World Bulletin of Public Health (WBPH)
Available Online at: https://www.scholarexpress.net
Volume-45, April 2025
ISSN: 2749-3644

COMPARATIVE ANALYSIS OF MECHANICAL PROPERTIES OF ARTIFICIAL TEETH MADE FROM VARIOUS MATERIALS IN REMOVABLE PROSTHETICS

Khabilov Bekhzod Nigmonovich
Doctor of Medical Sciences, Associate Professor
Department of Faculty Prosthetic Dentistry
Tashkent State Dental Institute
Tashkent, Uzbekistan
Yakhyoyeva Gulbonu Sodikovna
Department of Faculty Prosthetic Dentistry
Tashkent State Dental Institute
Tashkent, Uzbekistan

Article history:
Received: January 11th 2025
Accepted: February 10th 2025

Abstract:
Today, the necessity of using complete removable prosthetics comprises 15-46% among patients aged 45 to 75 years. However, according to WHO data, 26% of patients do not use plate prostheses for various reasons, one of which is the unsatisfactory quality of artificial dentition. It should also be noted that the average service life of a plate prosthesis is about 5 years. Therefore, the task of increasing the functional value of removable prostheses remains relevant.

Keywords: removable prosthetics, artificial teeth.

INTRODUCTION. One of the main components of a removable prosthesis is artificial teeth, which should be as identical as possible to natural ones both in appearance and functionally. They must meet the following requirements: absence of irritating effects on the oral mucosa, imitation of the anatomical shape, coloration, and translucency of natural teeth, reliable adhesion of teeth to the prosthesis base, high strength indicators, sufficient microhardness of the material, and the fluorescent effect inherent in natural teeth. Non-compliance with the above requirements can cause a number of complications, one of which is increased pressure on the tissues of the prosthetic bed. With pronounced tooth anatomy, the time of mechanical food processing is reduced, thereby minimizing the pressure exerted. Modern prosthetic dentistry actively uses artificial teeth as part of removable prostheses, but their mechanical properties can vary significantly depending on the material. Compressive strength and hardness are key characteristics that affect the durability and functionality of prostheses. Insufficient mechanical resistance of some materials can lead to accelerated wear and a decrease in patients' quality of life. In this regard, an important aspect is the selection of materials with optimal mechanical properties. Removable prosthetics remains one of the most demanded methods of dental arch restoration, despite the active development of dental implantology. The most important component of removable prostheses is artificial teeth, the quality and durability of which directly affect the functional efficiency and long-term success of orthopedic treatment. The modern dental market offers a wide range of materials for the manufacture of artificial teeth, including acrylic plastics, composites, ceramics, and their various modifications.

The relevance of studying the mechanical properties of artificial teeth is due to the need for a scientifically based choice of material when planning orthopedic treatment, taking into account the individual characteristics of the clinical case. Insufficient strength, wear resistance, and adhesion of artificial teeth to the prosthesis base lead to premature wear, chips, cracks, and tooth detachment, which requires correction or complete replacement of the prosthesis.

Despite a significant number of studies on individual materials, there is a deficit of comprehensive comparative works in the literature that take into account the entire spectrum of mechanical characteristics in conditions close to physiological. Modern methods of studying microhardness, flexural and compressive strength, abrasion resistance, impact strength, as well as adhesion properties allow for a more complete understanding of the behavior of materials under chewing load.

RESEARCH OBJECTIVE. Conduct a comparative analysis of the compressive strength and hardness of various types of artificial teeth most commonly used in the clinical practice of removable prosthetics.

World Bulletin of Public Health (WBPH)
Available Online at: https://www.scholarexpress.net
Volume-45, April 2025
ISSN: 2749-3644

MATERIALS AND METHODS. To evaluate the mechanical properties of artificial teeth, the following methods were used:

1. Testing samples for Vickers microhardness (HV 0.5), which allows determining the material's resistance to abrasion.
2. Conducting compressive strength tests, which included measuring the maximum load (kN) and maximum stress (MPa) that the studied materials can withstand.
3. Comparing the mechanical properties of various materials used for manufacturing artificial teeth.
4. Statistical processing of the obtained data, which allowed identifying patterns and the significance of differences between materials.

RESULTS. The highest compressive strength was observed in Tiziano, Yamahachi, Super S, Eray, and Kali (≈ 207 MPa). These materials demonstrate high resistance to mechanical loads, making them preferable for long-term use. Press Ceramic and Spofad showed lower indicators, which may limit their application in areas of high masticatory load.

The main data on the hardness of artificial tooth materials for removable prostheses from Tiziano (Colombia), Yamahachi (Japan), Super S (Colombia), Eray (Turkey), Kali (China), Press Ceramic, Spofad (Czech Republic), and wisdom teeth are presented in the tables.

Table 1.

Material	Hardness (HV 0.5)
Tiziano (Colombia)	40.1
Yamahachi (Japan)	27.0
Super S (Colombia)	23.9
Arya (Turkey)	176.1
Kali (China)	67.9
Press Ceramic	56.3
Spofa (Czech Republic)	22.6
Wisdom Tooth	22.4

The Eray material has the highest hardness (176.1 HV), making it resistant to abrasion. However, when choosing a material, it is necessary to consider not only mechanical properties but also factors such as biocompatibility, adhesion to the base, and aesthetics. In particular, high-strength materials, such as metal-ceramics, may not provide the necessary aesthetics, while composite materials may better match natural teeth in color and translucency.

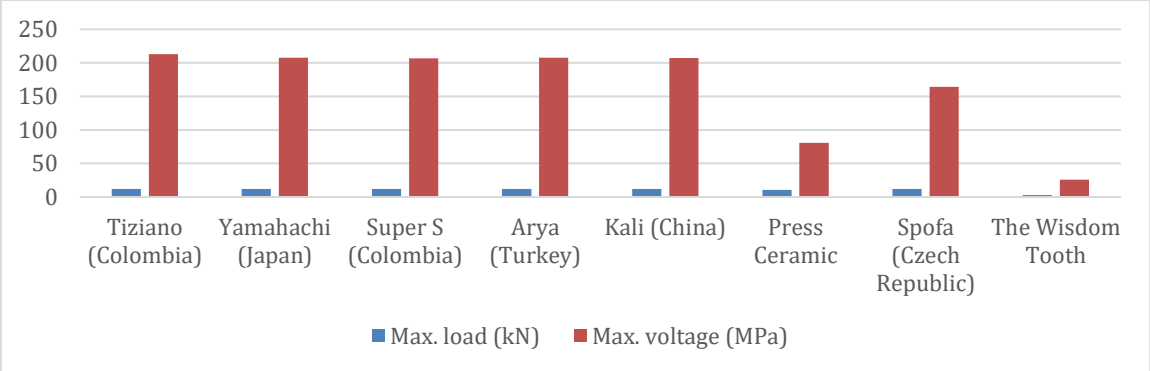

Fig 1. Compressive strength of artificial tooth materials for removable prosthesis: Tiziano (Colombia), Yamahachi (Japan), Super S (Colombia), Eray (Turkey), Kali (China), Press Ceramic, Spofad (Czech Republic), and wisdom teeth.

The research results show significant differences in the mechanical characteristics of various types of artificial teeth. The optimal choice of material should consider:

• Compressive strength (high indicators are important for chewing teeth).
• Hardness (resistance to abrasion reduces the likelihood of prosthesis replacement).
• Aesthetic properties (especially important for anterior teeth).
• Biocompatibility and adhesion to the base.

CONCLUSIONS: Thus, Tiziano, Yamahachi, Super S, Eray, and Kali materials are the most promising for use in removable prostheses due to their high strength and resistance to loads. The comparative analysis of the mechanical properties of artificial teeth made from

World Bulletin of Public Health (WBPH)
Available Online at: https://www.scholarexpress.net
Volume-45, April 2025
ISSN: 2749-3644

various materials revealed significant differences that have clinical importance in planning removable prosthetics. The study demonstrated that none of the considered materials has an absolute advantage in all mechanical characteristics, which necessitates a differentiated approach to the selection of artificial teeth. Composite teeth demonstrated an optimal combination of flexural strength (92±4.3 MPa) and wear resistance (1.2±0.15 μm/cycle), making them preferable for patients with pronounced masticatory load and parafunctional activity. Ceramic teeth showed the highest microhardness (480±15 HV) and abrasive resistance (0.8±0.12 μm/cycle), but have lower impact strength (0.9±0.1 kJ/m²), which limits their use in patients with a risk of prosthesis falling. Acrylic teeth, despite relatively low indicators of microhardness (22±1.8 HV) and wear resistance (2.4±0.25 μm/cycle), demonstrated the best adhesion to the prosthesis base (7.1±0.4 MPa) and higher impact strength (2.2±0.2 kJ/m²), which justifies their use in elderly patients and in cases of pronounced atrophy of the alveolar processes.

Modified acrylic teeth with the addition of fillers showed intermediate values for most parameters, allowing them to be considered as a compromise option for standard clinical situations. Their microhardness (32±2.1 HV) and wear resistance (1.8±0.2 μm/cycle) indicators significantly exceed ordinary acrylic teeth while maintaining good adhesion to the base (6.8±0.3 MPa). Based on the obtained results, clinical recommendations have been developed for selecting artificial tooth material taking into account the patient's age, the condition of supporting tissues, the nature of occlusal relationships, the presence of antagonists, and economic factors. The proposed algorithm allows optimizing orthopedic treatment and improving the long-term prognosis of removable prostheses functioning. A promising direction for further research is the study of the correlation between the mechanical properties of artificial teeth and their clinical effectiveness in long-term observations, as well as the development of new composite materials with improved mechanical characteristics based on nanotechnologies.

REFERENCES:

1. Abolmasov N.G., Abolmasov N.N., Bychkov V.A. Orthopedic Dentistry. Moscow: MEDpress-inform, 2005.
2. Abadzhyan V.N. The effect of complete removable dentures on the mucous membrane of the prosthetic bed. Tver, 2003.
3. Bogatov A.I., Zotov V.M. Features of orthopedic treatment of patients with complete absence of teeth. Dentistry, 2005.
4. Gavrilov M.I. Prosthesis and prosthetic bed. Moscow: Medicina, 1979.
5. Sadykov E.I. Dental rehabilitation of patients with complete absence of teeth. Institute of Dentistry, 2002.
6. Novikov A.I., Sidorov B.S. "Modern trends in prosthetics." Moscow: Medical Literature Publishing House, 2007.
7. Ivanov P.P. "Materials for removable dental prostheses: a comparative analysis." Saint Petersburg: Profmedpress, 2008.
8. Petrov V.V., Kozlov D.I. "Physical and mechanical properties of materials in orthopedic dentistry." Moscow: Nauka, 2009.
9. Sidorov A.A. "Aesthetics and functionality in modern dentistry." Moscow: Medical University, 2011.
10. Kuznetsov I.I. "Innovative materials and technologies in prosthetics." Moscow: Technique-medicine, 2012.