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Research Article

THE EFFICIENCY OF THE USE OF INDIVIDUAL REMOVABLE DENTAL BITE SPLINTS FOR CORRECTION OF DENTAL DEFORMATIONS DEGREE IN PATIENTS WITH DENTURE DEFECTS

A. Kovalyuk*, Z. Ozhohan

Abstract
Objective: introduction of prevention methods and increase of the treatment efficacy of teeth deformations using individual dental bite splints.
Materials and methods: The results of clinical examination of 67 patients of different age (20 to 59 years) with the existing dentition defects before and after use of individual removable dental bite splints are given in this article.
The results of the work: the objective study showed a difference in data of the distances between certain points of the teeth surrounding the defect without dentition deformations and in their presence (distances AB in the control and experimental groups was respectively7.16 ± 0.19 mm and 4.32 ± 0.19 mm, AD -7.62 ± 0.19 mm and 4.16 ± 0.20 mm, BC - 7.49 ± 0.19 mm and 4.07 ± 0.19 mm, CD – 6.96±0.19 mm and 3.67±0.19 mm). After the performance of the preparation of the patients with the dentition defects and deformations of the teeth with the use of individual dental bite splints to the prosthetic repair in several stages, it became possible to reduce significantly indexes of the distances in the presence of pathology and bring them closer to physiological data (AB - 5.85 ± 0.21 mm, AD - 6.09 ± 0.18 mm, BC - 6.22 ± 0.19 mm, and CD-5.73±0.19mm).
Conclusions: The use of individual removable dental bite splints gave the possibility to improve significantly the prosthetic efficacy by normalizing the occlusal relations and chewing load onto the displaced teeth in the area of dentition defect.

Keywords
orthopedic treatment; deformation of dentition; chewing efficiency

Ivano-Frankivsk National Medical University, Ivano-Frankivsk, Ukraine
*Corresponding author: stomandron@gmail.com

Problem statement and analysis of the recent research

It is known that the main factor of functional harmony of dentoalveolar system is maximum contact between dental rows at an optimal vertical and stable horizontal jaws' position, and a feature of optimal occlusion is considered to be a two-way type of chewing. In the process of dentoalveolar system functioning with time there is a violation of the integrity of the single teeth and dentition, which leads to occlusal relationships. [2].

According to the theory of equilibrium articulation proposed by Hodon, which is described as saving of dental arches and fitting one tooth to another, chewing efficiency of each tooth is constant and changes in the process of loss of one or more parts of the dentition. Chewing pressure in these conditions acts as a traumatic factor, which entails the progressively developing and intensifying destruction of dental apparatus [5]. According to the scientist Tryl I.B. one may state that the prosthetics of patients with available dentition deformations will restore chewing efficiency not fully, but in some cases it will even be harmful without a preliminary preparation of the supporting teeth for putting of the structures of various types. In addition, prosthetics of patients with teeth deformations by standard methods leads to a decrease of longevity use of the structures due to pathological changes in the structure of displaced teeth [1].

So, there arises the question of the dentofacial system preparation with the signs of secondary deformations to prosthetic by normalizing of occlusal relationships in the partial or full restoration of the physiological position of the teeth surrounding the defect.

The use of individual teeth bite splints in prosthetic dentistry is also promising factor in the method of teeth displacement since they have proved effectiveness in the field of orthodontics as a method of eliminating of congenital deformations of dentition [10].

Objective.

Implementation of the methods of prevention and treatment efficacy of teeth deformations by studying the feasibility

of using the individual dental bite splints.

1. Materials and methods

In the course of dental practice at the department of Prosthodontics of IFNMU there were examined 206 people who suffered from the violation of chewing function or aesthetics, among whom there were found dentition defects in 112 patients of 20-59 years. For the study were selected 96 patients with first molar absence and divided into two groups (control and research) depending on the presence of deformation. The clinical evaluation was performed on the collection of complaints, anamnesis of life and disease, data of objective inspection, biometric analysis of diagnostic models.

Persons with existing dentition defects and secondary deformations of teeth in this area (research group) initially were trained using bite splints in several steps, then were held endodontic preparation and prosthetics. Choosing the retention cap as a method of stopping the process of deformation and repositioning of the displaced teeth is performed based on the properties of the material from which they are made (polyurethane plate has the ability to return to its original position, and its strength to change the shape is greater than the force created by the displaced tooth during its movement), aesthetics (thanks to transparent cap is not visible in the mouth), age-appropriate (no age limit), the method of fixing (a removable structure), simplicity of replacement (short time of making designs with updated anatomical landmarks) and self-care (easy cleaning of cap and oral cavity), the cost of the procedure (making caps is not expensive). In view to the above conditions were rejected, tooth displacement methods such as plate mechanically and functionally-operating-guide (poor aesthetics, age restrictions and more valued in manufacturing), teeth splinting (poor aesthetics and oral care, inability replacement in short term).

The deleting of teeth deformation was performed using individual removable bite splints, which were made of polyurethane plates ErcodentErcodur (Germany) with a thickness of 1 mm, 1.5 mm or 2 mm, depending on the stage of treatment and symmetry identified deformations. Before the treatment was conducted the determination of the displacement axis hinge of temporomandibular joint heads in three areas using articulation system Cadiax Compact (AmannGirrbach, Germany) was performed and parameters calculation, which later were used in individual articulator Artex. Planning of manufacturing each of aligners and their correction first of all was carried out in articulator, then a bite splint was transferred to the clinic to fit in the oral cavity.

At each stage (the number varies on the severity of the clinical picture) displacement of teeth in the desired direction was provided by phased manufacturing lateral overlays using photopolymer material Estelite Posterior (Tokuyama Dental, Japan) according to horizontal type of deformation and/or occlusal overlays – according to the vertical type of deformation. Each stage duration was 21-28 days and provided predictable shift teeth (distance CD) to 2.5 mm.

Changing of teeth position was evaluated on diagnostic models according to the method of determining the distance (intervalue) between the teeth during their displacement described by Mirchuk B.M. and Zavoyko O.B. [3], and involves the following steps: make repeated receipt of partial imprints of dentition fragments by using basic silicone impression materials (in terms that depend on controlling the dynamics of teeth moving), mark on them the same points that were selected on the first model, conduct measurements between them with electronic calliper. The result is compared with the previous data and then perform correction of lateral or/and occlusal overlays or changing individual dental bite splint. The determination of the distances between the surfaces of the teeth surrounding the defect was performed, namely: distance AB – from the center of the medial approximal surface of the distally placed tooth defect to the center of distal approximal surface of medially placed tooth defect at the clinical teeth necks area; distance AD – from the center of medial approximal surface of distally placed tooth defect at the clinical teeth necks area to the centre of distal approximal chewing surface of medially placed tooth defect; distance BC – from the center of distal approximal surface of medially placed tooth defect at the clinical teeth necks area to the centre of medial approximal chewing surface of distally placed tooth in the defect and distance CD – from the center of the medial approximal surface of the distally placed tooth in the defect to the center of distal approximal surface of medially placed in the tooth in the defect at the clinical teeth necks area of chewing or cutting surface.

Treatment of patients in both groups was carried out by conventional methods, such as using non-removable metal prosthesis of dentures with ceramic cladding or metal-free structures based on zirconium dioxide. Choosing the structure was agreed with patients during their counseling. The manufacture of temporary structures after preparation of abutment teeth for patients in both groups was compulsory. The prosthetics was conducted immediately after the preparation of dental abutment teeth in control group patients. Persons with existing dentition defects and secondary deformations of the teeth in this area (experimental group) initially were prepared using bite splints in several steps, and then endodontic preparation and prosthetics were performed.

The adjustment of the position of the displaced teeth was carried out in several clinical receptions (3-7 times depending on the objective picture) in cooperation with dental technician, entrusted with the task of repositioning displaced tooth within 0.2-0.3 mm on the working model by preparing and modeling with wax “Modewax” followed by manufacturing of individual removable bite splint with polyurethane film thickness of 0.75 mm. Number of steps depended on the degree of teeth deformation. The displacement was conducted to the establishing a physiological position or teeth movement disappearance.

Statistical analysis of the received results was performed on a personal computer using computer program STATISTIKA-

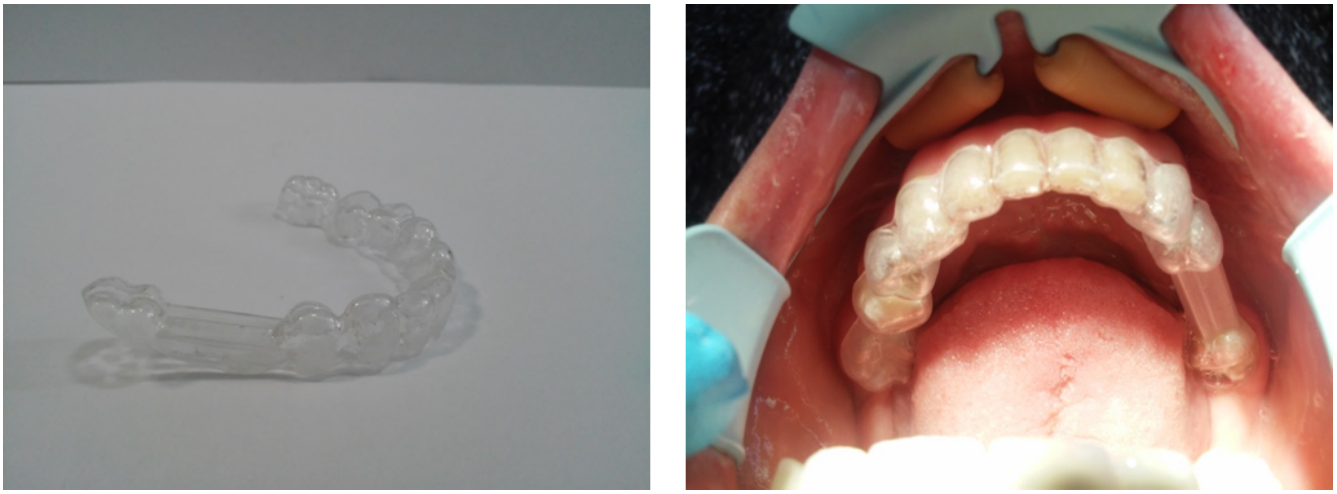

Figure 1. Individual removable bite splint (view after manufacturing (left) and after fitting in the mouth (right))

6 and package of statistical functions of the program "Microsoft Excel" according to Student-Fisher method, reliability of the results was considered at the margin of error of $p<0.05$.

2. Results

Due to the complaints and clinical examination of patients it was found that among 206 people who applied to the clinic of prosthodontics, 112 patients complained of the absence of one or more teeth (54.4%) and the need for prosthetic replacement of the present defect of dentition to restore the chewing function and aesthetics. In particular, after distributing of dental defects using Kennedy classification it was found that the diagnosis "Partial absence of teeth. I class by Kennedy" is in 16 persons (14.3%), II class – in 21 persons (18.8%), III class – in 69 persons (61.6%), IVclass – in 6persons (5.4%). The absence of front teeth was observed in 10 clinical cases (14 teeth), lateral group – in 136 clinical cases (187 teeth).

Systematization of objective review and analysis of the diagnostic models made it possible to perform the general distribution of patients (57 persons, 50.9% from the general number of patients with dentition defects) into two groups, control and research, in which the number of situations of the first molar absence and availability of both approximally placed teeth due to the diagnosis "Partial absence of teeth. III, II and I class by Kennedy" was 67 clinical cases. Control group was 21 persons (36.8%) who had the first molar dentition defects without apparent complications (29 clinical cases); research group was 36 persons (64.2%) with the first molar dentition defects and secondary deformations (38 clinical cases).

It should be noted that during the study, the impossibility of use bite splints in 7people (19.4% of the research group number) (9 clinical cases) was established due to excessive inclination of the chewing group tooth (teeth), which is contraindicated in this case.

Data of distances between points, which were obtained before the treatment, showed that distance AB in control group of patients was7.16 ± 0.19 mm, AD – 7.62 ± 0.19 mm, BC–7.49 ± 0.19 mm, CD – 6.96 ± 0.19 mm. Distances differed due to the innate characteristics (size of teeth, their style, belonging to the jaw) and acquired (presence of restorations of the studied surfaces, non-carious lesions and destructive changes in periodontium).

Measurements of above-mentioned parameters in research group patients were conducted twice: before the correction of displacement degree of teeth (Stage I) and after these procedures (Stage II). So, on the I stage in research group patients were next data: distance AB was 4.32 ± 0.19 mm, AD – 4.16 ± 0.20 mm, BC – 4.07 ± 0.19 mm, CD – 3.67 ± 0.19 mm. Data have changed considerably on the II stage: distance AB was 5.85 ± 0.21 mm, AD – 6.09 ± 0.18.BC – 6.22 ± 0.19 mm, CD – 5.73 ± 0.19 mm. Average number of clinical receptions of preparation for prosthetics with replacement of individual dental bite splints was 5.8 times. Whereas the fewest times (3-4) bite splints were made for patients with existing devital teeth in the area of dentition defect (13 clinical cases, 44.8%).

3. Discussion

After a detailed study of efficiency of removable bite splints use we compared the facts presented in the article with the researches of other scientists. The first molar absence and included defect development was observed in 50.9% of patients (57 persons), but the diagnosis "Partial absence of teeth. III class by Kennedy" took place in 61.6% of applications (69 people), which is the highest indicator in comparison with the data presented by Kuchera M.V. (203 persons, 54.7%) [2].

Difference in data values of the distances between these surfaces in patients with existing dentition defects and the absence of the first permanent molar was described in compare with the work of Sidorenko L.P. [4], particularly indicators AB and AD in the following article lower than in the control (7.16 ± 0.19 mm and 7.62 ± 0.19 mm in compare with 7.32 ± 0.19

Table 1. Frequency of chromosomal aberrations among long livers of Ivano-Frankivsk region depending on gender, M±m

	AB	AD	BC	CD
Research group (before using bite splint)	4.32±0.19	4.16±0.20	4.07±0.19	3.67±0.19
Research group (after using bite splint)	5.85±0.21	6.09±0.18	6.22±0.19	5.73±0.19
Control group	7.16±0.19	7.62±0.19	7.49±0.19	6.96±0.19

mm and 7.73±0.19 mm respectively) and research (4.32 ± 0.19 mm and 4.16 ± 0.20 mm in compare with 7.17±0.19 mm and 7.16±0.20 mm respectively) groups.

Getting good orthopedic results of use of individual removable bite splint observed in the I.M. Tkachenko's work [8], but this author used a similar method of making temporary constructions as part of the treatment of abnormal tooth abrasion. A similar methodology of making individual removable bite splint described in the patent for utility model of R.M. Puts [6]. He conducts teeth displacement using a series of aligners by grinding. The author also considers the data of condylography, but does not specifies the thickness of the cap and further methods of patients treating. However, there were not found any scientific articles recorded information on the results of this method in the clinic.

The most informative due to clinical point of view is patent of Nespriadko V.P. and Zakharova G.E. [4] that used the aligners with struts to enhance the action to the displaced tooth. As a result of studies [5], the displacement rate was fixed at 7.8±0.32 mm for 3.5 months, which differs from the results of this study (2.06±0.19 mm for 70 days). However, the authors did not consider TMJ indicators and possible changes in the joint and periodontal of teeth that could occur as a result of enough fulminant displacement of teeth.

4. Prospects for further research

The study of possibilities of adjusting the position of the displaced teeth is necessary and perspective for the study of the rational and effective treatment of teeth deformations.

5. Conclusions

- We found that the absence of the first permanent molar and the third class of partial absence of teeth by Kennedy are the most common pathologies and they are 50.9% and 61.6% respectively of all cases of tooth loss. This indicator of teeth deformations at this diagnosis is high – 64.2%.

- Detection of the required distances between the surfaces of the teeth surrounding the defect, and their indexes (reducing of the distances AB at 39.7%, AD – at 45.4% and BC – at 45.7% and CD – at 47.3% compared to the control group) made it possible to assess the severity of the clinical picture in the presence of teeth deformations.

- Changing the above-mentioned indicators during preparing patients with existing teeth deformations before prosthetics closer to physiological norm (decline in reducing the distance AB at 18.3%, AD – at 20.1% and BC – at 17.0% and CD – to 17.7% compared to the control group) shows the efficiency of individual removable bite splints using for correcting position of displaced teeth.

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