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ORTHOPEDIC TREATMENT FOR MASTICATORY MUSCLES PARAFUNCTION: EXPLANATION BASED ON CLINICAL AND FUNCTIONAL STUDY

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ABSTRACT — This study was conducted to investigate two clinical types of masticatory muscles parafunction: teeth compression and teeth grinding using clinical and functional methods. Teeth compression and teeth grinding were found to have a common tooth compression symptom. Our finding has been proven not only through clinical, yet via electromyographic and axiographic research methods as well. Based on the obtained data we developed a palatal plate-occlusal guard. It enables to fix reliably the lower jaw and reduces muscle tension. The proposed appliance helps prevent possible complications that occur in the course of orthopedic treatment.

KEYWORDS — masticatory muscles parafunction, electromyographic study, electronic axiography, palatal plate, occlusal guard.

INTRODUCTION

Implantation is an advanced method employed for selecting dental treatment when replacing missing teeth. Indications for the methods are expanding steadily. Certain pathological conditions affecting the patient's dental status may remain hidden and require a more detailed examination [12–16].

Such disorders include masticatory muscles parafunction. As reported by the WHO, the prevalence of this problem lies in a range from 10% to 27% for various age groups [1]. It is postulated that masticatory muscles parafunction represent a function, which is unconscious, impractical and related to neither chewing nor speech activities, and which manifests itself as spontaneous lower jaw movements and unnecessary teeth compression. Unidentified parafunction results in excessive load not only on the teeth, yet on the implants, too, thus contributing to further progress of serious complications [2, 7, 8, 10, 11]. The most common clinical parafunctions include teeth clenching and grinding of teeth (bruxism). These share the following symptoms: chewing muscles tension and spasm; habitual teeth clenching, which leads to their erasure and chipped enamel. As far as available literature is concerned, we failed to find sufficient information regarding the nature of teeth compression and grinding, their combined action and alternation. The available study outcomes that describe masticatory muscles bioelectric activity caused by surface electromyography, are largely contradictory and require further investigation. Patients suffering from respective symptoms are recommended to test their dental status and undergo a comprehensive examination [3–5, 17–19] followed by some special preliminary orthopedic measures [6, 9].

Aim of the study

was to improve effectiveness of orthopedic treatment offered for cases involving masticatory muscles parafunction, as well as its clinical and functional explanation.

MATERIALS AND METHODS

We examined 59 patients aged 28 through 65 years. The inclusion criteria were complaints of teeth grinding, teeth abrasion, masticatory muscles fatigue, and difficulty opening the mouth due to spasm in the masticatory muscles. The exclusion criterion was destructive disorders of temporomandibular joint (TMJ). The patients were divided into 2 groups subject according to the registered complaints: Group I — patients with the clinical type of *teeth compression* parafunction (23 persons); Group II — patients with the clinical form of *teeth grinding* parafunction (22 persons). The control group included persons with neither dental nor somatic pathology (14 persons), while it was compatible the major groups in terms of the age and gender criteria. The study involved clinical methods as well as comprehensive laboratory and instrumental research: model analysis in the Stratos 300 articulator (Ivoclar); electronic axiography (Arcus digma II, Kavo); masticatory muscles electromyography (Synapsis, Neurotech). The obtained data underwent statistical analysis using the SPSS 25 software package where the values of the arithmetic mean (M) and standard deviation (G) standard error (m) were calculated. The differences between the samples were evaluated through the Student's t-test and the Mann-Whitney-Wilcoxon U-test with the Pearson χ^2 test employed; the differences were considered statistically significant at a probability level of 95% ($p<0.05$).

RESULTS AND DISCUSSION

Table 1 offers the outcomes of the clinical examination.

No statistically significant differences were identified between the groups based on the χ^2 criterion.

The tension and pain index of the masticatory muscles in Group I was 2.12±0.03, in Group II — 2.67±0.01. The tension and pain index of the temporal muscle was 1.53±0.06 and 1.77±0.03, respectively.

Table 1. Clinical examination, prior to the treatment

Symptoms	Group 1; n=23		Group 2; n=22	
	Males, n=14	Females, n=9	Males, n=15	Females, n=7
Masticatory muscles spasm	14	9	15	7
Teeth grinding	5	1	15	7
Pain in masticatory muscles	14	8	15	7
Masticatory muscles fatigue	14	9	15	7
Deviation, deflection	3	2	15	7
Super-contact	12	8	15	7
Disturbed mouth opening	4	2	15	7
Reducing height of the lower face	11	6	15	7

The values of the masticatory muscle stress index in Group II proved to exceed that of Group II by 8.4%, which could be due to the fact that the patients of Group I featured no nocturnal teeth compression. The temporal muscle tension index of Groups I and II differed slightly, yet but if matched against the masticatory muscle itself, then the difference with Group I was 72.2%, and Group II — 66.3%, which reveals a stronger tension the masticatory muscle had to experience.

Table 2 offers a view at the electromyography outcomes.

As can be seen from the table, almost all EMG indicators featured statistically significant differences in Groups I and II (except for Sc Td/Ts, Sc Md/Ms). This is also true for the angular parameters of the sagittal joint path, but not for the incisal point trajectory between Groups I and II.

Treating masticatory muscles parafunction is one of the most challenging issues since the disease is associated with a disturbed function of the neuromuscular complex. To relax the masticatory muscles, we developed a special palatal plate-occlusal guard (RF patent for utility model # 182370 of 15/08/2018). The palatal plate is to be installed on the upper jaw, and is made from a rigid base plastic with occlusal patches all over the upper and lower dentition, and tooth prints on the occlusal surface. The vestibular side of the mouthpiece bears pelottes that overlap the upper and lower jaw teeth to the equator level. At the same time, it implies separation of dentition up to 3.5 mm. Then, additionally, an elastic sandwich-shaped piece of plastic is applied to the occlusal surface of the plate, facing the lower jaw teeth and pelottes. That serves as a soft pad, whereas the dentition separation is to be up to 8.0 mm already. The soft pad acts as a shock absorber in case there is teeth compression.

Following the treatment, the differences between Groups I and II were almost gone. There were some statistical differences to remain for Td A and for Ts A (μV) only. Other electromyography and axiography values featured basically no difference from the statistical point of view ($p>0.05$). Both groups' values approached those of the control group.

CONCLUSION

The clinical and functional methods employed for studying the masticatory muscles parafunction revealed the predominance of the masticatory muscles indicators compared to the temporal muscles, which was observed through a lower value of the K coefficient. The proposed palatal plate-occlusal guard causes a positive effect by relieving tension in the masticatory muscles and fixing reliably the lower jaw over the treatment period, thus, shortening the length of treatment.

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***Table 2.** EMG and electronic axiography values at maximum jaw compression in case of conventional occlusion, prior to treatment*

EMG values	Group I, n=23	Group II, n=20	Control group n=14	p1-2	p1-к	p2-к
Td A (μV)	679.6±61.2	618.4±59.4	477.4±45.7	0.001	<0.001	<0.001
Ts A (μV)	664.8±63.4	601.2±57.3	465.1±41.9	0.001	<0.001	<0.001
Md A (μV)	698.4±67.2	641.3±63.7	513.7±47.4	0.006	<0.001	<0.001
Ms A (μV)	702.7±69.8	638.9±62.9	486.6±44.8	0.002	<0.001	<0.001
Sc Td/Ts	0.72 ±0.1	0.68 ±0.2	0.98 ±0.2	0.398	<0.001	<0.001
Sc Md/Ms	0.67 ±0.2	0.64 ±0.1	0.95 ±0.2	0.531	<0.001	<0.001
Sc Td/Md	0.74 ±0.2	0.61 ±0.1	0.89 ±0.2	0.009	0.016	<0.001
Sc Ts/Ms	0.76 ±0.1	0.63 ±0.2	0.91 ±0.1	0.008	<0.001	<0.001
Sagittal path angle, right	49.5±4.6	52.4±4.9	43.2±3.3	0.047	<0.001	<0.001
Sagittal path angle, left	50.0±4.8	53.8±5.1	44.1±3.6	0.014	<0.001	<0.001
Incisal point trajectory	30.6±2.5	31.2±2.5	40.2±3.1	0.425	<0.001	<0.001

***Note:** Td – right temporal muscle; Ts — left temporal muscle; Md — right proper masticatory muscle; Ms — left proper masticatory muscle; Sc — symmetry coefficient.*

***Table 3.** EMG and electronic axiography values at maximum jaw compression in case of conventional occlusion, after treatment*

EMG values	Group I, n=23	Group II, n=20	Control group n=14	p1-2	p1-к	p2-к
Td A (μV)	550,3±51,6	513,6±48,5	477,4±45,7	0,018	<0,001	0,014
Ts A (μV)	537,2±50,8	504,9±47,9	465,1±41,9	0,034	<0,001	0,005
Md A (μV)	589,2±53,3	561,2±52,2	513,7±47,4	0,082	<0,001	0,003
Ms A (μV)	594,1±53,9	571,1±52,9	486,6±44,8	0,156	<0,001	<0,001
Sc Td/Ts	0,89 ±0,2	0,87 ±0,1	0,98 ±0,2	0,676	0,139	0,023
Sc Md/Ms	0,84 ±0,2	0,83 ±0,2	0,95 ±0,2	0,868	0,072	0,051
Sc Td/Md	0,81 ±0,1	0,79 ±0,1	0,89 ±0,2	0,506	0,095	0,038
Sc Ts/Ms	0,82 ±0,2	0,90 ±0,2	0,91 ±0,1	0,187	0,065	0,834
Sagittal path angle, right	45,6±3,9	47,8±4,7	43,2±3,3	0,094	0,031	<0,001
Sagittal path angle, left	46,1±4,3	48,3±3,1	44,1±3,6	0,056	0,099	<0,001
Incisal point trajectory	39,3±3,0	38,8±2,9	40,2±3,1	0,573	0,328	0,125

***Note:** Td — right temporal muscle; Ts — left temporal muscle; Md — right proper masticatory muscle; Ms — left proper masticatory muscle; Sc — symmetry coefficient.*

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