular joint [11]. Some authors define the application of this method as a golden standard in bruxism diagnosis and treatment [17, 10]. The examination of muscle activity of m.masseter is successfully used in diagnosing and treating patients with different types of orofacial pain [12]. Previous findings demonstrate the relationship between hyperactivity of masticatory muscles and pain in temporomandibular joint [8].

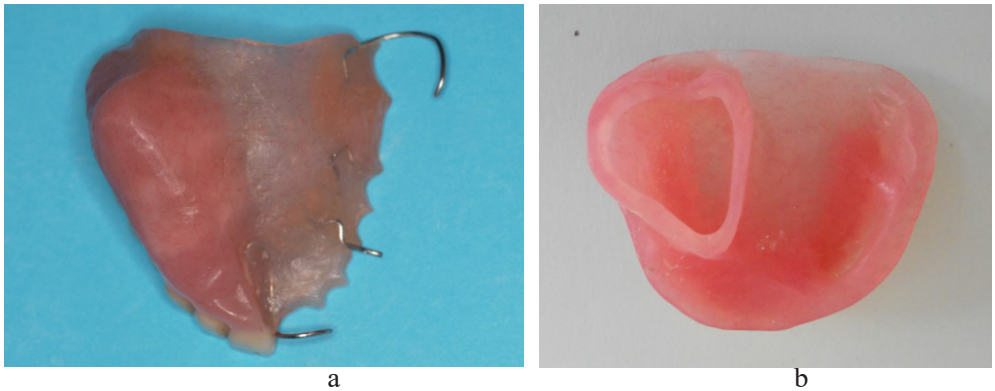
The available literature provides anecdotal evidence regarding the alterations in m. masseter after maxillary resection and treatment with obturator, despite its role as the main masticatory muscle [9]. An electromyographic study among six patients with unilateral defects and preserved partial dentition, who have hollow-bulb and buccal flange obturators, shows better recovery of masticatory function when treatment is based on the latter type of dentures [6]. Comparative studies about these two types of obturators confirm the above-mentioned advantages when speech recovery and comfort of patients are taken into consideration [4]. Other studies indicate that prosthetic treatment after maxillary resection has positive impact on the masticatory muscles on the resected side; thereby, contributing to the recovery of the muscle tone to identical levels seen on the healthy side [2]. The results regarding patients with mandible resection are the contrary – they experience reduced muscle activity after treatment [5].

Research findings show that prosthetic treatment with partial or complete dentures improves EMG activity of the masseter muscles [15, 19]. According to some studies, the recovery of the muscle tone of masticatory muscles depends on denture's type and used materials [20]. It is found that the most commonly used acrylic dentures improve EMG activity of m.masseter which in turn facilitates chewing [3]. Such alterations in m. masseter and m. temporalis are not found in the cases of treatment with occlusal splints made of acrylic resin [1, 16]. The application of dentures with a silicone base leads to an increase of masseter and temporal muscles activity, as well as improved chewing effectiveness [14, 13]. Electromyographic activity of masticatory muscles also depends on the correct tongue positioning along the oral cavity floor. The latter requires the development of a barrier isolating the nasal cavity during the obturator treatment [18].

Materials and methods

A two-channel 16-bit EMG devise Нейро-МВП-Микро (Neurosoft, Russia) is used for the purpose of the study. The devise measured the action potentials of m. masseter among six patients with hollow-bulb and buccal flange obturators (**Fig. 1 a, b**). Each patient had a defect limited to the midline, as well as a preserved partial dentition – characteristics allowing for a treatment with the two types of obturators. Only six patients, who were equally distributed in two groups, took part in this study due to the inclusion criteria, specifics of the disease and its relatively low frequency. The prosthetic treatment of each patient took place four months after surgery in order to complete the healing process in the defect, as well as overcome the trismus caused by the radiotherapy. After adjustments and articulations of the dentures over a period of one month, their stability and tightness were examined. During this period, minor corrections were performed in some areas in order to cope with decubitus wounds and pain.

The EMG examination took place after a monthly period of adaptation and six months after the resection. Superficial bipolar silver electrodes were used and attached to the m. masseter on the healthy and resected sides in order to measure the action potentials at rest and during muscle activity.



a b

Fig. 1. Hollow-bulb (a) and buccal flange (b) obturators

Results

The electromyographic tests of m. masseter on the healthy side of all patients showed no spontaneous activity at rest. Normal action potentials with amplitude of 350-500 μV were recorded during muscle contraction (**Fig. 2**).

Fig. 2. EMG potentials during contraction of m.masseter on the healthy side

The results from the examination of patients with buccal flange obturators showed single fibrillar potentials at rest and low amplitude action potentials within the range of 150-300 mV during muscle contractions (**Fig. 3**).

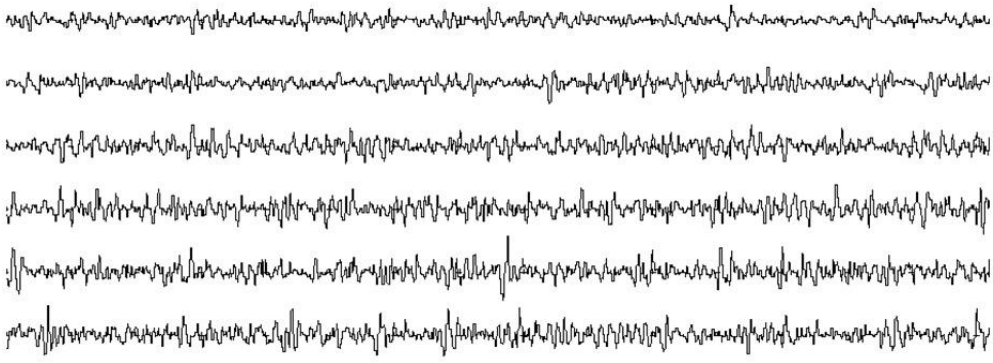


Fig. 3. EMG potentials of m. masseter on the resected side of a patient with a buccal flange obturator

The results of patients with hollow-bulb obturators reported no spontaneous activity at rest with single fibrillar potentials. During contraction of m. masseter were registered action potentials within the range of 150-300 μV were registered during contractions of m. masseter (**Fig. 4**).

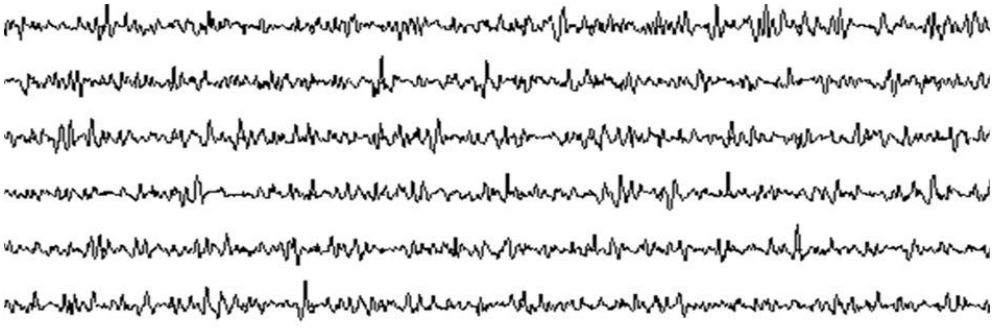


Fig. 4. EMG potentials of m.masseter on the resected side of a patient with a hollow-bulb obturator

Discussion

The results from the EMG examination delivered an objective assessment of m. masseter condition of the healthy and resected sides. Regardless the conducted radiotherapy and subsequent trismus, there were no alterations in m. masseter tone, while action potentials during contractions remained normal. Changes were observed in the muscles on the resected side where lower action potentials from 150 to 300 μV were reported in both groups. The amplitude values were measured as a result of conducted prosthetic treatment. They were close to the minimum values on the healthy

side. Research findings confirmed the conclusions from other studies suggesting that prosthetic treatment with definitive obturators improved the tone of m. masseter; thereby, contributing to the achievement of almost normal amplitude values [2].

The study demonstrated that obturator's type and design did not influence treatment results, as action potentials in both groups remained within the range of 150–300 μV. Previous findings from identical studies among patients with similar defects suggesting better results from the application of buccal flange obturators were not confirmed [6].

Research findings demonstrated an increase of m. masseter's action potentials on the resected side after treatment. The measured outcomes are comparable to the results achieved from treatment with partial or complete dentures [15, 19]. The idea that acrylic resins provide stable transmission of the masticatory pressure and improve masticatory tone, was confirmed [3]. The durability of the material facilitated the creation of a stable barrier between oral and nasal cavities in order to achieve a proper tongue positioning – a reliable approach for the reduction of muscle activity [18].

Conclusions

The prosthetic treatment after maxillary resection improves the condition of masticatory muscles regardless the type of applied obturators. Irrespectively of the treatment method, the amplitude values of m.masseter on the resected side remain lower in comparison to the normal one.

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