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REHABILITATION OF A PATIENT WITH MANIFESTATIONS OF INTOLERANCE TO DENTAL MATERIALS IN THE ORAL CAVITY (clinical case)

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Key words: *biocompatibility, individual sensitivity, material intolerance, tests*
Ключові слова: *біосумісність, індивідуальна чутливість, непереносимість матеріалів, тести*

Abstract. Rehabilitation of a patient with manifestations of intolerance to dental materials in the oral cavity (clinical case). Davydenko V.Yu., Davydenko H.M., Sokolovska V.M., Khilinich Ye.S., Tarashevska Yu.Ye. *Significant achievements in modern dental materials science, improvements in all-ceramic technologies, microprosthetics, and inert removable prosthetics have not eliminated the relevance of assessing the biocompatibility of dental construction materials with the tissues of the prosthetic bed. Currently, almost 47% of the global population suffers from food, drugs, various materials, and chemical compounds intolerances. Aim of the study – to present a clinical case of intolerance to structural materials, and to demonstrate the prediction and prevention of their adverse effects on the whole organism through biocompatibility testing with the tissues of the prosthetic bed. A 62-years-old male patient sought prosthodontic care with complaints of pain, bleeding, redness, and swelling at the sites where metal-ceramic crowns contacted the oral mucosa, along with itching, burning sensations, and halitosis. Approximately two weeks after fixing the bridge prostheses, skin rashes appeared on the neck, accompanied by itching and tingling sensations. Given that the patient associated symptom onset with the fixation of full-cast metal-ceramic bridges, and based on the clinical picture in the oral cavity and results of epicutaneous patch testing, a diagnosis was established: "Intolerance to dental materials. Localized periodontitis complicated by Kennedy Class II, Subclass 2 maxillary and Class I, Subclass 1 mandibular edentulous areas. Masticatory efficiency loss according to Agapov – 84%." Due to positive patch test results and clinical findings, removal of the metal-ceramic constructions from the oral cavity was deemed necessary. After extraction of all mobile teeth and their destroyed roots, it was planned to restore the edentulous spaces with zirconia bridge prostheses and fabricate clasp dentures based on polyamide for both jaws.*

Реферат. Реабілітація пацієнта з проявами непереносимості стоматологічних матеріалів у ротовій порожнині (клінічний випадок). Давиденко В.Ю., Давиденко Г.М., Соколовська В.М., Хілініч Е.С., Тарашевська Ю.Є. *Значні досягнення в сучасному дентальному матеріалознавстві, удосконалення технологій безметалевої кераміки, мікропротезування та інертного знімного протезування не зняли актуальності питання біосумісності конструкційних стоматологічних матеріалів з тканинами протезного ложа. Нині майже 47% населення земної кулі страждає на непереносимість продуктів харчування, медикаментів, різних матеріалів та хімічних сполук. Мета дослідження – демонстрація клінічного випадку непереносимості конструкційних матеріалів, прогнозування і профілактика їх негативного впливу на організм у цілому за допомогою проведення тестів біосумісності з тканинами протезного ложа. За ортопедичною допомогою звернувся пацієнт Ш. 62 років зі скаргами на біль, кровоточивість, почервоніння і набряк у місцях контакту металокерамічних коронок зі слизовою оболонкою, а також свербіж, відчуття печії та неприємний запах з порожнини рота. Приблизно через два тижні після фіксації мостоподібних протезів з'явилося висипання на шкірі шиї, яке супроводжувалися свербінням та поколюванням. Зважаючи на те, що пацієнт Ш. пов'язував виникнення симптомів цього захворювання з фіксацією суцільнолитих мостоподібних протезів з керамічним облицюванням, ураховуючи клінічну картину в порожнині рота та результати проведених епікутанних проб «патч-тестами», нами було встановлено діагноз «Непереносимість стоматологічних матеріалів. Парадонтит локалізованої форми, ускладненої дефектами зубних рядів верхньої щелепи – II клас другий підклас та нижньої щелепи – I клас перший підклас за класифікацією Кеннеді. Втрата жувальної ефективності за Агаповим – 84%». Враховуючи позитивні результати проведених епікутанних проб «патч-тестами», дані, отримані на основі огляду ротової порожнини, ми дійшли*

висновку щодо необхідності вилучення металокерамічних конструкцій з порожнини рота. Після видалення всіх рухомих зубів та їх зруйнованих коренів планували відновити включені дефекти зубних рядів мостоподібними протезами з діоксиду цирконію та виготовити бюгельні протези на поліамідній основі для верхньої та нижньої щелеп.

Significant progress in contemporary dental material science, including advancements in all-ceramic technology, micro-prosthodontics, and the use of inert materials for removable prostheses, has not eliminated the relevance of biocompatibility between prosthodontic materials and the tissues of the prosthetic bed [1]. Since the clinical implementation of new materials often outpaces the comprehensive evaluation of their long-term outcomes, the issue of selecting materials that are inert and comfortable for each individual patient remains highly relevant. Unfortunately, metal-containing dental restorations present a number of disadvantages, particularly due to hypersensitivity reactions in some individuals to specific metal components [2].

Currently, nearly 47% of the global population suffers from intolerance to certain foods, medications, materials, and chemical compounds. Factors that predispose the body to intolerance reactions include pathological conditions of the nervous and endocrine systems, weakened immune defenses, gastrointestinal diseases, environmental pollution, and the widespread use of household chemicals with pronounced antigenic properties. Therefore, intolerance may be considered a manifestation of the immune system's response to allergens, triggering either humoral or cell-mediated immune reactions [3].

Intolerance is a form of pathological immune response characterized by an abnormal reaction to specific antigens that, under normal circumstances, should not provoke such a response. Allergens may have infectious origins, such as viruses or bacteria, or non-infectious origins, including food, household substances, pharmaceuticals, and certain chemical agents [4]. Among the latter, allergic reactions are most commonly associated with dyes, paints, polymeric materials, and metals such as nickel, chromium, and lead. In the oral cavity, intolerance may manifest as edema, pigmentation, vesiculobullous or ulcerative mucositis, catarrhal stomatitis, burning sensations, and xerostomia [5].

Material intolerance in dentistry represents a significant challenge in modern prosthodontics. This condition is more frequently observed in individuals with a history of bronchial asthma, eczema, vasomotor rhinitis, trichophytia, or epidermophytia. Thus, one of the key aspects of diagnosing individual hypersensitivity involves the collection of a detailed allergological history and the application of both specific and non-specific diagnostic tests [6].

Treatment of intolerance reactions to dental materials involves eliminating the underlying causes of the condition. This includes the removal of all prosthetic appliances, restorative, or luting materials from the oral cavity [7]. Preventive strategies play a crucial role and are aimed at minimizing the adverse effects of dental materials through the implementation of biocompatibility testing to detect individual sensitivity prior to prosthodontic treatment.

The aim of the study is to present a clinical case of intolerance to prosthodontic materials and to emphasize the importance of predicting and preventing their adverse effects through the use of biocompatibility testing with prosthetic bed tissues.

MATERIALS AND METHODS OF RESEARCH

A 62-year-old male patient, referred to as Patient Sh., presented to the clinic of prosthodontic dentistry for consultation regarding a persistent and pronounced inflammatory condition in the oral cavity that had not resolved over an extended period. The patient underwent clinical and additional diagnostic examinations, including a detailed collection of medical history (*anamnesis morbi*) and objective clinical assessment.

To establish a definitive diagnosis, a series of additional investigations were conducted. These included 3D diagnostic imaging, standard patch testing to assess material intolerance, and biocompatibility tests for the components of the fixed dental prosthesis and luting material. The methodology used was based on the protocol for assessing material intolerance prior to prosthetic treatment, as proposed by Dmytro Hryzodub [8].

A similar set of tests was performed for the structural elements of a removable partial denture with an acetal framework, polyamide saddles, retentive elements, and artificial teeth.

Following expert review, the institutional ethics committee determined that the materials used in the present study complied with the principles of humane treatment of patients, in accordance with the Tokyo Declaration of the World Medical Association, international guidelines of the Helsinki Declaration on Human Rights, the Council of Europe Convention on Human Rights and Biomedicine, the Laws of Ukraine, orders issued by the Ministry of Health of Ukraine, and the Ethical Code of the Ukrainian Medical Professional. The study was approved for open publication (Extract from the protocol of the meeting of the Ethics and Biomedical Ethics Committee of Poltava State Medical University, No. 236 dated March 20, 2025).

The patient provided informed voluntary consent for diagnostic procedures, anesthesia, and treatment (Form of Primary Medical Documentation

No. 003-6/0), as well as for the use of the obtained data for future publication.

RESULTS AND DISCUSSION

A 62-year-old male patient, referred to as Patient Sh., sought prosthodontic care due to complaints of pain, bleeding, redness, and swelling at the sites where metal-ceramic crowns were in contact with the oral mucosa. Additional symptoms included itching, burning sensations, and halitosis. Approximately two weeks after the placement of fixed metal-ceramic bridges, he developed skin rashes on the neck accompanied by itching and tingling sensations [9].

During the last two months of wearing these prosthetic constructions, the patient reported the onset of pronounced neurological symptoms, including tongue paresthesia, headaches, and sleep disturbances. According to the patient, about six months prior, he had been fitted with monolithic metal bridges veneered with ceramic material. The aforementioned symptoms began to manifest as early as the fourth or fifth day after the placement of these restorations in the oral cavity. However, the patient did not seek dental assistance and instead self-medicated using antihistamines and nonsteroidal anti-inflammatory drugs. These measures provided only temporary and minor improvement in both systemic symptoms and local oral manifestations [10].

Clinical examination of the oral cavity revealed diffuse hyperemia, edema, and bleeding of the mucosa in areas where the metal-ceramic bridgework was in contact with the soft tissues [11] (Fig. 1).

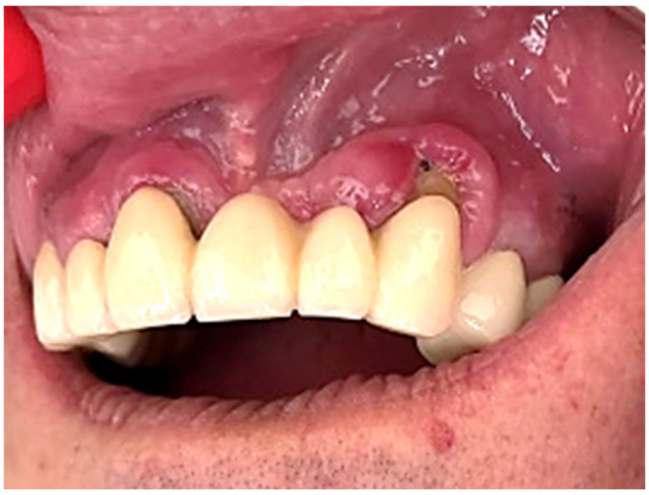


Fig. 1. Manifestations of intolerance to a metal-ceramic prosthesis in the oral cavity

Erythema was observed against the background of red, edematous, and loosened oral mucosa, with structural changes of a hypertrophic nature. The abutment teeth – 14, 13, 23, 27, 37, and 47 – exhibited grade II-III mobility, with the presence of pathological periodontal pockets. The gingiva was extremely tender on palpation and bled easily upon probing. The mentioned fixed bridge prostheses showed no visible defects, and the condition of the ceramic veneer was deemed satisfactory. A distinct unpleasant odor was noted from the oral cavity, which became more pronounced when the patient was asked to take a deep breath in and then exhale. The dorsal surface of the tongue was coated with a white plaque that could be easily scraped off with a spatula. The Schiller-Pisarev iodine test yielded a positive result, with a score of 8 points on the severity scale [12].

Upon examination of the skin on the neck, an exanthema was detected in the form of elevated hyperemic areas with eruptions consisting of small fluid-filled vesicles, interspersed with regions of dry, flaky skin beginning to desquamate [13] (Fig. 2).

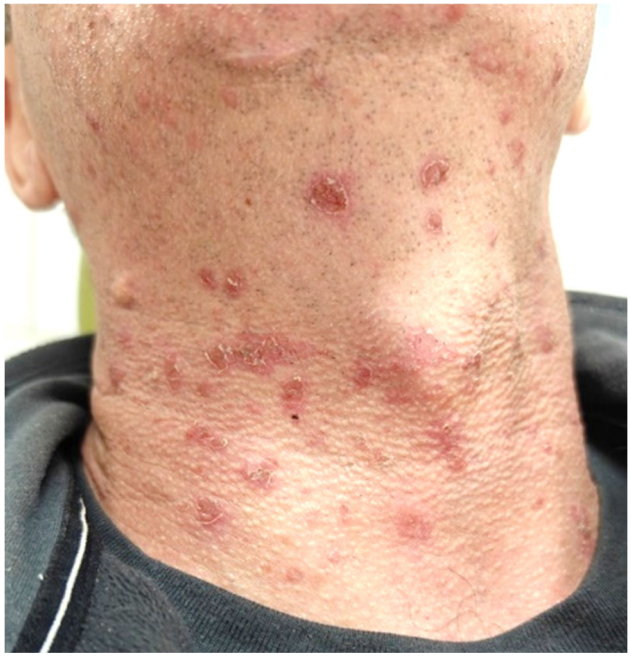


Fig. 2. Manifestations of intolerance to a metal-ceramic prosthesis on the skin of the neck

Considering that the patient Sh., associated the onset of symptoms with the placement of metal-ceramic bridge prostheses, and taking into account the clinical picture in the oral cavity, we decided to perform epicutaneous “patch tests” [14].

The structural materials used in dentistry interact with the tissues of the prosthetic bed and the body as a whole, leading to certain alterations. It is generally accepted that truly “inert” materials do not exist. The presence of foreign materials in the oral cavity can modify immune system activity, both locally and systemically. Aberrant responses to foreign bodies, including dental prostheses, may therefore manifest in localized or generalized forms. Materials used in prosthetic constructions, through contact with the oral

mucosa, may exert toxic effects, triggering mast cell and basophil migration. This, in turn, can lead to the non-specific release of various mediators, particularly histamine, which modulates immune responses by enhancing the reactivity of specific immune pathways to diverse antigens [15].

Given that intolerance to dental materials is a systemic process affecting multiple tissues, we prioritized skin patch testing as a more convenient and safer alternative to epimucosal (intraoral) testing. Patch testing was performed in accordance with international protocols for the diagnosis and management of intolerance to chemical substances and their compounds. To this end, we employed the "TOP-3 Metals" ME-3 patch test series, which includes allergens for nickel, cobalt, and chromium [16]. To ensure accurate results, the patient was advised to discontinue hormonal and antihistamine medications 7-10 days prior to testing and to avoid tanning salons. Throughout the testing period, exposure to sunlight and intense physical activity was to be avoided.

The hypoallergenic patch containing the "TOP-3 Metals" ME-3 allergens was applied to the patient's left forearm after degreasing the test area with alcohol to improve adhesion. The patient was scheduled to return after 48 hours for patch removal and preliminary result assessment. Since most haptens exert their effects by day 4 or 5 after exposure, the final evaluation was conducted 120 hours after the start of the test (Fig. 3).

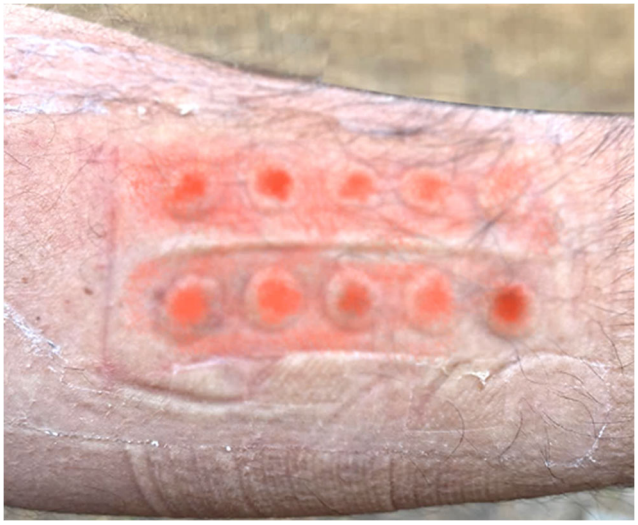
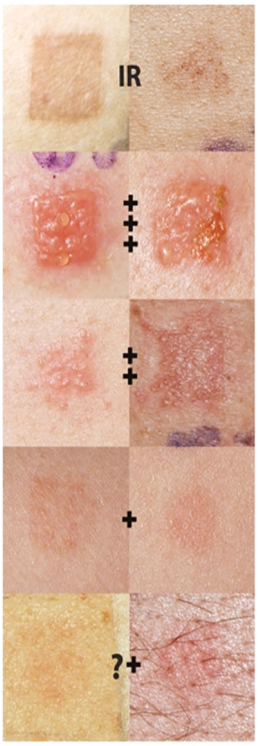


Fig. 3. Results of patch testing for metals

The test results were evaluated using the criteria recommended by the International Contact Dermatitis Research Group (ICDRG).

To facilitate result interpretation, a scale placed on a specialized ruler was used (Fig. 4).



IR – Irritant Reaction
• Discrete erythema without infiltration.

+++ Extreme Positive Reaction
• Coalescing vesicles
• Bullous or ulcerative reaction

++ Strong Positive Reaction
• Erythema • Infiltration
• Papules • Discrete vesicles

+ Weak Positive Reaction
• Erythema • Infiltration
• Papules

? + Doubtful Reaction
• Faint spots without infiltration
• Homogeneous erythema

Fig. 4. Scoring scale for the severity of allergic reaction manifestations

All results were documented in a screening card, and the patient received detailed recommendations for prevention and treatment of the diagnosed pathology. Since an allergic reaction to nickel and cobalt was confirmed, the patient was advised to carry express diagnostic kits – Chemo Cobalt Test and Chemo Nickel Test – to detect these elements on personal and household items. The use of these tests will help the patient avoid exposure to allergens and prevent symptom exacerbation [16].

Given the correlation between the onset of symptoms and the placement of cast metal-ceramic bridges, as well as the clinical findings and patch test results, the diagnosis was confirmed: «Intolerance to dental materials. Localized periodontitis, complicated by Kennedy Class II, Subclass 2 (maxilla) and Class I, Subclass 1 (mandible). Masticatory efficiency loss according to Agapov – 84%».

In light of the positive epicutaneous test results and oral examination data, it was concluded that the metal-ceramic prosthetic structures should be removed from the oral cavity (Fig. 5).

Before the patient's prosthetic rehabilitation, comprehensive surgical and therapeutic preparation of the oral cavity was carried out. Following the extraction of all mobile teeth and severely damaged roots, it was planned to restore the partially edentulous arches with fixed zirconia-based prostheses and fabricate removable partial dentures with polyamide bases for both the maxilla and mandible.

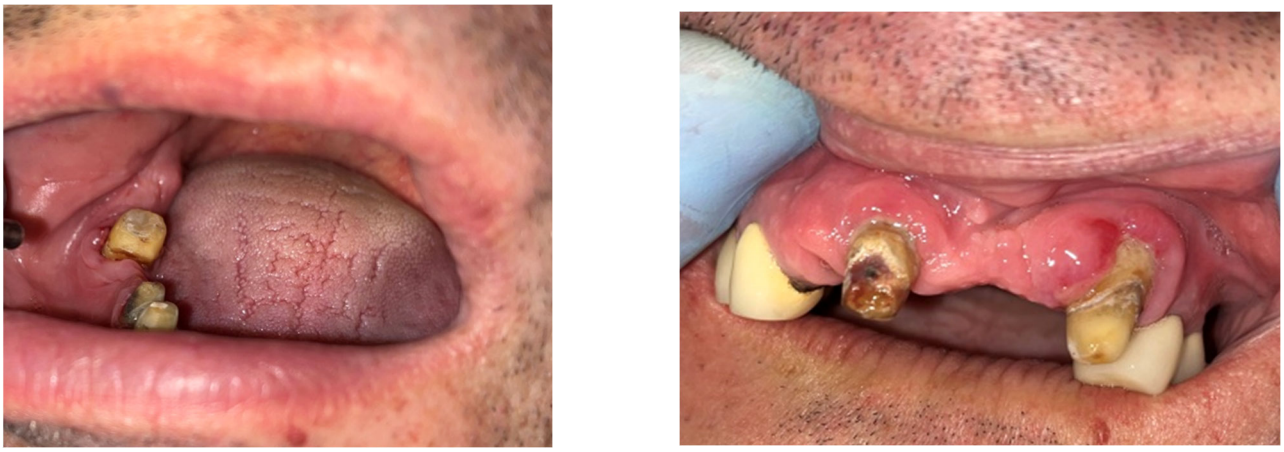


Fig. 5. Oral cavity condition after removal of metal-ceramic restorations

Given that the patient Sh. had been diagnosed with intolerance to certain dental materials, it was decided during the first clinical visit to perform sensitivity testing to the components of the planned fixed prosthesis and luting agent. The approach was based on the methodology proposed by Dmytro Hryzodub for assessing material intolerance in prosthodontic patients.

In preparation for this, zirconium dioxide powder was obtained from a dental laboratory. It was planned to use a dental zirconia block designed for aesthetic restorations – Emotion Zr GT.M Functional Line, produced by Microtech-Dental, Ukraine. During the test procedure, the zirconia powder was mixed with a drop of adhesive from a light-cured restorative composite material. The resulting mixture was applied around the cervical area of one of the abutment teeth and then polymerized. The patient was scheduled to return after 72 hours for assessment of the tissue response (Fig. 6).

An identical test was performed for the components of the planned removable partial denture, which was to have an acetal resin framework, polyamide saddle bases, retentive elements, and artificial teeth (Fig. 7).

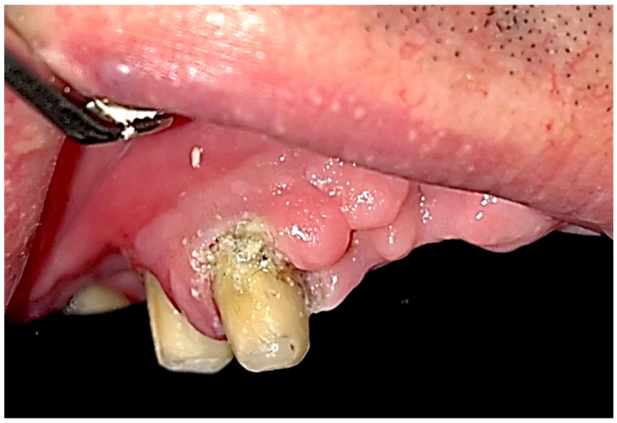


Fig. 6. Condition of the oral mucosa 72 hours after zirconium dioxide biocompatibility testing

The fixed prostheses were planned to be cemented using the dual-cure resin-based luting agent *Variolink Esthetic* (Ivoclar Vivadent, Liechtenstein). To assess the material's biocompatibility, its components were mixed

and applied to the cervical area of one of the abutment teeth, followed by polymerization with a light-curing lamp. The patient was monitored for three days, and a thorough clinical evaluation was performed.

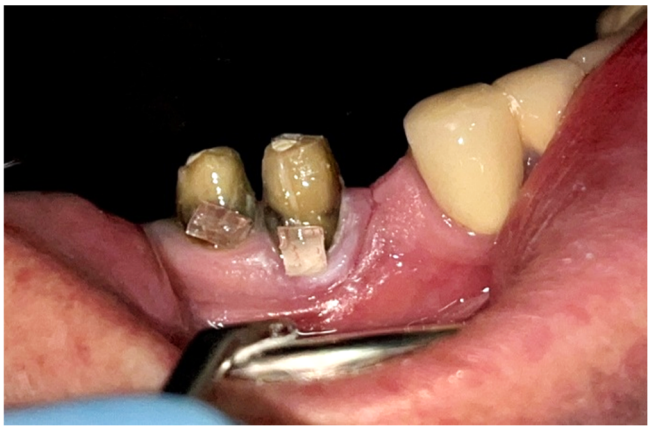


Fig. 7. Condition of the oral mucosa 72 hours after biocompatibility testing with polyamides

At the end of the observation period, the mucosa in contact with the tested materials appeared pale pink, with no traumatic lesions or pathological eruptions, indicating good tissue tolerance.

Given the patient's oral malodor and a positive Schiller-Pisarev test score of 8 points, a two-pronged therapeutic strategy was adopted. Firstly, the patient received instruction and motivation regarding proper oral hygiene practices. Appropriate hygiene aids were selected, and techniques for cleaning lingual coating were demonstrated, including the use of antiseptic mouth rinses and oral fresheners.

Secondly, meticulous selection of prosthetic materials and maintenance protocols was emphasized, along with timely replacement of prostheses when indicated. The patient was advised to clean the tongue after each toothbrushing session and mouth rinse. For this, a lingual brush (*Enfresh*) and an antibacterial gel were recommended. The patient was trained to remove the coating by sweeping from the base of the tongue toward the tip. Additionally, a carbamide peroxide-based toothpaste was prescribed to release atomic oxygen with a bactericidal effect on anaerobic flora. The use of an oral irrigator with a decoction of *Chamomilla recutita* (German chamomile) flowers was also recommended.

At the subsequent clinical appointment, the abutment teeth 15, 16, 18, 24, 25, 44, and 45 were prepared for zirconia-based fixed partial dentures. Double anatomic impressions of both maxilla and mandible were taken using *Speedex* silicone impression material and forwarded to the dental laboratory.

The final clinical stage involved the cementation of the zirconia prostheses with the dual-cure adhesive system *Variolink Esthetic* (Ivoclar Vivadent, Liechtenstein). In Figures 8 intraoral photographs of the patient's oral cavity following prosthesis placement are presented.

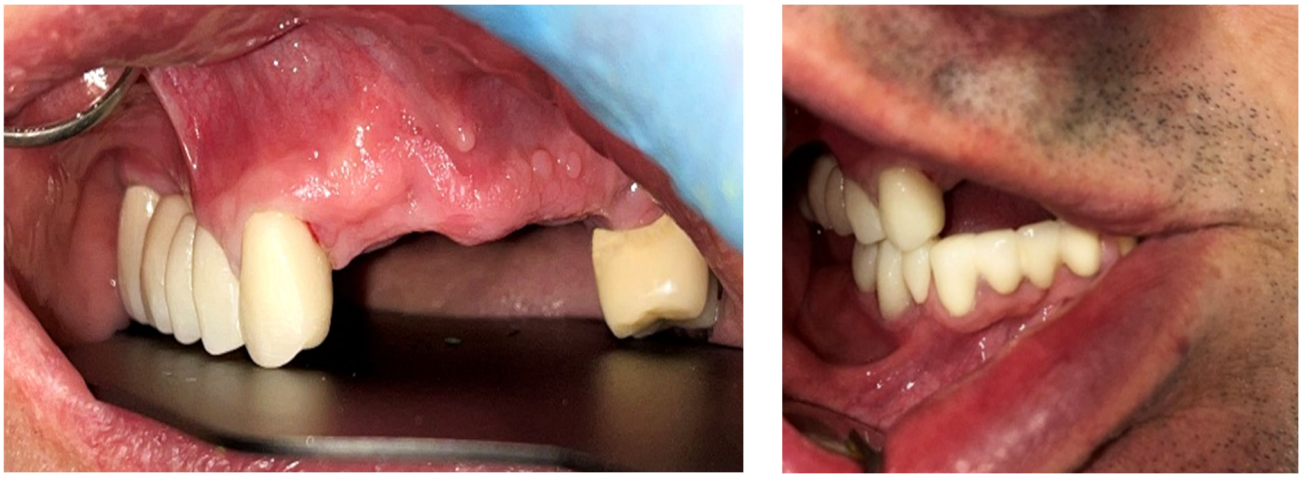


Fig. 8. External appearance of final zirconium dioxide restorations after cementation

The patient was scheduled for the following day to obtain functional impressions of the maxilla and mandible. Given that the patient exhibited a stable occlusion, occlusal records were taken using *Speedex* impression material.

The try-in stage, involving the verification of the polyamide framework fit and the arrangement of artificial teeth, was considered essential. This step ensured accurate occlusal contact and optimal adaptation of the prosthesis (Fig. 9).

Upon completion of treatment, removable partial dentures with a polyamide base and a clasp fixation system were delivered and secured in the patient's mouth (Fig. 10).

Fig. 9. Stages of evaluation of polyamide removable partial dentures

According to the research conducted by Forkel S. and Schubert S., effective dental prosthetic treatment is defined by the restoration of aesthetics and function, which must be grounded in the biocompatibility of the structural dental materials used [18]. It has been demonstrated that metal-based prosthetic constructions have several disadvantages, primarily due to hypersensitivity reactions in certain patients to metallic components. Several researchers, including Bacchi A. and Cesar P.F., support the opinion that zirconium dioxide and lithium disilicate ceramics are currently the most favorable materials in prosthodontics due to their superior aesthetic properties, functional longevity, and biocompatibility [19].

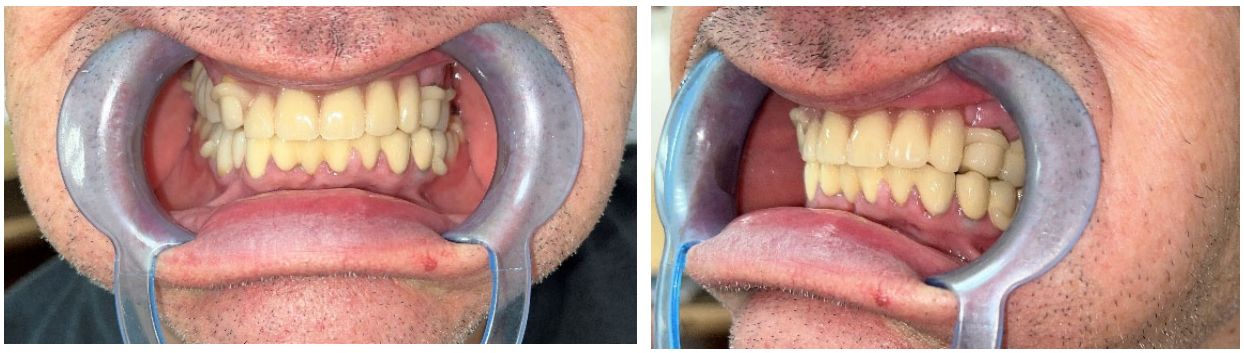


Fig. 10. Aesthetic appearance of a patient with fixed and removable prosthetic restorations

A commonly used method for diagnosing intolerance to dental materials is based on the assessment of changes in salivary pH. Muntian L.M. and Kulygin O.B. reported that hypersensitivity reactions to prosthetic materials are most frequently observed when salivary pH ranges from 6.65 to 7.15. This diagnostic approach may also include the evaluation of salivary composition, particularly the levels of potassium, calcium, and sodium ions, as well as coagulation factors [20].

Zemelka-Wiacek M. proposed the use of biomarkers to detect hypersensitivity to metallic

prosthetic components [21]. Given the constant contact of oral mucosa with structural materials, hypersensitivity reactions are often accompanied by microbiota imbalance. Kilik K. and Kok A.N. reported suppression of endogenous microbiota and an increased prevalence of pathogenic microorganisms, particularly *Staphylococcus aureus* and *Candida* species [22].

A number of authors, including Brown A., Mandelberg N.J., Munoz-Mendoza D., Palys V., Schalock P.C., and Mogilner A., emphasized the diagnostic value of epicutaneous patch testing in identifying all types of allergic reactions [23].

Clinical studies by Gryzodub D.V. and Badalov R.M. demonstrated the practical effectiveness of testing compatibility between prosthetic bed tissues and both structural and luting materials. This approach allows for individualized treatment planning and helps prevent adverse hypersensitivity reactions [24].

CONCLUSIONS

1. For patients with hypersensitivity to dental materials, it is advisable to perform epicutaneous "patch testing" during the diagnostic phase. If an allergic reaction is confirmed and the specific antigen identified, patients should be advised to carry rapid diagnostic allergen tests. These tools can help promptly detect allergenic substances in everyday objects, thus preventing unintended exposure and avoiding exacerbation of the condition.

2. Since no dental material is entirely inert, as confirmed by the clinical case presented, we strongly recommend performing biocompatibility testing between the patient's prosthetic bed tissues and the intended structural and luting materials. We suggest using the method of determining individual intolerance to dental prosthetic materials developed by Dmytro Gryzodub as the basis for such testing. This approach enables clinicians to predict treatment outcomes and prevent adverse reactions associated with individual hypersensitivity.

Contributors:

Davydenko V.Yu. – data curation, research;

Davydenko H.M. – software;

Sokolovska V.M. – data curation, research, methodology;

Khilinich Ye.S. – Software;

Yu.Ye. Tarashevska – visualization.

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