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## ANALYSIS OF ACCURACY OF DETERMINING THE CENTRIC RELATION OF JAWS IN SECONDARY COMPLETE ADENTIA

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The purpose of the study is to investigate the accuracy of determining jaw center relations in clinical practice in secondary complete adentia. In the study, complete removable plate prosthesis preparation was performed using the improved method in 204 patients aged 45 to 90 years, including 102 (50.0 %) men and 102 (50.0 %) women with secondary complete dentition, which constituted the main group. We performed traditional preparation of prosthesis in 405 patients aged 45 to 90 years, including 206 (50.9 %) men and 199 (49.1 %) women with second complete adentia, and formed a control group. The occlusal method was used to study the central jaw relationships in the central occlusal state. This method was compared with control group, when during preparing completely removed plate prosthesis, the area of the prosthesis and surrounding tissues are changed as a result of pressure when the doctor measures.

**Key words:** secondary full adentia, central relation, central occlusion, orthopedic treatment, complete removable plate prosthesis, a state of relative calmness of the jaws, prosthetic bed.

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## АНАЛІЗ ТОЧНОСТІ ВИЗНАЧЕННЯ ЦЕНТРАЛЬНОГО СПІВВІДНОШЕННЯ ЩЕЛЕП ПРИ ВТОРИННІЙ ПОВНІЙ АДЕНТІЇ

Метою дослідження є вивчення точності визначення центральних співвідношень щелеп у клінічній практиці при вторинній повній адентії. У ході дослідження було проведено виготовлення повних знімних пластинкових протезів за вдосконаленою методикою у 204 пацієнтів віком від 45 до 90 років, у тому числі 102 (50,0 %) чоловіків та 102 (50,0 %) жінок з вторинною повною адентією, які склали основну групу. Ми провели традиційне виготовлення протезів у 405 пацієнтів віком від 45 до 90 років, у тому числі 206 (50,9 %) чоловіків та 199 (49,1 %) жінок із вторинною повною адентією, які склали контрольну групу. Оклюзійний метод використовувався для вивчення центральних співвідношень щелеп у центрально-оклюзійному стані. Даний метод порівнювався з контрольною групою, коли при виготовленні повного знімного пластинкового протеза в результаті тиску при вимірюванні лікарем вимірюється площа протеза та навколишніх тканин.

**Ключові слова:** вторинна повна адентія, центральне співвідношення, центральна оклюзія, ортопедичне лікування, повний знімний пластинчастий протез, стан відносного спокою щелеп, протезне ложе.

Orthopedic treatment with completely removed prostheses aims to achieve optimal functional restoration of anatomical and physiological parameters in secondary complete adentia [12].

Central occlusion is particularly important for the stabilization of fully removed plastic prostheses and their compatibility. The central occlusion is the occlusion contacts of functional articulation, balanced by an occlusive charge force provider, which means the restoration of optimal localization of topography [9, 13].

Thus, the central relationship that creates the central bite was the most controversial area of dentistry and its definition remains an ongoing problem. The central position in secondary full-adeny is defined by finding the repetitive position of the lower jaw independently of the teeth. This question has been a controversial one for almost 100 years. According to the domestic and foreign literature, there are more than 30 proposed methods of defining this term [1, 8, 12].

A number of methods for determining the central jaw relationship are more commonly used by dentists in clinical practice. Bilateral manipulation (P. Dawson, 2006); frontal deprogrammer (V. Lucia, 1964); multileaf template (J. Long, 1970); intraoral gothic angle recording device (A. Gysi, 1908) have been used to determine CA [3, 4].

A number of modern scientists compare and critically analyze occlusion contact recording methods using quantitative and qualitative methods. It is believed that the use of modern jointed paper of different structure and thickness ensures the objectivity of indirect occlusion pressure analysis. However, this is disputed by some contemporary sources and not accepted unequivocally.

Also, the development of digital technologies in our time [3, 7, 8] makes it possible to record occlusal strength characteristics at the bite and interpret them in practice, while at the same time, optimally bilaterally, in the case of maximum intercuspidation, teeth bonding in the central occlusal state.

Determination of central proportion of the jaws in secondary full-adenia is a critical clinical skill necessary for predictable and effective orthopaedic rehabilitation. Thus, numerous studies have a significant influence on the coordination of occlusive interference chewing function, which prevents the displacement of the cleft of the temporal-maxillary joint (TMJ) in the central area of the jaws. Thus, errors in determining the central ratio of the jaws can lead to occlusive muscle dysfunction and pain syndrome not only in the craniomandibular system [10, 11].

The relevance of studying this problem is related to the uncertainty of approaches to assessing the central attitude to the occurrence of central occlusion in secondary complete adenias and the difference in the definition of indicators for it.

All this raises the question of the possible integration of modern digital methods for analyzing occlusion in a clinical diagnostic protocol comprehensively for the articulation of completely removed lamellar prostheses. This method is highly relevant and needs to be discussed, as scientific data in this direction are still insufficient.

**The purpose** of the study was to investigate the accuracy of determining the central relation of the jaws in clinical practice with secondary full-adenia by various methods used by evaluating the application of a clinical diagnostic protocol of articulation.

**Materials and methods.** The study was performed at the Departments of Orthopedic Dentistry, in the Dental Clinic of the Azerbaijan Medical University. The state of jaw central relationship 33 days after fabrication and delivery of fully removable plate prostheses in 609 patients aged 45 to 90 years with secondary complete adenias was studied.

In the study, complete removable plate prosthesis (CRPP) preparation was performed using the improved method in 204 patients aged 45 to 90 years, including 102 (50.0 %) men and 102 (50.0 %) women with secondary complete dentition, which constituted the main group.

**Clinical stages 1.** Examination, diagnosis, treatment plan, anatomical measurement of the prosthetic area.

**Technical stages 1.** Preparation of the main and auxiliary models from the size along with an acrylic-based wax.

**Clinical stages 2.** Determination of the central relations of the jaws and selection of

**Technical stages 2.** Transferring the models to the articulator, aligning artificial teeth

**Clinical stages 3.** Examining the wax structure of the prosthesis and taking functional measurements

**Technical stages 3.** Replacement of the wax structure of the prosthesis with acrylic along with the functional dimension

**Clinical stages 4.** Delivery of the prepared complete removable plate prosthesis structure [3].

With our colleagues' participation, we performed traditional preparation of CRPP in 405 patients aged 45 to 90 years, including 206 (50.9 %) men and 199 (49.1 %) women with secondary complete adenias, and formed a control group.

In accordance with the purpose of the study, it was performed in three subgroups, depending on the dental status of both groups. Thus, in the first subgroup of the main group, 84 patients, including 42 (50.0 %) males and 42 (50.0 %) females, and in the first subgroup of the control group, 140 patients, including 71 (50.7 %) males and 69 (49.3 %) females, do not undergo prosthetic treatment of CRPP after tooth loss. A prosthesis was designed for them for the first time.

In the second subgroup of the main group, 60 patients, including 30 (50.0 %) males and 30 (50.0 %) females, in the second subgroup of the control group, 147 patients, including 74 (50.3 %) males and 73 (49.7 %) females, for both jaws, 'was a CRPP designed by the traditional method. During orthopaedic treatment, the CRPP was fabricated using the traditional method, but they did not use it for a single day for reasons such as pain, poor fixation, inability to chew food, and speech impairment.

In the third subgroup of the main group, 60 patients, including 30 (50.0 %) males and 30 (50.0 %) females, and in the third subgroup of the control group, 118 patients, including 61 (50.0 %) males and 57 (50.0 %) females, have CRPP due to secondary complete adenias (SCA). CRPP in orthopaedic treatment was developed by the traditional method and is not considered satisfactory because it has been used for more than three years, creates difficulties in use, and needs to be updated.

The occlusal method was used to study the central jaw relationships in the central occlusal state. When the jaws transitioned from relative tranquility to the central occlusal state, the denture was determined by tooth-colored occlusal paper and wax contact used for occlusion. In this method, wax (2 mm thick) was used for the colored occlusal paper and occlusion of each patient (Fig. 1).

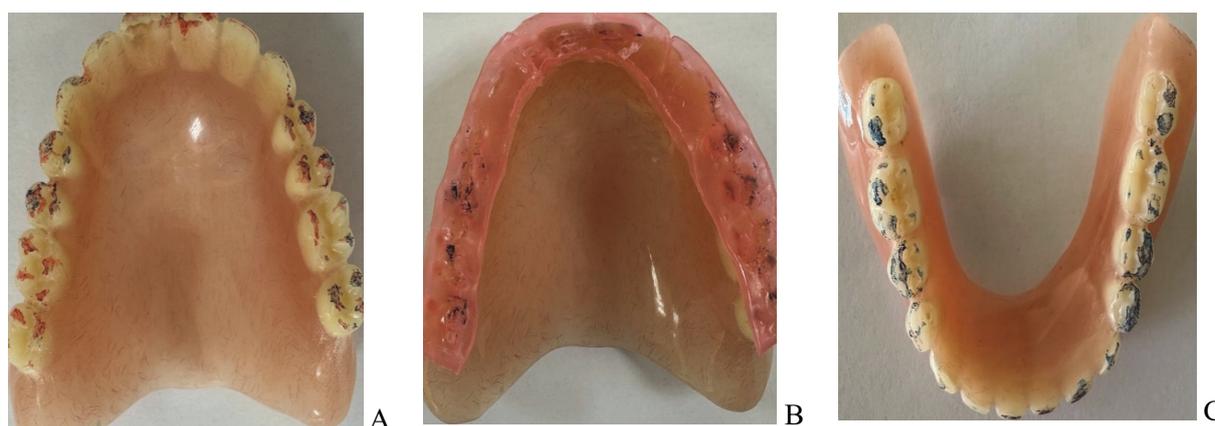


Fig. 1. Occlusal method for preparing CRPP (A, B, C – sequential steps of the method).

The occlusion contacts were registered with colored occlusion paper in a two-step process. So, first of blue paper (Jean Ba & Co. used KG and then red color (Bausch Arti-Fol 8 ml). In the analysis of occlusion reflections, the number and topography of occlusion-contact reflections were determined.

To prevent interference, the wax used in occlusionography was applied by placing a prosthesis of the upper jaw on the occlusionic surface of the teeth instead of using an occlusionic spoon.

Statistical analyses were performed using MS Excel 2019 and IBM SPSS-26 programs. The average values (M), their standard error (m), the minimum (min) and maximum (max) values of the series, as well as the frequency of occurrence of the quality indicators in the groups, were determined for the group indicators. The differences were considered statistically significant at  $P < 0.05$ .

**Results of the study and their discussion.** The results of the sequential process of preparing complete dentures during secondary complete adentia in the main group of patients is presented in Table 1.

Table 1

**The distance between the state of relative jaw tranquility and the central occlusal state in the main group**

Subgroups	Min-max distanses (mm)	
	Male	Female
Subgroup I (n=84)	2.0 (38.1 %)–3.0 (2.4 %)	2.0 (35.7 %)–3.0 (4.8 %)
Subgroup II (n=60)	2.0 (34.0 %)–3.5 (3.4 %)	2.0 (30.0 %)–3.5 (3.3 %)
Subgroup III (n=60)	2.0 (30.0 %)–4.0 (3.3 %)	2.0 (26.7 %)–4.0 (6.7 %)

Thirty-three days after the use of plate prostheses completely removed in secondary complete adentia, the accuracy of jaw central relations was determined by occlusiography in clinical practice. In this case, the distance between the state of relative jaw tranquility and the central occlusal state in the main group of 84 patients in the first subgroup, 32 (38.1 %) male and 30 (35.7 %) female patients had 2.0 mm, 8 (9.5 %) male and 8 (9.5 %) female patients had 2.5 mm, 2 (2.4 %) male and 4 (4.8 %) female patients had 3.0 mm, 4 in the first subgroup of the control group, out of 140 patients, 8 (3.0 %) male and 6 (4.3 %) female patients had 4.0 mm, 10 (3.7 %) male and 8 (5.7 %) female patients had 5.0 mm, 11 (4.1 %) male and 10 (7.1 %) female patients had 6.0 mm, 42 (40.9 %) male and 45 (39.6 %) female patients had 1.0 mm.

The distribution of distans for control group of patients (traditional preparation of CRPP) is presented in Table 2.

Table 2

**The distance between the state of relative jaw tranquility and the central occlusal state in the control group**

Subgroups	Min-max distanses (mm)	
	Male	Female
Subgroup I (n=140)	1.0 (40.9 %)–6.0 (4.1 %)	1.0 (39.6 %)–6.0 (7.1 %)
Subgroup II (n=147)	1.0 (32.7 %)–6.0 (5.4 %)	1.0 (32.1 %)–6.0 (5.4 %)
Subgroup III (n=118)	1.0 (31.4 %)–6.0 (6.8 %)	1.0 (30.3 %)–6.0 (5.2 %)

In the second subgroup of the main group 20 (34.0 %) male and 18 (30.0 %) female patients out of 60 patients had 2.0 mm, 8 (13.4 %) male and 10 (16.7 %) female patients had 3.0 mm, 2 (3.4 %) male and

2 (3.3 %) female patients had 3.5 mm, 3.3 % in the second subgroup of the control group, out of 147 patients, 10 (6.8 %) male and 8 (5.4 %) female patients had 4.0 mm, 8 (5.4 %) male and 10 (6.8 %) female patients 5.0 mm, 8 (5.4 %) male and 8 (5.4 %) female patients 6.0 mm, 48 (32.7 %) male and 47 (32.1 %) female patients 1.0 mm.

Main group in the third subgroup of 60 patients, 18 (30.0 %) male and 16 (26.7 %) female patients had 2.0 mm, 10 (16.7 %) male and 10 (16.7 %) female patients had 3.0 mm, 2 (3.3 %) male and 4 (6.7 %) female patients had 4.0 mm, control group in the third subgroup of 118 patients, 8 (6.8 %) male and 8 (6.9 %) female patients had 4.0 mm, 8 (6.8 %) male and 8 (6.9 %) female patients had 5.0 mm, 8 (6.8 %) male and 6 (5.2 %) female patients had 6.0 mm, 37 (31.4 %) male and 35 (30.3 %) female patients had 1.0 mm.

The preparation of upper complete dentures in secondary edentulous patients has a number of challenges. The biological challenge is to prepare complete dentures within physiological limits to maintain tissue integrity and continuity [5].

The performance of various functions (chewing, speaking, swallowing) by the patient with prosthesis during secondary full addency for a certain period of life depends on the functionality of the developed prosthesis. If the patient is not performing any functions (in a state of relative quietness of the jaws), the main condition is that the prosthesis does not fall out of its position - the area of the prosthesis, that is, it stops, sticks [2, 9].

To perform any function, the patient must have a functional physiological distance between the relative quietness and the central occlusive state of the jaws, in order to ensure the performance and stability of the prosthesis. Stabilization of the prosthesis is that the prosthesis does not separate from the site of the prosthesis when the patient performs various functions such as chewing, speech, swallowing [3, 6]. In our work the area of patients in the main and control groups who sought orthopedic treatment with fully removed plate prostheses in secondary full addency, as determined by the process of resorption in solid tissues and atrophy in soft tissues, holds special significance.

During the production of a plate prosthesis that was completely removed from patient 204, an advanced method was utilized for secondary full-admixture measurement of the prosthetic wax structure, which consisted of artificial teeth placed on an acrylic base in clinical stage 3. The patient can perform all functional actions with the help of a prosthesis that will be prepared. In this case, the pressure that is being measured is the patient's own pressure, not the physician's. Functionality is achieved by a better and more accurate reflection of the prosthesis area and borders, which is produced when measuring the functional acrylic base wax construction of the prosthesis. The distance between the relative quietness and the central occlusive state of the jaws becomes physiologically functional.

The doctor uses a spoon to measure with the traditional method when making a prosthesis with a completely removed plate for 405 patients. At this time, the doctor thinks that the pressure applied by the patient to the area of the prosthesis when using a fully removed dental prosthesis that will be manufactured will equal the pressure applied by the physician during measurement. But it's not. Pressure causes the location of the area surrounding the prosthetic and surrounding tissue to change. When the pressure is removed, the torn tissue returns to its place. The prepared area and borders of the prosthesis are inaccurate due to disturbed fixation and a physiologically dysfunctional distance between the relative calm and the central occlusive state of the jaws.

Wiechens B, et al with the purpose to assess using conventional and digital occlusal registration techniques to evaluate time-dependent fluctuations in static and dynamic occlusion revealed that occlusion cannot be considered constant and that the topography and intensity of the contact points vary. They reported that circadian variation in occlusion can be assumed without a preference for a particular time of day. Thus, this differentiated view of occlusion as a changing system helps clarify the problem of dental restoration for both the patient and the clinician [14].

Youness A, et al presented case report about patient with complete secondary adentia. The used single symphyseal implant and noted that the prosthesis was stable and retentive. In addition, masticatory comfort and efficiency were satisfactory and the psychological integration of the prosthesis was improved. Several studies have shown that a single symphyseal implant is a therapeutic alternative that completes the therapeutic range in specific cases. But it should be limited to the mandibular arch in elderly patients with reduced bone volume [15]. Our method have less limitations and more cases for implementation.

Mubaraki MQ, et al, analysing 102 articles from Pubmed, Overall, Science Direct, Cochrane, and Google Scholar databases concluded that computer-engineered complete dentures have several advantages over conventional dentures due to better fit, reduced chair time, shorter appointments, and fewer post-

insertion visits. These dentures allow for precision and reproducibility with fewer procedures compared to conventional dentures. The advantages of computer-engineered complete dentures include a reduced number of appointments, saving chairside time, a digital workflow allowing easy reproducibility and greater patient satisfaction with a better fit. But in all cases the accuracy of jaw central relations during measurement is critical for making prosthesis physiologically functional [12].

### Conclusion

In the production of a completely removed plate prosthesis by an advanced method at secondary full-arch clinical stages are performed by wax structure of the prosthesis with acrylic base. During this time, the patient is easier and more comfortable to perform functional actions. The distance between relative calm and central occlusive state of the jaws becomes physiologically functional.

In the secondary full-arch fabrication of a completely removed plastic prosthesis by traditional method, the area of the prosthesis and surrounding tissues change their location as a result of pressure when the doctor measures. When the pressure is removed, the torn tissue returns to its place. Therefore, the prepared area and borders of the prosthesis are not accurate, fixation is disturbed, the distance between the relative calm and the central occlusive state of the jaws is not physiologically functional.

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