Academic year 2021./2022.

Course title

CERAMICS IN PROSTHODONTICS

Department

Department for Fixed Prosthodontics

Adress

Gundulićeva 5, Zagreb

Total ECTS points

4

Course leader

Prof. dr. sc. Ketij Mehulić

Course associates

Teaching plan

	No. classes
Lecture	6
Seminar	10
Practical	4
Total	20

1 class = 45 minutes

Course description

Among dental materials that have been used for decades to repair damaged and or lost chewing units, ceramics occupies a significant place compared to other constituent materials because it meets the high aesthetic requirements of modern fixed prosthetics, hygiene, tissue tolerance, durability and stability. With or without a metal base, it solves reconstructions with crowns, three-unit and multi-unit bridges, as well as inlays, onlays and veneers.

The chronology of ceramics in dentistry, from enameling to controlled glass crystallization, subtraction and additive processes and the development of high quality materials, was in line with new knowledge of silicate chemistry, development of new possibilities for processing ceramic raw materials and new and sophisticated technologies.

Ceramics, as a brittle material, do not deform under load. This makes it, despite the stability of the shape, particularly sensitive to small defects in the structure, which can later be the starting point for fracture cracks. Stresses, which act on the material from the outside, are

concentrated on these small errors, and when the critical toughness of the material is exceeded, the ceramic object breaks. Ceramics withstand compressive and low tensile and shear stresses well, because tensile and shear stresses open the sides of the crack.
Metal-ceramic restorations combine good properties of prosthetic alloys (strength, hardness, durability, stability), and aesthetic problems are solved by using ceramic materials that can completely cover the metal base and mimic a natural tooth. Weinstein's patent in 1963 and the collaboration with the Vita (ceramics) and Degussa (alloy) factories led to the application of the technology of porcelain fused to metal (metal-ceramics), which is still the standard in fixed prosthetics. Ceramics must have: a firm bond with the surface of cast, a harmonized coefficient of thermal expansion with the alloy, shape stability, low contraction during firing, insensitivity to re-firing, reliable color reproduction, transparency and fluorescence, easy grinding and polishing, and durability in mouth, biocompatibility and high strength. The application of metal-ceramics has stimulated the development of a whole range of auxiliary materials and apparatus in the dental laboratory as well as the supporting industry.
A marked increase in aesthetic criteria in modern prosthodontics with a tendency to reduce the occurrence of allergic reactions and corrosion processes by removing the metal base structure, especially nickel, has led to the replacement of metal restorations with chemically more durable materials and optically similar to hard dental tissues. The strengthening of the ceramic material was obtained by a whole series of procedures; from the insertion of certain fibers or alumina, magnesium or zirconium oxide and other compounds into the basic ceramic mixture to special processes of controlled crystallization of glass and controlled factory production of ceramic blocks. Today, there is a whole range of new systems on the market with precisely defined indication areas and a specific technological process of making a prosthodontics appliance.

Learning outcomes

1. Name and critically judge contemporary ceramic materials and their properties
2. Distinguish the possibility of applying a particular ceramic material in a particular clinical situation. Analyze the causes and consequences of incorrect application
3. Analyze the impact of different methods of technical fabrication and processing of ceramic restorations on mechanical and optical properties. Explore opportunities for improvement
4. Valorize the impact of constituent materials on periodontal health. Recommend the optimal constituent material and method of surface treatment of the restoration for a specific clinical case
5. Judge and compare the chemical stability of ceramic materials

Course contet

Lecture

	Lecture topics	Number of classes/hours
1.	Significance and application of ceramic materials in dental prosthetics. Division of modern ceramic materials; by composition, purpose and by technology of production of substitutes	1
2.	Mechanical, chemical, physical properties of ceramic materials Analysis of chemical stability of ceramics Analysis of optical properties of ceramics (color and color parameters, translucency) Microstructure; phase composition and chemical composition Surface condition, gloss and roughness	1
3.	Fragile materials and their features	-
4.	Metal-ceramic systems: Compatibility of alloy and ceramic material Theories of bonding between alloy / metal and ceramic material, bond strength Analysis of the influence of different cooling modalities of an object on its microstructure Layering and sintering of ceramics - possible errors and consequences Surface treatment and its influence on the structure and properties of the substitute; wear relations	1
5.	All ceramic systems: Glass chemistry; ways of strengthening all-ceramic materials Analysis of the influence of cement type, color and thickness on the optical properties of ceramics Zirconium oxide ceramics; 5 generations, Transformational strengthening, aging	1
6.	Comparative analysis of individual systems in relation to:	1

	-Indications -Production process in the dental laboratory -Mechanical and chemical properties -Aesthetic possibilities, edge fit Durability and maintenance of ceramic restorations	

1 sat = 45 minuta

Seminari

	Seminar topics	**Number of classes/hours**
1.	Strengthening mechanisms of ceramic materials	1
2.	Periodontium and ceramic restoration	1
3.	Optical properties of modern ceramic materials, colors and color parameters, translucency	1
4.	Glassceramics	1
5.	Zirconia	1
6.	Bi-layered systems-bond strength	1
7.	Adhesive cementation, preparation of tooth surfaces and restorations	1
8.	Chemical degradation of ceramic materials	1
9.	Mechanical properties of individual constituent materials in relation to each other and in relation to hard dental tissues	1
10.	Bond strength analysis of bilayer systems	1

1 sat = 45 minuta

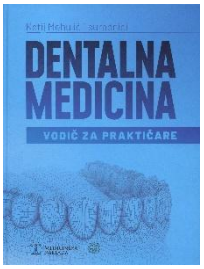
	practicals topics	**Number of classes/hours**

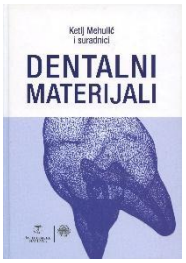
1.	Efficiency of different casting surface treatment processes on bond strength in metal-ceramic systems	1
2.	Efficiency of different core surface treatment processes on bond strength in all-ceramic systems	1
3.	Surface condition: gloss and roughness Influence of different surface treatment (sandblasting, polishing, glazing) on the quality of the restoration	1
4.	Examination of hardness among different building materials in relation to each other and in relation to hard dental tissues Examination of the structure of differently cooled objects	1

1 class = 45 minutes

Literature

1. Mehulić K i sur. Dentalna medicina – vodič za praktičare. Zagreb: Medicinska naklada; 2020.
2. Mehulić K i sur. Dentalni materijali. Zagreb: Medicinska naklada; 2017.
3. Mehulić K. Metal-keramička krunica. Potpune-keramičke krunice. Održavanje i higijena krunica. Popravak i uklanjanje krunice. U Ćatović A, Komar D, Ćatić A. Klinička fiksna protetika – Krunice. Zagreb: Medicinska naklada; 2015.
4. Mehulić K. Keramički materijali u stomatološkoj protetici. Zagreb: Školska knjiga; 2010.
5. Anusavice KJ. Phillips Science of Dental Materials. St. Louis: Saunders Elsevier Science; 2003.

1. 

2. 

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CV (*curriculum vitae*) and bibliography of course leader

Born in 1963. in Split. Primary education in Vela Luka.
Graduated from the School of Dentistry, University of Zagreb and enrolled in postgraduate studies (1988), master's degree in 1992, PhD in 1996. Specialist exam in dental prosthetics in 1997., and professional exam before the commission of the Ministry of Health of the Republic of Croatia.
11/01/1989 To this day, works at the Department of Fixed Prosthodontics, School of Dentistry, University of Zagreb as a research assistant (1989), assistant (1993), assistant professor (1999), associate professor (2004), scientific advisor (2010). full professor (2010) and full professor in permanent position (2015). The number of scientists is 177760. Since 1997 he has been working part-time at the Department of Dental Prosthodontics of the Clinic of Dentistry, University Hospital Center Zagreb. In 2007. primarius.
Actively involved in the scientific and teaching activities of the Department of Fixed Prosthetics at the School of Dentistry, University of Zagreb since 1989 until today in all forms of teaching.
Leader of the course Dental Materials in graduate and integrated studies at the School of Dentistry, University of Zagreb from 2014 to today, Dental Materials in English and from 2020 to 2021. Fixed prosthetics 2. In postgraduate specialist study, head of the course "Ceramic Systems", and in doctoral studies study "Ceramic systems in dental prosthetics" from 2000 to the today. Participated in the whole life continuing education of dentists. The best rated teacher at the School of Dentistry, University of Zagreb, according to a survey of students at the Faculty. The grade in the last academic year is 5.0. She won the Rector's Award (1987). Under the mentorship, 61 qualification theses were defended (45 graduate, 5 masters', 5 postgraduate specialist theses and 6 doctoral).
Principal investigator of scientific projects in the country (No. 065-0650446-0435) and abroad financed by the Ministry of Science, Education and Sports of the Republic of Croatia and university grants (5).
Proposer of the program of the new university postgraduate specialist study Dental Prosthetics of the School of Dentistry, University of Zagreb, approved by the Senate of the University of Zagreb.
She has published a total of 227 scientific and professional papers and conference abstracts (without qualifying papers) in various databases, including several university textbooks and teaching texts.
She is a mentor of the Croatian Chamber of Dental Medicine and the School of Dentistry, University of Zagreb in the process of nostrification of a foreign diploma. She is the main mentor to a number of residents in dental prosthetics. The Ministry of Health of the Republic of Croatia appointed her an examiner in specialist exams in dental prosthetics.
Editor-in-chief of 2 journals, member of the editorial board of 6 journals, reviewer for 21 journals, 1 book and one university textbook.

Full member of the Academy of Medical Sciences of the Republic of Croatia and the President of the Oral Health Committee, College of Dental Sciences (2018 to present).
Chairman of the Reference Center for Biomaterials in the Rehabilitation of the stomatognathic System of the Ministry of Health of the Republic of Croatia (from 2020 until today).
Head of the Department of Dental Prosthodontics, Clinic of Dentistry, University Hospital Center Zagreb (since 2021).
Member of the Society for Dental Prosthetics of the Croatian Medical Association and the Croatian Chamber of Dental Medicine.
Research interest are Fixed Prosthodontics, Dental Materials, Dental ceramics.

Bibliography of course leader

https://www.bib.irb.hr/pretraga?operators=and|Mehuli%C4%87,%20Ketij%20%2814092%29|text|profile