

Research Article

Kappa-splints application for the treatment of pathological dental hard tissues abrasion in combination with dentition defects and dentition deformations

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Abstract

Research objective: to develop and implement a new clinical method of producing a set of kappa-splints for splint therapy: treatment and prevention of various forms of pathological teeth abrasion in combination with dentition defects and dentition deformations, which will enable to prevent significant disorders in the dentition.

Materials and Methods: 36 patients aged 30-59 have been selected for the targeted research with a generalized form of pathological tooth wear in combination with dentition defects and dentition deformations.

Results: After studying the movements of conventional hinge axis in articulate heads of TMJ with the help of condylograph «Cadiax Compact», some asynchronous, asymmetrical bias of articulate heads during the movements of the mandible were revealed in patients with pathological tooth wear in combination with dentition defects and dentition deformations. While examining, the patients complained about the aesthetic defects due to the abrasion of teeth and the change of their colour, the discomfort while closing, chewing and phonetic disorders. In the clinical picture of these patients, the typical symptoms of TMJ dysfunction can be singled out, such as pain and crunch in joints, fatigue of chewing muscles and pain in the muscles, the displacement of the mandible to the side during vertical movements, a feeling of fullness in the ears, headaches and bruxism. Dentition deformations were presented as a violation of the occlusal curve. The results indicate on the presence of functional TMJ disorders and masticatory muscles dysfunction in pathological teeth abrasion in combination with dentition defects.

So, in most cases, temporary prosthesis structures and occlusal splints can be applied to normalize occlusive correlations at the dysfunction of TMJ and masticatory muscles. Gradual lifting of occlusion has been done due to a set of kappa-splints in terms of 14 days, 1 month and 3 months from 1.0 to 5.0 mm to the full restoration of occlusal height, depending on the severity of pathological teeth abrasion. It is the gradual application of a kappa-splints' set which allows prevention of further tooth wear; it doesn't influence the periodontium of teeth; it's aesthetic and does not violate the pronunciation of sounds. The material, which a kappa-splints set is made of, provides better fixation and bite separation with optimal thickness throughout the dentition, which allows the lower jaw to take a position that helps to restore the functional balance of the entire dentition.

Conclusions:

1. According to the results of the research it has been established that the orthopedic treatment with the help of occlusive splints at the preparatory stage for the patients with occlusive disorders at pathological dental hard tissues abrasion in combination with dentition defects, periodontium tissue disease and dentition deformations are urgent for the normalization of occlusive correlations of the jaws.
2. After studying the movements of conventional hinge axis in articulate heads of TMJ with the help of condylograph «Cadiax Compact» and eliminating the symptoms of stress in masticatory muscles of the patients with occlusive disorders at pathological dental hard tissues abrasion, it is the gradual application of a kappa-splints set, made of hard transparent plates of Ercodent Ercodur material (Germany) with a thickness of 1.0 to 5.0 mm, which allows prevention of further tooth wear, normalization of occlusive correlations of the jaws, separating a bite with optimum thickness throughout the dentition, thus the lower jaw takes a position at which the state of functional equilibrium of the entire dentition is restored.

Keywords

pathological tooth wear, articulation system «Cadiax Compact», TMJ dysfunction, dentition deformations, condylography, kappa-splints, splint therapy

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Problem statement and analysis of the recent research

The prevalence of pathological dental hard tissues abrasion reaches a fairly high percentage (8-14%) among the people who ask for orthopedic care [1]. The term “pathological abrasion” combines different states of dentition but with a common clinical characteristic – excessive loss of enamel and dentin. The main indications of pathological teeth abrasion are the damage of the relief in occlusal surfaces of the teeth resulting in losing the occlusal vertical height; the conditions for the formation of unstable teeth-antagonists’ contacts are created; the position of the mandible at closing changes. Pathological abrasion is accompanied by the functional overloading of parodontium tissues, decreasing of interalveolar height and the height of the lower face. While combining pathological dental hard tissues abrasion with dentition defects and dentition deformations, the clinical picture gets quite complex: the parafunction of chewing muscles, the displacement of the mandible and the dysfunction of temporomandibular joints appear [2-4]. 230 patients have been examined and, as a result, it has been established that the prevalence of pathological dental hard tissues abrasion makes up 58.6%, the predominance of the generalized nature of lesions is found in 81.5% and the increase in frequency of pathological teeth abrasion is common for the population of Ivano-Frankivsk district aged 50-59. The number of patients with the pathology mentioned above depends on the conditions of residence, age, comorbidity, genetic predisposition [5]. According to some authors, pathological abrasion depends on the type of a bite. The most significant loss of dental hard tissues is common for the direct occlusion – 53.5% of the cases, for a deep bite – 49.6% of the cases and orthognathic – 23.75% of cases respectively [6]. Therefore, a large number of scientific works by local and foreign authors indicates that the normalization of occlusion correlations of the jaws is the main task of orthopedic treatment of the patients suffering from pathological dental hard tissues abrasion, dentition defects and dentition deformations. To achieve such a result, a temporary prosthesis elements and occlusal splints of different structure can be applied: Stabilization Disconnecting Splint, Michigan Splint, Relaxation Splint with protrusive and retrusive control. Splints provide good occlusal correlations for the functioning of masticatory muscles due to the removal of the usual mandible closing [7, 12]. Nowadays, despite the great variety of the offered devices that are used in determining a comfortable position of the lower jaw, and a significant amount of research in this area, there are no clear guidelines as for the type of splints and the timing of their correction during the treatment [12].

Thus, due to the spread of pathological abrasion and the widespread use of occlusive splints in modern dentistry as well as lots of controversial recommendations as for the types of splints, timing and effectiveness of their usage for the patients with occlusive disorders of the masticatory system, the analysis of the results taken after the treatment of patients with pathological teeth abrasion using occlusal splints at the

preparatory stage is urgent.

Objective: to develop and implement a new clinical method of producing a set of kappa-splints for splint therapy: treatment and prevention of various forms of pathological teeth abrasion in combination with dentition defects and dentition deformations, which will enable to prevent significant disorders in the dentition.

1. Materials and methods

36 patients aged 30-59 have been selected for the targeted research with a generalized form of pathological tooth wear in combination with dentition defects and dentition deformations. These patients belonged to the experimental group which would be treated for comorbidity. The clinical evaluation has been carried out on the basis of collecting complaints, history of life and disease, objective examination. M.H. Bushan’s classification has been used for the diagnosis of pathological tooth wear which fully reflects the clinical picture and includes clinical aspects of functional and morphological nature [2]. The study of diagnostic models has been conducted to determine the degree of abrasion, plane lesion, prevalence of pathological tooth wear, dentition conditions, and while their analysing in the articulator – the nature of occlusive interrelations of teeth and dentition in various types of occlusion, especially important in the diagnosis of TMJ pathology [8-11].

A lot of studies prove that due to the elimination of static and dynamic contacts of teeth by isolating the occlusal surfaces, the central position of the mandible is gradually established and the relaxation of chewing muscles is carried out. In addition, the chewing muscles may be adapted to a new occlusal height [12]. However, due to the changes in the spatial position of the mandibular, the application of one occlusal splint only requires the constant correction of its occlusal contacts. Besides, some splints can be used only while sleeping. Therefore, we have proposed to apply a new method of producing a set of kappa-splints made of hard transparent plates of Ercodent Ercodur material (Germany) with a thickness of 0.5 to 5.0 mm for the upper or lower jaw in our clinic [15].

The research involved the analysis of articulate axis shift in articulate heads of TMJ in three dimensions with the help of the articulation system «Cadiax Compact» and it helped to calculate the parameters that are required for individual customizing of articulators.

To produce a kappa-splint, a patient was taken prints from the upper and lower jaws, then plaster models were cast. After analyzing tooth contacts to identify the type of interdigitation, wax occlusal basis was produced which is placed on the chewing surface of the teeth in the upper jaw. The measuring of constructive occlusion (the height in the position of central occlusion, which a patient had before the loss of dental hard tissues) was done with regard to the condylograph data. The models were fixed in the articulator in the constructive occlusion [12, 13]. A set of kappa-splints for orthopedic treatment of pathological tooth wear was produced by vacuum press-

ing of hard transparent plates made from Ercodent Ercodur material (Germany) with a given thickness of 0.5 or 1.0 mm, 2.0 mm, 3.0 mm, 4.0 mm, 5.0 mm in the upper or lower jaw in terms of 14 days, 1 month and 3 months before the full recovery of occlusal height and the centering of articulate heads of TMJ. These terms are chosen due to the physiological mechanisms of human body's adaptation to the prostheses and foreign bodies [14].

Efficient application of kappa-splints was conducted on the basis of occlusal contacts on their surface, eliminating the symptoms, the tension of masticatory muscles during the timing of treatment (14 days, 1 and 3 months of using the splint) and the state of TMJ with the help of the articulation system «Cadiax Compact».

2. Results and Discussion

After studying the movements of conventional hinge axis in articulate heads of TMJ with the help of condylograph «Cadiax Compact», some asynchronous, asymmetrical bias of articulate heads during the movements of the mandible were revealed in patients with pathological tooth wear in combination with dentition defects and dentition deformations. While examining, the patients complained about the aesthetic defects due to the abrasion of teeth and the change of their colour, the discomfort while closing, chewing and phonetic disorders. In the clinical picture of these patients, the typical symptoms of TMJ dysfunction can be singled out, such as pain and crunch in joints, fatigue of chewing muscles and pain in the muscles, the displacement of the mandible to the side during vertical movements, a feeling of fullness in the ears, headaches and bruxism. Dentition deformations were presented as a violation of the occlusal curve. The results indicate on the presence of functional TMJ disorders and masticatory muscles dysfunction in pathological teeth abrasion in combination with dentition defects.

So, in most cases, temporary prosthesis structures and occlusal splints can be applied to normalize occlusive correlations at the dysfunction of TMJ and masticatory muscles. Gradual lifting of occlusion has been done due to a set of kappa-splints in terms of 14 days, 1 month and 3 months from 1.0 to 5.0 mm to the full restoration of occlusal height, depending on the severity of pathological teeth abrasion. Consequently, a set of kappa-splints (1mm of thickness for 14 days and 2 mm thick for 1 month) was produced at the 1st degree of the horizontal form of pathological teeth abrasion. Kappa-splints of 2 mm thick for 14 days and 3 mm of thickness for 1 month were produced at the 2nd degree of the horizontal form of pathological teeth abrasion. At the 3rd degree of the horizontal form of pathological tooth wear kappa-splints of 2 mm thick for 14 days, 3 mm thick for 1 month, 4 mm thick for 3 months and 5 mm of thickness to the full restoration of occlusal height were used. It is the gradual application of a kappa-splints set which allows prevention of further tooth wear; it doesn't influence the periodont of teeth; it's aesthetic and does not violate the pronunciation of sounds. The ma-

terial, which a kappa-splints set is made of, provides better fixation and bite separation with optimal thickness throughout the dentition, which allows the lower jaw to take a position that helps to restore the functional balance of the entire dentition. Kappa-splints can be used during the day. The device, used for producing a kappa-splints set, is a vacuum molding apparatus "Ultra – Form Vacuum Former". For kappa producing, a dentition print of the patient was taken with the help of alginate mass "Tropigalgin" (Zhermack, Italy), due to which a working model of polyurethane mass "Exacto Form" ("Bredent", Germany) was cast. Kappa-splints were made of hard transparent plates of certain thickness with the help of vacuum pressing. The number of kappas, necessary for treatment, was calculated for each individual clinical case. The method of application: a hard transparent plate was placed on a special table and fixed; the parameters of the device were set: time, heating, pressure. The plate was heated, pressed according to the model, cut along the marginal edge of the gums and polished. The application of models made from polyurethane mass will allow getting several kappas (a kappa-splints' set for one patient only). After a detailed diagnosis and a treatment plan, a set of the necessary kappas of appropriate thickness and its replacement are produced in the corresponding terms for the patient by a podiatrist. Kappa replacement was done within 14 days, 1 month and 3 months.

3. Conclusions

1. According to the results of the research it has been established that the orthopedic treatment with the help of occlusive splints at the preparatory stage for the patients with occlusive disorders at pathological dental hard tissues abrasion in combination with dentition defects, periodontium tissue disease and dentition deformations are urgent for the normalization of occlusive correlations of the jaws.
2. After studying the movements of conventional hinge axis in articulate heads of TMJ with the help of condylograph «Cadiax Compact» and eliminating the symptoms of stress in masticatory muscles of the patients with occlusive disorders at pathological dental hard tissues abrasion, it is the gradual application of a kappa-splints set, made of hard transparent plates of Ercodent Ercodur material (Germany) with a thickness of 1.0 to 5.0 mm, which allows prevention of further tooth wear, normalization of occlusive correlations of the jaws, separating a bite with optimum thickness throughout the dentition, thus the lower jaw takes a position at which the state of functional equilibrium of the entire dentition is restored.

4. Prospects for further research

The research showed the necessity of normalization of occlusive correlations of the jaws with the gradual application of

kappa-splints during the orthopedic treatment and prevention of the patients suffering from pathological dental hard tissues abrasion in combination with dentition defects and dentition deformations.

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