

Results of complex rehabilitation patients with temporomandibular joint disease and parafunction of masticatory muscles

Roman Fadeyev¹, Vasily Parshin²

SUMMARY

Objective. Definition of the effective and appropriate essential use of myogymnastic exercises and orthopedic methods of posture correction in the complex rehabilitation of patients with TMJ pathology and parafunction of the masticatory muscles.

Methods. In the study, 63 patients (11 men and 52 women) aged from 20 to 67, with the middle age 31 ± 2.3 were treated, 43 of them had TMJ disease. In 51 patients, parafunctions of masticatory muscles were diagnosed. The treatment was carried out with the help of uncoupling the dentition rows of the splint, made after the TENS-therapy; used medicamentation treatment, using an individual plan for myogymnastic exercises and individual insoles for correction the posture.

Results. Total effectiveness of the treatment is shown as the average of the findings. Analysis of treatment dynamics was due to only those data the results of which after treatment in the control and main groups were different. Treatment effectiveness of the main group in comparison with the control one is as follows – periodontal vessels dopplerography – 16.22%, tonus of the right chewing muscle – 11.45%, right temporal muscle tone – 4.8%, the number of hours per a day in case of increased tone of the chewing muscles – 12.9%, mouth opening amplitude – 17.1%. Thus, total treatment effectiveness in the main group was $12.49 \pm 2.18\%$ higher than in the control group.

Conclusions. Results of complex rehabilitation, including myorelaxation procedures, medicamentation treatment, splint therapy, an individual plan of myogymnastic exercises for chewing muscles, and correction of posture using individual insoles showed its effectiveness more than $12.49 \pm 2.18\%$ in comparison with traditional methods of treatment.

Key words: complex rehabilitation, TMJ diseases, myogymnastic exercises.

INTRODUCTION

TMJ pathology treatment is a complex problem, to solve it must not only dentists, but also psychologists, neurologists, therapeutics and physicians of other specialties (1, 9).

Treatment of TMJ and masticatory muscles is divided into symptomatic (removing the symptoms

of the disease), etiological (removing the cause of the disease), pathogenetic (selective polishing, restoration of occlusion with orthopedic, orthodontic and surgical methods) (3, 8, 11).

The first task of the treatment is the removal of pain syndrome (6, 7, 13). Three main methods are used: medicamentation, physiotherapy, orthopedic (splint therapy).

Above-mentioned methods of TMJ pathology treatment are described in studies of many authors (2, 4, 5, 14). Besides, at the initial stage of treatment in a number of cases it is advisable to use methods of psychotherapy, autogenic training, the use of biological feedback, etc. (12, 10). However, the problem of patient's rehabilitation together with physiotherapists is not studied enough.

Objectives. The proof of the complex rehabilitation effectiveness for patients with TMJ pathology

¹Department of Orthopedic Dentistry, North-Western State University named after I. I. Mechnikov, St. Petersburg, Russia

²Department of Aesthetic Dentistry, Research Institute of Dentistry and Maxillofacial Surgery, Pavlov First Saint Petersburg State Medical University, St. Petersburg, Russia

Address correspondence to Vasily Parshin, Department of Aesthetic Dentistry, Research Institute of Dentistry and Maxillofacial Surgery, Pavlov First Saint Petersburg State Medical University, Petrogradskaya quay, house 44, St. Petersburg 197101, Russia.

E-mail address: vasily-v-parshin@yandex.ru

and parafunction of masticatory muscles with the use of traditional methods of treatment and physiotherapy.

METHODS

In the study, 63 patients (11 men and 52 women) aged from 20 to 67 with the middle age 31 ± 2.3 were treated, 43 of them had TMJ disease. In 51 patients were diagnosed masticatory muscles parafunction.

All patients were taken the following parameters:

- Quality findings: pain in the masticatory muscles before and after treatment, an increased tone of the masticatory muscles before and after treatment, fatigue of the masticatory muscles before and after treatment, a decreased tone of the masticatory muscles before and after treatment.
- Quantity parameters: pain degree assessment of the masticatory muscles in points before and after treatment, the time of increased tone in masticatory muscles before and after treatment from the patient's words (hours per day), assessment of eating discomfort before and after treatment, assessment of the anxiety for the disease outcome before and after treatment, measuring the amplitude of mouth opening before and after treatment (mm), periodontal dopplerography data before and after treatment (see/sec).

Depending on the method of treatment, patients were divided into 2 groups (main, control). Treatment of patients in the main group (32 patients: 25 women (78.13%) and 7 men (21.87%), with middle age 31 ± 2.3 years) was conducted with the help of the splint dentition made after TENS therapy. To relax the masticatory muscles, medication treatment was also used (Mydocalm 100 mg 3 times a day for 3 weeks). In addition to the treatment methods described above, the patients of the main group were given individual plan with myogymnic exercises and individual insoles of Formtotix for correcting the posture.

Treatment of patients in the control group (31 patients: 27 women 87.1% and 4 men 12.9%, with middle age 31 ± 2.3 years) was conducted only with the help of the dentition line of the kappa made after TENS therapy. To relax the masticatory muscles, medication treatment was also used (Miodocalm 100 mg 3 times a day for 3 weeks).

From patients of the control group, the disease of the TMJ was diagnosed in 23 patients (74.2%), it

was not diagnosed in 8 patients (25, 8%); parafunctions of the masticatory muscles were revealed in 22 persons (70.1%), in 9 patients (29%) they were absent.

From patients of the main group, the disease of the TMJ was diagnosed in 20 persons (62.5%), it was not diagnosed in 12 people (37.5%), chewing muscle parafunction was diagnosed in 29 persons (90.63%), it was not diagnosed in 3 people (9.37%).

For the calculation of the data, a personal computer with Statistic 7.0 software of Stat Soft Inc. and Microsoft Office Excel in the MS Windows environment was used. Differences in the findings were considered significant at the level of $p < 0.05$.

For quantity data, the normal findings was verified using the Shapiro-Wilks test. To assess the dynamics of categorical data, the McNamara criterion was used. To compare the effectiveness of treatment methods (in groups) the Mann-Whitney test was used (in case of 2 groups).

Dynamics of data was observed using the Wilcoxon test. Dynamics was studied in each group separately. To estimate the interrelation of quantitative variables, the nonparametric Spearman correlation coefficient was calculated.

RESULTS

The results of complex treatment showed high effectiveness of this complex rehabilitation method in patients with TMJ pathology and parafunction of masticatory muscles.

Comparative analysis of the dynamics based on the findings in the control and main groups after treatment.

The dynamic analysis was carried out using only those findings, the results of which after treatment differed in the control and main groups. The results of the rest findings: decreased tonus of the chewing muscles, fatigue of the masticatory muscles, anxiety for the disease outcome of the after the treatment did not differ in the control group from the main one, after the treatment the patients had no complaints according to these findings.

As the analysis showed, in both groups there was a positive, highly significant dynamics in all the parameters studied.

To assess the dynamics of qualitative parameters, the Mac-Nemar criterion was used (Table 1). To assess the dynamics of quantitative parameters, the Wilcoxon test was used (Table 2).

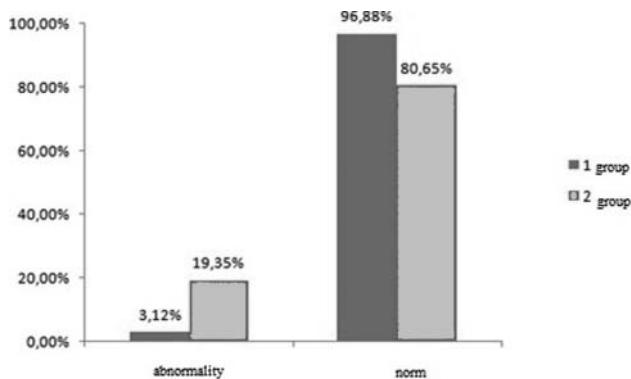


Fig. 1. Analysis of dopplerography parameters of periodontal vessels after treatment

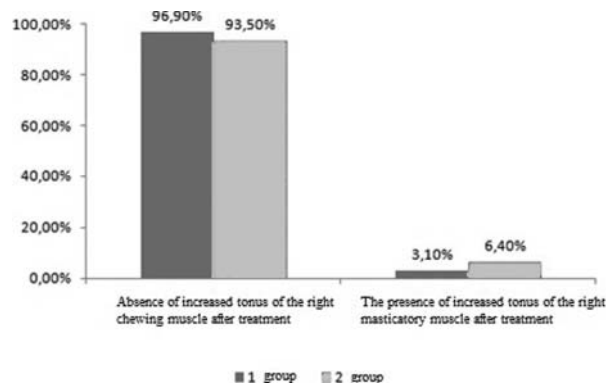


Fig. 2. Analysis of the state of the right chewing muscle tone after treatment in the main (group 1) and control (group 2) group

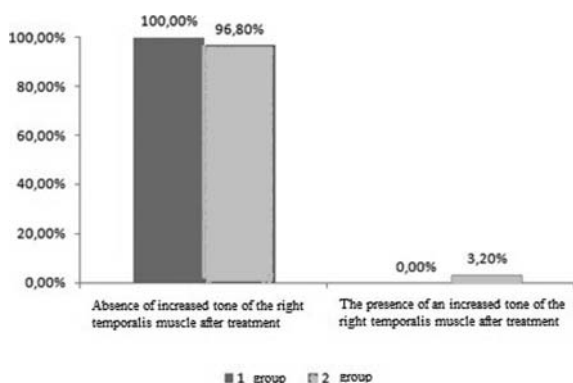


Fig. 3. Analysis of the state of the right temporal muscle tone after treatment in the main (group 1) and control (group 2) group

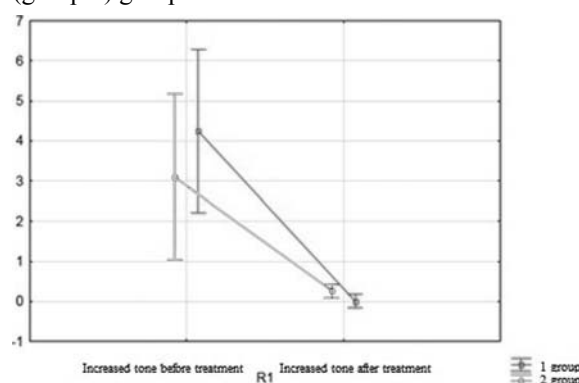


Fig. 4. Dynamics of the parameter in the presence of increased tonus of masticatory muscles (the number of hours per a day) after treatment

Evaluation of individual parameters effectiveness, the results of which differed in the control group from the main one after the treatment

To define the effectiveness of the treatment, a formula was taken into account to define the dynamics of changes in parameters during the treatment.

Table 1. Evaluation of the dynamics of qualitative parameters of the study

Parameters	Group number 1 (main)			Level of significance (P) of group 1	Group number 2 (control)		
	Frequencies before treatment	Frequencies after treatment			Frequencies before treatment	Frequencies after treatment	Level of significance (P) of group 2
Increased chew tone m. on the right	no	16 (50%)	32 (100%)	p=0.0069	13 (41.9%)	29 (93.6%)	p=0.0098
	yes	16 (50%)	0 (0%)		18 (58%)	2 (6.4%)	
Increased tone of the temporal m. on the right	no	27 (84.38%)	32 (100%)	p<0.00001	22 (71%)	30 (96.77%)	p=0.00001
	yes	5 (15.63%)	0 (0%)		9 (29%)	1 (3.23%)	

Table 2. Evaluation of the dynamics of quantitative parameters of the study

Parameters	Median of 1 group (main) before treatment	Median of 1 group (primary) after treatment	Level of significance (P) of 1 group (main)	Median of 2 group (control) before treatment	Median of group 2 (control) after treatment	Level of significance (P) of 2 group (control)
Increased chew tone m. (hours per day)	4 (0; 4)	0 (0; 0)	p=0.0001	0 (0; 4)	0 (0; 0)	p=0.004
The amplitude of opening the mouth	3 (1; 5)	1(1; 1)	p=0.00006	3 (1; 3)	1(1; 1)	p=0.0001
Number of points	26.5 (19; 40)	11(11; 11)	p=0.000001	22 (16; 32)	11(11; 13)	p=0.000001
Indicators dopplerography of periodontal vessels	9.1 (4.75; 10.3)	6.3 (6.1; 7.25)	p=0.0032	9.1(4.7; 10.3)	6.2 (5.8; 7.3)	p=0.0019

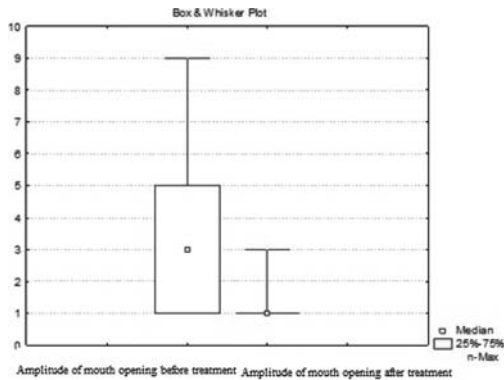


Fig. 5. Diagram of the range for the parameter of the mouth opening amplitude for all patients as a whole

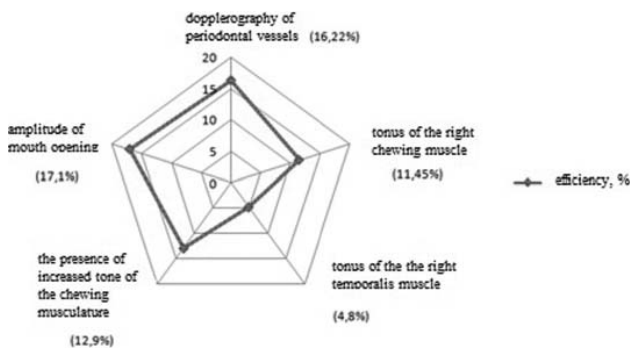


Fig. 7. Overall effectiveness of treatment

$$Z = X(X_2 - X_1) - Y(Y_2 - Y_1)$$

X – percentage of cured patients in the main group after treatment

Y – percentage of cured patients in the control group after treatment

X₁ – percentage of patients in the main group with symptoms of disease before treatment

X₂ – percentage of patients in the main group with symptoms after treatment

Y₁ – percentage of patients in the control group with symptoms of disease before treatment

Y₂ – percentage of patients in the control group with symptoms of diseases after treatment

Z – treatment Effectiveness Index

Evaluation of periodontal vessels dopplerography after treatment in the control and main groups

According to the results of the control group ex-

Table 3. Parameters for which the overall effectiveness of treatment was determined

Indicators.	The effectiveness of treatment in the main group compared with the control (%).
periodontal vessels dopplerography	16.22
tonus of the right chewing muscle	11.45
the tone of the right temporalis muscle	4.8
the number of hours per day of having an increased tonus of chewing muscles	12.9
mouth opening amplitude	17.1

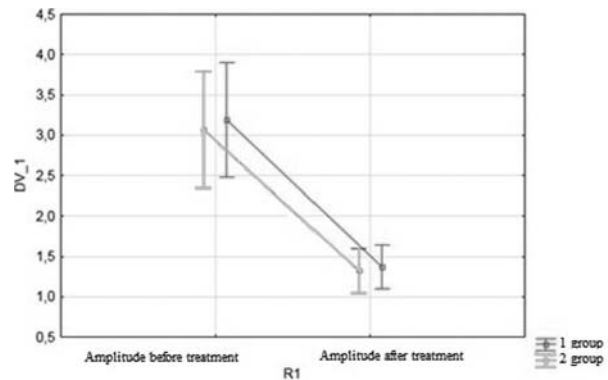


Fig. 6. Analysis of the mouth opening amplitude in the dynamics before and after treatment

amination, the normal signs of the maximum systolic (V1) velocity of the periodontal blood vessels were determined from 5 to 8 cm/sec. For the analysis, a new variable was introduced – the results of the periodontal vessels dopplerography: 0 – abnormal indicator, 1 – normal.

Before treatment, the groups were the same and all indicators were abnormal.

According to the parameters of the periodontal dopplerography in the periodontal vessels before and after treatment in the control and main groups, it was found that there was a tendency for differentiation of the groups (an exact two-sided Fisher test p=0.053). In patients of the control group, the parameters of periodontal vessels dopplerography after treatment were more abnormal. In the control group, in 6 of 31 patients (19.35%), abnormality of the periodontal vessels dopplerography remained the same till the end of the treatment. In the main group only in 1 of 32 patients (3.13%) the parameters of periodontal vessels dopplerography remained abnormal (Fig. 1).

Both in the control group and in the main one there was a significant dynamics of normal periodontal vessels dopplerography after treatment, but in the main group, it was 16.22% better than in the control group. Thus, the treatment of patients in the main group proved to be more effective than in the control group.

Assessment of the masticatory muscle tone on the right side after treatment in the control and main group

In 12 persons (38.7%) of 31 patients of the control

group the pain in the chewing muscles on the right side before the treatment was found. In the main group the pain in the chewing muscles on the right side before the treatment was found in 15 of 32 patients (46.9%).

Before treatment, the groups were identical, p=1 by the Fisher criterion.



Fig. 8. Clinical photographs of the dental rows of the patient G., 26 years old

After treatment, the symptoms remained the same in 2 of 31 patients in the control group (6.45%); in 1 of 32 patients in the main group, the symptoms remained (3.12%) (Figure 2).

Both in the control group and in the main group, there was a significant dynamics in reducing symptoms of increased muscle tone on the right side after the treatment, but in the main group, it was 11.45% more than in the control group. Thus, the treatment of patients in the main group proved to be more effective than in the control group.

Evaluation of the temporal muscle tone on the right side after treatment in the control and main groups

In patients of the control group, the increased tone of the temporal muscle on the right side before treatment was diagnosed in 9 patients (29%). In patients of the main group, the increased tone of the temporal muscle on the right side before treatment was diagnosed in 5 patients (15.6%). Groups before the treatment were identical concerning the right temporal muscle tone ($p=0.37$, criterion CI-square).

After the treatment, in one patient of the control group, the symptoms of the increased tone of the temporal muscle on the right side remained. Patients of the main group of symptoms of increased tonus of the temporal muscle on the right were not diagnosed (Figure 3).

After treatment, both in the control group and in the main group, there was a significant dynamics of decrease in symptoms of increased tone of

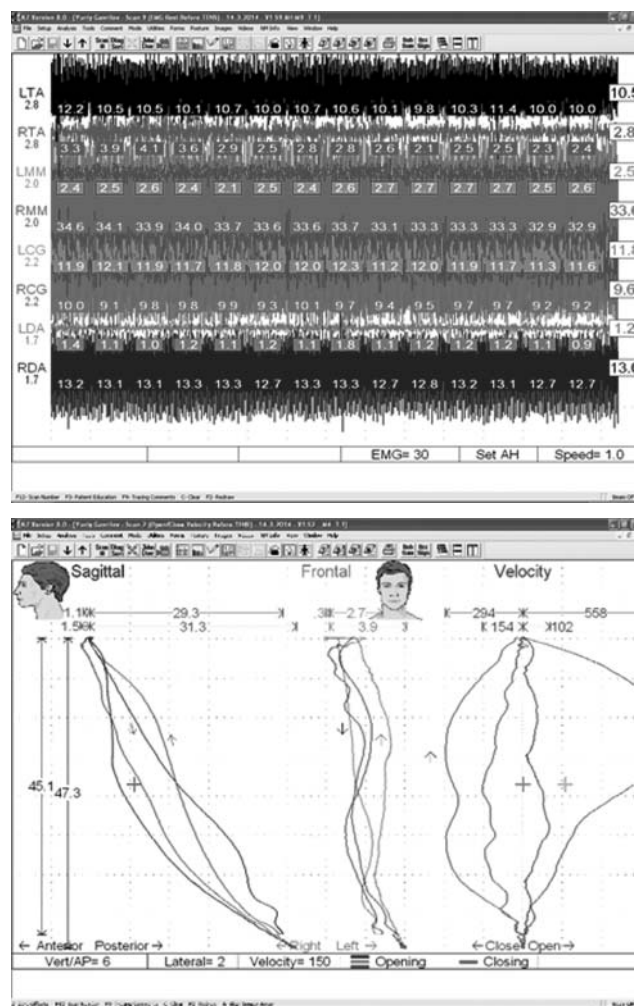


Fig. 9. The electromyography of the masticatory muscles and lower jaw kinesiology before the TENS-therapy

the temporal muscle on the rights, but in the main group, it was 4.8% more. So the treatment of patients in the main group was more effective than in the control one.

Evaluation of the treatment quality performed according to the parameter of the number of hours per a day at presence of increased tonus of the chewing musculature in the control group and the main group after treatment

Before treatment the groups according to the presence of increased tone of the chewing muscles (the number of hours per a day) did not significantly differ ($p=0.09$, the Mann-Whitney test).

After treatment, the groups did not differ significantly either ($p=0.38$, Manna-Whitney). In both groups, there was a significant decrease of the measured parameter. Patients of the main group had no complaints of the increased tone of the masticatory muscles after treatment. In the control group, 4 patients had complaints of increased tone after treatment. Thus, the parameter of increased tonus

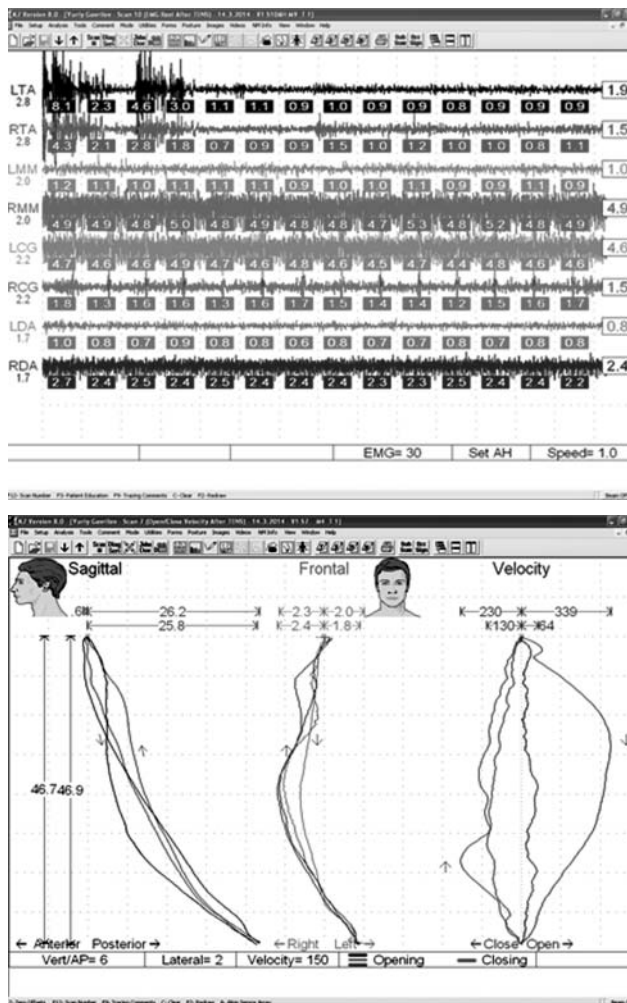


Fig. 10. The electromyography of the masticatory muscles and mandible kinesiography after TENS-therapy

of masticatory muscles was 12.9% according to the formula.

To assess the effectiveness of the treatment, the parameter of increased tonus in the chewing muscles after treatment was also demonstrated in the form of a categorical variable (Figure 4).

Evaluation of the mouth opening amplitude before and after treatment

The parameter of the mouth opening amplitude in both groups (according to the doctor's assessment) were homogeneous before the treatment ($p=0.58$, the Mann-Whitney test), and the groups did not differ significantly after treatment either ($p=0.78$, Mann-Whitney test). To assess the dynamics of the parameter, the Wilcoxon test was used, which showed of significant parameter dynamics in each group.

Figure 5 shows the swing diagram for the amplitude parameter of mouth opening for all patients.

After treatment in three patients of the control group, the amplitude of mouth opening remained 36-40 mm, in patients of the main group the amplitude



Fig. 11. Fix position of the lower jaw



Fig. 12. Splint fixed to the lower jaw

of mouth opening was more than 40 mm.

Both in the control group and in the main group there was a significant dynamics in normalization of the amplitude of mouth opening after treatment, but in the main group, it was 17.1% higher than in the control group, that proved more effective of treatment in the control group (Figure 6).

Total effectiveness of treatment

The overall effectiveness of treatment was defined as the average of the indications and was 12.49 ± 2.18 (Table 3, Figure 7).

DISCUSSION

A complex clinical picture of TMJ manifestations and parafunction of masticatory muscles, multifactoriality of their causes induced the development of a new direction of the complex approach in the treatment of patients with this pathology (1, 5, 7). To solve the problem of clinical evaluation of the effectiveness of myogymnic exercises and individual insoles for posture correction in the complex treatment of patients with TMJ pathology and parafunction of the masticatory muscles, a formula was used to calculate the total treatment effect. The overall effectiveness of treatment was defined as the average of the individual indicators. More effective treatment in the main group according to the data of periodontal vessels dopplerography results – 6.22%, by the tonus of the chewing muscle on the rights – 11.45%, by the temporal muscle tone on the

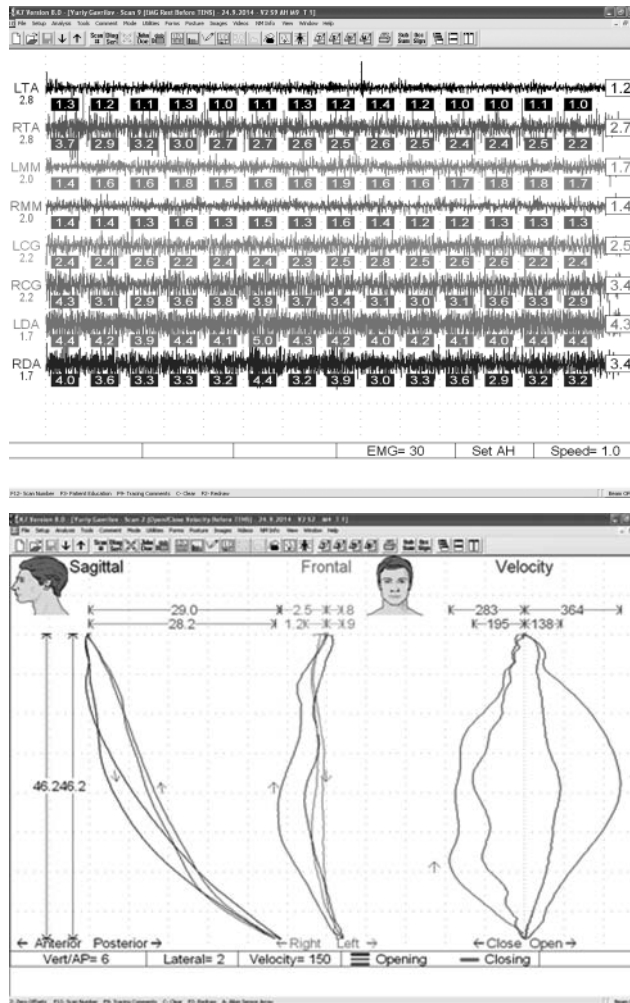


Fig. 13. Indicators of repeated diagnostic studies

right – 4.8%, by the number of hours per a day with the increased tone of the chewing muscles – 12.9%, by terms of the mouth opening amplitude – 17.1%. Thus, the total effect of the treatment in the main group was $12.49 \pm 2.18\%$ higher than in the control group.

CLINICAL CASE

Patient P., aged of 26 was admitted to the clinic of the Research Institute of Dentistry and FGP PSPbGMU

Complaints: headache, sleeplessness, fatigue of the chewing muscles during the day, uncomfortable position of the lower jaw, crunching and clicking in both TMJ in opening mouth, erasability of the upper and lower teeth.

Diagnosis: Osteoarthritis of right and left TMJ, ICD-10 – pathology of TMJ "clicking jaw", distal ratio of the dentition, retraction of the upper incisors, pressed position of the teeth on the lower jaw.

Clinical photos of dentition in the position of common occlusion were made (Figure 8). Functional diagnostic examination of TMJ and masticatory

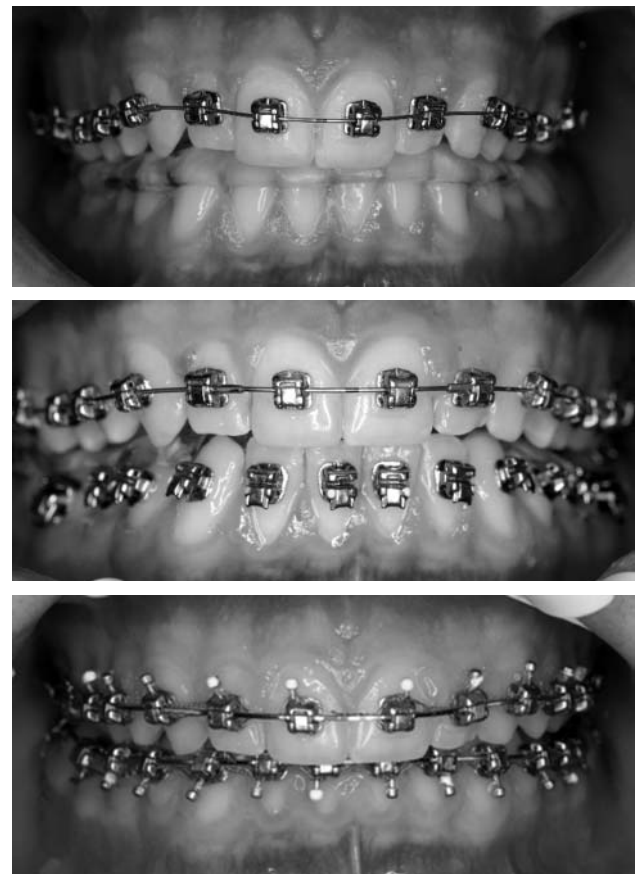


Fig. 14. Stage of orthodontic treatment

muscles were performed to the patient using MYO-TRONICS K7 + J5 complex.

According to the results of the primary electromyography of the masticatory muscles, the patient had an increased tonus, by the data of the lower jaw kinesiology; the mouth opening amplitude was 41 mm (Figure 9). After TENS-therapy, a significant fall in masticatory spasm muscles was obtained, the movements of the lower jaw became more synchronous and smooth, the mouth opening amplitude increased to 43 mm (Figure 10).

After TENS-therapy, fixed position of the lower jaw was performed (Figure 11). On the basis of the received silicone registrar, uncoupling dentition of the kappa on the lower jaw was made to the patient. The patient used the kappa for 6 months wearing it 22 hours a day and taking it off only while eating and following hygiene of the oral cavity (Figure 12).

Repeated indices of functional diagnostic tests, made after 6 months of using the muscle relaxant jaw splint, after the performing the prescribed myogymnastic exercises and the use of individual insoles, are demonstrated the signs of equalizing the tone of the masticatory muscles, normalizing the movements of the mandible and the function of TMJ, a significant decrease of paranormal noise in TMJ (Figure 13).

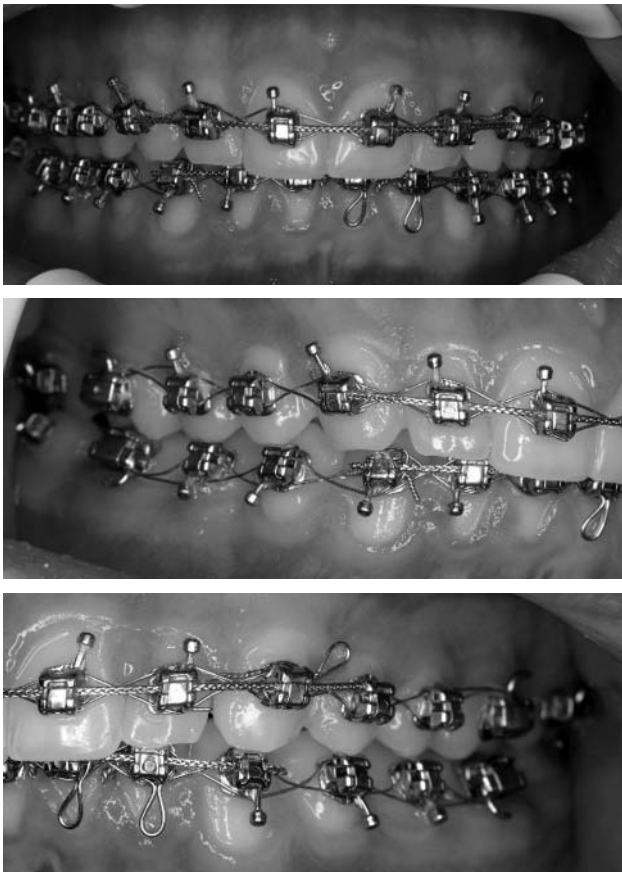


Fig. 15. Stage of orthodontic treatment

The braces fixation of the system on the upper jaw was performed after 3 months of using the dentition splint, on the lower jaw after 6 months of using it (Figure 14). The fragmentation of the arch on the upper and lower jaw was also performed (Figure 15).

After removal of the braces, fixed retention devices for the upper and lower jaw were made to the patient. Now, the patient is at the stage of retention (Figure 16).

CONCLUSIONS

The object of treating patients with TMJ pathology and parafunction of the masticatory muscles



Fig. 16. Clinical photographs of the patient's dental rows after braces removal and non-removable retainers fixation

are: removing pain symptoms; elimination of the causes leading to the development of the disease; restoration and normalization of the organs and / or systems function; improving the quality of patients life, as well as reducing the risk of disease recurrence. Tactics of complex rehabilitation, including miorelaxation procedures, medication treatment, splint therapy, using an individual plan of myogymnastic exercises for chewing muscles, and correction of posture using individual insoles proved to be $12.49 \pm 2.18\%$ more effective in comparison with traditional methods of treatment.

STATEMENT OF CONFLICTS OF INTEREST

The authors state no conflict of interest.

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