ANALYSIS OF ELECTROMYOGRAPHIC INDEXES OF TEMPORAL AND MASTICATORY MUSCLES IN PATIENTS WITH DISTAL OCCLUSION COMPLICATED BY DENTAL CROWDING

ANALIZA ELEKTROMIOGRAFICZNYCH WSKAŹNIKÓW MIĘŚNI SKRONIOWYCH I MIĘŚNI ŻWACZY U CHORYCH Z TYŁOZGRYZEM POWIKŁANYM STŁOCZENIEM ZĘBÓW

Maryna I. Dmytrenko

DEPARTMENT OF ORTHODONTICS, HIGHER STATE EDUCATIONAL ESTABLISHMENT OF UKRAINE, "UKRAINIAN MEDICAL STOMATOLOGICAL ACADEMY", POLTAVA, UKRAINE

ABSTRACT

Introduction: Rate of distal occlusion (up to 40%) and dental crowding (up to 65%) is the largest in the structure of orthodontic pathology.

The aim of the study was to investigate bioelectrical activity of temporal and masticatory muscles and to set parameters of electromyographic indexes in patients with distal occlusion and dental crowding in permanent occlusion.

Materials and methods: Bioelectrical activity of temporal and masticatory muscles in 11 patients aged 16-24 years was determined before orthodontic treatment. Distal occlusion complicated by severe degree of dental crowding was revealed in this group of patients. These patients comprised the treatment group. The control group consisted of 10 subjects (mean age $21,3 \pm 1,25$ years) with physiological occlusion.

Results: It was found that functional state of temporal and masticatory muscles in patients with distal occlusion complicated by dental crowding changes during permanent dentition. It was determined that in clenching state, according to ACTIV index, temporal muscles are more active, due to the lack of activity of masticatory muscles (ACTIV =-20,73% \pm 8,01%). Moreover it is worthy of notice, that functional muscle symmetry (index SIM_{TA/MM}) at rest in presence of distal occlusion is lower than in subjects with physiological occlusion (p <0,05).

Conclusions: According to index ACTIV_{TA/MM} it was established the dominance of temporal muscle activity due to lack of activity of masticatory muscles in patients with distal occlusion complicated by dental crowding and it was determined lower overall muscle symmetry index than in individuals with physiological occlusion.

KEY WORDS: Dental crowding, electromyographic activity, temporal muscles, masticatory muscles.

Wiad Lek 2018, 71, 2 cz. II, 295-298

INTRODUCTION

Frequency of abnormal occlusion during mixed dentition is 79,96% and during permanent dentition is 84,33% [1]. It was established that rate of distal occlusion (up to 40%) and dental crowding (up to 65%) are the largest in the structure of dental pathology [1]. Interralation between electromyographic (EMG) activity of masticatory muscles and morphological disorders contributes to understanding of etiology and pathogenesis of malocclusion and provides the development of rational methods of treatment [2, 3]. However, there is not enough data in literature about the importance of violations of bioelectrical activity of masticatory and temporal muscles in diagnostic process and complex treatment of patients with distal occlusion complicated by dental crowding in permanent occlusion.

THE AIM

The aim of the study is to investigate bioelectrical activity of masticatory and temporal muscles and to set parameters of

electromyographic indexes in patients with distal occlusion complicated by dental crowding in permanent occlusion.

MATERIALS AND METHODS

Bioelectrical activity of temporal and masticatory muscles in 11 patients aged 16-24 years was determined before orthodontic treatment. Distal occlusion complicated by severe degree of dental crowding was revealed in this group of patients. These patients comprised the treatment group (I). The control group (II) consisted of 10 subjects (mean age $21,3 \pm 1,25$ years) with physiological occlusion.

Electromyographic (EMG) activity during the first 5 seconds in state of physiological rest and during performing functional test: maximum voluntary clenching of teeth in habitual occlusion (5 s), was recorded. The average values of oscillation amplitude (microwaves) of muscles biopotentials (BP) on both sides were determined. Quantitative analysis calculated EMG-indixes [4]: asymmetry index of symmetric muscles, separately for temporal (ASIM_{TA}, %) and masticatory muscles (ASIM_{MM}, %) as well as overall index (ASIM_{TA/MM},

Muscle	Group	
	I	II
	Distal occlusion with dental crowding	Physiological occlusion
	During rest position	
ТА		
right	33,75 ± 3,17	26,87 ± 3,24
left	25,76± 4,13	26,38 ± 3,17
average	29,75± 2,44	26,63 ± 2,89
ММ		
right	23,09± 3,79	20,28 ± 3,59
left	21,54±3,03	20,03 ± 3,27
average	22,32± 2,51	20,15 ± 3,00
	During clenching	
ТА		
right	680,60 ± 118,26*	750 ± 93,13
left	622,42± 100,05	653,41 ± 67,61
average	651,51±97,50	701,89 ± 71,29
MM		
right	346,63± 35,16	510,01 ± 67,67
left	466,54± 78,27	557,89 ± 68,27
average	406,58± 51,82	533,95 ± 64,26

Table I. Average values $(M \pm m)$ and variation coefficient (Cv) of BP oscillation amplitude (microwave) of temporal (TA) and masticatory (MM) muscles in experimental groups

Note:*Significant difference between the indices of the I and II groups at P<0,05.

When comparing the asymmetry index (ASIM) in state of relative physiological rest balance upset of right and left muscles was observed: great activity of temporal muscle was observed more often (high ASIM TA index) on

the right side, and activity of masticatory muscles on the left side (low ASIM MM index) (Table II).

%.) Muscles activity index (ACTIV,%) and torsion coefficient (TORS,%) were calculated too. Absolute value of indicators of asymmetry, module of indicators (MASIM) were determined. With regard to them indicators of symmetry were calculated by the following formula: symmetry index (SIM,%) = 100 - absolute value of asymmetry index (MASIM, %). Finding obtained in the study were processed by mathematical statistics methods.

RESULTS AND DISCUSSION

Results of oscillation amplitude (microwave) of investigated muscles biopotentials (BP) are given in Table I. In assessing amplitude of BP of temporal and masticatory muscles in state of relative physiological rest no statistically significant difference in groups was found (p > 0,05).

Analysis of oscillation amplitude of muscles BP in clenching also showed that there is no statistically significant difference in EMG activity of temporal muscles in both groups. Meanwhile, average BP of masticatory muscles in patients with distal occlusion and dental crowding were lower compared to the control group.

In subjects with physiological occlusion overall asymmetry index was the lowest (ASIM $_{TA/MM}$ = 1,01% ± 3,92%), that is temporal and masticatory muscles functioned more symmetrically than in patients with orthodontic pathology (p> 0,05).

It was established that in patients with distal occlusion complicated by dental crowding, parameters of functional muscle symmetry were low (SIM $_{TA/MM}$ = 78,54% ± 4,24%). It is statistically proven that index SIM $_{TA/MM}$ in patients of the main group in state of physiological rest was significantly lower (p <0,05), than in the control group.

When comparing index of muscles activity (ACTIV, %) in experimental groups it was determined higher temporal muscle activity (negative ACTIV % index), it was (ACTIV) = $-20,73\% \pm 8,01\%$) particularly in patients with distal occlusion.

	Group		
Index, %	I	II	
	Distal occlusion complicated by dental crowding	Physiological occlusion	
During rest position			
ASIM _{TA}	15,29± 8,59	5,39 ± 5,41	
MASIM _{TA}	27,05± 4,90*	15,32 ± 2,53	
MSIM _{TA}	72,95± 4,90*	90,52± 3,00	
ASIM _{MM}	3,00± 8,67	-4,47 ± 4,76	
MASIM _{MM}	24,49±4,00	12,02 ± 2,97	
SIM MM	75,51± 4,00	87,98 ± 2,97	
ASIM	11,54± 6,18*	1,01 ± 3,92	
MASIM	19,99±3,40	11,15 ± 1,28	
SIM	80,01±3,40*	88,85 ± 1,28	
ACTIV	-15,42±6,26	-14,13 ± 2,06	
TORS	11,54± 6,18	5,18 ± 3,47	
During clenching			
ASIM	3,66± 6,30	5,39 ± 5,41	
MASIM _{TA}	16,26± 3,82	15,32 ± 2,53	
SIM	83,74± 3,82	84,68 ± 2,53	
ASIM	-7,63 ± 7,63	-4,47 ± 4,76	
MASIM _{MM}	21,46± 4,24	12,02 ± 2,97	
SIM _{MM}	78,54± 4,24	87,98 ± 2,97	
ASIM	-2,23±4,90	1,01 ± 3,92	
MASIM	13,80±2,33	11,15 ± 1,28	
SIM _{TA/MM}	86,20±2,33	88,85 ± 1,28	
ACTIV	-20,73± 8,01	-14,13 ± 2,06	
TORS	2,04 ± 5,23	5,18 ± 3,47	

Table II. EMG indices of temporal (TA) and masticatory muscles (MM) in groups ($M \pm m$)

Note: * – Significant difference between the indixes of the I and II groups at P<0,05.

In evaluating the torsion coefficient (TORS, %) in experimental groups its positive values were determined. It denotes excitation what attempts to reject the lower jaw to the right.

A number of current researches [5, 6] identified similar deviations in functional state of masticatory muscles in patients with distal occlusion during temporal dentition. It manifested in damping of BP of masticatory muscles in clenching and spontaneous muscles activity in state physiological rest; temporal muscles predominant influence on the formation of occlusion.

CONCLUSIONS

Therefore, the investigation has indicated that functional state of temporal and masticatory muscles in patients with distal occlusion complicated by dental crowding changes during permanent occlusion. It was found that in clenching according to index ACTIV temporal muscles are more active, due to the insufficient activity of masticatory muscles. It is noteworthy that functional muscle symmetry (SIM _{TA/MM} index) during rest in patients with distal occlusion was significantly lower than in those with physiological occlusion.

The results of the investigation give grounds to assert that during orthodontic treatment of patients with distal occlusion complicated by dental crowding in permanent dentition it is necessary to use complex techniques, ie orthodontic appliance therapy should be accompanied by massage and mio-gymnastics to improve functional state of temporal and masticatory muscles.

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ADDRESS FOR CORRESPONDENCE Maryna I. Dmytrenko

Department of Orthodontics Higher State Educational Establishment of Ukraine "Ukrainian Medical Stomatological Academy" Shevhenko str. 23, 36011, Poltava, Ukraine tel: +380506324055 e-mail: dmitrenko25@ukr.net

Received: 28.10.2017 Accepted: 03.04.2018