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PREVALENCE AND CHARACTER OF OCCLUSIONAL DISORDERS AMONG YOUNG PEOPLE

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Abstract. Prevalence and character of occlusional disorders among young people. Fastovets O.O., Shtepa V.O.

Dynamic occlusion is the main indicator of the harmonious functioning of the dental apparatus. At the same time, irrational reconstructive treatment can lead to its disorders and, as a result, increased tooth wear, periodontal diseases, dysfunction of masticatory muscles and temporomandibular joints. To date, the computer diagnostic methods allow studying occlusion in dynamics. The aim of the research was to study the prevalence and character of occlusal disorders in young people with intact dentitions, and those whose defects in teeth and dentitions were restored by direct and indirect restorations. 300 persons aged 25-44 years were examined, equally men and women: the first group – 100 persons with intact dentitions; the second one – 100 persons with direct composite restorations located on the occlusal surfaces of the molars; the third one – 100 persons, who had indirect restorations of the crowns of teeth and dentitions of small sizes. Intercuspitation were analyzed using methods of occlusiography, the study of diagnostic models in the articulator, and computer analysis of occlusion. According to the peculiarities of centric and eccentric occlusions, the sequence of formation of the maximum occlusal load vector, the balance of occlusion and the time of closing and opening of dentitions, occlusal disorders were diagnosed in 14.0% of the first group, 35.0% of the second one and 44.0% of the third one. In 100% of patients these disorders were compensated, asymptomatic. The presence of supracontacts in centric occlusion leads to a displacement of the mandible in a forced position in 17.7% of cases. In 83.0% of the examined persons, the occlusion balance was at the level of 50%-50% and in 13.7% – 60%-40%. The remaining 3.3% of patients had an occlusive imbalance in the range of 70%-30%. In this case, significant deviations of the total trajectory vector of the occlusal load were not revealed. The most common occlusion disorders were centric contacts, which are formed as consecutive single, multiple, unilateral and bilateral overload areas, constantly being changed on sliding in dynamic occlusion. Occlusive disorders are characterized by an increase in the time of closure and opening of the dentitions, and the time to reach the maximum number of interdental contacts. The efficiency of occlusiography was only 29.7%, the efficiency of the study of diagnostic models in the articulator was 59.7% compared to the computer method with 100% of the information value. The widespread use of direct and indirect restorations of teeth and dentitions leads to an increased prevalence of occlusal disorders in young people. Usually, small restorations are integrated into the dentition by grinding their occlusal surface, focusing on patient's comfort on closing the teeth and unhindered movements of the mandible to the sides and forwards. This simplified approach is conformative and incapable of providing optimal functional occlusion. The presence of occlusal imbalance requires appropriate measures for its diagnosis and correction.

Реферат. Распространенность и характер окклюзионных нарушений у лиц молодого возраста. Фастовец Е.А., Штепа В.А.

Динамическая окклюзия является основным показателем гармоничного функционирования зубочелюстного аппарата. Вместе с тем, нерациональное реконструктивное лечение может привести к ее нарушению и, как следствие, повышенному стиранию зубов, заболеваниям тканей пародонта, дисфункции жевательных мышц и височно-нижнечелюстных суставов. На сегодняшний день изучать окклюзию в динамике позволяют компьютерные методы диагностики. Цель исследования – изучить распространенность и характер окклюзионных нарушений у лиц молодого возраста, имеющих интактные зубные ряды, и тех, у кого дефекты зубов и зубных рядов восстановлены путем прямых и непрямых

реставрацій. Обстежено 300 чоловік в віці 25-44 років, порівну чоловіків і жінок: перша група – 100 чоловік з інтактними зубними рядами; друга – 100 чоловік з прямими композитними реставраціями, розташованими на окклюзійних поверхнях молярів; третя – 100 чоловік, цілісність коронок зубів і зубних рядів у яких відновлена непрямою реставрацією малих розмірів. Окклюзійні співвідношення аналізувалися з використанням методів окклюзіографії, вивчення діагностичних моделей в артикуляторі і комп'ютерного аналізу окклюзії. По особливостям центричної і ексцентричної окклюзії, послідовності формування вектора максимальної окклюзійної навантаження, балансу окклюзії і часу замикання і розмикання зубів окклюзійні порушення діагностовані у 14,0% осіб першої групи, у 35,0% – другої і у 44,0% – третьої. В 100% випадків ці порушення мають компенсований, бессимптомний характер. Наявність супраконтактів в центричній окклюзії призводить до зміщення нижньої щелепи в вимушене положення в 17,7% спостережень. У 83,0% обстежених баланс окклюзії знаходиться на рівні 50%-50%, а у 13,7% – 60%-40%. В 3,3% випадків виявлено окклюзійний дисбаланс в межах 70%-30%. При цьому суттєвих відхилень суммарного вектора траєкторії окклюзійної навантаження не встановлено. Найбільш поширені порушення окклюзії – центричні контакти, формуються як послідовні одиночні, множественні, одно- і двосторонні ділянки перевантаження, постійно змінюються при скользянні в динамічній окклюзії. Окклюзійні порушення характеризуються збільшенням часу замикання і розмикання зубних рядів, а також часу досягнення максимальної кількості міжзубних контактів. По даним нашого дослідження, ефективність окклюзіографії становить 29,7%, вивчення моделей в артикуляторі – 59,7% порівняно з 100% інформативністю методу комп'ютерної діагностики. Широке застосування прямих і непрямих реставрацій зубів і зубних рядів призводить до збільшення поширеності окклюзійних порушень у осіб молодого віку. Як правило, реставрації малих розмірів інтегруються в зубочелюстний апарат шляхом пришлифовування їх окклюзійної поверхності, з орієнтацією на комфорт пацієнта при замиканні зубів і безперешкодливі рухи щелепи в сторони і вперед. Такий спрощений підхід вважається конформативним і неспроможним забезпечити оптимальну функціональну окклюзію. Наявність окклюзійного дисбалансу вимагає проведення відповідних заходів по його діагностиці і корекції.

Recently, in dentistry, there have been advances in the use of the latest technologies and modern materials. Now dentures are able to create a complete imitation of natural dentition. At the same time, patients with various unpleasant sensations caused by dental prosthetics, ranging from hypersensitivity of the teeth, morning fatigue of the masticatory muscles and ending with facial pain, are visiting the clinic increasingly. The reason for such visits in many cases is a disorder of functional occlusion [6].

Creation of false occlusal relations, which are quite difficult to diagnose, can also lead to dysfunction of the temporomandibular joints, disorders in the functioning of the masticatory muscles, increased abrasion of the hard tissues of the teeth, as well as periodontal tissue damage due to the lack of systemic gnathological treatment, tendency to restore only the anatomical shape of individual teeth in the dentition [1, 3, 7]. It should also be borne in mind that any changes in the occlusal ratio due to dental prosthetics can significantly affect the adaptability of the dental apparatus, in particular the coordinated functioning of the masticatory muscles and temporomandibular joints [4].

In turn, to ensure the harmonious functioning of the dental apparatus is possible only if the joint characteristics are in concordance with occlusive. The initial position of the jaw closure, which depends entirely on the morphology of the tooth

surfaces, significantly affects the condition of other components of the masticatory apparatus. Accordingly, the starting point for the analysis of movements in the temporomandibular joints is the position of the central ratio of the jaws, which in practice is defined as a conditionally terminal hinge axis (kinematic center). Defining such a center and transferring it to the articulator is important for proper analysis of occlusal relationships [8].

In the future, when analyzing diagnostic models in an individually adjusted articulator, the state of occlusion in closing the teeth is determined by the number of occlusal contacts – increased or decreased area may indicate occlusal instability (disorder of occlusal balance, occlusal imbalance). Multiple symmetrical uniform contacts in all possible occlusions allow providing high masticatory efficiency and adequate distribution of teeth loading [9].

It should also be noted that previously normal occlusion was determined only by static features, not taking into account the fact that the closure of the dentition is a dynamic process. Now for the characterization of occlusal relations and diagnosis of occlusal disorders in particular, there is a need to study such dynamic characteristics as time and strength of perception of occlusal loading by different functional groups of teeth, parameters of placement of occlusal loading vector, sequence of occlusal contacts of dentitions, which is possible with computer analysis of occlusion [5].

Based on all the above, we considered it appropriate to study how reconstructive treatment of teeth and dentitions using both indirect (dentures) and direct restorations can affect the functional dynamic occlusion in young people.

Thus, the aim of the presented work is to study the prevalence and nature of occlusal disorders in young people with intact dentition, and in those with defects of teeth and dentition restored by direct and indirect restorations.

MATERIALS AND METHODS OF RESEARCH

As part of this work, we surveyed 300 people aged 25 to 44 years, who according to the WHO classification belong to the young age. During the three-year study, we formed three groups identical in quantitative composition, as well as by gender (men and women in equal number). Thus, 100 people with intact dentitions were included in the first group. Only direct restorations of the crown portions of the teeth, located outside their occlusal surface were allowed in them. The second group included 100 people who had direct composite restorations, in particular localized on the occlusal surfaces of molars. The third group included 100 people in whom the integrity of the crowns of individual teeth and dentitions was restored by indirect restorations (inlays, crowns, dental bridges of short length (up to 3 units in each segment)). It should be noted that such experiments assumed a high probability of reproducing new occlusal relations in the articulator.

Criteria for exclusion from the study were the presence of periodontal and oral mucosa disease, as well as diagnosed dental anomalies. All subjects included in the study had an orthognathic occlusion. Significantly, the selected individuals did not

complain of either the quality of the restorative treatment or of the discomfort of the teeth closure, functioning of the masticatory muscles and joints.

Examination of this contingent, first of all, included an external examination, during which the proportionality of the face was assessed, the correspondence of the interalveolar height to the height of relative physiological rest was established as well. In addition, palpation of the actual masticatory and temporal muscles and temporomandibular joints was performed to determine the synchronicity of movements and the presence of pain. According to the indications, the condition of the temporomandibular joints was additionally examined using computed tomography "Orthphos DS" ("Sirona", Germany).

On examination of the oral cavity the ratio of dentitions in the position of central occlusion, as well as signs of functional overload of teeth in the form of facets of increased teeth abrasion, cracks and chips of enamel or dentures, wedge-shaped defects of dentitions was defined. In addition, the clinical part of the study involved determining the nature of occlusal relationships in centric (or habitual) and eccentric occlusions using the method of occlusiography and articulation paper of different thickness of "Bausch" company (Fig. 1). If in the center of the stained area a small bright area of spot-size was observed, then this contact was considered the true place of supracontact. During the analysis of occlusal relations, the description of the stained areas was carried out as follows: crushed contact, contact with intensive staining, contact with non-intensive staining, slight articulation paper trace, no articulation paper trace.

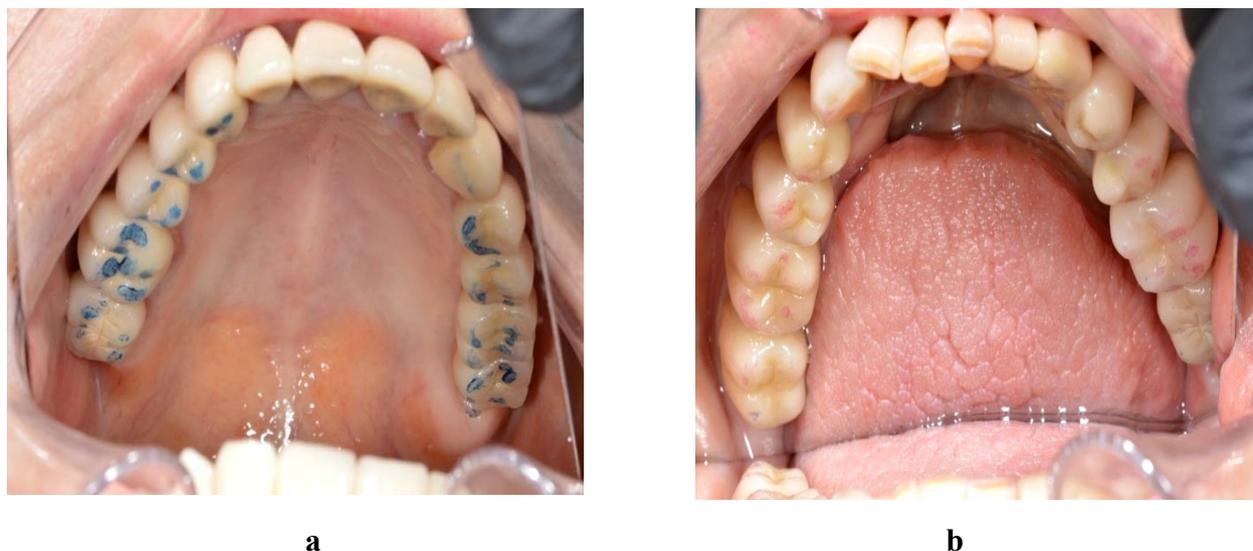


Fig. 1. Occlusiography technique with the use of articulation paper of different thickness, "Bausch" company: a - 200 microns; b - 40 microns

The analysis of occlusal ratios of dentitions was also performed on diagnostic models in the articulator "Stratos® 300" type Non-Arcon company "Ivoclar, Vivadent", Austria [6]. For individual adjustment of the articulator, each patient received

occlusion recorders made of silicone materials in a state of centric (habitual) and eccentric (anterior and lateral) occlusions. Comparison of models of jaws in the articulator was carried out using a facial arc UTS 3D "Ivoclar, Vivadent, Austria" (Fig. 2).

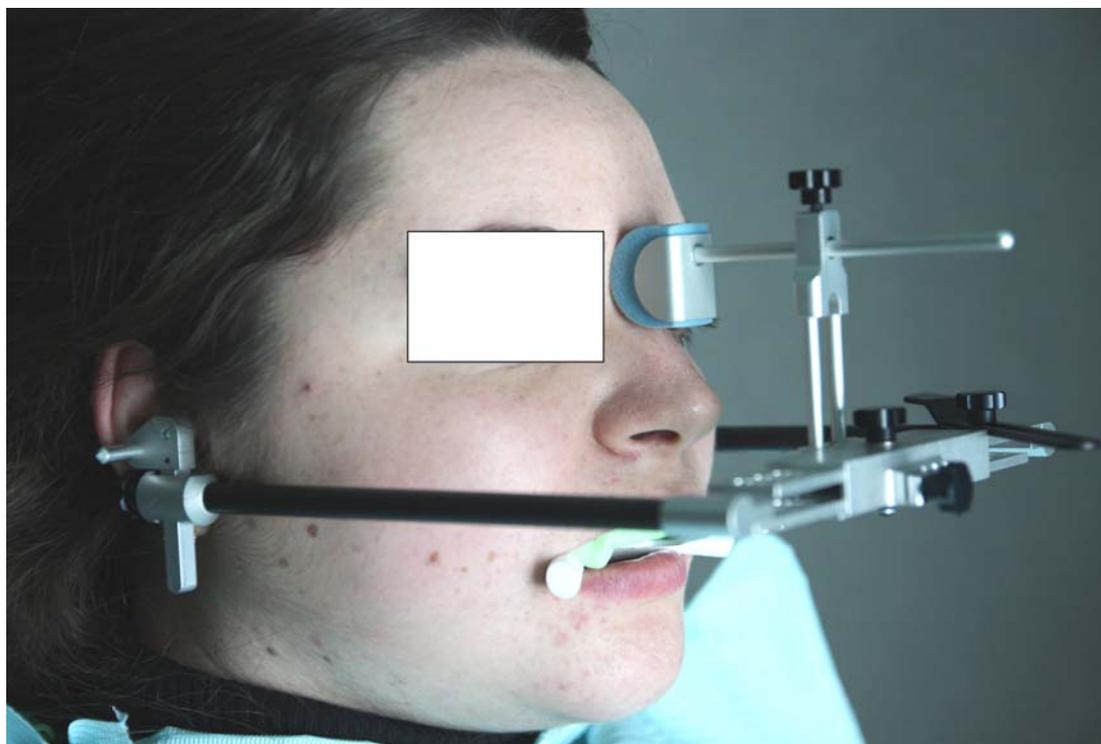


Fig. 2. Fixation of the facial arch in clinical settings

Additionally, the central ratio of the jaws by the method of a vertical post was determined in the clinic [8]. This technique allowed to register the

horizontal movements of the lower jaw and the lateral and anteroposterior directions in the form of a record of the Gothic angle (Fig. 3).



a



b

Fig. 3. Determination of the central ratio of the jaws by the method of a vertical post; a - vertical post; b - image of the Gothic angle, the point of position of the central ratio of the jaws and the line of protrusion movement

The models in the articulator were plastered in a centric (habitual) occlusion using silicone occlusion registrants (Fig. 4) or using the method of the control base of the upper jaw model [8] to establish the direction of displacement. First of all, occlusal contacts in the position of the posterior contact place

and along sliding on the center were studied. Subsequently, in the position of the central occlusion, the interdental contacts on the supporting tubercles were marked for further consideration in finding the usual occlusion.



a

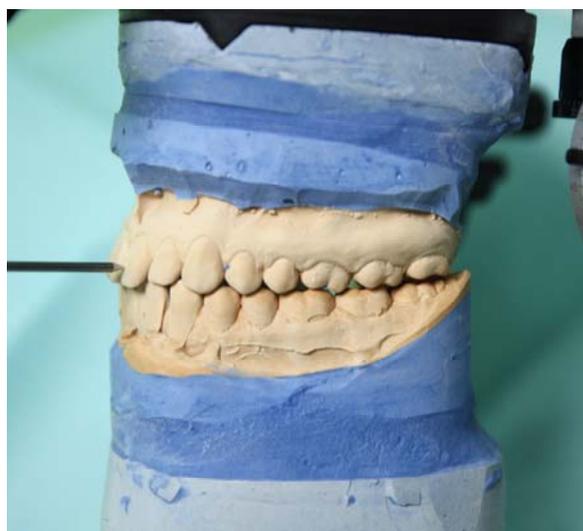


b

Fig. 4. Plastering of models in the articulator with the help of bite registrants: a - models of jaws in the closed state; b - in the open state

The appearance of a gap during movements between the basement of the upper model and its base when comparing the models of both jaws by the blocks obtained in the position of habitual occlusion,

revealed the direction and degree of displacement between the positions of the central ratio of jaws and habitual (actual) occlusion (Fig. 5).



a



b

Fig. 5. Disorder of occlusion ratios (habitual occlusion of teeth mismatches centric): a – left view; b – right view

Eccentric occlusion analysis was used to study the existing previous contacts (supracontacts) on the working and balancing sides. The nature of the contacts on the laterotrusion side (canine conduction or group guiding function) indicated the nature of the closure and occlusal contacts in the anterior occlusion.

In addition, the area, intensity and sequence of interdental contacts in centric and eccentric occlusions were examined by computer analysis using a T-Scan III device from Tekscan (USA) according to the manufacturer's methodology. After adjusting the device, the occlusion parameters were recorded in the following positions: the central ratio of the jaws to display the first occlusal contacts; maximum interdental contact to determine the force of closure, occlusion imbalance and the time of occlusion and desocclusion; excursion movements of the mandible (laterotrusion and protrusion) to determine working and non-working obstacles; habitual closure to determine previous tooth contacts. The standardized recording of the computer occlusion was performed

in the usual occlusion position. The analysis of the occlusiogram was performed according to the following main parameters: localization, duration, share of each tooth and the resulting strength of the total occlusal loading. Each record determined the period of appearance of the first occlusal contact and its placement, the presence or absence of contact between all teeth and the percentage distribution of the balance of forces between the left and right sides at the time of multiple occlusion.

Signs of physiological occlusion were considered to be the absence of contacts stained in red and pink; the presence of multiple contacts, mostly of blue color, evenly distributed throughout the dentition; absence of significant difference in strength between multiple contacts of blue and contacts of other colors (except red and pink); uniformity of the percentage loading between the antagonist teeth on the right and left relative to the central line; the relative straightness of the total loading vector which should begin in the frontal area and end in the center of the middle third of the hard palate (Fig. 6).

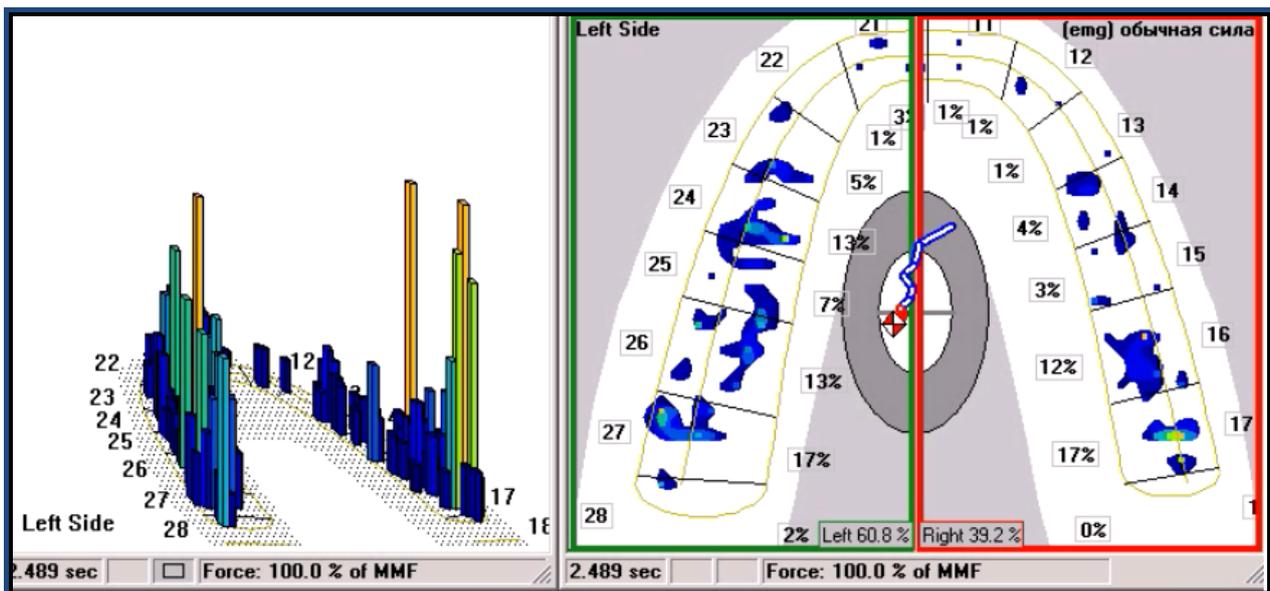


Fig. 6. Computer analysis of occlusion with using «T-Scan III»: a – three-dimensional image; b – two-dimensional

The results of computer diagnostics of occlusion were compared with the data of occlusiography in the clinic, as well as the results of the study of diagnostic models in the articulator.

The obtained data were processed by traditional methods of variation statistics using the licensed software product MS Excel 2003 [2].

RESULTS AND DISCUSSION

The evaluation of data of external surveying of the study subjects did not reveal any impairments. Disorders of the masticatory muscles and tempo-

romandibular joints were also not detected. According to the results of additional computed tomography in 12 subjects from the third study group, the normal relative position of the elements of the joints was registered.

Subsequent examination of the oral cavity allowed to study the contacts of the central ratio of the jaws, which were located on the occlusal surfaces of almost all groups of teeth (on the apexes and slopes of the humps, as well as in the fissures of molars and premolars, on the cutting edges of lower

front teeth and palatal surfaces). Symmetrical position of interdental contacts prevailed in all study subjects (84.0% of observations). Unilateral position of the contacts of the central ratio of the jaws was found in the remaining 16.0%, of which 12.0% – on the molars and premolars.

Further occlusiography revealed the presence of supracontacts in the subjects of the second and third observation groups. Centric occlusion disorders were manifested by unstable occlusion of the dentition, minimal deocclusion of the lateral teeth, overload of the anterior teeth during closure and were detected in 10.0% of the subjects of the second group and 23.0% of the third.

In turn, the disorder of dynamic occlusion was manifested by a long centric sliding, difficult displacement of the mandible forward and sideways, blocking of movements in the protrusion. The use of articulation paper revealed balancing and hyperbalancing contacts on the non-working side (mediotrusion supracontacts) in 8.0% of the second group and 6.0% of the third. Respectively, balancing and hyperbalancing contacts on the working side (laterotrusion supracontacts) were established in 7.0% of the second and 6.0% in the third group. Finally, protrusion supracontacts were observed in 8.0% of the second group and 8.0% of the third. Mention the impossibility of differentiating balancing and hyperbalancing contacts, because they were primarily determined by the individual force of compression of the jaws.

The analysis of the records of the Gothic angle revealed a discrepancy between the usual closure of the jaws and the central one in 12.0% of the patients from the first group, in 18.0% – from the second and 23.0% – from the third. However, the lack of complaints from the patients indicated the processes of compensation in the dental apparatus. In 27.0% of patients asymmetry of the sides of the Gothic arch, different length of the trajectories of the right and left movements was observed, which testified to a disorder of displacement of the mandible sideways, as well as curvature of figure of occlusal movement in central occlusion and deformation of the protrusion line, and therefore the inability to find a fixed position of the lower jaw.

According to the results of studying the diagnostic models of the first study group in the articulator, we found an incisal overlap in the frontal area of the dentition and fissure-hump contact - in the lateral, which were determined by uniform slight abrasion of tooth surfaces in the form of facets. In the analysis of eccentric occlusions in 67.0% of the subjects canine management, and in the remaining 33.0% – group guiding function was established. In

contrast to clinical occlusiography, centric supracontact was observed in 8.0% of cases, protrusion - in 6.0%, laterotrusion – in 1.0%, mediotrusion – in 4.0%.

In the second experimental group, no teeth closure disorders in central occlusion were detected, although there was a tendency to increase in the area of tooth closure and to replacement of point contacts with plane ones. When the mandibular model in the articulator shifted sideways, canine management was diagnosed in 58.0% of patients, group guiding function – in 37.0%, and balancing occlusion – in 5.0%. Failed restoration of occlusal surfaces of teeth contributed to an increase in the number of supercontacts on the working and balancing sides to 8.0% of observations. No hyperbalancing contacts were detected.

In the third experimental group, the analysis of diagnostic models in the articulator allowed to register an increase in the area of contacts between the antagonist teeth, as well as the phenomenon of local desocclusion, the appearance of which was associated with ultra-high humps on dental bridges. Moreover, in 7.0% of the subjects, not only the supporting but also the retaining humps of the molars were in contact. Canine management was established in 67.0% of persons, group directing function – in 19.0%, balancing occlusion – in 14.0%. Supra-contacts on the working side were detected in 18.0% of observations, balancing contacts – in 13.0%, hyper-balancing contacts – in 5.0%.

Balance of occlusion (uniformity of interdental contacts on the right and left sides of the jaws) is one of the signs of its physiology. A balance of 50% to 50% is considered ideal, 60% to 40% – acceptable. Further imbalance leads to a functional overloading of the teeth on one side of the jaws. Symmetrical distribution of occlusal forces on both sides of the dentition corresponds to balanced occlusion and is denoted as the total vector of the trajectory of the occlusal loading (Fig. 6).

Of course, the most accurate method of studying the above characteristics of occlusion is the computer diagnostics used in our work. In the vast majority of subjects (83.0%) the balance of occlusion was registered at the level of 50%-50%, in 13.7% – as 60%-40%. The remaining 3.3% had an occlusive imbalance in the range of 70%-30%. Thus, no significant occlusion imbalance was observed in any patient.

As can be seen from Figure 7, the degree of balanced occlusion decreased in accordance with the increase in the volume of restorations of the dentition in the study groups. No significant disorders of the total vector of the trajectory of the occlusal

loading were detected. In all subjects it was localized from the first occlusal contact to the last

contact in the area of the molars, which is the point of physiological support in closure of the dentitions.

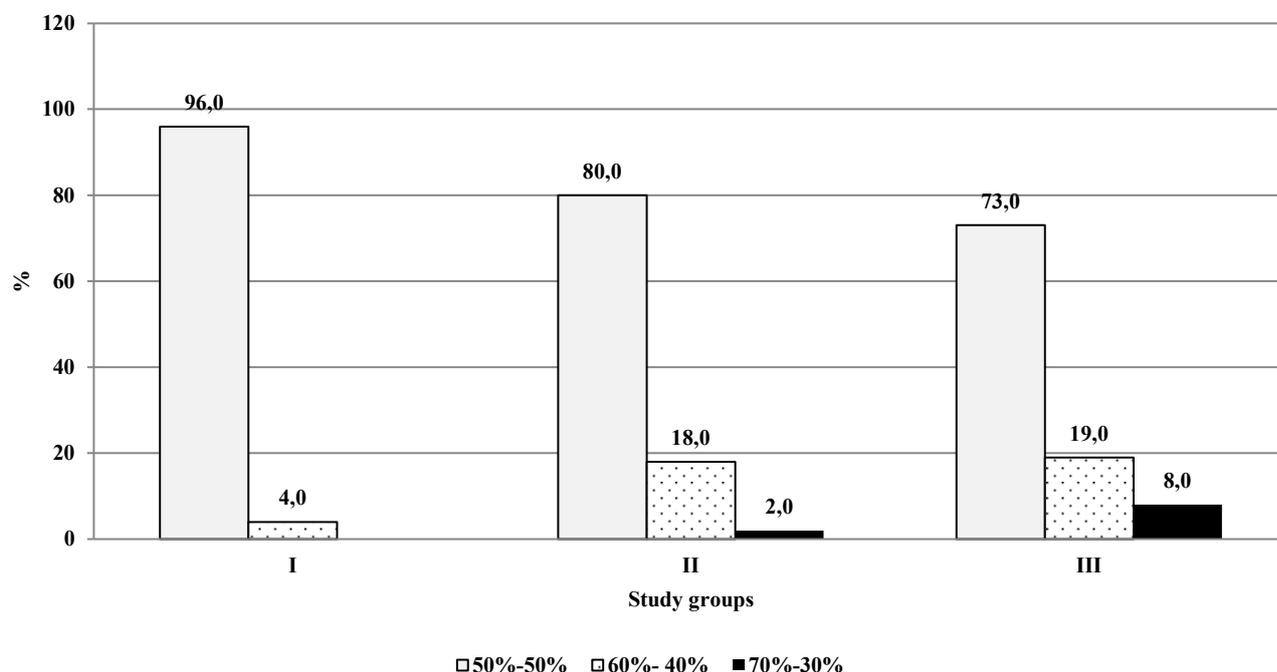


Fig. 7. Balanced state of occlusion load in study subjects of different groups (%)

While the balance between the right and left sides of the jaws at the time of maximal interhump closure is the leading characteristic of occlusion, but not alone. A perfectly balanced occlusion may contain components of functional overload. Thus, if in the first group in dynamic occlusions, obstacles to free laterotrusion movements of the mandible were observed only in 4.0% of cases, herewith the total occlusal load schedule showed a balanced and coordinated work of the masticatory muscles, then in the other two experimental groups supracontacts at the time of maximum interstitial compression, as well as premature contacts that prevented the emergence of symmetrical contacts on both sides of the jaws were observed. At the same time, with an almost ideal balance of occlusion of 55%-45% in the area of the molars on both sides, occlusal contacts which significantly exceeded the strength of physiological were noted.

In the study subjects from the first group the supracontacts in dynamic occlusion were single, the movements of the mandible were free, without obstacles. In these individuals, the uniform occurrence of occlusal contacts throughout the dentition was noted both in the initial phases of jaw closure and in the final phase, which characterizes

the state of maximum interdental contact in functional occlusion.

Among the rest of subjects under study during the computer analysis of occlusion, the most common disorders were centric contacts which were formed as successive single, multiple, unilateral and bilateral areas of overload; they constantly changed when sliding into a dynamic occlusion.

A comparison of the prevalence of static centric and eccentric supracontacts detected by occlusiography, the study of articulatory diagnostic models and computer diagnostics is shown in Figure 8.

It should be noted that 107 supracontacts were detected with articulation paper, 214 – with articulators and 358 – with computer diagnostics. Thus, the use of computer analysis of occlusion significantly increases the accuracy of diagnosis of occlusal disorders. In turn, the traditional technique of occlusiography using articulation paper does not always give reliable results.

According to our data, the accuracy of diagnosis of occlusal contacts using articulation paper is only 29.7%, and when studying diagnostic models in the articulator – 59.7% compared to 100% efficiency of computer occlusion.

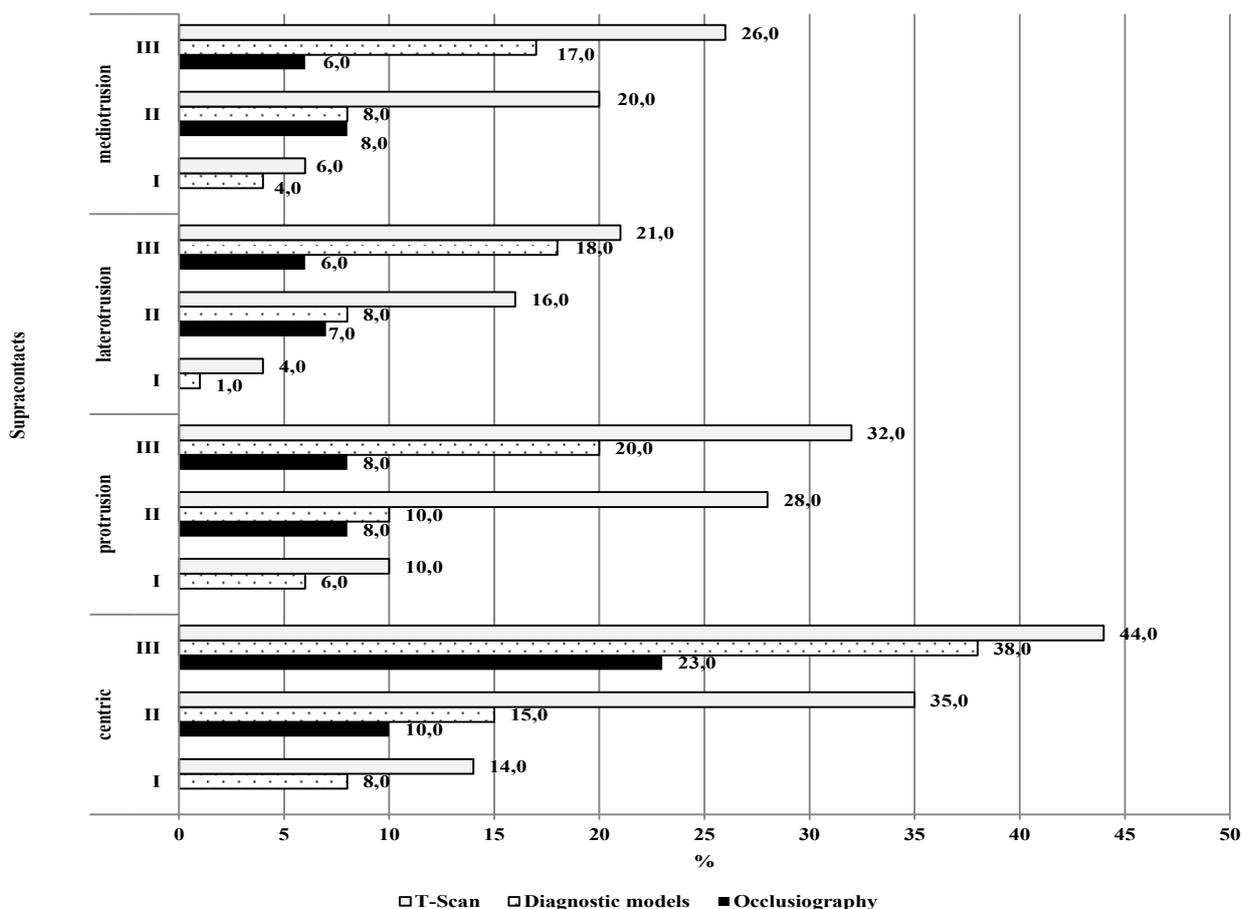


Fig. 8. Prevalence of occlusion disorders in study groups by the data of various research methods (%)

Finally, the nature of occlusal relationships is determined not only by the area of contacts, but the sequence and time of their occurrence. Occlusive disorders are characterized by an increase in the time of

closing and opening of the dentition, as well as the time to reach the maximum number of contacts. Thus, in our observation we found differences in these indicators for the three groups of observations (Fig. 9).

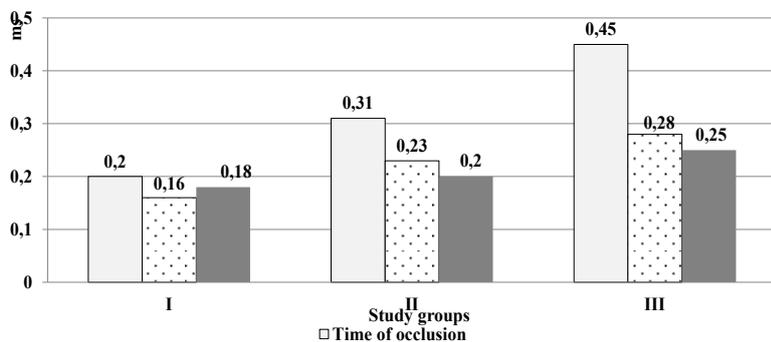


Fig. 9. Comparative analysis of time indicators of occlusion in study groups (ms)

CONCLUSIONS

1. Occlusive disorders in the form of foci of occlusal overload and premature occlusive contacts are widespread in young people. Comprehensive analysis of occlusion by the parameters of the state of centric, eccentric occlusions, the sequence of formation of the vector of maximum occlusal load, balance of occlusion and time of closing and opening of teeth allowed to claim the presence of occlusive disorders in 14.0% of people with intact dentition, 35.0% – with the presence of direct restorations of occlusal surfaces and in 44.0% – in the restoration of dentition with fixed dentures of small size.

2. In 100% of patients occlusal disorders have a compensated nature and asymptomatic course, which complicates the diagnosis. Lack of adequate correction can lead to a number of complications. Thus, in the presence of supracontacts in central occlusion, the mandible is displaced to a forced position, registered in 17.7% of cases in our study, which can turn into a stable functional displacement on the background of musculoskeletal dysfunction. At the same time, supracontacts that occur in eccentric occlusions are an obstacle to smooth sliding occlusion, they cause a change in trajectory or limit the amount of eccentric articulatory movements.

3. Carried out restorations of teeth and dentitions lead to changes in the normal state of occlusion, in particular to the formation of premature contacts. The reason is that in practice, small

restorations are integrated into the dental apparatus by grinding the occlusal surface, focusing on comfort in teeth closing and unimpeded movements of the jaws to the side and forward. At the same time, the study of dynamic occlusion for other groups of teeth is not performed. This simplified approach is conformational and unable to provide optimal interdental relationships.

4. Reconstructive treatment without substantiation of the occlusal scheme, including modeling of both direct and indirect restorations in the adjustable articulator, measures of occlusal diagnostics and correction, as well as the use of wax-up and mock-up techniques and the manufacture of temporary structures can not provide a sufficient level of efficiency from the standpoint of functional occlusion.

5. The presence of occlusal imbalance after irrational rehabilitation treatment requires diagnostic and therapeutic measures of occlusal correction in a set of rehabilitation measures among this group of patients. Otherwise, the asymptomatic course of occlusal imbalance neutralizes the positive results of treatment.

6. The use of computerized T-Scan occlusion analysis can significantly increase the efficiency of supracontact diagnostics compared to traditional occlusography methods and detect a dynamic component in central occlusion, and therefore can be recommended for widespread implementation including the diagnosis of occlusal disorders in young people.

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