FUNCTIONAL CONDITION OF MASSETERS MUSCLES OF PATIENTS WITH CLASS II SUBDIVISION

STAN CZYNNOŚCIOWY MIĘŚNI ŻWACZY U PACJENTÓW Z JEDNOSTRONNĄ KLASĄ II

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ABSTRACT

Introduction: Main functional characteristics of masticator muscles in patients with class II malocclusions is activity dominance of m. temporalis in comparison with m. masseter. We have not found datum about functional status of the masticators in patients with class II subdivision.

The aim: The purpose of our study was to investigate the functional characteristics of m. masseter, m. temporalis in adult patients with class II subdivision malocclusion.

Materials and methods: There have been carried out the surface electromyographic study of m. masseter, m. temporalis in 17 adult patients with class II subdivision. It was realized quantitative analysis of 271 electromyogram, it was determined the average bioelectric activity, index activity, symmetry and torsion index.

Results: It was observed predominance of the bioelectrical activity of m. temporales on m. masseter for all persons with class II subdivision. Bioelectrical activity for m. masseter was bigger on side of distal ratio and for m. temporales on side of neutral ratio. In class II subdivision right, the mandible was deviated to the left side and in class II subdivision left is deviated to the right side. Thus, rotational moment generated during compression of the jaws, causes deviation of the lower jaw to the side, with a neutral molar ratio. During voluntary chewing bioelectrical activity of m. masseter and m. temporalis was higher in the right side.

Conclusion: In accordance with the functional condition of the masticatory muscles of class II subdivision is characterized with functional features of distal occlusion.

KEY WORDS: class II subdivision, electromyographic study of the masticators.

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INTRODUCTION

In accordance with generally accepted E.H. Angle classification of malocclusions to among the II class anomalies there are two divisions: with protrusion and retrusion of frontal teeth. Every division can be symmetric and unilateral (asymmetric) form, when distal molar ratio is observed only from one side. That was called class II subdivision [1]. Class II subdivision reaches 13% among all others malocclusions [2].

To date class II subdivision is studied extremely not enough. Some authors specify on it connection with asymmetric violations of dentition [3], other authors have opinion about origin of anomaly They specify on connection of class II subdivision with bone asymmetry of maxilla and mandible [4,5]. In our previous researches was found that class II subdivision is accompanied by rotational displacement of lower jaw, asymmetry of condyles and is not related with dentoalveolar asymmetry of dentition [6,7,8].

It is known that main functional characteristics of masticator muscles in patients with class II malocclusions is activity dominance of m. temporalis in comparison with m. masseter, that leads to development of temporal mastication type. This type of mastication is in less measure physiological, because for such mastication is typical vertical (incisive) movements of mandible [9].

We have not found datum about functional status of the masticators in patients with class II subdivision. In this connection it is appeared a question about presence of functional violation in patients with II class subdivision like classic bilateral distal occlusion?

THE AIM

The purpose of our study was to investigate the functional characteristics of the masticator muscles (m. masseter, m. temporalis) in adult patients with class II subdivision malocclusion.

MATERIALS AND METHODS

We carried out the surface electromyographic (EMG) study of the masticators (m. masseter, m. temporalis) in 17 adult patients (7 male and 10 female) with class II subdivision: 9 patients with II class subdivision right (group A), 8 patients with II class subdivision left (group B). EMG recording was performed with the help of standard method on the "Neuro-MVP" appliance produced by "Neurosoft" [10] using the static test, which reveals the maximum voluntary contraction of the jaws in the central occlusion (1) and dynamic tests: voluntary chewing (2) specified chewing on right side (3) specified chewing on the left side (4). It was realized quantitative analysis of 271 electromyogram, it was determined the average bioelectric activity, index activity (AC), symmetry (SIM) and torsion index (Tor)

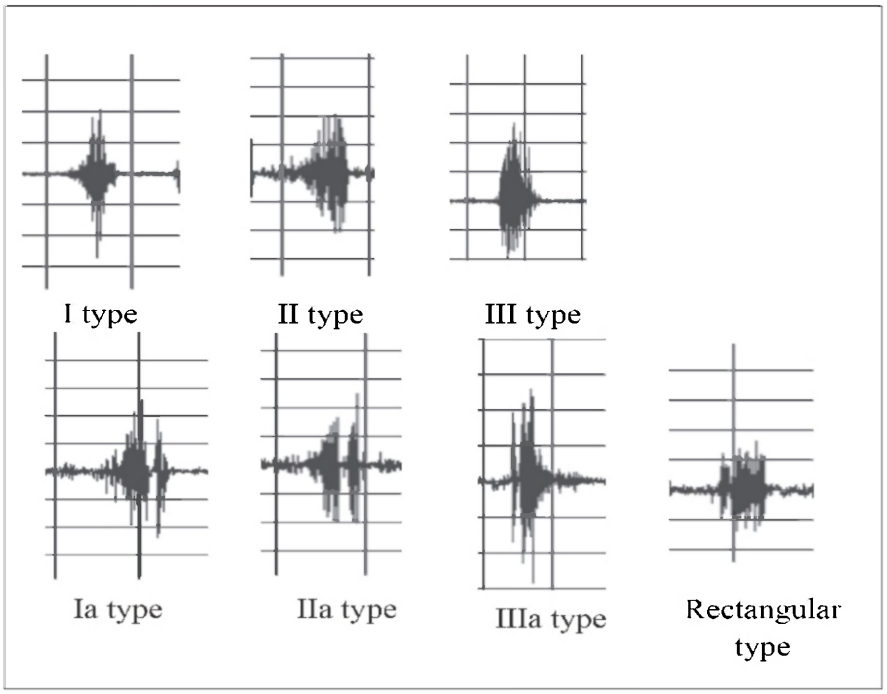

Fig. 1. Types of spikes: physiological and pathological.

[10]. The analysis of indices was carried out among all the examined patients and separately in groups A and B.

Qualitative analysis of EMG was realized with evaluation of the graphic image of the process of excitation of the muscles that occur during chewing of the so-called "spikes". The spike consists of groups of waves with different amplitude. Form of spikes depends on the degree of inclusion in the contractive process of certain number of muscle fibers, the level of synchronization of electrical discharges in muscle. Form of spikes is associated with a specific type of movements of the mandible also. The shape of the spike is characterized by its form of the envelope curve [9]. Three main forms of physiological spikes and their pathological forms are shown in figure 1.

Pathological spikes in accordance with the form correspond to the physiological spikes, but they have intermittent form (Ia, II, III (Fig.1). These types of spikes are occurred in case of the simultaneous inclusion in the process of mastication of the

Table I. Electromyographic indices of patients with class II subdivision

Test	Groups	SIM m. masseter, %	SIM m. temporales, %	Ac, %	Tor, %
Test 1	A+ B	86,66±2,47*	93,67±1,55*	-4,69±5,37	1,48±2,07
	A	83,8±3,87°	94,88±1,66°	-7,64±7,37	-0,93±3,71
	Б	89,87±3,02	92,3±2,89	-1,38±8,71	4,2±1,46
Test 2	A+ B	83,93±4,32	88,54±1,75	0,11±4,46	0,78±3,58
	A	77,23±7,41**	90,58±2,62**	4,74±6,13	-1,77±6,16
	B	91,49±2,8°°	86,25±2,33°°	-5,1±6,78	3,66±3,83
Test 3	A+ B	74,51±3,33	82,36±2,86	-5,41±4,01	-3,04±2,34
	A	70,27±4,1	81,96±3,19	-5,84±7,08	-4,74±3,62
	B	79,28±5,38	82,81±5,45	-4,93±4,31	-1,14±3,23
Test 4	A+B	75,19±5,5	87,71±2,79	-2,68±4,77	0,18±4,29
	A	76,43±7,65	89,06±4,78	-5,08±7,27	-4,26±5,71
	B	73,8±8,98	86,2±3,19	0,03±6,89	5,18±6,76

*Note * accuracy of results 95%*
***, °° the validity of the results 80%*

individual motor units, alternating with periods of electrical "silence" of muscle fibers. Pathological spikes with rectangular shape are observed usually in patients with malocclusion. Among the rectangular spikes intermittent forms can occur [9].

There was evaluated the form of spikes, calculated the percentage of physiological and pathological spikes on the sides with a distal and a neutral molar ratio.

RESULTS

Assessment of the quantitative parameters: during realization of static test (1) it was observed predominance of the bioelectrical activity (BA) of m. temporales on m. masseter for all persons with class II subdivision. It was confirmed by the negative value of the index As (tab.1). It is typical for predominance of m. temporales in comparison with m. masseter.

In persons with class II subdivision right, the activity index (Ac) demonstrates a more pronounced predominance of m. temporales in comparison with m. masseter than in persons with the class II subdivision left (tab. 1). In both groups bioelectrical activity for m. masseter was bigger on side of distal ratio and for m. temporales on side of neutral ratio.

After analysis of Tor index it was estimated that in class II subdivision right, the mandible is deviated to the left side and in class II subdivision left is deviated to the right side (tab.1). Thus, during realization of test (1) rotational moment generated during compression of the jaws, causes deviation of the lower jaw to the side, with a neutral molar ratio.

In accordance with the SIM indices, which is need for estimation of the synchrony of muscles pair functional activity of, expressiveness of synchronization of m. temporalis was higher than in m. masseter with 95% confidence ($p<0.05$) in patients with class II subdivision right.

In patients with class II subdivision left SIM index of m. temporalis was also higher than in m. masseter (the difference is not statistically reliable) (tab.1).

During voluntary chewing (2) bioelectrical activity of m. masseter and m. temporalis was higher in the right side. In persons with class II subdivision right it was estimated the dominance of m. masseter in comparison with m. temporales (tab.1). In patients with class II subdivision left bioelectrical activity it was estimated the of dominance m. temporales in comparison with m. masseter, which was typical for significant functional disorder (tab.1).

Tor index tended to offset the lower jaw in patients with class II subdivision right to the left (Fig.1), while in the in patients with class II subdivision left to the right (tab.1), i.e. in the side with a neutral molar ratio, as in the static test (1).

Synchronism during functional activity of m. temporales in in patients with class II subdivision right was more significant than for m. masseter, and in patients with class II subdivision left contrary it was prevalence of synchronism for m. masseter than for m. temporales with accuracy of 80% ($p<0,2$) (tab.I).

During realization of test 3 and test 4 (specified chewing) for all persons it was prevalence of less functionally rational temporal type of chewing, which is typical characteristic for bilateral class II. In case of prevalence of the right chewing bioelectrical activity of m. masseter and m. temporales it was domination in right position, while in case of l of prevalence of the left chewing it was domination in left position, regardless of the side of the distal ratio.

The synchronism of functional activity for m. temporales was more significant in comparison with m. masseter in both groups. The SIM indices were lower than during the static test and during voluntary chewing, which was conditioned unilateral specified chewing load. The lowest SIM indices were during realization such test as the specified chewing on the right side.

Tor index during specified chewing on the right side in both groups of patients showed that the lower jaw moves to the left, i.e. in the balancing side. It should be taken in account that such shift is more pronounced in patients with class II subdivision right. During specified chewing on the left side in patients with class II subdivision right it was deviation to the left (working side), and in patients with class II subdivision left and to the right (balanced) side.

Evaluation of quality parameters: total percentage of physiological spikes in m. masseter was 79,41±3.45%, and the pathological spikes was 20,59±3,45% respectively, that is every 5-th spike was pathological. In m. temporales physiological spikes was 87,19±2,58% and pathological spikes was 12,08±2,58%, that is to say presents of seventh part of them. Thus, the number of abnormal spikes almost doubled with 90% confidence ($p<0,1$) was greater in m. masseter than in m. temporalis. It should be taken in account that in persons with class II subdivision m. temporahs were more functionally "adequate," in comparison with m. masseter. In other words, it was functional prevalence of m. temporalis over m. masseter in patients with unilateral class II. This was proved with the help of qualitative evaluation of EMG.

Comparison of the abnormal spikes number on both sides, showed that in the right m. masseter the number was of 22,21±4,06%, in the left m. masseter it was 18,98±3,71%, in the right m. temporales – 13,91±3,16% left m. temporalis – 11,71±3,09%.

Thus, accordantly qualitative indicators of EMG, as in m. masseter and m. temporales pathological spikes are more common on the right side (the difference is statistically not confirmed). It was discovered a slight functional asymmetry, in our view, it reflects the complex processes neurological regulation of masticatory muscles (direct and cross-innervation) and the extremely complex mechanisms of higher nervous activity. It should be taken in account the functional asymmetry principle of higher nervous activity of the cerebral hemispheres [11].

For assessment of the unilateral molar ratio accordantly to II class, we use a quahtative analysis of EMG of 17 patients not on the basis of comparison of the left and right sides. For this purpose we use the basis of affiliation to the side with the distal (pathological) or of neutral (physiological) aspect ratio. The number of abnormal spikes in m. temporahs, on the side of pathological distal ratio was in average 13,91±3,16%. It was less: only 11,71±3,09% on the side with the physiological neutral ratio. The opposite picture was for m. masseter: on the side with a patho-

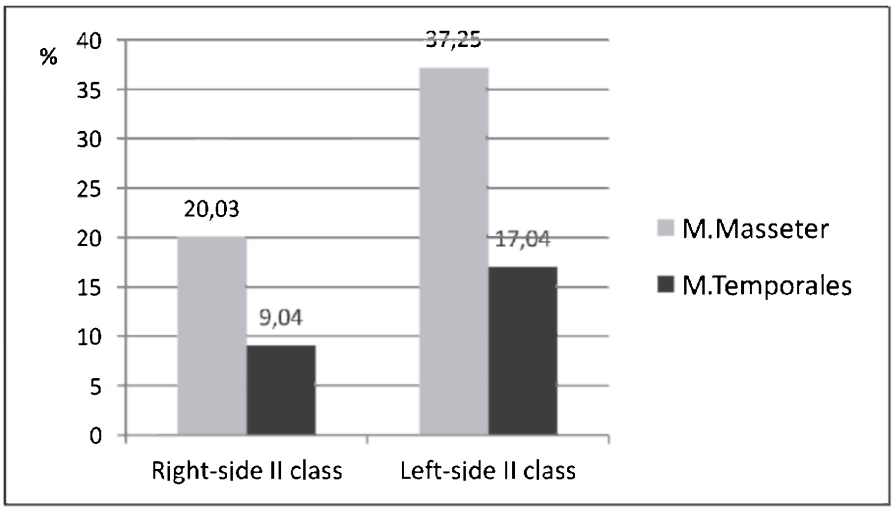

Fig. 2. the Number of abnormal spikes (%) in the class II subdivision right and subdivision left.

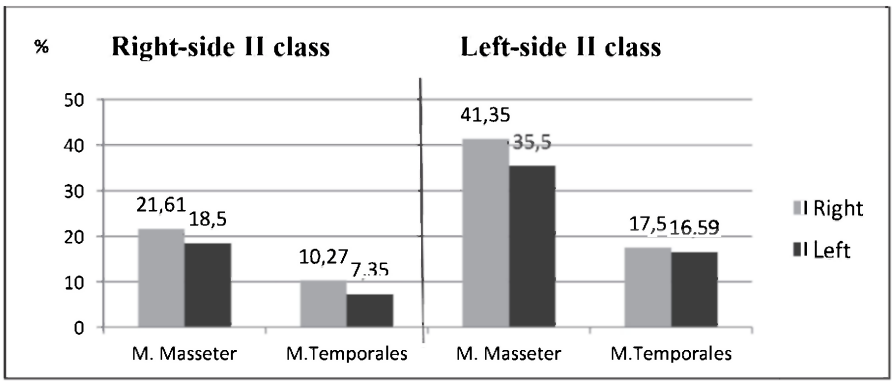

Fig. 3. Comparison of number of pathological spikes with taking in account distal and a neutral ratio in patients with class II subdivision right and subdivision left.

logical ratio the percentage of pathological spikes was 20,65±3,76%, and on the side with the physiological molar ratio it was 23,08±4,06%.

Thus, the number of abnormal spikes in m. temporales prevailed on the side with distal ratio, and m. masseter – on the contrary – on the side with a neutral (normal) ratio.

For taking of answering for question about presence of a functional difference between class II subdivision right and subdivision left it was realized analysis of the EMG with using of the principle of "distal-neutral" separately among patients with right-sided II class (9 patients) and left-sided II class (8 patients).

The total number of abnormal spikes in m. masseter in class II subdivision right was 20,03±4,3%, while for class II subdivision left such index was 37,25±6,05%. Thus in patients with II class subdivision left the number of abnormal spikes in m. masseter was higher with confidence 95% ($p<0,05$). In m. temporalis in patients with class II subdivision right quantity of pathological spikes was 9,04±2,31%, while for left class II subdivision left it was 17,04±4,72%. Thus in the left-side class II in m. temporales pathological spikes were found more often with accuracy of 80% ($p<0,2$) (Fig.2).

So, according to the qualitative assessment of the EMG, it was found statistically significant functional difference between class II subdivision right and subdivision left. It should taking in account presence of such distinctive feature for patients with class II subdivision left as more severe functional impairment, especially for m. masseter.

Based on the identified functional difference, we compared the number of abnormal spikes on the sides with a distal and a neutral ratio separately for right and left class II (Fig.3)

It was observed prevalence of number of pathological spikes in. masseter and m. temporales on the right side without dependence from side of distal ratio. It is logically for patients with right side II class. It is proved due to prevalence of number pathological spikes on the side of distal ratio in these patients. However, it is very difficult for analysis fact of prevalence of pathological spikes on the side of neutral (normal) ratio.

DISCUSSION

Thus, it is discovered that an asymmetrical forms of II class have some functional characteristics: the temporal type of chewing is typical also for bilateral distal occlusion. Functional dominance of m. temporales in comparison with m. masseter was confirmed after qualitative assessment of EMG: pathological spikes in m. masseter were appeared in 2 times more often than in m. temporales.

In patients with unilateral class II such characteristics as more expressive synchronicity of functional activity of m. temporales and tendency for displacement of the mandible in the direction of the side with neutral molar ratio.

In addition, it was discovered functional difference between class II subdivision right and subdivision left. This difference has statistical accuracy. Class II subdivision left is accompanied with more expressive functional disorders. It is known that during mastication of food is realized better on functional dominant side, i.e. in the right side [10,11]. That is why the right side perhaps due to its dominant status significance has better adaptation for disorder of first molars ratio. For class II subdivision left is not typical such facilitative adaptation.

CONCLUSION

In accordance with the functional condition of the masticatory muscles of class II subdivision is characterized with functional features of distal occlusion.

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