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Complex treatment of iatrogenic occlusal disorders of the tooth-jaw system

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The aim of the study was to improve occlusal parameters, normalization of masticatory muscles function by correcting re-prosthetic treatment of patients with partial and total ceramic prostheses using different occlusal splints. The algorithm of re-prosthetic approach to occlusal adjustment and reconstruction of mandible position in patients with iatrogenic occlusal disorders was proposed. The clinical groups included 45 patients with iatrogenic occlusal disorders who used removable and fixed ceramic dental prostheses with simplified or detailed design of occlusal surface. The time of treatment using different occlusal splints was from 2 to 3.5 months what had been mentioned in patients' past case histories. Symptomatic and pathogenetic therapy was provided for additional correction of temporomandibular joint (TMJ) functions by anti-inflammatory drugs, vitamins C, D and calcium food supplements, kinesiotherapy and magnetotherapy. It was 73.6% rate of satisfactory results of treatment. Such algorithm of re-prosthetic treatment allows to normalize bioelectric activity of masticatory muscles, functional status of TMJ and occlusal relations of the teeth. Its efficiency was proven by X-Ray and functional diagnostics methods (electromyography of masticatory muscles, T-Scan III computerized occlusal analysis).

Key words: re-prosthetic treatment; temporomandibular joint; ceramic prosthesis; occlusal splint; electromyography.

INTRODUCTION

There are some strict relations between adaptation to dental prosthesis and delayed complications of treatment. Acute pain syndrome usually can be reduced by symptomatic treatment. According to several authors, in every case of any pain complaints identified as severe, etiological factor must be eliminated [1-3]. But stomatognatic dysfunction is not always accompanied by acute pain. There is interaction between upper and lower teeth arches when the mouth is closed, temporomandibular joint (TMJ) elements are in stable position [4-6]. The role of occlusal contacts of the teeth can be named "occlusal programming". When the mouth is closed, total force is spread through the teeth arches to the skull buttresses and TMJ. Several authors mentioned that occlusal contacts dynamically change during life [6-8]. Ineffective treatment of occlusal dysfunction does not always lead to dysfunction of TMJ and muscles because the maticatory apparatus has significant functional adaptation ability. However, individuals have different adaptive capacity to occlusal disorders and stress situations. So, when adaptation does not occur, muscle tension increases and, as a result, there develops a violation of functional harmony. It can be caused by changes in occlusal relationship or basic trigger factors for the pain symptoms [2, 3, 7].

In case of premature occlusal contact presence, the movements of lower jaw will be changed, then periodontal receptors will be activated. As a result, the organism would send forces to avoid this premature contact, that can be seen as a mechanism of "forced" position of lower jaw, named "habitual occlusion." Mandible appears in position of steady shift by means of uncoordinated muscle contractions. This, in its turn, can lead to development of a

sound phenomena in TMJ and pain appearance [3]. Moreover, the term «trigimino-cervical complex» means the close realtionships between cervical pain and headache, changes in cervical spine and movements of lover jaw.

The use of therapeutic and diagnostic devices at the prliminary stage to re-prosthetics must have individual peculiarities depending on level of iatrogenic occlusal disorders and functional disturbances. The main indications for use of occlusal splints are: pain and dysfunction of temporomandibular joint; violation of elements of TMJ; protection of teeth against autodestruction, parafunction (bruxism); preparing the patient to greater occlusal reconstruction and surgery in order to correct occlusion of the teeth (orthognathic surgery) [1, 6]. Contraindications for use of occlusal splints are: acute inflammation of TMJ and masticatory muscles, psychogenic factors. The starting point is the centric relation of the jaws, as it is the initial and final point of any articulation process. No doubts, there is always a central relation, that is an autonomous position, which is not limited by occlusal contacts, but determined by anatomy of TMJ. We treat our patients using different schemes of occlusal splints or selective grinding and this algorithm allows us to find this starting point [3, 5, 9].

The objective of our study was to improve re-prosthetic treatment with partial and total ceramic prostheses of patients with iatrogenic occlusal disorders by using different splints adjusting the vertical dimension of occlusion and position of the mandible, medication support.

METHODS

In clinical study were included 45 patients with occlusal disorders and functional disturbances after prosthetic treatment without any trauma or concomitant general pathology. All 45 patients (men – 28 (62%); women – 17 (38%); mean age – 38.2±4.3 years) were divided into three clinical groups. The first group (20 (44%), mean age – 31.5±0.5 years) – patients, which had non-satisfying multiple prosthetic restorations of low and medium length, but didn't have any pain complaints. The second group (15 (33%), mean age – 35.3±0.2 years) – patients who had non-satisfying total fixed ceramic prostheses with detailed anatomical design of occlusal surface and complained about some sound phenomena in TMJ, but without any pain. The third group (10 (23%), mean age – 44.2±0.11 years) – patients who had non-satisfying removable and total fixed ceramic prostheses with simplified design of occlusal surface of distal teeth that led to the loss of support and who suffered from pain.

We developed an algorithm of re-prosthetic treatment of patients with partial or total tooth loss. At the stage of preparation for prosthetics we followed further steps: comprehensive examination, finding out the causative factors of dysfunction, elimination of primary etiological factors and comparing the achieved after treatment functional status with the initial condition by functional diagnostics (electromyography and T-Scan computerized analysis of occlusion). All patients undergone computed tomography of TMJ in order to control interrelation of TMJ elements. In all cases we used different occlusal splints to eliminate etiological factors and return the lower jaw in proper position that leads to relaxation of masticatory muscles, preventing damage of TMJ structures.

For patients from the the first group we used occlusal splints on the upper jaw with inclined platform which was ajusted during the treatment. The main purpose was to locate the lower jaw in proper position and therefore achieve centering of TMJ condyles. In the second group we considered fabrication of a series of occlusal splints depending on eliminating objective symptoms and discomfort. At the beginning we tried to find the proper position of lower jaw, then used finishing splints for finding proper vertical dimension of occlusional. Duration of the treatment was 6.2±0.23 months. For patients from the third group we used splinting prostheses on upper and lower jaws or occlusal

splint on the upper jaw in combination with splinting prosthesis on the lower jaw. Duration of the treatment was 3.6 ±0.31 months.

Additionally, for each group of patients were given some advices and prescribed medicines in direct indications: special diet (lack of hard and hot food; products containing animal and plant-based proteins; fish (preferred from the sea)); vitamin C (1000 mg per day, 10 days); calcium (1250 mg) and vitamin D (400 IU) (IV generation) – 1 tablet twice a day, 1 month. As symptomatic and supportive therapy we prescribed NSAIDs, 5 kinesiotherapy sessions for postisometric relaxation of masticatory muscles (focus on m. masetter, m. temporalis and lateral pterygoid muscle) and magnetotherapy applied on the area of TMJ (induction of magnetic field 240 mTl), NSAIDs.

RESULTS

In the first group of patients the reducing of symptoms and complaints occurred in 16 patients (36%), duration of the treatment was 3.1±0.4 months. 4 patients (9%) used several splints in past time which led to significant increase of the duration of treatment. The difference in terms of the preparation period using occlusal appliances was 2 – 2.5 months.

In the second group of patients satisfactory results were obtained in 10 patients (22%) based on gnathological correction. 5 patients (11%) had improvement which was due to use multiple splint fabricated in constructive position of the lower jaw respecting correction of vertical dimension of occlusion. Thus, duration of treatment was increased in amount to 3-4 months.

In the third group 7 patients (16%) had symptoms and complaints of TMJ dysfunction after splint therapy. 3 patients (7%) of this group noticed disappearance of symptoms after use of occlusal splints for centering the mandible and changing designs of old dentures. The duration was also up to 3-4 months.

Improvement of re-orthopedic treatment by using splinting prostheses was possible in patients with partial and total ceramic prostheses. If the phase of preprosthetics and provisionally fixed dentures was skipped, we could observe in patients slight limitation of the mouth opening; low intensity and rare TMJ or muscle pain which occurs only during activity; TMJ clicking and tension feelings in deep parotid-masseteric area, when mouth opens widely, crunching during chewing.

Additional data for control of improvement of dental rehabilitation and normalization of function was obtained from such diagnostic methods as computed tomography of TMJ; electromyography (Fig. 1, 2; Table 1) and T-Scan III computerized occlusion analysis (Table 2). Normalisation of functional parameters of stomatognatic system was observed in 73.6% of patients.

DISCUSSION

Overloading of TMJ can lead to impairment of structure but not in all cases. Commonly Julius Wolff's law states: if loading on a particular bone increases, the bone will remodel itself over time to become stronger to resist that sort of loading. The internal architecture of the trabeculae undergoes adaptive changes, followed by secondary changes to the external cortical portion of the bone, perhaps becoming thicker as a result [10]. But sometimes it can cause trauma when loads are excessive.

Based on our approach, we get the possibility to show the therapeutic effect of gnathological correction. It was possible to reduce treatment to 2 – 2.5 months. Using of occlusinal splints without multiple functional multifocal therapeutic and diagnostic devices didn't allow us to get appropriate result. TMJ is complex and multifunctional joint. Soltz M.A. and Ateshian G.E. proved that hydrostatic pressure in articular disc prevents high stress and strain in cartilage tissue [11]. During clinical study there were no pain or discomfort when patients of I group used their occlusal appliances. In II group patients had to adapt to the differences

in height of occlusional position. In III group it was determined proper occlusional height and stabilized distal support.

However, at the preparatory stage medical diagnostic and appliances are useful for re-prothetics in patients with iatrogenic occlusal disorders, medication support is the kind of symptomatic therapy when patient suffers of TMJ dysfunction. Approximately 70%–90% of vitamin C is absorbed at moderate intakes of 30–180 mg/day. It acts as antioxidant, activator of collagen and second specific transport proteins. Calcium and vitamin D should be used in combination because 1,25(OH)2D stimulates intestinal calcium absorption. Without vitamin D, only 10–15% of dietary calcium and about 60% of phosphorus are absorbed. Vitamin D sufficiency enhances calcium and phosphorus absorption by 30–40% and 80%, respectively [12, 13].

Magnetic field has a beneficial effect on the regenerative mechanisms occurring in the tissue and stimulates humoral and immune activity in the whole organism [14, 15, 16]. It also acts on

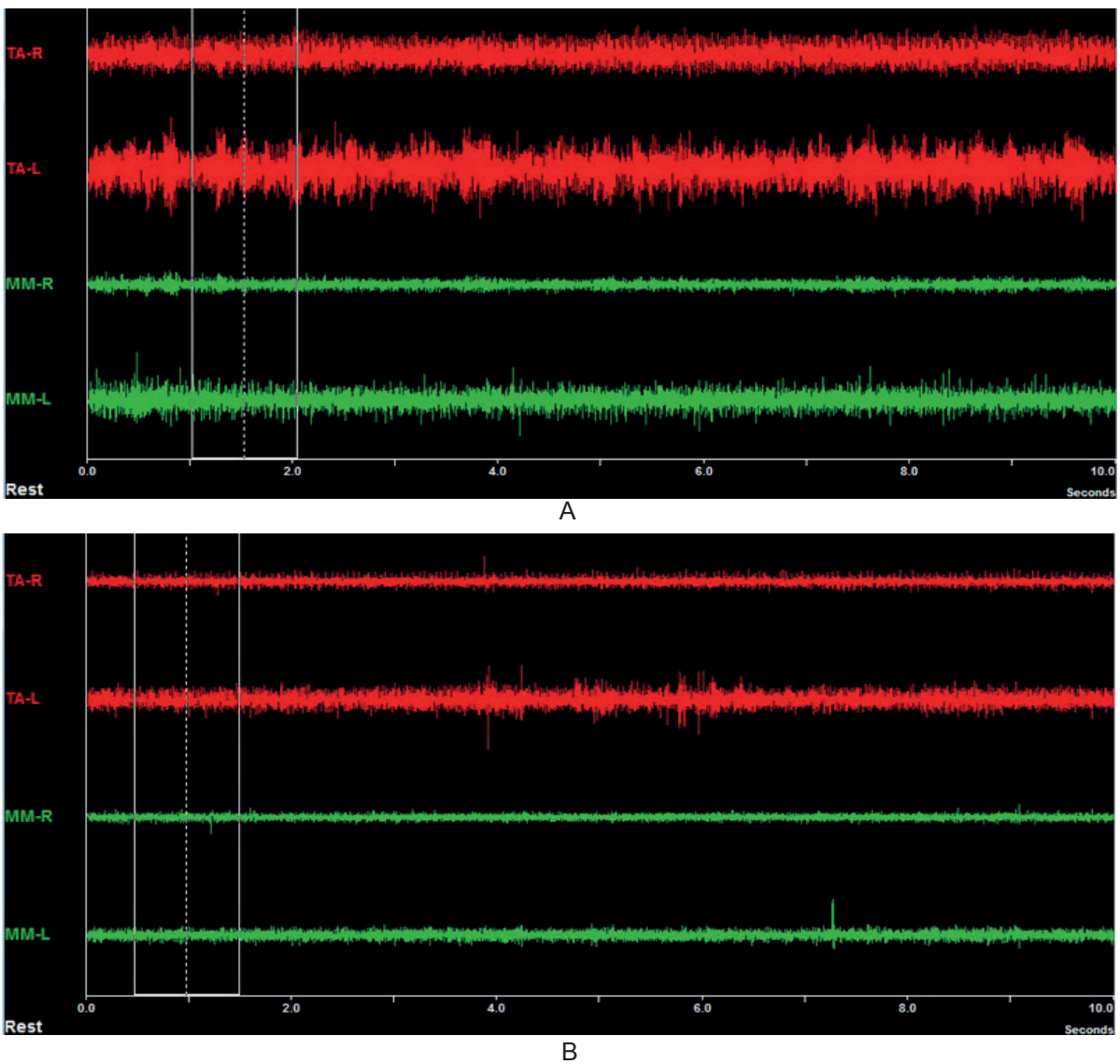

Fig. 1. Electromyographic activity of masticatory muscles during rest before (A) and after treatment (B)

bone and connective tissue. Electric currents induced in tissues may affect the piezoelectric properties of materials, causing mechanical deformation, which stimulates the formation of callus in the case of obstruction in bone healing. Magnetotherapy also has an analgesic effect, affects muscle tension, and stimulates the regeneration of tissues [17, 18].

Any malocclusion is always associated with altered cervical neuromuscular function and postural mechanics. This results in a tendency for neck problems, such as cervical subluxation or fixation. A cervical fixation arising as a result of stress or injury may alter the occlusion, and can even lead to undue stresses on masticatory system. The term Lovett Brother is used to describe the compensatory response to displacement or rotation of a component of the skeletal chain [19].

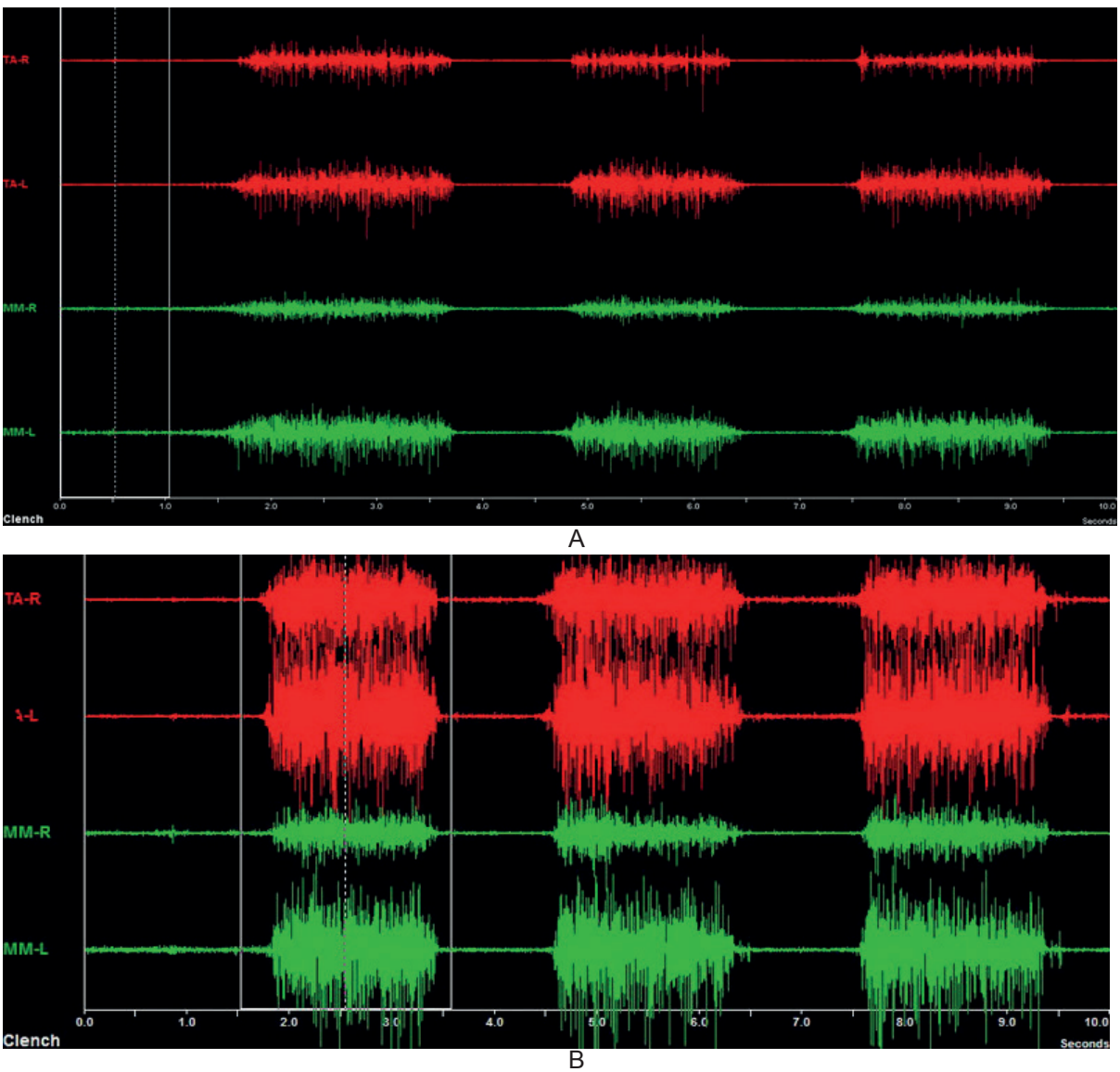

Fig. 2. Electromyographic activity of masticatory muscles during clenching before (A) and after treatment (B)

Table 1. Results of electromyographic examination of masticatory muscles of paatients after treatment

Group of patients	Muscle	Rest, μV	Clenching, μV	Mastication, μV	Symmetry of muscle activity, %
1	m. TA R	1.78±0.53	46.3±0.42	26.3±0.32	62.9±3.1
	m. TA L	1.75±0.49	47.2±0.41	27.2±0.34	
	m. MM R	1.8±0.56	55.9±0.43	34.8±0.33	62.8±3.3
	m. MM L	1.81±0.59	56.4±0.53	35.2±0.23	
2	m. TA R	1.53±0.52	45.1±0.45	25.1±0.34	57.2±2.1
	m. TA L	1.52±0.47	44.2±0.47	24.5±0.31	
	m. MM R	1.48±0.56	53.1±0.46	34.8±0.34	58.9±1.8
	m. MM L	1.49±0.53	52.3±0.51	33.7±0.29	
3	m. TA R	1.72±0.55	40.3±0.46	21.1±0.32	51.2±2.2
	m. TA L	1.77±0.49	41.2±0.43	21.5±0.31	
	m. MM R	1.88±0.52	43.1±0.46	24.8±0.34	51.9±1.9
	m. MM L	1.89±0.57	42.3±0.51	23.7±0.35	

Table 2. Dynamics of occlusal contacts in patients obtained by T-Scan III computerized occlusion analysis

Group of patients	Parameter	Before treatment	6 months after treatment
1	Time of Occlusion	0.52±0.18	0.39±0.15
	Balance of left/right side	20%-80%	45%-55%
2	Time of Occlusion	0.2±0.18	0.29±0.15
	Balance of left/right side	20%-80%	45%-55%
3	Time of Occlusion	0.7±0.28	0.39±0.17
	Balance of left/right side	20–80 %	45%-55%

CONCLUSIONS

Iatrogenic factors of prosthetic treatment play an important role in delayed complications, especially when the host resistance of stomatognatic system and its ability to adjust does not work. Proposed algorithm of treatment describes individual approach to re-prothetics using occlusal splints, improves the tooth-jaw system functional status and reduces the treatment time.

The authors of this study confirm that the research and publication of the results were not associated with any conflicts regarding commercial or financial relations, relations with organizations and/or individuals who may have been related to the study, and interrelations of co-authors of the article.

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КОМПЛЕКСНЕ ЛІКУВАННЯ ЯТРОГЕННИХ ОКЛЮЗІЙНИХ ПОРУШЕНЬ ЗУБО-ЩЕЛЕПНОЇ СИСТЕМИ

Мета нашого дослідження полягала в поліпшенні оклюзійних параметрів, нормалізації функції жувальних м'язів корекцією попереднього ортопедичного лікування за допомогою часткових і повних керамічних реставрацій і використання різних оклюзійних шин. Був запропонований алгоритм повторного протезування із забезпеченням оклюзійної корекції та зміни положення нижньої щелепи у пацієнтів з ятрогенними оклюзійними розладами. Клінічне дослідження включало 45 пацієнтів із зубними протезами з простим або деталізованим дизайном оклюзійної поверхні. Ретроспективно визначені терміни лікування пацієнтів становили від 2,0 до 3,5 міс. Для додаткової корекції функції скронево-нижньощелепних суглобів призначали протизапальні засоби, вітаміни групи С, Д і препарати

кальцію, сеанси кінезіотерапії жувальних м'язів і магнітотерапії привушножувальної ділянки. Такий алгоритм повторного протезування дав змогу нормалізувати біоелектричну активність жувальних м'язів, функціональний стан скронево-нижньощелепного суглоба, а також оклюзійні співвідношення зубів верхньої і нижньої щелепи. Рівень задовільних результатів лікування становив 73,6%. Його ефективність було підтверджено рентгенологічно та за допомогою методів функціональної діагностики (електроміографія жувальних м'язів, комп'ютеризований аналіз оклюзії T-Scan III).

Ключові слова: повторне протезування; скронево-нижньощелепний суглоб; керамічний протез; оклюзійна шина; електроміографія.

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КОМПЛЕКСНОЕ ЛЕЧЕНИЕ ЯТРОГЕННЫХ ОККЛЮЗИОННЫХ НАРУШЕНИЙ ЗУБО-ЧЕЛЮСТНОЙ СИСТЕМЫ

Цель нашего исследования состояла в улучшении окклюзионных параметров, нормализации функций жевательных мышц коррекцией предыдущего ортопедического лечения пациентов с помощью частичных и полных керамических реставраций, использованием различных окклюзионных шин. Был предложен алгоритм повторного протезирования с обеспечением окклюзионной коррекции и изменения положения нижней челюсти у пациентов с ятрогенными окклюзионными нарушениями. Клиническое исследование включало 45 пациентов с зубными протезами с простым или детализированным дизайном окклюзионной поверхности. Ретроспективно определеные сроки лечения пациентов составляли от 2,0 до 3,5 мес. Для дополнительной коррекции функции височно-нижнечелюстных суставов назначали противовоспалительные средства, витамины группы С, Д, препараты кальция, сеансы кинезиотерапии жевательных мышц и магнитотерапии околоушножевательной области. Такой алгоритм повторного протезирования позволил нормализовать биоэлектрическую активность жевательных мышц, функциональное состояние височно-нижнечелюстного сустава, а также окклюзионные взаимоотношения зубов верхней и нижней челюсти. уровень удовлетворительных результатов лечения составлял 73,6%. Его эффективность была подтвеждена рентгенологически и с помощью методов функциональной диагностики (электромиография жевательных мыщц, компьютеризированный анализ окклюзии T-Scan III).

Ключевые слова: повторное протезирование; височно-нижнечелюстной сустав; керамический протез; окклюзионная шина; электромиография.

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