Ministry of Science, Higher Education, and Innovation of the Kyrgyz Republic
Educational Institution
"Royal Metropolitan University"
Department of Dental Disciplinces

"APPROVED"
Vice Rector for Academic and
and Administrative Affairs
N.A. Urazalieva
"06" 02 2025

TEACHING AND METHODOLOGICAL COMPLEX OF THE DISCIPLINE

"Impression and Prosthetic Materials"

of the main educational program
in the specialty 56004 **"Dentistry" (for foreign citizens)**

Graduate qualification: Specialist (Doctor)

Bishkek 2025

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WORKING PROGRAM OF THE DISCIPLINE
"Impression and Prosthetic Materials"

of the main educational program
in the specialty 560004 **"Dentistry" (for international students)**

Graduate Qualification: Specialist (Doctor)

Full-time program	
Course	4
Semester	7
Exam (semester)	
Credit (semester)	8
Total credits in the curriculum	2
Total hours in the curriculum	60

Program developer:
Makenzhanov A.

Reviewed and approved at a meeting of the
Department of Dental Disciplines
Minutes No. 1 of September 6, 2025
Head of Department, Ph.D. A.K. Bektasheva
_____ *(signature)*

Bishkek 2025

The work program for the course "Impression and Prosthetic Materials" has been developed in accordance with the requirements of the State Educational Standard for Higher Education in specialty 560004 "Dentistry."

The work program has been approved by the Educational and Methodological Department of the RMU
Head of the Educational and Methodological Department
Kurtubaeva N.K. _____
(Full Name)
(signature)
"06" 09 2025

The work program has been approved by the head of the main educational program for specialty 560004 "Dentistry"
Head of the Main Educational Program Saparova A.Z. _____
(Full Name)
(Signature)
"06" 09 2025

External review provided on
M.d., professor Mamytova A.B.
"26" 08 2025 (review attached)

The work program has been approved by a specialist from the RMU Quality and Monitoring Department
Q&M Department Mambetaliev U.T. _____
(Full Name)
(Signature)

"06" 09 2025

Content

1. The working program of the academic discipline

1.1. Explanatory note

The mission of the educational institution "Royal Metropolitan University" is to improve the health and quality of life of the population through high-quality training of medical personnel capable of intercultural interaction, based on the integration of advanced scientific knowledge, innovation and high standards of practice in the context of the unity of education, science and clinical activity**.**

Abstract of the academic discipline

The course "Impression and Prosthetic Materials in Dentistry" provides students with the theoretical and practical foundations for selecting and using modern impression and prosthetic materials in orthopedic dentistry. Students study the physicochemical properties, classification, and clinical protocols for working with alginates, silicones, polyesters, digital impressions, and materials for fixed and removable prosthetics (ceramics, zirconium dioxide, PEEK, and hybrid composites). Particular attention is paid to adhesive protocols and biocompatibility.

The purpose and objectives of the discipline

The purpose of discipline

The main objective of training in the discipline "Impression and prosthetic materials in dentistry" is to develop students' systematic clinical knowledge and practical skills in:

- physicochemical properties, classification and clinical characteristics of modern impression materials used at the stages of orthopedic treatment;
- curing mechanisms, hydrophilicity, fidelity, shrinkage and dimensional stability of alginates, C-silicones, A-silicones, polyesters, polysulfides, hardening and thermoplastic masses;
- digital technologies for obtaining impressions: operating principles of intraoral scanners, differences from traditional methods, advantages and disadvantages of the digital protocol, working with virtual models and material libraries in CAD/CAM systems;
- modern prosthetic materials for the production of fixed and removable structures: glass ceramics (E-max), zirconium dioxide (fully and partially stabilized), hybrid ceramics, high-tech polymers (PEEK), composites for milling;
- adhesive protocols for fixing metal-free restorations, types of fixing cements (composite, glass ionomer, temporary) and criteria for their selection;
- methods of clinical assessment of the quality of impressions (precision of marginal fit, absence of pores and deformations, clarity of gum retraction), typical errors when taking impressions and methods for eliminating them;

- biocompatibility and allergological status of polymers, ceramics and alloys, clinical manifestations of material intolerance (galvanism, allergic stomatitis) and methods of their prevention;
- algorithms for selecting impression and prosthetic materials depending on the clinical situation (single crowns, bridge prostheses, prosthetics on implants, complete removable dentures), as well as taking into account the age characteristics and aesthetic requirements of the patient;
- methods of asepsis, antisepsis and disinfection of impressions and finished structures, rules of sanitary and epidemiological regime in the dental office and laboratory.

Achieving this goal is ensured by consistently solving the problems of the discipline (studying the comparative characteristics of elastomers, mastering CAD/CAM technologies, mastering adhesive protocols, developing skills in selecting materials and assessing their biocompatibility), which together prepares the graduate for independent professional activity as a dentist-orthopedist.

Objectives of the discipline

- To develop a comprehensive fundamental knowledge of the physicochemical properties, curing mechanisms and clinical characteristics of alginate, silicone (C and A), polyester, polysulfide, curing and thermoplastic impression materials.
- To teach methods of clinical assessment of impression quality, identification and elimination of typical defects (pores, stretching, deformation), as well as rules for disinfection and storage of various types of impressions.
- To explore modern digital technologies in orthopedic dentistry: the operating principles of intraoral scanners, the differences between digital and traditional protocols, and the advantages and limitations of the method.
- To master the classification, properties and indications for the use of modern prosthetic materials: glass ceramics (E-max), zirconium dioxide, hybrid ceramics, PEEK, composites for CAD/CAM.
- To study adhesive protocols for fixing metal-free structures, types of fixing cements (composite, glass ionomer, temporary) and criteria for their selection depending on the restoration material.
- To develop practical skills in working with impression materials: mixing alginates, working with automatic mixers for elastomers, obtaining single- and double-layer impressions, selecting and making individual trays.
- To master the skills of clinical selection of impression and prosthetic materials depending on the type of prosthetics (crowns, bridges, implants, complete removable dentures), as well as taking into account aesthetic requirements and biocompatibility.
- Develop the ability to work in a team with related specialists (dental technician, implant surgeon) and effectively communicate material selection issues.

The block “Impression and prosthetic materials” is included in the basic part of the professional cycle for the specialty “Dentistry” (code 560004).

The place of the discipline in the structure of the OOP (prerequisites, postrequisites)

This discipline is studied by students in the specialty 560004 “Dentistry” (for foreign citizens) and is considered an elective discipline.

The course content builds on the content of such preceding disciplines as: propaedeutics of orthopedic dentistry, propaedeutics of dental diseases, chemistry, and physics. The knowledge gained during the course will subsequently be essential for studying the following disciplines: orthopedic dentistry, implantology, maxillofacial prosthetics, and pediatric dentistry.

The main purpose of the program is to develop students' clinical thinking, the ability to interpret clinical data, and the ability to reasonably select optimal impression and prosthetic materials to achieve high-quality and durable orthopedic structures.

The total workload of the subject is 60 hours (2 credits).

The course consists of lectures and practical exercises. Ongoing assessment includes oral quizzes, testing, practical skills assessments on phantoms, and solving case studies. The final assessment is an exam.

Course prerequisites: Propaedeutics of orthopedic dentistry, chemistry, physics.

Postrequisites: Orthopedic dentistry, implantology, maxillofacial prosthetics, pediatric dentistry.

Competencies of students formed as a result of mastering the discipline, planned results of mastering the academic discipline.

- Graduate in the specialtyDentistrywith the assignment of a specialist qualification"Doctor"in accordance with the goals of the OOP and the objectives of professional activity,must have the following professional competencies:

Code	Contents of competence
GC-1	able and willing to analyze socially significant problems and processes, to use methods of natural sciences, mathematics and humanities in various types of professional and social activities
IC-1	able and ready to work with computer equipment and software for system and application purposes to solve professional problems
SPC-1	able and willing to implement ethical, deontological and bioethical principles in professional activities;
PC-2	able and willing to conduct and interpret interviews, physical examinations, clinical examinations, results of modern laboratory and instrumental studies, morphological analysis of biopsy, surgical and autopsy material of patients, and prepare medical records for outpatient and inpatient patients of children and adults;

SPC-2	Capable and willing to work in a team, tolerant of social, ethnic, religious and cultural differences.
PC-6	able and ready to work with medical and technical equipment used in work with patients, computer equipment, receive information from various sources, apply the capabilities of modern information technologies to solve professional problems;
PC-4	able and willing to apply aseptic and antiseptic methods, use medical instruments, carry out sanitization of treatment and diagnostic rooms, children's healthcare organizations, and possess the skills to care for sick children and adults;
PC-16	able and ready to make a diagnosis based on the results of clinical and laboratory studies of biological materials and taking into account the laws of the course of pathology in organs, systems and the body as a whole;
PC-19	able and ready to diagnose typical dental diseases of the hard and soft tissues of the oral cavity, dentofacial anomalies in patients of all ages;
PC-20	able and ready to analyze and interpret the results of modern diagnostic technologies in children, adolescents and adults for successful treatment and preventive activities;
PC-22	able and ready to perform basic treatment measures for the most common dental diseases and conditions in adults and children;
APC-1	ability to use modern digital technologies in the diagnosis and treatment of dental diseases;
APC-2	willingness to use innovative aesthetic materials and restoration methods to restore the dentition.

1.3 Planned results of mastering the academic discipline/practice

LO1: To analyze socially significant and professional problems in dental materials science using scientific methods.
LO2: Use computer technologies and software to solve professional problems (CAD/CAM, analysis of materials properties).
LO3: Apply the principles of bioethics, deontology and medical ethics when selecting materials and informing the patient.
LO4: Communicate professionally with the dental technician and colleagues, and work as a team when planning orthopedic treatment.
LO5: Conduct a clinical examination of the patient, collect an allergy history and prepare medical documentation.
LO6: Perform pathophysiological analysis of clinical syndromes of material intolerance and interpret diagnostic results.
LO7: Conduct diagnostics and select optimal impression and prosthetic materials for patients of all ages.

LO8: Develop and implement a sound orthopedic treatment plan using modern materials and adhesive protocols.
LO9: Apply methods of asepsis, antisepsis and disinfection of impressions and structures, ensure sanitary safety.
LO10: Use modern digital technologies (intraoral scanning, CAD/CAM) to obtain impressions and manufacture prostheses.

After mastering this discipline, the student:
Will know terms used in dental materials science and the main methods of taking impressions and manufacturing prosthetic structures; concepts of etiology, pathogenesis, morphogenesis of complications associated with the use of materials, nosology, principles of classification of impression and prosthetic materials;
Will understand the essence and basic patterns of physical and chemical processes occurring during the curing of impression and prosthetic materials; their influence on accuracy, stability and biocompatibility, characteristic changes in the tissues of the prosthetic bed in case of intolerance to materials (galvanism, allergic stomatitis);
Will be able to use rules for constructing a clinical diagnosis in relation to the choice of material, principles of working with impression materials (alginates, silicones, polyesters) and orthopedic structures made of various materials;
Will be able to determine macroscopic and microscopic defects of impressions (pores, stretches, deformations, inaccuracy of marginal fit) and associate them with a violation of the protocol for working with the material;
Will be able to carry out clinical and laboratory analysis; differential diagnosis of errors in taking impressions; diagnosis of the causes of failures in orthopedic treatment related to the material (incorrect choice, violation of the adhesive protocol, bioincompatibility);
Will be able to analyze characterization of the physical and chemical properties of impression and prosthetic materials (shrinkage, hydrophilicity, flowability, strength, aesthetic parameters) in order to establish indications for their use; clinical, laboratory and other data, and formulate a conclusion on their basis about the most probable causes and mechanisms of development of complications associated with the material;
Will be able to synthesize results of clinical examination, analysis of diagnostic models and digital impressions for an informed choice of the optimal impression and prosthetic material;
Will be able to evaluate and develop principles of etiotropic and pathogenetic therapy for complications caused by intolerance to dental materials (material replacement, desensitizing therapy, correction of the adhesive protocol).

1.2. Recommended educational technologies

The following educational technologies are used to help students master the academic discipline "Impression and Prosthetic Materials," gain knowledge, and develop professional competencies:

- lecture with elements of discussion and problem solving;
- lectures - electronic presentations;
- analysis of specific situations;
- role-playing game "doctor - patient";
- lecture-visualization;
- brainstorming;
- small group method;
- analysis of clinical cases;
- situational tasks;
- student's research work;
- preparation and defense of abstracts;
- excursions, visits to the dentist's office

1.3. Scope of the discipline and types of academic work

The section data is presented in tabular form in accordance with the curriculum. It also specifies the volume of classroom instruction (lectures, seminars, practical classes, and labs) and independent student work (overall and by semester in which the course is studied), as well as the types of final assessments.

Form of study – full-time

According to the 2025 curriculum	**8 sem.**	**Total**	
		in hours	**in loans**
Total labor intensity	**60**	**60**	**2**
Classroom work	36	24	
Lectures	18	18	
Practical classes	18	18	
Independent work	12	12	
SRSP	12	12	
Type of final control	Credit		

1.4. Structure of the discipline

1.4.1. Thematic plan for studying the discipline –Reflects the course structure, reveals the sequence of study of sections and topics of the program; is presented in the form of a table and provides information on the distribution of the number of hours by topics, types of classes (lectures, seminars, practical classes, laboratory work, independent work of students), the competencies developed, the educational technologies used, the methods and methods of teaching, and forms of assessment.

Subject plan for studying the discipline and competency matrix(workload is indicated in academic hours)

No.	Name sections and topics disciplines (lectures and practical classes)	Classroom classes				Total hours on classroom work	SRSP	Independent work of a student	Formed competencies	Used educational technologies, methods	Dummies	Forms of current and border control academic performance
		lectures	seminars	practical classes	laboratory work							
	7th semester											
1	Introduction to impression materials. Impression trays. Classification and properties.	*2*		2		4		2	GC-1, PC-2, PC-15	*visualization lecture*	*Diagnostic plaster model*	*Oral survey*
2	Alginate materials. Chemical composition, properties, mixing technique.	2		2		4	2		PC-4, PC-22	*lecture-visualization*		*Testing, control work. Solving situational problems*
3	Elastomers: C-silicones and A-silicones. Chemistry of processes, properties, technology.	2		2		4		2	PC-22, APC-1	*visualization lecture*	*Artificial jaws*	*A lesson using head mannequins*

4	Polysulfides and polyester materials. Properties and indications for use.	2		2		4	2		PC-19, PC-20	*lecture-visualization*		*classes using diagnostic models Testing Analysis of OPT*
5	Hardening and thermoplastic materials. Zinc oxide-eugenol pastes.	2		2		4		2	PC-16, PC-22	*visualization lecture*	*Diagnostic plaster models*	*analysis of clinical cases.*
6	Impression quality control. Material selection in the clinic. Criteria and errors.	2		2		4	2		PC-2, PC-4	*Visualization lecture*		*classes using training equipment and simulators. Assessing the acquisition of practical skills (abilities). Solving situational problems*

7	Modern digital impressions. Intraoral scanners, CAD/CAM.	2		2		4	2	2	IC-1, APC-1	*Visualization lecture*		*analysis of clinical cases. Classes using simulators and training equipment*
8	Prosthetic materials. Ceramics and zirconium dioxide. Properties and indications.	2		2		4	2	2	PC-22, APC-2	*lecture-visualization*		*business and role-playing educational game. Classes using simulators and training equipment*
9	Prosthetic materials: composites, hybrids, PEEK. Adhesive protocols.	2		2		4	2	2	PC-6, APC-2	*Visualization lecture*		*analysis of clinical cases. Use of computer-based training programs*
	Total 8 semester	18		18		36	12	12				**Credit**

	Total hours by discipline:	**18**		**18**		**36**	**12**	**12**				***60***

Examples of educational technologies, methods and teaching techniques (abbreviated):*traditional lecture (L), lecture-visualization (LV), problem lecture (PL), lecture-press conference (LPC), lesson-conference (LC), training (T), debates (D), brainstorming (MS), master class (MC), activation of creative activity (ATD), regulated discussion (RD), forum-type discussion (F), business and role-playing educational game (DI, RI), small group method (MG), analysis of clinical cases (CA), preparation and defense of medical history (IB), preparation of written analytical works (AP), preparation and defense of abstracts (R), distance educational technologies (DOT).*

Sample forms of current and midterm monitoring of academic performance (abbreviated):*T – testing, Pr – assessment of mastery of practical skills (abilities), ZS – solving situational problems, CR – test, KZ – test assignment, IB – writing and defending a medical history, CL – writing and defending a supervisory sheet, R – writing and defending an abstract, S – interview on test questions, D – preparing a report, etc.*

1.4.2. Organization of independent work of students

No.	Topic of independent work for students of 5th semester:	Assignment for independent work	Recommended literature	Deadlines surrender (week number)
1.	Evolution of impression materials: history and modernity.	Abstract, presentation, preparation of the report.	Dental Materials Science: TextboGC / E. S. Kalivradzhiyan, E. A. Bragin, I. P. Ryzhova [et al.]. - Moscow: GEOTAR-Media, 2023 Dictionary of professional dental terms / E. S. Kalivradzhiyan, E. A. Bragin, I. P. Ryzhova - Moscow: GEOTAR-Media, 2017 Fundamentals of Dental Prosthetics Technology. Vol. 1.2: textboGC: in 2 volumes / S. I. Abakarov [et al.]; edited by E. S. Kalivradzhiyan. - Moscow: GEOTAR-Media, 2022 Dental Materials Science with a Course in Occupational Health and Safety: TextboGC / M. L. Mironova, T. M. Mikhailova. - Moscow: GEOTAR-Media, 2021 https://pubmed.ncbi.nlm.nih.gov	1
2.	Comparative characteristics of hydrocolloid and	Abstract, presentation,		2

	elastomeric impression materials.	preparation of a report		
3.	Silicone impression materials: C-silicones vs. A-silicones.	Abstract, presentation		3
4.	Methods for disinfecting impressions made from various materials. WHO protocols.	Abstract, presentation, preparation using dummies.		4
5	Digital technologies in dentistry: 3D printing and CAD/CAM.	Abstract, presentation, preparation of the report.	.	5
6	PEEK in dentistry: indications, advantages and disadvantages.	Abstract, presentation, preparation of the report.		6
7	E-max glass ceramics: types, manufacturing technology, clinical aspects.	Abstract, presentation, preparation of the report.		6

1.4.3. Assessment tools for monitoring academic performance

- **Current and midterm (modular) control**

*Current monitoring of students' knowledge*may represent:

- oral survey;
- solving situational problems;
- assessment of the acquisition of practical skills using dummies;
- test task; test work;
- checking the completion of written homework;
- checking abstracts, reports, presentations.

Sample situational problems for the discipline:
Situational tasks

Problem #1

A 38-year-old patient requires a metal-ceramic crown for tooth 2.6 (upper first molar). Clinical examination revealed normal mucosa around the tooth, a dense gingival margin, and a subgingival preparation margin located 0.5 mm below the gum line.

Questions:

1. Which impression material is preferable for this clinical situation and why?
2. What technique for taking an impression would be optimal?
3. List the mandatory preparation steps before taking an impression.

Answers:

1. It is preferable to use high- and medium-viscosity A-silicone (additive type). A-silicones offer high precision (minimal shrinkage up to 0.1%), hydrophilicity, which is important in the humid oral environment, and good dimensional stability over time.
2. The optimal two-layer, one-stage technique is the simultaneous insertion of a tray with a high-viscosity base paste and a low-viscosity corrective paste applied directly to the prepared tooth.
3. Mandatory steps: gum retraction (with retraction thread or paste), careful isolation and drying of the working field, checking the quality of preparation (presence of a clear ledge), selection of a perforated tray with adhesive.

Problem #2

After taking a two-layer A-silicone impression of the upper jaw, the dentist discovered multiple small pores and poor gingival coverage in the area of the prepared tooth (2.4). The margin of the margin was barely visible.

Questions:

1. What are the most likely causes of pores?
2. Is it necessary to retake the impression? If so, what steps should be taken to ensure a high-quality impression?
3. What is the correct procedure for disinfecting this impression if it were deemed acceptable?

Answers:

1. Causes of pores: insufficient isolation from moisture (blood, saliva) before applying the corrective paste; inserting the tray too early (the material did not fill all areas); insufficient amount of corrective paste; air ingress during mixing (when mixing by hand).
2. Yes, the impression must be retaken. Measures to be taken include: thorough gingival retraction and hemostasis (use of retraction cords impregnated with a hemostatic agent); thorough drying and isolation of the working area; use

of a dynamic mixer for the corrective paste; and increasing the amount of corrective material.

3. Disinfection of A-silicone impressions is performed by spraying them with a disinfectant spray (e.g., a 0.5% chloramine solution or a special silicone spray) or by briefly immersing them in a disinfectant solution (no more than 10 minutes). Autoclaving and prolonged soaking are not permitted, as this may cause deformation.

Problem #3
A 65-year-old patient is scheduled for a complete removable denture for his edentulous lower jaw. The alveolar portion is severely atrophied, and the mucosa is thin and mobile.

Questions:

1. What impression material is recommended to be used to obtain a functional impression in this case?
2. What is the fundamental difference between an anatomical impression and a functional one?
3. Which tray (standard or custom) should be used at which stage? Describe briefly the steps involved in taking a functional impression.

Answers:

1. To obtain a functional impression of an edentulous jaw, it is recommended to use zinc oxide eugenol paste (a hardening material) or low-viscosity A-silicone. Zinc oxide eugenol paste has good flow properties, provides an accurate representation of the functional state of the mucosa, and does not compress it during insertion.
2. An anatomical impression (taken with alginate and a standard tray) only shows the mucosal relief at rest. A functional impression is taken with a custom tray, taking into account functional tests (mouth opening, swallowing, lip movement), which allows for the compliance and mobility of the mucosa to be assessed during the functioning of the prosthesis.
3. Sequence: 1) taking an anatomical impression with alginate using a standard tray; 2) casting the model; 3) making a custom tray from light-curing plastic; 4) fitting the custom tray in the mouth; 5) obtaining a functional impression using zinc oxide eugenol paste (or low-viscosity A-silicone) with functional tests.

***Boundary (modular) control*may represent:**
- testing by section (computer);
1. What material is most often used to obtain an anatomical impression?
A) A-silicone
B) Alginate

C) Polyester
D) Zinc oxide eugenol paste
Correct answer: B

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2. What is the main advantage of A-silicones over C-silicones?
A) Lower cost
B) No shrinkage during polymerization
C) High rigidity after curing
D) Possibility of boiling for disinfection
Correct answer: B

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3. To obtain an impression for an all-ceramic crown with high precision of marginal fit, it is preferable to use:
A) Alginate
B) Thermoplastic mass
C) Polyester material
D) Gypsum
Correct answer: C

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4. What is CAD/CAM in dentistry?
A) Method of disinfection of impressions
B) Computer modeling and production of restorations
C) Method of fixing temporary crowns
D) Type of impression material
Correct answer: B

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5. What material is considered a hardening impression material?
A) Alginate
B) A-silicone
C) Zincoxide eugenol paste
D) Thermoplastic mass
Correct answer: C

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6. For fixation of metal-free ceramic restoration (E-max) it is recommended to use:
A) Zinc phosphate cement
B) Glass ionomer cement
C) Composite (adhesive) cement
D) Temporary cement
Correct answer: C

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7. What tool is used to take a digital impression?

A) Dental mirror
B) Impression tray
C) Intraoral scanner
D) Dental probe
Correct answer: C

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8. The main disadvantage of alginate materials:
A) High cost
B) Toxicity
C) Significant shrinkage in air
D) Difficulty of mixing
Correct answer: C

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9. What is the preferred method for disinfecting alginate impressions?
A) Autoclaving
B) Immersion in alcohol
C) Irrigation with a disinfectant spray
D) Boiling
Correct answer: C

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10. What is PEEK in dentistry?
A) Ceramic material
B) High-tech polymer for prosthetic frameworks
C) Impression material
D) Fixing cement
Correct answer: B

- The remaining test tasks can be found in the FOS app.

- **Final control**

Final control at the end of the study of the academic discipline it is carried out in the form of a test whichis exhibitedbased on the results of testing and midterm (modular) control in the discipline.

1.4.4. Course policy and assessment criteria

Students' knowledge is assessed using a point-rating system.in accordance with the standard “Regulations on the modular point-rating system for assessing students’ knowledge.

Discipline "Impression and Prosthetic Materials"assessed on a 100-point scale:

The maximum score is 100, of which:

- SRS - 20 points;
- current control - 40 points
- midterm control (module completion) - 40 points.

The results of the two modules are added together to produce an average score.

Scoring Policy	**Module 1**	**Module 2, etc.**
SRS	20 points	20 points
Classroom work (activity in discussions, oral questioning, group work, etc.)	40 points	40 points
Total for the module (testing)	40 points	40 points
Total for the discipline:	100 points	
Exam		

Final assessment in the form of a test is carried out based on the results of attendance, current and midterm (modular) assessment.
The final assessment form is a credit.
The following scale of grades and scores is used to evaluate student performance:

Rating and Scoring Scale				
Maximum score	Intervals			
	unsatisfactory	"satisfactorily"	"Fine"	"Great"
20	0-11	12-15	16-17	18-20
40	0-23	24-30	31-35	36-40
60	0-35	36-45	46-53	54-60
100	0-59	60-75	76-89	90-100

Academic achievement grading scale

Rating (points)	**Letter grading system**	**Value for calculating GPA**	**Digital equivalent of the assessment**	**Assessment according to the traditional system**
96-100%	A+	4.00	5	Great
93-95.99%	A	3.75		
90-92.99%	A-	3.67		
87-89.99%	B+	3.33	4	Fine
83-86.99%	B	3.00		
80-82.99%	B-	2.67		
77-79.99%	C+	2.33	3	Satisfactorily
73-76.99%	C	2.00		
70-72.99%	C-	1.67		
67-69.99%	D+	1.33	2	
63-66.99%	D	1.00		
60-62.99%	D-	0.67		
00-59.99%	F	0.00	1	Unsatisfactory
	P			Credit
	NP			Fail
	I		Not taken into account when	Failed to comply with all

			calculating the average grade	disciplinary requirements for a valid reason
	W			Refusal to attend a course that is not mandatory
	AU			Attended the course as a listener, without receiving grades (awarded to a student if he/she has attended at least 80% of the classes in the additional discipline as a listener).

I - awarded to a student who has failed to complete all course requirements for a valid reason. The student has the right to complete all course requirements within the time limit established by the educational institution, after which the grade will be adjusted.

W - assigned to a student who decides to withdraw from a course no later than the sixth week of the semester. Applies only to elective courses.

AU - awarded to a student if he/she has attended at least 80% (eighty percent) of the classes in the additional discipline as a listener.

For each discipline, GPA is calculated automatically in the information system.

GPA (Grade Point Average (GPA) is a weighted average of a student's academic achievement. GPA is a key indicator of academic performance.

Based on academic performance, a GPA is calculated, with a maximum of 4.0. A student's GPA is calculated based on their academic performance in each semester and at graduation.

1.4.5. Educational, methodological and informational support of the discipline

List of sources and literature:

a) main literature:

1. **Dental materials science**: textboGC / E. S. Kalivradzhiyan, E. A. Bragin, I. P. Ryzhova, etc. - Moscow: GEOTAR-Media, 2023.
2. **Orthopedic Dentistry. Materials and Technologies**: textboGC / A. I. Abdurakhmanov, O. R. Kurbanov. - 3rd ed. , processed and additional - Moscow: GEOTAR-Media, 2016.

3. **Microprosthetics in dentistry**: textboGC / S. I. Abakarov, D. V. SorGCin, D. S. Abakarova; edited by S. I. Abakarov. - Moscow: GEOTAR-Media, 2023.
4. **Fundamentals of Dental Prosthetics Technology. Vol. 1, 2**: textboGC : in 2 volumes / S. I. Abakarov et al.; edited by E. S. Kalivradzhiyan. - Moscow : GEOTAR-Media, 2022.

b) additional literature:

1. 1**Dental Materials Science with a Course in Occupational Health and Safety**: textboGC / M. L. Mironova, T. M. Mikhailova. - Moscow: GEOTAR-Media, 2021.
2. **Interaction of dental materials with the human body**: textboGC / Kurbanov O. R., Alieva A. O., Kurbanov Z. O. - Moscow: GEOTAR-Media, 2019.
3. **Orthopedic Dentistry (faculty course)**: textboGC / V. N. Trezubov, A. S. Shcherbakov, L. M. Mishnev; edited by V. N. Trezubova. - 9th ed. , processed and additional - Moscow: GEOTAR-Media, 2019.
4. **Orthopedic dentistry**: textboGC / edited by E. S. Kalivradzhiyan, I. Yu. Lebedenko, E. A. Bragin, I. P. Ryzhova. - Moscow: GEOTAR-Media, 2018.
5. **Orthopedic dentistry (fixed dental prosthetics)**: textboGC / O. R. Kurbanov, A. I. Abdurakhmanov, S. I. Abakarov. - Moscow: GEOTAR-Media, 2015.
6. **Dictionary of professional dental terms**/ E. S. Kalivradzhiyan, E. A. Bragin, I. P. Ryzhova. - Moscow: GEOTAR-Media, 2017.

List of resources of the information and telecommunications network "Internet" necessary for mastering the discipline

Provide links to websites that are publicly accessible.

List of resources of the information and telecommunications network "Internet" required for mastering the discipline (modules)

- Scientific electronic library eLibrary (https://elibrary.ru)
- PubMed Central (https://www.ncbi.nlm.nih.gov/pmc)
- Websites of dental material manufacturers (3M, Ivoclar Vivadent, GC, Dentsply Sirona)

1.4.6. Material and technical support of discipline

When teaching students, modern methods and forms of teaching are used, using the latest information technologies, electronic educational resources and other information systems necessary for the successful implementation of educational, scientific and therapeutic activities.

The department has the necessary equipment for teaching, including demonstration devices, multimedia, educational films, simulators, maps, posters, and visual aids. The classroom requirements include computer labs, academic and specially equipped classrooms and laboratories, and a blackboard.

The lecture room is equipped with a power supply kit (220 V, 2 kW, complete with an RCD), specialized furniture and office equipment (a blackboard for writing with chalk and felt-tip pen, a stand-lectern, a lecturer's desk, a chair-chair, classroom tables, a classroom chair, as well as technical teaching aids (a wall-mounted screen with an electric drive and remote control, a multimedia projector with a laptop).
A new innovative teaching method is used for presentations, lectures and videos.
The direction “Impression and prosthetic materials” is selected, nosology on the topic of a practical lesson or lecture.
Table 1

No. p/p	Type	Name	Note
1.	Presentations.	Throughout the lecture course	From 20 to 30 slides per presentation
2.	Written and test assignments.	Throughout the lecture course	In a significant way quantity
3.	Practical training. Simulation center (stations)	Throughout the course	In a significant way quantity

List of premises used
Table 2.

No.	Audience type	List of equipment
1	An auditorium for lecture-type classes.	A stationary multimedia projector, laptop, 3x4 m screen, whiteboard, and audio equipment. (microphone, speakers)
2	Auditorium for seminars, ongoing monitoring and midterm assessment, group and individual consultations	Stationary multimedia projector, laptop, 3x4 m screen, interactive whiteboard, dummies, phantoms.

1.4.7. Student research work

The research work on the subject "Impression and Prosthetic Materials" has the following goals: increasing the level of professional and creative training of students, improving the forms of involving young people in scientific research and using the creative potential of students to solve current scientific problems.
The research work is aimed at solving the following problems:

- to form an idea of the main stages of scientific research activities;
- to teach how to use the conceptual apparatus of scientific research in work;
- teach how to work with various information sources;
- development of skills for perception and analysis of professional information;
- development and improvement of decision-making and implementation abilities;
- training students by means of their acquisition of methods, techniques and skills for carrying out scientific research work during the learning process;
- development of their creative abilities, independence, initiative in studies and future professional activities within the framework of their specialty.

The program of scientific research work of students (SRW), as a section for mastering practical skills, includes:

- study of specialized literature and other scientific and medical information, achievements of domestic and foreign science and technology in the field of medical knowledge, preparation of scientific abstracts (literature reviews);
- participation in conducting scientific research or in carrying out certain developments in departments;
- collection, processing, analysis and systematization of scientific information on a topic or assignment;
- preparing reports and presenting a paper at a conference, preparing scientific work for publication;
- participation in mass events of the research and development system (student scientific conferences, seminars, subject Olympiads, competitions, Science Week, exhibitions, discussions, debates, etc.).

To solve the problem, students are offered to read and meaningfully analyze scientific monographs and articles on various issues of obstetrics and gynecology contained inlist of resources of the information and telecommunications network "Internet":

- Scientific electronic library eLibrary (https://elibrary.ru)
- PubMed Central (https://www.ncbi.nlm.nih.gov/pmc)
- Websites of dental material manufacturers (3M, Ivoclar Vivadent, GC, Dentsply Sirona)

The results of work with scientific monographs and articles are discussed during practical classes.

To develop and improve communication skills, decision-making skills, and medical tactics in emergency situations, special training sessions are organized in the form of work in small groups, role-playing games, brainstorming, discussions, presentations, or, in preparation for which, students are divided into groups in advance, defending one or another point of view on the issue under discussion.

2. Educational and methodological materials

Educational and methodological materials (EMM), as methodological support for the discipline, are presented in the form of lecture texts, developments of practical classes, both in printed and electronic form.

2.1. Lecture notes

Lecture 1. Introduction to Impression Materials. Impression Trays

1. The purpose of the lecture:

To study the goals and objectives of the course, the classification of impression materials, the requirements for an ideal impression material, the types of impression trays and indications for their use.

2. Issues under consideration:

- Definition of an impression, its importance in orthopedic dentistry.
- Classification of impression materials by physical state after curing (elastic, hard, thermoplastic).
- Requirements for an ideal impression material (precision, biocompatibility, convenience, cost-effectiveness).
- Impression trays: standard (anatomical, perforated, sectional) and individual.
- Criteria for choosing a spoon: size, shape, presence of retention holes.
- Methods for manufacturing a custom tray from light-curing plastic or polystyrene.

3. Educational technologies:

Lecture-visualization (multimedia presentation, demonstration of various spoons).

4. Primary and secondary literature:

- Kalivradzhiyan E.S. Dental materials science. – M.: GEOTAR-Media, 2023.
- Powers J.M. Craig's Restorative Dental Materials. – Elsevier, latest edition.

Lecture notes:

An impression (cast) is a negative representation of the hard and soft tissues of the oral cavity, used to create models of the jaws. Impression materials are classified as hard (gypsum, zinc oxide-eugenol pastes), elastic (alginates, silicones, polyesters, polysulfides), and thermoplastic (waxes, gutta-percha, thermoplastics). The ideal material should be non-toxic, biocompatible, have good flow properties, accurately reproduce details, minimal shrinkage, have a sufficient working time, be easily removed from the oral cavity, not deform, and be easily disinfected. Impression trays come in standard (metal or plastic) and custom-made. Standard trays are selected based on the size and shape of the jaw; they should overlap the teeth by 3-5 mm without causing tension on the soft tissue. Perforated trays improve the mechanical retention of the material. Custom-made trays are made from a model for functional impressions in cases of complete edentulism, complex structures, or when a precise fit is required.

Lecture 2. Alginate Materials

1. The purpose of the lecture:

To study the chemical composition, curing mechanism, properties, operating rules, and disinfection methods of alginate impression materials.

2. Issues under consideration:

- Chemical composition: sodium alginate, calcium sulfate, phosphates, fillers.
- Curing mechanism: ion exchange, formation of insoluble calcium alginate.
- Properties: hydrophilic, elastic, shrinkage during drying, limited accuracy.
- Mixing instructions (water-to-powder ratio, mixing time). Working time and curing time.
- Disinfection methods (irrigation, immersion in disinfectant solutions).
- Advantages (cheapness, speed) and disadvantages (low accuracy, shrinkage).

3. Educational technologies:

Lecture-visualization, demonstration of mixing alginate.

4. Literature:

- Kalivradzhiyan E.S. Dental materials science. – M.: GEOTAR-Media, 2023.
- Rosenstiel S. Contemporary Fixed Prosthodontics. – Elsevier

Lecture notes:

Alginates are reversible hydrocolloid materials (although irreversible once cured). The powder contains sodium alginate, calcium sulfate (reagent), sodium phosphate (retardant), and fillers (diatomaceous earth). When mixed with water, calcium sulfate reacts with sodium alginate, forming an insoluble calcium alginate gel. Sodium phosphate binds calcium at the initial stage, preventing premature curing. Working time is 1.5-2 minutes, curing time is 2-3 minutes. Mixing is done with a spatula in a rubber cup until a uniform consistency is achieved. Accuracy is affected by the water-to-powder ratio, water temperature, and mixing intensity. The impression should be removed after complete curing, rinsed immediately, and disinfected with irrigation (do not soak!). Alginates cannot be stored – the model should be cast immediately, as air shrinkage reaches 1-2% per hour.

Lecture No. 3. Elastomers: silicones (C-silicones, A-silicones)

1. The purpose of the lecture:

To study the chemistry of the processes, properties, advantages and disadvantages of C-silicones (condensation curing) and A-silicones (additive curing), as well as the technique of obtaining two-layer impressions.

2. Issues under consideration:

- C-silicones (condensation type): polycondensation reaction, alcohol release, shrinkage (up to 0.4-0.6%).
- A-silicones (additive type): hydrosilylation reaction, no shrinkage (less than 0.1%), high precision, hydrophilic.

- Comparison: A-silicones – better dimensional stability, disinfectability, hydrophilicity.
- Two-layer, two-stage impression technique (base and corrective pastes).
- Technique of two-layer one-stage (simultaneous) impression.
- Indications: crowns, bridges, inlays, implants.

3. Educational technologies:

Lecture with video materials, demonstration of a dynamic mixer.

4. Literature:

- Rosenstiel S. Contemporary Fixed Prosthodontics. – Elsevier
- Van Noort R. Introduction to Dental Materials.

Lecture notes:

Silicone elastomers are the most common materials for precision impressions. C-silicones (condensation) cure through a polycondensation reaction between the hydroxyl groups of polysiloxane and silane crosslinkers, releasing ethyl alcohol. The alcohol release causes shrinkage (0.4-0.6%), so the impression must be cast within an hour. A-silicones (additive) cure through a hydrosilylation reaction—the addition of hydride groups to vinyl groups without byproducts. Shrinkage is minimal (0.1%), and dimensional stability is high (the impression can be stored for several days). A-silicones are available in two pastes (base and catalyst) and a low-viscosity corrective paste. Mixing is performed using dynamic mixers or hand mixing. Two-step method: first, a preliminary impression is taken with the base material. After curing, a layer of material is removed from the prepared tooth. Then, a corrective paste is applied, and the tray is reinserted. One-step method: the base paste is applied to the tray, the corrective paste is applied to the tooth, and both are injected simultaneously. A-silicones are hydrophilic, which improves wetting in a humid environment.

Lecture No. 4. Polysulfides and polyester materials

1. The purpose of the lecture:

To study the composition, properties, indications for use of polysulfide (thiGCol) and polyester materials, and their comparative characteristics.

2. Issues under consideration:

- Polysulfide materials: composition (polysulfide polymer, oxidizer), unpleasant odor, slow curing, high elasticity, shrinkage.
- Polyester materials: chemistry (curing by the polyaddition mechanism), high precision (error less than 0.02%), rigidity after polymerization.
- Indications for the use of polyesters: veneering for metal-free structures, long bridges, prosthetics on implants.
- Comparative characteristics of polyesters and A-silicones.

3. Educational technologies:

Lecture-visualization.

4. Literature:

- Kalivradzhiyan E.S. Dental materials science. – M.: GEOTAR-Media, 2023.
- Powers JM Craig's Restorative Dental Materials.

Lecture notes:

Polysulfide materials (thiGCol) were the first elastomers. They contain a polysulfide polymer with terminal thiol groups and an oxidizing agent (lead dioxide). Curing occurs through oxidation of the thiol groups. Disadvantages: unpleasant odor, dirty color, slow curing (10-15 minutes), significant shrinkage (0.4%). Rarely used today. Polyester materials are polyethylene glycol esters with terminal ethyleneimine groups. Curing is polyaddition upon contact with water contained in the catalyst paste. Advantages: ultra-high precision (less than 0.02% shrinkage), rigidity after curing, good hydrophilicity, dimensional stability. Disadvantages: high rigidity (may complicate removal from undercuts), high cost. Indicated for precision work: long bridges, implants, all-ceramic restorations.

Lecture No. 5. Hardening and thermoplastic materials

1. The purpose of the lecture:

To study the composition, properties and methods of application of zinc oxide-eugenol pastes (hardening) and thermoplastic masses for functional impressions.

2. Issues under consideration:

- Zinc oxide-eugenol pastes: composition (zinc oxide, eugenol), curing mechanism (chelation), use for functional impressions from edentulous jaws.
- Thermoplastic materials: gutta-percha, waxes, and thermal components (Correcta). Application: softening with heating and cooling in the mouth.
- Use of thermoplastic materials for functional testing and bonding of individual spoons.

3. Educational technologies:

Lecture-visualization, demonstration of samples.

4. Literature:

- Mironova M.L. Dental materials science. – M.: GEOTAR-Media, 2021.
- Rosenstiel S. Contemporary Fixed Prosthodontics.

Lecture notes:

Hardening impression materials are represented by zinc oxide-eugenol pastes. The paste consists of a main component (zinc oxide, rosin, oil) and a liquid (eugenol, sometimes clove oil). Hardening occurs by forming a chelate of zinc ethyl eugenolate. The pastes are flowable, accurately reflect the mucosal contours, do not compress the mucosa, and have a weak analgesic effect. They are used for functional impressions of edentulous jaws on a custom tray. Disadvantages: they irritate the mucosa (eugenol), have an unpleasant taste. Thermoplastic materials (waxes, gutta-percha, thermal components) soften when heated (50-70°C) and harden when cooled to mouth temperature. They are used for functional tests, for gluing the edges of a custom tray, and for obtaining compression impressions.

Lecture #6. Impression Quality Control. Material Selection in the Clinic

1. The purpose of the lecture:

To teach criteria for assessing the quality of an impression, identifying typical errors and their causes, as well as an algorithm for selecting an impression material depending on the clinical task.

2. Issues under consideration:

- Impression evaluation criteria: integrity, absence of pores and ridges, clarity of marginal fit, reproduction of the gingival sulcus.
- Typical mistakes: tears, pores (moisture, improper mixing), deformation (early removal), poor processing of the distal sections.
- Algorithm for selecting an impression material: for single crowns – A-silicone or polyester; for bridge prostheses – high-viscosity A-silicone; for implants – polyester or A-silicone with transfers; for edentulous jaws – alginate or zinc oxide eugenol paste.

3. Educational technologies:

Problem-solving lecture, analysis of photographs of defective prints.

4. Literature:

- Kalivrajiyan E.S. Dental materials science.
- Rosenstiel S. Contemporary Fixed Prosthodontics.

Lecture notes:

A high-quality impression should accurately reproduce all details: the mucosal relief, preparation margins, gingival sulcus, and occlusal surface. It should be free of pores, retractions, and gaps. Defects: pores result from poor moisture insulation or air entrapment; retractions result from premature impression removal; deformation results from tray flexibility or material shrinkage; poor margins result from insufficient gingival retraction. The choice of material depends on the required accuracy: A-silicone is sufficient for single crowns; polyester or high-precision A-silicone is suitable for implants and metal-free structures; and alginate for anatomical impressions and zinc oxide eugenol paste for functional impressions are used for complete dentures.

Lecture #7: Modern Digital Prints

1. The purpose of the lecture:

To introduce the principles of intraoral scanning, its differences from traditional methods, the advantages and disadvantages of the digital protocol, and working with virtual models and CAD/CAM material libraries.

2. Issues under consideration:

- Principles of intraoral scanning: optical structured illumination or laser triangulation.
- Differences from traditional methods: no material, instant virtual model, no shrinkage or deformation.
- Types of scanners (laser, structured light), advantages and disadvantages.

- Working with virtual models: stitching scans, cutting out artifacts, CAD/CAM material libraries.
- Indications: complete removable dentures, single crowns, implants (using scan posts).

3. Educational technologies:

Lecture-visualization, demonstration of the scanner operation on a phantom.

4. Literature:

- Abdurakhmanov A.I. Orthopedic dentistry. Materials and technologies. – M.: GEOTAR-Media, 2016.
- Modern educational technologies in dentistry (simulation course). – Moscow: GEOTAR-Media, 2021.

Lecture notes:

Digital impressions are obtained using intraoral scanners (e.g., 3Shape TRIOS, iTero). The sensor projects structured light or a laser beam onto the tooth surface, the camera records any distortion, and the software creates a 3D model. Advantages: no mixing, shrinkage, or deformation; instant quality control; the ability to rescan defective areas; CAD/CAM integration. Disadvantages: high equipment cost, the need for a dry field, and the difficulty of scanning subgingival areas without retraction. In a digital protocol, the dentist creates a virtual model, then designs the restoration in the software and sends it for milling or 3D printing.

Lecture #8. Prosthetic Materials. Ceramics and Zirconium Dioxide

1. The purpose of the lecture:

To study the properties, indications and manufacturing technology of E-max glass ceramics and zirconium dioxide.

2. Issues under consideration:

- E-max glass ceramics (lithium disilicate ceramic): properties (400 MPa strength, high aesthetics, translucency). Indications: veneers, inlays, crowns.
- Zirconium dioxide (ZrO_2): types (fully stabilized, partially stabilized – Y-TZP). Properties (strength up to 1200 MPa, biocompatibility, color camouflage). CAD/CAM technology – milling in pre- or fully sintered form.
- Comparison of E-max and ZrO_2: aesthetics vs. strength, indications for anterior and posterior teeth.

3. Educational technologies:

Lecture-visualization, demonstration of samples.

4. Literature:

- Abakarov S.I. Microprosthetics in dentistry. – M.: GEOTAR-Media, 2023.
- Kurbanov O.R. Orthopedic dentistry (fixed dental prosthetics). – M.: GEOTAR-Media, 2015.

Lecture notes:

E-max glass ceramics are lithium disilicate ceramics available as blocks for pressing (IP S e.max Press) or milling (CAD/CAM). They boast a strength of 400

MPa and offer high aesthetics due to their translucency. They are recommended for veneers, inlays, and single crowns. Zirconia is a yttrium-stabilized ZrO_2-based ceramic (Y-TZP). It boasts exceptional strength (1200 MPa) and biocompatibility, but low translucency. They are used for crown and bridge frameworks, as well as for all-zirconia crowns with veneering ceramics. The technology includes scanning, milling from a partially sintered block, and final sintering (20-25% shrinkage). Gradient blocks are used to improve aesthetics.

Lecture #9. Prosthetic Materials: Composites, Hybrids, PEEK. Adhesive Protocols

1. The purpose of the lecture:

To study modern polymeric materials for prosthetics (PEEK, hybrid ceramics, composites for CAD/CAM) and adhesive protocols for fixing metal-free structures.

2. Issues under consideration:

- PEEK (polyetheretherketone) is a high-tech polymer used for the frameworks of removable and fixed dentures and implants. Properties: lightweight, flexible, biocompatible.
- Hybrid ceramics (Vita Enamic, Cerasmart) – a mesh structure, millable. Indications: inlays, crowns, short bridges.
- Composites for CAD/CAM (Lava Ultimate) – polymers with filler.
- Adhesive fixation protocols: etching with hydrofluoric acid (for E-max), sandblasting (for ZrO_2), use of primers (silane, MDP-containing).
- Types of fixing cements: composite (adhesive) for aesthetic restorations, glass ionomer for temporary fixation.

3. Educational technologies:

Lecture-visualization.

4. Literature:

- Kalivradzhiyan E.S. Dental materials science. – M.: GEOTAR-Media, 2023.
- Abdurakhmanov A.I. Orthopedic dentistry. Materials and technologies.

Lecture notes:

PEEK is a thermoplastic polymer that is wear-resistant, chemically inert, and has an elastic modulus close to bone. It is used for frames of removable dentures, splints, and temporary implants. Hybrid ceramics are a composite impregnated with a polymer (e.g., Vita Enamic). They combine elasticity and aesthetics and can be milled. Composites for CAD/CAM (Lava Ultimate) are nanoceramic hybrids that are easier to process but less durable. Adhesive fixation: for glass ceramics: etching with hydrofluoric acid (5%, 20 sec) + silane primer; for zirconium dioxide: sandblasting 50 μm Al_2O_3 + MDP primer; for hybrids: sandblasting + silanization. Cements: dual-curing composites (RelyX Ultimate, Panavia) – for permanent fixation; Glass ionomer (Fuji) – for temporary structures.

Practical Lesson #1. Classification of Impression Materials. Study of Properties

1. Objective of the lesson:

Learn to classify impression materials, understand their basic physical and chemical properties, and distinguish between samples.

2. Educational technologies:

Pre-test, work in small groups with sample materials, post-test.

3. Basic concepts:

Requirements for the ideal impression material. Classification by elasticity, curing mechanism, and chemical nature. Application areas of different groups.

4. Questions for the lesson:

- What are the requirements for impression materials?
- By what criteria are impression materials classified?
- What is the difference between elastic materials, rigid materials, and thermoplastic materials?
- Name the representatives of each group.

5. Questions for self-control:

- List 5 requirements for an ideal impression material.
- What group does alginate belong to? A-silicone? Zinc oxide eugenol paste?

6. Literature:

- Kalivrajiyan E.S. Dental materials science. – Ch. 1,2.
- Rosenstiel S. Contemporary Fixed Prosthodontics. – Ch. 10.

Practical Lesson #2: Impression Trays

1. Objective of the lesson:

Learn the rules for selecting a standard spoon and making a custom one.

2. Educational technologies:

Working with sets of spoons on phantoms, demonstration of making a custom spoon.

3. Basic concepts:

Standard trays (sizes S, M, L, types – for upper/lower jaw, sectional). Custom trays made of light-curing plastic. Selection criteria.

4. Questions for the lesson:

- How to determine the size of a tray for the upper jaw?
- What retention elements should be on an alginate tray?
- Indications for use of a personal spoon.
- Stages of making a custom spoon.

5. Questions for self-control:

- Why shouldn't the spoon stretch the mucous membrane?
- What is spoon adaptation?

6. Literature:

- Mironova M.L. Dental materials science.
- Kalivrajiyan E.S. Dental materials science.

Practical Lesson #3: Alginate Materials

1. Objective of the lesson:

Practice the technique of mixing alginate and obtaining an anatomical impression.

2. Educational technologies:

Demonstration, work on phantoms, evaluation of the resulting prints.

3. Basic concepts:

Water to powder ratio, mixing time, consistency, adhesive, impression removal.

4. Questions for the lesson:

- How to measure powder and water correctly?
- Signs of properly mixed alginate.
- How to avoid pores and stretch marks?
- Methods of disinfection of alginate impressions.

5. Questions for self-control:

- Why can't an alginate impression be soaked in a disinfectant solution?
- How long does it take to cast the model?

6. Literature:

- Kalivrajiyan E.S. Dental materials science. – Chapter 3.
- Rosenstiel S. Contemporary Fixed Prosthodontics. – Ch. 11.

Practical Lesson #4. C-Silicones and A-Silicones. Two-Layer Impression

1. Objective of the lesson:

Master the two-stage and one-stage technique of two-layer impression with A-silicones.

2. Educational technologies:

Demonstration of working with a dynamic mixer, testing on phantoms.

3. Basic concepts:

High viscosity base paste, low viscosity corrective paste, retraction, adhesive.

4. Questions for the lesson:

- What is the difference between a two-stage technique and a one-stage technique?
- How to prepare a tooth before applying corrective paste?
- What are the signs of a quality two-layer print?

5. Questions for self-control:

- Why are A-silicones preferred for implants?
- How long can an A-silicone impression be stored?

6. Literature:

- Rosenstiel S. Contemporary Fixed Prosthodontics. – Ch. 12.
- Van Noort R. Introduction to Dental Materials.

Practical Lesson #5. Polyester Materials

1. Objective of the lesson:

To study the properties of polyesters and practice the technique of obtaining an impression using a dynamic mixer.

2. Educational technologies:

Demonstration, work on phantoms, comparison with A-silicone.

3. Basic concepts:

Polyester, high precision, rigidity, indications (veneers, implants).

4. Questions for the lesson:

- What is the curing mechanism of polyesters?
- Why is polyester more difficult to remove from the mouth?
- What are the advantages of polyesters over A-silicones?

5. Questions for self-control:

- What constructions is polyester indicated for?
- What are the retraction requirements when working with polyester?

6. Literature:

- Kalivrajiyan E.S. Dental materials science. – Chapter 4.
- Powers JM Craig's Restorative Dental Materials.

Practical Lesson #6. Hardening and Thermoplastic Materials

1. Objective of the lesson:

To study zinc oxide eugenol pastes and thermal components, and to practice obtaining a functional impression on a model of an edentulous jaw.

2. Educational technologies:

Working on models, demonstrating heating of thermal components.

3. Basic concepts:

Zinc oxide eugenol paste, functional impression, individual tray, thermoplastic samples.

4. Questions for the lesson:

- How to mix zinc oxide eugenol paste?
- What is the difference between a functional impression and an anatomical one?
- How are functional tests performed with thermal mass?

5. Questions for self-control:

- Why is zinc oxide eugenol paste not used for dental impressions?
- What material is best for a functional impression with thin mucosa?

6. Literature:

- Mironova M.L. Dental materials science.
- Kalivrajiyan E.S. Dental materials science.

Practical Lesson #7. Print Quality Control. Defect Identification

1. Objective of the lesson:

Learn to identify and interpret print defects and suggest ways to eliminate them.

2. Educational technologies:

Analysis of defective prints (real or photo), solving situational problems.

3. Basic concepts:

Pores, stretch marks, tears, blurred edges, deformation, poor retraction.

4. Questions for the lesson:

- What does a pore on an impression loGC like and what is its cause?
- What is the difference between a guy line and a break line?
- What defects occur with insufficient gingival retraction?
- What defects are unacceptable and require re-filming?

5. Questions for self-control:

- What should I do if I find a pore in the shoulder area of the impression?
- Is it possible to correct a deformed impression?

6. Literature:

- Rosenstiel S. Contemporary Fixed Prosthodontics. – Ch. 13.
- Kalivrajiyan E.S. Dental materials science.

Practical Lesson #8: Introduction to Intraoral Scanners

1. Objective of the lesson:

Gain basic knowledge of intraoral scanner operation skills. Learn about the different types of intraoral scanners.

2. Educational technologies:

Video demonstration of the scanner's operation.

3. Basic concepts:

Intraoral scanner, digital impression, frame stitching, blind spots.

4. Questions for the lesson:

- How does an intraoral scanner work?
- What are the stages of scanning?
- How to avoid blind spots?
- Advantages of digital printing over traditional printing.

5. Questions for self-control:

- Is it possible to scan implants?
- What to do if artifacts appear on the model?

6. Literature:

- Abdurakhmanov A.I. Orthopedic dentistry. Materials and technologies. – Chapter 9.
- Modern educational technologies in dentistry.

Practical Lesson #9. Selecting an Impression Material Depending on the Design

1. Objective of the lesson:

To consolidate the skill of clinical selection of impression material and technique depending on the type of prosthetics.

2. Educational technologies:

Solving clinical cases in small groups, discussion.

3. Basic concepts:

Selection algorithm: required accuracy, humidity, type of construction (single crown, bridge, implant, complete removable denture).

4. Questions for the lesson:

- What material will you choose for an implant crown? Why?
- What is the difference between an impression for metal-ceramics and an impression for metal-free ceramics?
- When is alginate used and when is polyester used?
- What material is used for a functional impression in case of complete edentulism?

5. Questions for self-control:

- List the indications for the use of A-silicone.
- In what cases should alginate not be used?

6. Literature:

- Kalivrajiyan E.S. Dental materials science. – Chapter 5.
- Rosenstiel S. Contemporary Fixed Prosthodontics. – Ch. 14.

3. METHODOLOGICAL RECOMMENDATIONS/INSTRUCTIONS FOR STUDENTS

3.1. Methodological recommendations for students on studying the discipline

The theoretical component of the course "Impression and Prosthetic Materials" is designed not only to deepen and consolidate the knowledge acquired in the classroom, but also to promote the development of students' clinical thinking, skills in analyzing the properties of materials, and the informed selection of impression and prosthetic structures depending on the clinical situation.

The material taken from lectures must be regularly reviewed and supplemented with information from other sources of literature, presented not only in the course program, but also in periodicals (magazines “Dentistry”, “Institute of Dentistry”, “Dental Market”, “Quintessence International”).

When studying this course, it is necessary to first read the recommended literature for each topic and compile a brief summary of the key concepts, terms, and

information that must be memorized and that is fundamental to mastering subsequent course topics. Particular attention should be paid to the chemical curing mechanisms of impression materials (alginates, C-silicones, A-silicones, polyesters), factors influencing impression accuracy, and algorithms for selecting a material depending on the type of prosthetics. To expand your knowledge of this course, it is recommended to use online resources; conduct searches in various systems and use materials from websites recommended by the instructor (PubMed, eLibrary, websites of dental material manufacturers - 3M, Ivoclar Vivadent, GC, Dentsply Sirona).

Each student maintains a workboGC, the design of which must meet the following requirements:

- the title page indicates the subject, year, group, last name, first name, and patronymic of the student;
- each work is numbered in accordance with the methodological instructions, and the date of completion of the work is indicated;
- write down the title of the work, the purpose and principle of the method in full, briefly describe the progress of the task and the object of the study (for example, analysis of the properties of an alginate print or comparative characteristics of A-silicones and polyesters);
- If necessary, provide a graphic image (diagram of the chemical reaction of curing, table of comparative properties); the results of the tasks are presented in the form of tables or described verbally;
- At the end of each work, a conclusion or inference is made (for example, “Based on the analysis conducted, it was established that A-silicones have less shrinkage compared to C-silicones and are recommended for precision prints”), which are discussed when summing up the lesson.

All initial notes must be made in the noteboGC as the assignments are completed. The teacher periodically reviews the workboGC to ensure the student's academic performance and the quality of their work.

3.2. Methodological recommendations for completing independent work

When studying the course "Impression and Prosthetic Materials", the following types of independent student work are used:

- study of theoretical material using lecture notes and recommended teaching aids, educational dummies, educational literature, and reference sources;
- independent study of some theoretical issues not covered in lectures, with writing papers and preparing presentations;
- analysis of issued impressions (alginate, silicone, polyester) with identification of defects and drawing up a conclusion on the quality and possible causes of errors;
- anthropometric study of diagnostic models of jaws (measurement of the width of dental arches, assessment of marginal fit);

- preparation for testing and modular control.

Students are invited to read and analyze monographs and scientific articles on issues in dental materials science (e.g., modern methods for taking impressions during implantation, the comparative effectiveness of digital and traditional impressions, and adhesive protocols for the cementation of metal-free structures). The results of this work are discussed during practical classes.
To develop independent work skills, students complete assignments by independently consulting textboGCs, reference boGCs, and scientific literature. Assignment completion is assessed both during practical classes through oral presentations and group discussions, and through written independent work (conclusions on print quality, comparative tables of material properties). Independent work helps students develop such essential skills as selecting and solving a given problem (for example, choosing the optimal impression material for various clinical situations), collecting and analyzing published data, and the ability to highlight the main points and make a well-founded conclusion.

3.3. Methodological recommendations for the implementation of practical/seminar classes, laboratory work

*Practical classes*These are held after lectures and serve as explanatory, generalizing, and reinforcing elements. They can be held not only in the classroom, but also in a phantom classroom, and even in a clinical office (for patient demonstrations).
During practical classes, students absorb and comprehend new educational material, practice manual skills, and learn to interpret data from additional research methods. Practical classes are systematic, regularly following each lecture or two or three lectures.
Practical classes are carried out according to the schedule of the educational process and independent work of students in the discipline.
When preparing for practical training, it's important to study the methodological guidelines in advance. Pay attention to the purpose of the training, the key questions for preparation, and the content of the training topic.
Before each practical lesson, students review the seminar plan, including a list of topics and questions, a bibliography, and homework assignments for the material covered. The following seminar preparation plan is recommended:

1. Work through the lecture notes.
2. Read the primary and secondary literature recommended for the section being studied.
3. Answer the questions in the seminar plan.
4. Study the topic and select literature for writing essays, reports, etc.

3.4. Guidelines for completing papers, reports, and essays

Abstract– a written summary of the content of a scientific paper on the given topic. This is an independent research paper in which the student explores the essence of

the problem under study, with elements of analysis relevant to the topic of the paper. The paper presents various points of view, as well as personal perspectives on the issues covered by the paper (for example, a comparison of the effectiveness of various treatment protocols for distal occlusion). The paper's content should be logical, and the presentation of the material should be problem-based and thematic.

Requirements for the abstract:

The length of the abstract may vary between 9-10 printed pages. Main sections: table of contents (outline), introduction, main content, conclusion, bibliography.

The text of the abstract should contain the following sections:

- title page indicating: name of the university, department, topic of the abstract, full name of the author and full name of the teacher;
- introduction, relevance of the topic;
- main section;
- conclusion (analysis of the results of the literature search); findings;
- The list of literary sources must have at least 10 bibliographic titles, including online resources.

*The text part of the abstract is formatted*on a sheet of the following format:

- top indent – 2 cm; left indent – 3 cm; right indent – 1.5 cm; bottom indent – 2.5 cm;
- text font: Times New Roman, font height – 14, space – 1.5;
- Page numbers are at the bottom of the sheet. The first page is not numbered.

The abstract must be written competently and in a respectful manner. References to references, including periodicals from the past five years, must be included.

Abstract evaluation criteria:

- relevance of the research topic;
- compliance of the content with the topic;
- depth of material processing;
- the correctness and completeness of the development of the questions posed;
- the significance of the conclusions for further practical activities;
- correctness and completeness of use of literature;
- compliance of the abstract design with the standard;
- the quality of the message and answers to questions during the defense of the abstract.

3.5. Methodological recommendations for student research work

The aim of the research work on impression prostheses and materials is to develop the intellectual abilities of students by studying the algorithm of scientific research and acquiring initial experience in carrying out a research project using the educational material of the chosen specialty.

The main objectives and results of the research work are:

- mastering scientific methods of cognition and deepening the theoretical knowledge of students in their specialty;

- mastering modern methods of scientific research in the field of dental materials science (assessment of the accuracy of impressions, study of the properties of prosthetic materials, analysis of digital models);
- development of students' practical skills in independently searching for scientific and technical information, conducting theoretical and/or experimental work;
- students acquire the ability to analyze the results of conducted research, formulate conclusions and recommendations;
- developing in students the ability for independent, creative, active work to continuously update and enrich their scientific knowledge.

When completing research work, a student must master the following basic steps:

- independent search for information on a given topic (for example, comparative accuracy of prints obtained with A-silicone and polyester);
- selection of essential information necessary for full coverage of the problem being studied, separation of this information from secondary information (within the framework of a given topic);
- analysis and synthesis of knowledge and research on the problem;
- generalization and classification of information on research problems;
- logical and consistent disclosure of the topic;
- generalization of clinical and scientific knowledge on the problem and formulation of conclusions from a literature review of the material;
- stylistically correct presentation of scientific thought of the abstract type;
- competent design of scientific abstract text;
- correct formatting of scientific work (including references to sources, list of references);
- creation of a glossary of terminology;
- role-playing games and trainings on a given topic, discussions, situational tasks.

For research work, senior students are recommended to:

- write an abstract using general scientific and special methods;
- participate in the department's research projects (for example, analysis of long-term results of using various impression materials in prosthetics on implants);
- prepare and deliver a report or presentation on a given topic at conferences and round tables;
- study and analyze general concepts, programs, clinical protocols on a given topic (e.g. impression disinfection protocols, adhesive fixation protocols);
- conduct an experimental study (for example, compare the linear dimensions of models cast from alginate and silicone impressions).

In order to conduct research work, it is recommended for 7th semester students:

- participate in a scientific project, scientific conference;
- manage a planned or standardized patient under the guidance of a teacher;

- carry out a study of the quality of impressions obtained with different materials, with the preparation of a protocol;
- present a prepared report at a conference;
- to study and analyze clinical guidelines and protocols for the management of orthopedic patients (choice of impression material, adhesive protocols).

4. Glossary

A-silicone (addition silicone)– a silicone elastomer that cures via a hydrosilylation mechanism without the formation of byproducts. It features minimal shrinkage (less than 0.1%), high precision, hydrophilicity, and dimensional stability.
Spoon adhesive– a special composition (usually polymer-based) applied to the inner surface of the impression tray to improve the fixation of the impression material and prevent its detachment.
Adhesive protocol– a sequence of stages of preparation of the tooth surface and prosthetic structure to ensure a strong chemical and mechanical bond of the fixing cement with the tooth tissues and restoration material.
Alginate impression material– an irreversible hydrocolloid material based on alginic acid used for making anatomical impressions. It hardens through ion exchange to form insoluble calcium alginate.
Anatomical impression– an impression taken with a standard tray without regard to the functional state of the mobile mucosa. It is used to make diagnostic models and custom-made trays.
Biocompatibility– the ability of a dental material not to have a toxic, allergic, mutagenic or carcinogenic effect on the human body during prolonged contact with oral tissues.
Curing time– the period from the start of mixing the components of the impression material until the moment when the material reaches sufficient hardness to remove the impression from the oral cavity.
Working hours (working hours)– the interval from the start of mixing the impression material until the moment when the material loses its plasticity and cannot be introduced into the oral cavity without the risk of deformation.
Galvanism– a pathological condition that occurs when there are dissimilar metals (or alloys) in the mouth, accompanied by the occurrence of galvanic currents, manifested by a metallic taste, burning sensation, and dry mouth.
Hybrid ceramics– a CAD/CAM material consisting of a ceramic mesh impregnated with a polymer (e.g., Vita Enamic). It combines elasticity and aesthetics and is milled.
Hydrophilicity– the ability of the material to be easily wetted by water (or saliva), which ensures better reproduction of details in the humid environment of the oral cavity. This is characteristic of polyesters and A-silicones.

Disinfection of impressions– the process of destroying pathogenic and opportunistic microorganisms on the surface of an impression using chemical disinfectants (sprays, solutions) without damaging the material.
Zirconium dioxide (ZrO_2)– high-strength ceramic (up to 1200 MPa) stabilized with yttrium (Y-TZP). Used for the fabrication of crown and bridge frameworks, as well as all-ceramic restorations. It offers high biocompatibility and aesthetics.
Double-layer print– a method of obtaining an impression in which two pastes of different viscosity are used simultaneously or sequentially: a base paste (high viscosity) for the general shape and a corrective paste (low viscosity) for an accurate representation of the prepared teeth and marginal fit.
Individual spoon– an impression tray, custom-made for each patient using a plaster model (usually made of light-curing plastic or polystyrene). It is used to obtain functional impressions in cases of complete edentulism or complex structures.
Intraoral scanner– a device for obtaining digital impressions by optically scanning dental arches and soft tissues of the oral cavity. It creates a virtual 3D model.
Corrective paste– a low-viscosity elastomeric material (usually A-silicone or polyester), applied directly to the prepared teeth before taking a two-layer impression to accurately reproduce the marginal groove.
MDP primer– an adhesive primer containing the phosphorus-containing monomer MDP (10-methacryloyloxydecyl dihydrogen phosphate). It is used for chemical bonding of composite cement with zirconium dioxide and other oxide ceramics.
Jaw model– a positive representation of the dentition and mucous membrane, cast from plaster or another material using an impression. It serves as the basis for the fabrication of orthopedic structures.
Impression (cast)– a negative image of the hard and soft tissues of the oral cavity, obtained using impression materials. Used for the production of diagnostic and working models.
Impression tray– an instrument for inserting impression material into the oral cavity and holding it in place while it hardens. It comes in standard (metal, plastic) and custom-made versions.
guy rope– an impression defect in the form of an elongated ridge or thin edge that occurs when the impression is removed from the oral cavity prematurely (the material has not yet fully hardened).
PEEK (polyetheretherketone)– a high-tech thermoplastic polymer used for the frameworks of removable and fixed dentures and temporary implants. It is lightweight, flexible, chemically inert, and has an elastic modulus close to that of bone.
Polyester material– an elastomeric impression material based on polyethers. It cures via a polyaddition mechanism. It is characterized by high precision (shrinkage less than 0.02%), rigidity after curing, and hydrophilicity.

Polysulfide material (thiGCol)– an elastomeric impression material based on a polysulfide polymer. It has an unpleasant odor, is slow to cure, and exhibits significant shrinkage. It is rarely used today.
It's time– a defect in the impression in the form of a small bubble or cavity, caused by air getting in when mixing the material, insufficient insulation from moisture, or inserting the spoon too quickly.
Primer– adhesive solution (silane, MDP-containing, etc.) applied to the surface of the prosthetic material before fixation to improve the bond with the composite cement.
Etching– a stage of the adhesive protocol, which consists of applying acid (hydrofluoric acid for ceramics, phosphoric acid for enamel/dentin) to create a microrelief and open micropores that provide mechanical retention.
Working hours (see Working hours)
Gum retraction– temporary mechanical or chemical-mechanical retraction of the gingival margin to expose the preparation margin (ledge) and obtain a high-quality impression of the subgingival area. This is accomplished using retraction cords, pastes, or electrocoagulation.
C-silicone (condensation silicone)– a silicone elastomer that cures via polycondensation with the release of ethyl alcohol. It exhibits shrinkage (0.4-0.6%) and lower dimensional stability compared to A-silicones.
Silane primer– an adhesive solution containing silane compounds (e.g., 3-methacryloxypropyltrimethoxysilane). It provides a chemical bond between silicon-containing ceramics (e.g., glass ceramics) and composite cement.
Standard spoon– a factory-made impression tray, available in various sizes for the upper and lower jaws. It can be perforated (for better material retention) or non-perforated.
E-max glass ceramics– lithium disilicate ceramic ($Li_2Si_2O_5$) for highly aesthetic restorations. Available as blocks for pressing (IP S e.max Press) or milling (CAD/CAM). Strength up to 400 MPa, high translucency. Indicated for veneers, inlays, and single crowns.
Glass ionomer cement– a fixing cement that forms a chemical bond with hard dental tissue. It is used to fix temporary structures and some permanent ones (with low aesthetic requirements). It has an anticaries effect (fluoride release).
Thermoplastic material– an impression material that softens when heated (waxes, gutta-percha, thermal components) and hardens when cooled to body temperature. It is used for functional testing and for gluing the edges of custom trays.
Accuracy of the imprint– the degree to which the dimensions and relief of the impression (and subsequently the model) correspond to the actual dimensions and relief of the oral tissues. This is determined by the properties of the material, the production technique, and storage conditions.

Shrinkage of impression material– a decrease in the linear dimensions of a material during the curing process or during storage. This is most pronounced in alginates (during drying) and C-silicones (chemical shrinkage).
Functional impression– an impression taken with a custom-made tray, taking into account the functional state of the mobile mucosa (for complete dentures). The patient performs functional tests (mouth opening, swallowing, lip movement) while the impression is being taken.
Composite cement (adhesive)– a luting material based on dimethacrylate resins with a filler. It is chemically, light-cured, or dual-cured. It provides strong adhesion to dental tissue and various prosthetic materials (ceramics, zirconium, metal).
Digital imprint– a virtual 3D model of the dentition and soft tissues obtained using an intraoral scanner. It eliminates the need for physical impression materials and disinfection/transportation.
CAD/CAM– computer-aided design (CAD) and computer-aided manufacturing (CAM) of dental structures. This includes scanning, virtual modeling, and milling or 3D printing.

Application 1

Change Registration Sheet Form

p/p	Document (order, order, etc. (indicating the number and date) which reflects the changes	Signature	Full name
1			
2			
3			

5. Reference materials and appendices –*are indicated as necessary.*