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The efficiency of prevention and features of treatment of dentition deformations using individual removable

AV Kovalyuk and ZR Ozhohan

Abstract

Aim: introduction of methods increasing efficacy of teeth deformations treatment by using individual removable tire-cap.

Materials and methods: measures of Patients prevention and treatment (98 persons – 55.1%) with first permanent molar absence and, quite often, teeth deformations are carried out.

The results of the work: objective study showed presence of tooth displacement as result of first permanent molar absence in 34.8% of cases (62 patients). There was able to reduce level of pathology (from 39.7% to 45.7% for different distances) using tire-caps.

Conclusions: tire-cap using improve prosthetic efficacy by normalizing occlusal relations.

Keywords: Dentition defects, teeth deformations, chewing efficiency

Introduction

Problem analysis and latest research. It is known that the main factor of functional harmony of dentition is maximum contact between dental rows at an optimal vertical and stable horizontal jaws position. The feature of optimal occlusion is considered to be a two-way type of chewing. There is a violation of the integrity of the teeth and dentition, which leading to occlusal relationships violation over time during the operation of dentition [2]. The next link is a violation of the physiological values of the teeth, for example, the width of the crown part or the height of the clinical crown, which leads to an increase in disharmony [5, 6, 7].

According to the theory of equilibrium articulation proposed Hodon, which described as saving dental arches and fitting one tooth to another, chewing efficiency of each tooth is constant and changes in the process of losing 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 [8]. According to the scientific Tryl I.B statement it can be concluded that the prosthetic of patients with available dentition deformation will restore chewing efficiency not fully, and in some cases even stay harmful without a preliminary preparation for staging supporting teeth designs of various types. In addition, prosthetic of patients with teeth deformation by standard methods leads to a decrease longevity use designs due to pathological changes in the structure of displaced teeth [1].

So the question arises in the preparation dentition with signs of secondary deformations to prosthetic by normalizing occlusal relationships the partial or full restoration of the physiological position of the teeth surrounding the defect [4]. One of the most effective options for carrying out this manipulation and, at the same time, accessible is the use of individual removable tire-caps [3, 10, 11]. In addition, the appearance of the necessary space leads to the possibility of avoiding the deviations of supporting teeth or implantation, which is extremely important for the inaccuracy of the teeth surrounding the defect.

The aim of the study

Introduction of methods increasing efficacy of treatment of patient with teeth deformations and prevention of developing by using individual tire-cap.

Materials and methods

In the course of dental practice at the department of prosthodontics IFNMU there were examined 205 people who suffered from the violation of chewing function or aesthetics. There was found existing dentition defects in 178 patients (86.8%) of 18-79 years. Control group (Group I) included patients without dysfunction deficiencies of 27 patients (13.2%),

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group of prosthetics without preliminary preparation using thermoformed caps (group II, 47 patients) consist of the person making individual tire-caps in which after diagnosis was problematic or the time of prosthetics were limited (22.9%). For the study were selected 131 patients (63.9%) with premolars and molars absence and divided into research group and group of prevention based on availability of deformation and the possibilities of its correction. The clinical evaluation was conducted on the collection of complaints, anamnesis of life and disease, data of objective inspection, biometric analysis of diagnostic models before and after the treatment.

Changing of teeth position was evaluated on diagnostic models according to the method of determining the distance (interval value) between the teeth during their displacement described Mirchuk B.M. and Zavoyko O.B.^[5] and involves the following steps: it is made 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), marked on them the same points that were selected on the first model, conducted measurements between them with calipers and rulers. The result is compared with the previous data and perform correcting individual tire-cap.

It was conducted the determination of the distances between the surfaces of the teeth surrounding the defect, namely: distance AB – 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; distance AD – from the center of medial approximal surface of distally placed tooth in the defect at the clinical teeth necks area to the center of distal approximal chewing surface of medially placed tooth in the defect; distance BC - from the center of distal approximal surface of medially placed tooth in the defect at the clinical teeth necks area to the center of medial approximal chewing surface of distally placed tooth in the defect, distance CD - from the center of medial approximal surface of distally placed tooth in the defect at the clinical teeth necks area to the center of distal approximal surface of medially placed tooth in the defect at the clinical teeth necks area. The last indicator was also used to evaluate the width of the chewing surface of the lateral teeth in patients in the control group.

Also, the calculation of the height of clinical crowns to evaluate the development of vertical deformation, namely, XY - the vertical distance from the middle point of the cutting edge or chewing hollows to the enamel-cement border (clinical neck teeth).

For persons of group III at first were made preparations using caps in several stages, after which endodontic preparation and prosthetics were performed. Correction of teeth position was made according to the method described A.V. Kovalyuk and Z.R. Ozhohan, and involves the following steps: jaws models were gypsum in articulator according to individual data of patient with taking into account the physiological position of the temporomandibular joints; after diagnosis and preparation of the treatment plan with the determination of the predicted amount of stabilizing-active stages, a stabilizing tire-cap of 1.0 mm thickness, and then 1.5 mm and 2.0 mm thickness, are made in stages if necessary by vacuum pressing; the active action of tire-caps at each stage is activated and corrected by the modeling of approximal and / or occlusal overlays under constant x-ray control; the number of tire-caps is calculated individually for each clinical case, depending on the degree of

deformity of the tooth row, with the next their replacement on the upper and / or lower jaw in 4, 7, 11 and 13 weeks of use until a stable position of the displaced teeth has been achieved, and physiological indicators of the periodontal condition.

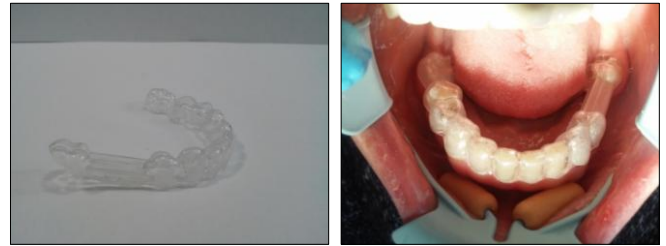


Fig 1: Individual removable tire-cap (appearance after manufacturing (left) and after fitting in the cavity of the mouth (right)).

Treatment of patients in both groups carried out by conventional methods, such as using non-removable metal prosthesis of dentures with ceramic cladding or metal-free designs based on zirconium dioxide, clasp prosthesis with different types of fixation, elastic and partial removable prosthesis. Choosing the design was agreed with patients during counseling patients. The manufacturing of temporary structures after preparation of abutment teeth for patients in both groups was compulsory.

The prevention of teeth deformation developing in persons of group IV was conducted by using individual removable tire-cap of 1.0 mm thickness, which manufactured immediately after surgical operation and were using before finishing fixation of construction or conducted of implantation. Endodontic preparation of supporting teeth was held before prosthetics.

For the comparative evaluation of the data of the effectiveness of using individual removable tire-caps in combination with setting, if necessary, occlusal or approximal photopolymer overlays in patients of groups III and IV, clinical cases with the absence of the first permanent molars with the presence of approximated teeth were selected (93 patients, 71.0% of the total value of the above groups) in connection with the greatest prevalence of this pathology and relatively close indicators of the width of the crown surface. Changes in the position of the teeth surrounding the defect on the main model (CD distance) and the height of the crown part of the tooth-antagonist on the auxiliary model (XY distance) were measured in case of this pathology.

Statistical analysis of the results was performed on a personal computer using computer programs STATISTIKA-6 package and statistical functions of the program "Microsoft Excel". Student-Fisher method were used, reliability of the results considered at the margin of error of $p < 0.05$.

Research Results

Due to examination of the complaints and clinical examination of patients it was found that among 205 people who applied in the clinic of prosthodontics, 178 patients complained of the absence of one or more teeth (86.8%) and the need for prosthetic replacement of the existing defect of dentition to restore the chewing function and aesthetics. It should also be noted the significant advantage of patients aged 18-29 (60 people), while the number of persons aged 30-39 was 54, 39-49 years old - 39 people, 50-59 years - 38 people, 60 years and over - 12 people.

After distributing of dental defects using Kennedy classification was found that the connection of different diagnosis in both jaws was in 42 persons, while "Partial absence of teeth. I class by Kennedy" was in 16 persons, II class – in 11 persons (18.8%), III class – in 107 persons, IV class – in 2 persons (5.4%). Among the total number of patients fixing of an identical diagnosis for upper and lower

dentition was carried out in 57 people, and the presence of a teeth defect on one of the jaws in the absence of loss of teeth in the opposite – in 77 patients. Taking into account the data in all clinical cases, the following prevalence of defects in dentition was obtained according to the Kennedy classification: the I class - 17.3%, the II class - 18.4%, the III class - 62.8%, the IV class - 1.4%.

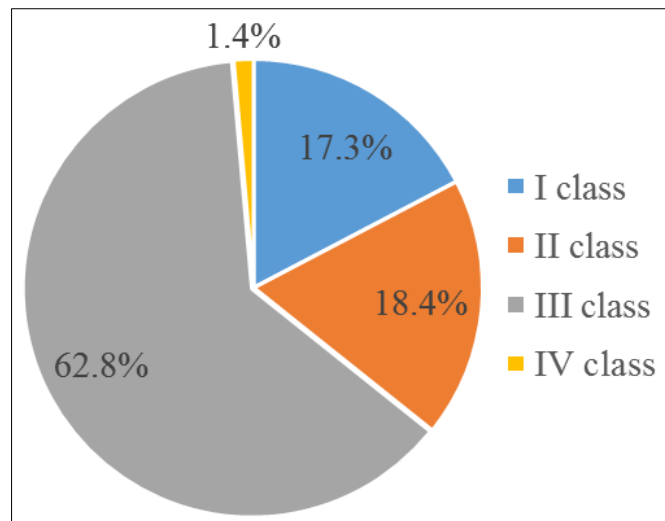


Fig 2: Indicators of the prevalence of dental defects according to Kennedy's classification (%).

Systematics of objective review and analysis of the diagnostic models made it possible to hold the patients of control group in number of 27 persons (13.2% from the general number of patients) the clinical picture of which was characterized by the presence of the destruction of the occlusive surface of the teeth and the absence of defects in the dentition. The distances

CD and XY differed due to the inherent features (size of teeth, their shape, membership of the jaws, the type of physiological or pathological bite) and acquired (with the presence of restorations of the studied surfaces, non-cariou lesions and destructive changes in periodontium).

Table 1: Indices of the height and width of the crown part of the teeth (mm) in the examined patients of group I.

Teeth	Height of the crown part (Distance XY) (mm)	Width of the crown part (distance CD) (mm)	Teeth	Height of the crown part (Distance XY) (mm)	Width of the crown part (distance CD) (mm)
11,21	9.2 ± 0.08	7.8 ± 0.06	31,41	6.6 ± 0.1	6.5 ± 0.06
12,22	7.4 ± 0.08	6.3 ± 0.04	32,42	6.5 ± 0.1	5.0 ± 0.08
13,23	8.8 ± 0.08	6.2 ± 0.09	33,43	7.8 ± 0.12	5.2 ± 0.07
14,24	6.6 ± 0.08	5.8 ± 0.08	34,44	6.5 ± 0.09	6.9 ± 0.15
15,25	6.4 ± 0.09	6.0 ± 0.08	35,45	6.5 ± 0.08	4.9 ± 0.18
16,26	7.0 ± 0.08	9.3 ± 0.46	36,46	6.2 ± 0.07	9.5 ± 0.39
17,27	6.5 ± 0.06	9.1 ± 0.07	37,47	6.2 ± 0.05	8.9 ± 0.07

Obtaining data of chewing, cutting surfaces and height of the clinical crown part on the diagnostic models in individuals of Group I (distance CD) and evaluation of the radiographic picture of patients made it possible to differentiate the presence of deformations of dental rows and to distribute 178 persons among other groups depending on the presence of deformation, efficiency and the possibility of their correction and the need to prevent the occurrence of displacement of teeth.

The second group consisted of persons for which were not manufactured individual tire-caps (47 patients, 22.9%), which was due in the first place to the absence of the required number of teeth for the manufacture of an individual removable tire-cap even in spite of the presence of deformations of various direction and localization in these persons. Also, the limited time of orthopedic treatment due to the individual situations of each patient was the factor prior to the prosthetics without preliminary preparation using thermoformed caps. In these group of people, most of whom

are 50-59 years old (19 persons - 40.4% of the group), defects of Class I of Kennedy (66.0%) are predominate, namely in 31 patients: one of the jaws with intact dentition on the other – in 7 people, on one of the jaws in the presence of a defect of another class on the opposite - in 16 and on both jaws – in 8 people. It should be noted that the presence of deformations of the dentitions is rarely recorded - only in 5 persons (10.6% of the group), and taking into account only cases with the absence of the first permanent molar and the presence of approximated teeth - only in 2 (4.3 % respectively).

The III group consisted of 80 persons (39.0%) with existing included defects of the tooth row and teeth deformations in the lateral area. Practically all patients in this group, which was characterized by almost identical number of people aged 18-29 (29 persons - 36.3% of the group), and 30-39 years old (27 persons - 33.8% respectively), diagnosed III class of Kennedy (74 persons - 92.5%) according to the next situations: in one of the jaws with intaction of the dentition on the other – in 38 persons, on one of the jaws in the presence

of a defect of another class on the opposite – in 13 persons and on both jaws - in 23 people. For persons of this group were made preparation to prosthesis with the use of individual removable tire-caps in several stages, the active action of which at each stage provide during modeling of approximal and / or occlusal lining.

The IV group consisted of 51 persons (24.9%), in which the included defect of the dentition in the lateral area was observed without displacement in any of the areas, for which in prevention events were manufactured individual removable tire-caps. Practically all patients in this group, which was characterized almost identical by the number of persons aged 18-29 (16 persons - 31.4% of the group) and 40-49 years old (15 persons - 29.4% respectively), diagnosed “III class of dentition defect by Kennedy ” (48 people - 94.1%): one of the jaws with intact tooth row on the other – in 25 people, one of the jaws in the presence of a defect of another class on the opposite side – in 7 people and on both jaws - in 16 people

If we take into account patients with clinical cases characterized by the absence of the first permanent molar with the presence of approximated teeth, then this pathology was recorded in 98 patients (55.1% of the total number of persons with dental defects): in 5 persons of group II and in 93 people (71.0% of the total number of people who made individual tire-caps), of which 60 persons of the III group and 33 persons of the IV group, which formed the basis of the comparative analysis of the efficiency of the use of individual demountable tire-caps.

The presence of deformities was observed in patients II and III groups, and their prevalence was recorded at 47.8% (85 patients) of the total number of persons with dental defects. Taking into account only the clinical situation with the absence of the first permanent molars (98 persons) in the presence of approximated teeth, this indicator was noted in 62 patients, which is 34.8%.

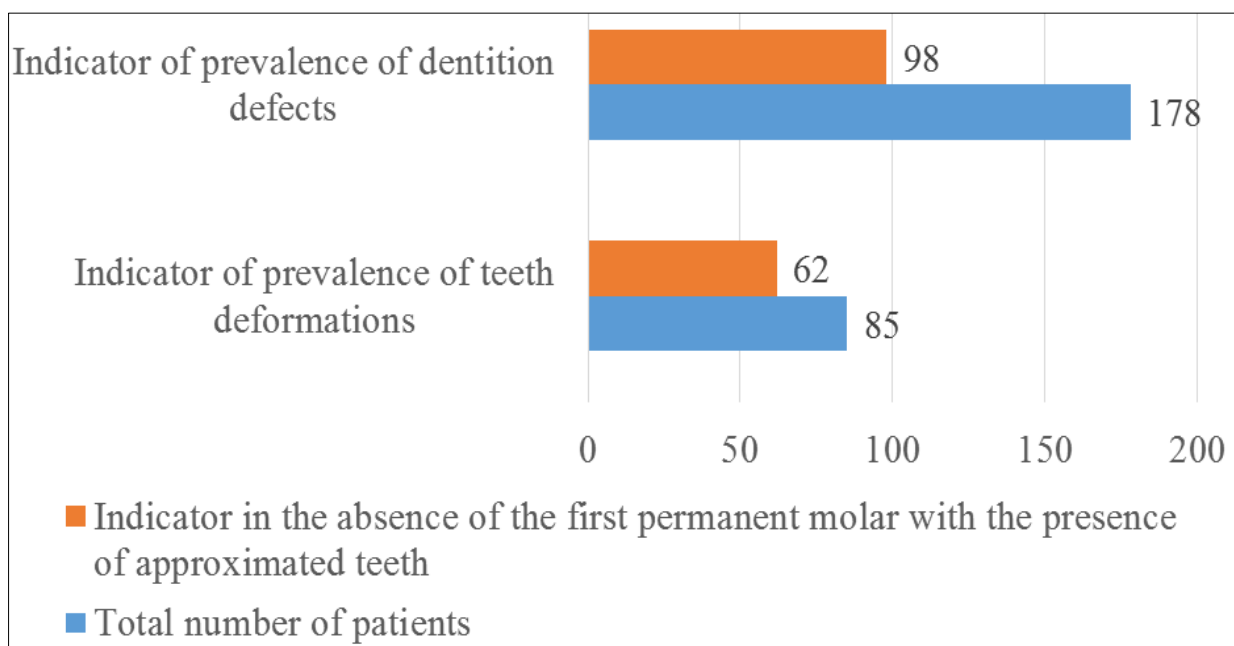


Fig 3: Prevalence of various pathologies dentition (number of patients).

Measurement of these five indicators in patients of the III and IV groups was performed twice: before using of an individual removable tire-caps (stage I) and after the use of one or several caps (Stage II). Data, which were obtained on I stage in group III, showed that distance AB was 4.32 ± 0.19 mm, AD is 4.16 ± 0.20 mm, BC is 4.07 ± 0.19 mm and CD is 5.67 ± 0.39 mm; in group IV showed that distance AB - $7.16 \pm$

0.19 mm, AD - 7.62 ± 0.19 mm, BC - 7.49 ± 0.19 mm and CD - 9.46 ± 0.41 mm. The data on the II stage showed that in the III group the AB distance was 5.85 ± 0.21 mm, AD - 6.09 ± 0.18 , BC - 6.22 ± 0.19 mm and CD = 8.73 ± 0.45 mm; in the IV group - AB - 7.23 ± 0.19 mm, AD - 7.55 ± 0.19 mm, BC - 7.43 ± 0.19 mm and CD - 9.53 ± 0.38 mm.

Table 2: Change in the distance between teeth surfaces in patients of different groups in the absence of the first permanent molars and the presence of approximated teeth (mm).

		AB	AD	BC	CD	XY	
						Premolar size	Molar size
Research group (60 persons)	I stage	4.32 ± 0.19	4.16 ± 0.20	4.07 ± 0.19	5.67 ± 0.39	6.9 ± 0.09	7.2 ± 0.08
	II stage	5.85 ± 0.21	6.09 ± 0.18	6.22 ± 0.19	8.73 ± 0.45	6.6 ± 0.09	6.9 ± 0.08
Group of prevention (33 persons)	I stage	7.16 ± 0.19	7.62 ± 0.19	7.49 ± 0.19	9.46 ± 0.41	6.5 ± 0.09	6.6 ± 0.08
	II stage	7.23 ± 0.19	7.55 ± 0.19	7.43 ± 0.19	9.53 ± 0.38	6.5 ± 0.09	6.6 ± 0.08
Group of persons for which were not manufactured individual tire-caps (5 persons)					8.90 ± 0.43	6.5 ± 0.09	6.6 ± 0.08
Control group (27 persons)					9.4 ± 0.43	6.5 ± 0.09	6.6 ± 0.08

The change in the height of the crown part of the tooth was rare, predominantly in the presence of antagonistic defects in

the tooth row, and was 6.9 ± 0.09 mm for premolars and 7.2 ± 0.08 mm for molars in patients in group II and was unchanged

in group IV. Before the preparation for the prosthetics for the patients of the research group with different size and location of the defect (80 persons), the following treatment methods were pre-selected: non-removable prosthesis with metal-ceramic constructs without pre-endodontic treatment of intact teeth - 18 persons (22.5%), non-removable prosthetics

with metal-ceramic constructs with pre-endodontic treatment of intact teeth - 45 persons (56.3%), implant placement with followed zirconium dioxide crowns manufacturing - 10 people (12.5%), clasp manufacturing with lock type of fixation - 7 persons (8.7%).

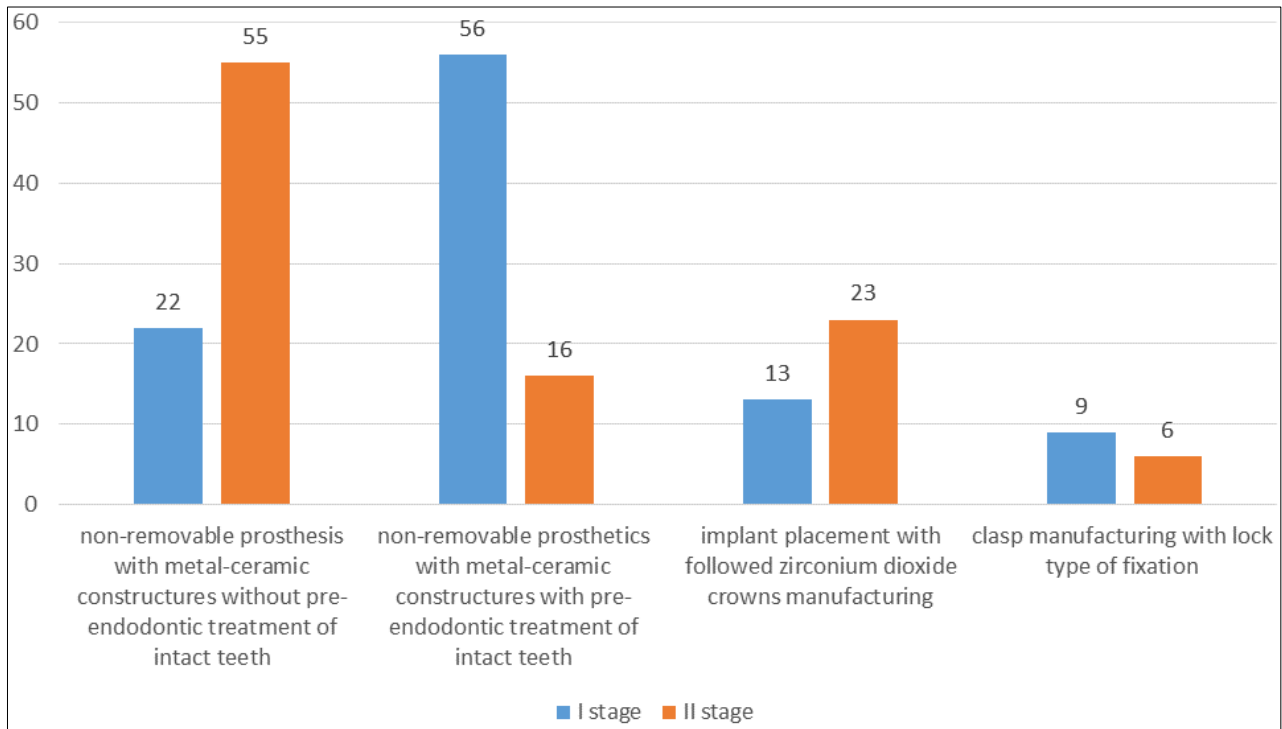


Fig 4: Parameters changing of choice of the treatment method before and after the use of individual removable tire-caps (%).

Average number of clinical receptions of preparation for prosthetics with replacement of individual tire-cap was 5.8 times.

After the use of individual removable tire-caps the situation are changed: non-removable prosthesis with metal-ceramic constructs without pre-endodontic treatment of intact teeth - 44 persons (55.0%), non-removable prosthetics with metal-ceramic constructs with pre-endodontic treatment of intact teeth - 13 persons (16.3%), implant placement with followed zirconium dioxide crowns manufacturing - 18 people (22.5%), clasp manufacturing with lock type of fixation - 5 people (6,2%).

Indications for prosthetics in patients of group of prevention had not changed.

Discussion

After a detailed study of efficiency of removable tire-caps using we compared the facts presented in the article to the research of other scientists. The first molar absence and included defect development was observed in 55.1% of patients (98 persons), but the diagnosis "Partial absence of teeth. III class by Kennedy "took place in 62.8% of patient, which is the highest indicator in comparison with the data presented 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 in the control (7.16 ± 0.19 mm and 7.62 ± 0.19 mm in compare with 7.32±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.

Determining the difference in data on the height of clinical crowns of teeth in patients in the control group made it possible to compare the reliability of the data with the work of Tkachenko I.M. [7] and to show the similarity of clinical outcomes. The small difference in the indices of the first permanent molars (7,0 ± 0,08 mm versus 6,7 ± 0,08 mm) can be explained by the size of the sample and the generalization of the indices of the various jaw sides in this work.

Conclusions.

1. We found that the third class of partial absence of teeth by Kennedy was observed more often and was 62.8% of all cases of tooth loss.
2. It was fixed that pathology of the absence of the first permanent molar and the presence of approximated teeth is one of the most common and was 55.1%.
3. This indicator of teeth deformations diagnosis in patients with dentition defects is high - 47.8%, from which if pathology of the absence of the first permanent molar and the presence of approximated teeth – 34,8
4. Detection the required distances between the surfaces of the teeth surrounding the defect, and their performance (reducing the distance AB to 39.7%, AD - at 45.4% and BC - at 45.7% compared to the group of prevention and CD – at 40.1% compared to the control group) made it possible to assess the severity of the clinical picture in the presence of teeth deformations.
5. Changing the above mentioned indicators during preparing patients with existing teeth deformations before

prosthetics closer to physiological norm (decline in reducing the distance AB to 18.3%, AD - to 20.1% and BC - to 17.0% compared to the control group) shows the efficiency of individual removable tire-caps using for correcting position of displaced teeth.

6. Changing the indications for orthopedic treatment with the aim of creating the possibility of implantation practically in 2 times (from 12.5% to 22.5%) and reducing the need for the deviations of supporting teeth due to excessive inclination by 40% indicates the effectiveness of correction of displaced teeth position.

Prospects for further research in this area

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.

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