



Course: DENTAL RADIOLOGY

Course Coordinator: Professor Petra Valković Zujčić, MD.

Department: Department of Radiology

Study program: University Integrated Undergraduate and Graduate Study of Dental Medicine

Study year: 3

Academic year: 2024/2025

SYLLABUS

Course description (a brief description of the course, general instructions, where and in what form the lessons are organized, necessary equipment, instructions for attendance and preparation for classes, student obligations, etc.):

The Dental Radiology course is a compulsory course in the third year of the integrated undergraduate and postgraduate dental medicine program and comprises 15 hours of lectures, 15 hours of seminars and 15 hours of tutorials, for a total of 45 hours (3 ECTS). The course is held via the Microsoft communication platform MS Teams.

Aim of the course

The aim of the Dental Radiology course is to equip students with the skills to recognize and independently interpret conventional imaging methods and layer imaging techniques used in dental radiology.

Course content

The content of the Dental Radiology course includes four thematic units:

1. Fundamentals of X-ray generation and biology, as well as the adverse effects of ionizing radiation on the human body (stochastic and deterministic effects); radiation protection (protective measures for staff and patients) and the ALARA principle.
2. Dental radiography, including intraoral and extraoral imaging techniques, as well as layered imaging techniques (computed tomography, cone-beam computed tomography – CBCT, and magnetic resonance imaging).
3. Anatomy and pathology of the dentoalveolar system, including the temporomandibular joint, paranasal sinuses, and the tissues and organs of the viscerocranium; the role of dental radiography in periodontal diseases, endodontics, and orthodontics.
4. Systemic bone and joint diseases with repercussions on the dentoalveolar system, tumors, trauma, degenerative changes, and post-radiation changes in the jaws.

Teaching

Teaching is organized through lectures, seminars and tutorials on the MS platform. Students are encouraged to study and follow the course content continuously so that they can apply the acquired knowledge in the exercises and clarify the doubts that arise during the course. To prepare for the course, it is recommended to read the relevant section from the literature mentioned above in order to interpret the visual material in the exercises and utilize the lecturer's knowledge. The student is encouraged to actively participate in all forms of instruction and to illustrate the concepts learned through visual examples of various radiologic techniques in order to fully understand the material covered in the syllabus.



LEARNING OUTCOMES RELATED TO CATEGORY I. COGNITIVE DOMAIN – KNOWLEDGE

1. Explain the biological effect of X-rays.
2. Explain the formation of X-rays and artifacts on X-ray images.
3. Distinguish radiography from computed tomography and magnetic resonance in dental radiology. Give an example of the use of X-rays, computed tomography and magnetic resonance in dental radiology and radiology of the neck.
4. Describe the technique of taking panoramic radiographs of the jaw and their use in dental radiology. Name the indications for an orthopantomogram. Define the special features of the device for panoramic radiography of the jaw: argue the advantages and disadvantages of the method. Describe the radiological anatomy of the jaw and teeth.
5. Point out the special features of the dental X-ray machine. Break down the different types of oral radiographs.
6. describe and recognize anomalies and disorders of tooth and jaw development.
7. Analyze the dental radiograph before, during and after treatment. Identify the pathological changes of the alveolar process of the jaw.
8. assess the radiologic symptoms of pathologic changes of the jaw and teeth. Distinguish between pathologic conditions of the teeth on radiographs such as abrasion, attrition, caries, degenerative pulp changes, root resorption, root remnants, calcification.
9. recognition of odontogenic and non-odontogenic expansive lesions of the jaw and teeth.
10. analysis of nutritional and internal secretory disorders affecting the dentoalveolar system, including avitaminosis, metabolic and hormonal disorders.
11. determination and comparison of periapical lesions and jaw cysts.
12. description of inflammatory and radiation-induced changes in the jaw and teeth.

LEARNING OUTCOMES RELATING TO CATEGORY II. PSYCHOMOTOR DOMAIN-SKILLS

1. application of protective measures and means during X-ray examination of jaws and teeth
2. perform a panoramic X-ray of the jaw under supervision. Demonstrate the special features of the equipment used for panoramic radiography of the jaw.
3. master the technique of positioning the patient for the intraoral X-ray of the jaw; bitewing X-ray, periodontal and apical X-ray, occlusal X-ray of the jaw.
4. master the technique of correct positioning of the patient for extraoral radiographs, craniogram, cephalometric radiographs, Waters projection and "reverse" Towne projection.



5. recognize the normal and pathological bone structure of the jaw and teeth.

Assigned reading:

Whaites E. Essentials of Dental Radiography and Radiology. 5th Ed. 2013 Elsevier, ISBN 9780702045998
eBook ISBN 9780702051685

Optional/additional reading:

White Stuart C. Pharoah Michael J. s Oral Radiology Principles and Interpretation. 6th edition. ISBN: 978-0-323-04983-2

COURSE TEACHING PLAN:

The list of lectures (with topics and descriptions):

P1; Radiography, conventional radiography, digital radiography, computed tomography, magnetic resonance in dental radiology and visceral and neck radiology.

Rationale: Students will learn basic radiologic methods of projection imaging of body regions and methods of slice imaging with potential applications in dentistry.

P2; Extraoral radiographs, craniogram, cephalometric radiographs, Waters projection, "reverse" Towne projection. Radiologic anatomy of the viscerocranium including the skull base.

Rationale: an important radiographic diagnostic technique in dentistry that provides a comprehensive view of the alveolar system and jaws is taught in detail.

P3; Panoramic radiography of the jaw: formation of radiographs, indications, peculiarities of the device, advantages and disadvantages of the method.

Rationale: Intraoral radiographs are processed using various techniques to obtain image information appropriate for the clinical problem. Overview of radiological anatomy of the jaw and teeth (physiological openings).

P4; Special features of dental radiography (RVG) and CBCT. Intraoral radiographs, bitewing radiographs, periodontal and apical radiographs, occlusal radiographs of the jaw.

Rationale: Students will learn the specifics of dental radiographic equipment, indications, radiographic imaging and interpretation of radiographs.

P5; Interpretation of radiographs, artifacts and their prevention on dental radiographs. DICOM and PACS systems.

Rationale: Students will learn about the occurrence of artifacts on radiographs and the characteristics of artifacts in dental radiology and how to avoid them. Systems for storing medical image documentation will be explored.

P6; Anatomical details of the maxilla and mandible on a radiograph. Temporomandibular joint.

Tooth development and age determination.

Rationale: The details of radiographic anatomy of both jaws are taught so that students can distinguish normal findings and variants from pathological findings on radiographs. Tooth development and age determination from dental radiographs are taught. Role in Forensic Medicine.

P7; Abnormalities and disorders in the development of the teeth and jaws.



Rationale: Students will learn about various anomalies and developmental disorders characteristic of this region of the body and their radiological presentation.

P8; Radiological control of teeth before, during and after endodontic treatment. Foreign bodies in the teeth and surrounding structures. Pathological changes of the alveolar process of the jaw. Physiological and pathological resorption.

Rationale: Conveys radiographic signs that should be assessed during treatment, radiographic visualization of foreign bodies, and pathologic changes of the alveolar process of the jaw on radiographs.

P9; Radiographic signs of pathological changes of the jaw and teeth. Abrasion, wear, caries, degenerative pulp changes, root resorption, root debris, accumulations of mineralized plaque.

Rationale: To explain to students the radiographic signs of various degenerative and destructive lesions of the jaws and teeth.

P10; Nutritional and internal secretory disorders affecting the dentoalveolar system: Avitaminosis, metabolic, hormonal and psychological disorders.

Rationale: Students will learn the radiologic presentation of certain systemic disorders of the jaws and teeth.

P11; Periapical Lesions. Clean Jaws.

Rationale: Typical radiologic patterns of periapical lesions are interpreted, with emphasis on differential diagnosis and clinico-radiologic correlation. Cysts in the jaw of various etiologies are shown.

P12; Odontogenic expansive lesions of the jaw and teeth.

Rationale: Students will be shown the patterns of pathologic changes on radiographs in expansive formations of the dentoalveolar region of odontogenic origin.

P13; Non-odontogenic expansive lesions of the jaws and teeth.

Rationale: Students will be shown the patterns of pathologic changes on radiographs in expansive formations of the maxillary and mandibular regions of non-odontogenic origin.

P14; Inflammatory and postradiologic changes in the maxillary and dental regions.

Rationale: Specific radiologic changes associated with inflammation and exposure of the jaws and teeth to ionizing radiation are discussed.

P15; Odontogenic and non-odontogenic changes of the paranasal sinuses. Foreign bodies in the paranasal sinuses.

Rationale: Students will become familiar with radiographic changes of the temporomandibular joint, which are often dental in origin, and the adjacent area of the paranasal sinuses, which is often involved in pathologic changes of the maxillary teeth.

The list of seminars with descriptions:

S1; Generation of X-rays. Biological effect of X-rays. Protection from ionizing radiation. Dosimeter.

Rationale: The biological effect of ionizing radiation, the different sensitivity of different tissues and the dependence of the damaging effect on the age of the patient are discussed.

S2; Preparation of radiographs, exposure, duration of exposure, technical characteristics of radiographs, artifacts, contrast and resolution of radiographs. Representation of dental structures on a radiograph.

Rationale: The importance of protection and how to apply protective agents to individual body parts depending on the imaging technique chosen are discussed.



S3; Traumatic changes in teeth and jaws (Le Fort) and their consequences (ankylosis, dilation, angulation of teeth, resorption - internal and external), pulporeal, deposition of reactive dentin, disappearance of pulporeal and pulpitis. Rationale: Specific radiographic signs of post-traumatic root and alveolar process lesions that cannot be detected on clinical examination are discussed.

S4; Diseases of the bone system affecting the jaws and teeth.
Rationale: Specific radiographic changes to the jaws and teeth in certain systemic diseases are discussed.

S5; Radiology and pathology of the paranasal sinuses with reference to the maxillary sinus, relationship to the teeth, mucosal changes, floor of the maxillary sinus.
Rationale: With the assistance of a mentor, students will present the radiologic anatomy of the paranasal sinuses and surrounding structures and specific radiologic changes in the pathology of this area.

S6; Pathologic changes at the base of the skull with special reference to cranial nerve lesions, neuralgias, injuries n. VII, perineural spread of tumors. Rationale: Changes from the field of neuroradiology that may manifest clinically in the face, jaws, and teeth are discussed.

S7; Radiology of the pharynx with special reference to the epipharynx and palatal arches.
Rationale: The complex radiologic anatomy of the neck organs, the limitations of the regions visible with imaging techniques, possible connections and barriers are discussed with the epipharynx and palatal arches as examples.

S8; Radiologic anatomy of the neck and lymphatic region of the neck, mineralization of blood vessels and ligaments and presentation on radiographs. Substantiation: The anatomic distribution of the lymph nodes of the neck, the lymphogenic routes of spread of pathologic processes, and the methods of radiologic visualization of the lymphatic regions of the neck are discussed.

S9; Radiology and pathology of the salivary glands.
Rationale: Students will present to their peers and mentor the radiologic anatomy of the salivary glands, radiologic imaging methods and relationship to surrounding structures, and the most common pathologies of this region.

S10; Radiology of the floor of the mouth and tongue.
Rationale: Clinical and radiologic manifestations of diseases of the oral cavity and tongue are discussed.

S11; Radiology of the temporal bone and temporomandibular joint (TM).
Rationale: With the assistance of a mentor, students present the radiographic anatomy of the temporal bone and TM joint and specific radiographic changes associated with pathologic changes in this area.

S12; CBCT examination method, indications and capabilities.
Rationale: The principle of operation of CBCT and indications are explained to the students. Advantages over conventional techniques and possibilities of the device.

S13; CBCT in endodontics and surgery - differences in radiation dose and resolution.
Clarification: the role of CBCT in endodontics will be discussed.

S14; The role of radiographs in periodontics (CBCT, panoramic radiograph and retroalveolar radiograph).
Rationale: The importance of radiology in periodontology and the specifics of each examination will be discussed. The most common indications and measurements on radiographs specific to periodontology will be analyzed.



S15; CBCT in orthodontics and planning and monitoring the effect of therapy.

Rationale: The importance of CBCT in orthodontics and the specifics of measuring the area of interest will be discussed.

The list of practicals with descriptions:

E 1-15

Students practice positioning the patient for each intraoral and extraoral projection, protection from ionizing radiation, and evaluation of the radiograph obtained. They also practice recognizing and describing typical radiological signs and their changes in the differential diagnosis of pathological changes in the maxillary and dental region.

Students' obligations:

Participation in all forms of teaching. Participation in colloquia according to the prescribed units. Preparation of a seminar with a presentation to a colleague and the director with discussion of the problem. Active participation in exercises, practical application of theoretical knowledge. Taking a written and oral examination.

Assessment (exams, description of written / oral / practical exam, the scoring criteria):

During the course of study, the knowledge acquired in lectures, seminars and exercises is tested in two intermediate examinations in the form of a written exam (intermediate examinations I and II). In each intermediate examination, the criterion for obtaining assessment points is that at least 50% of the questions are answered correctly. Both intermediate examinations consist of multiple-choice questions. Passed intermediate examinations are not transferable and are valid for the current academic year. Intermediate examinations I and II are carried out using the Merlin system.

The intermediate examinations consist of 25 questions, the correct answers to which are converted into grade points as follows.

Number of correct answers	0-14	15	16	17	18	19	20	21	22	23	24	25
Grade points	0	15	16	17	18	19	20	21	22	23	24	25

The assessment elements and criteria for the Dental Radiology course are: Lecture attendance (10 points), written midterm exam (50 points), evaluation of a seminar paper (10 points) that students complete independently on a given topic. Up to 70% of the grade can be achieved in the lecture and the remaining 30% of the grade in the final examination (of a total of 100 points, up to 70 points can be achieved in the lecture and up to 30 points in the final examination).

A seminar paper that the student prepares independently on a given topic - 10 points

Each student must prepare a PowerPoint presentation of at least 25 minutes on a given topic. The seminar paper is graded 1-10 (grade = point).



Final oral examination (15 – 30)

The final examination consists of a practical knowledge test on the illustrative material and a theoretical knowledge test on the entire subject matter.

In the final oral examination, students can achieve a maximum of 30 points, which are converted into grade points as follows:

Excellent knowledge – 27-30 points
Very good knowledge – 23 - 26 points
Good knowledge – 19-22 points
Sufficient knowledge – 15 - 18 points

- Final score:

Percentage of grade points achieved ECTS grade

90 - 100 A excellent (5)
75 - 89.9 B very good (4)
60 – 74.9 C good (3)
50 - 59.9 D is sufficient (2)
0 - 49.9 F unsatisfactory (1)

Other important information regarding to the course:

Any use of another's text or other form of an author's work, as well as the use of ChatGPT or any other tool whose functionality relies on artificial intelligence technology without clear and unambiguous acknowledgement of the source, is considered a violation of another's copyright and the principle of academic integrity and constitutes a serious breach of student responsibilities that will result in disciplinary responsibility and appropriate disciplinary action

Regulations on the disciplinary responsibility of students.

Consultation time: every working day from 11 to 12 AM by email: petra.valkovic.zujic@uniri.hr



COURSE SCHEDULE (for the academic year 2024/2025)

Date	Lectures (time and place)	Seminars (time and place)	Practicals (time and place)	Instructor
Mon 3.2.2025.	L 1 – 4 9 – 12:00 h MS Teams			Prof. Petra Valković Zujic
			P 1 – 4 15:30-19:00h Rijeka	Prof. Petra Valković Zujic
			P 1 – 4 15:30-19:00h Sušak	Lovro Tkalčić, PhD
Tue 4.2.2025.	L5 – 6 10:30 – 12:00h MS Teams			Prof. Damir Miletić
	L7- 9 12:00 – 14:15h MS Teams			Prof. Petra Valković Zujic
			P 5 – 7 group A 15:00 - 17:15h Rijeka	Tin Nadarević, PhD
			P 5 – 7 group B 15:00 - 17:15h Sušak	Lovro Tkalčić, PhD
Wed 5.2.2025.	L 10 – 11 11:00-12:30h MS Teams			Prof. Petra Valković Zujic
			P 8 – 11 group B 14:00-17:00h Rijeka	Prof. Petra Valković Zujic
			P 8 – 11 group A 14:00-17:00h Sušak	Tin Nadarević, PhD
Thu 6.2.2025.	L 12 – 13 12:00 – 13:30h MS Teams			Assist. prof. Slavica Kovačić
		S1 14:00-14:45h MS Teams		Lovro Tkalčić, PhD
		S2 14:45–15:30h MS Teams		Tin Nadarević, PhD
			P 12-13 group A 16:00 – 17:30h Rijeka	Lovro Tkalčić, PhD
			P 12-13 group B 16:00 – 17:30h Sušak	Assist. Prof. Slavica Kovačić



Fri 7.2.2025.		S3 8:00 – 8:45 h MS Teams		Assist. Prof. Slavica Kovačić
		S4 8:45 - 9:30h MS Teams		Assist. Prof. Slavica Kovačić
		S5 9:30 - 10:15h MS Teams		Tin Nadarević, PhD
		S6 10:15 – 11:00h MS Teams		Lovro Tkalčić, PhD
Fri 7.2.2025.		Midterm test 12	Merlin	
Mon 10.2.2025.		S7 9:30 -10:15h MS Teams		Prof. Petra Valković Zujčić
		S8 10:15-11:00h MS Teams		Prof. Petra Valković Zujčić
		S9 11:00 - 11:45h MS Teams		Assist. Prof. Danijela Veljkovic Vujaklija
		S10 11:45 – 12:30h MS Teams		Tin Nadarević, PhD
Tuesday 11.4.2025.		S11 11:30 – 12:15h MS Teams		Prof. Petra Valković Zujčić
		S12 12:15-13:00h MS Teams		Lovro Tkalčić, PhD
	Midterm test	14:00h		Merlin
Wed 12.2.2025.	L 14 – 15 8:00 – 9:30h MS Teams			prof.dr.sc. Damir Miletić
		S13 9:30-10:15h MS Teams		Assist. Prof. Slavica Kovačić
		S14 10:15-11:00h MS Teams		Tin Nadarević, PhD
		S15 11:00 - 11:45h MS Teams		Lovro Tkalčić, PhD
			P 14 - 15 group B 12:30 – 14:00 h Rijeka	Nina Bartolović, MD
			P 14 - 15 group A 12:30 – 14:00 h Sušak	Tin Nadarević, PhD
Thursday 13.2.2025.	Written exam	8AM		MERLIN
Friday 14.2.2025.	Oral exam	8AM		Prof. Petra Valković Zujčić



List of lectures, seminars and practicals:

	LECTURES (Topics)	Teaching hours	Location/Lecture room
L1	X-ray radiation, conventional radiography, digital radiography, computed tomography, magnetic resonance in dental radiology and visceral and neck radiology. Interpretation and quality assessment of radiographic images.	1	MS Teams
L2	Extraoral radiographs, craniogram, cephalometric radiographs, Waters projection, "reverse" Towne projection. Radiologic anatomy of the viscerocranium including the skull base.	1	MS Teams
L3	Panoramic radiography of the jaw: origin of radiographs, indications, peculiarities of the device, advantages and disadvantages of the method. Radiological anatomy of the jaw and teeth (physiological openings)	1	MS Teams
L4	Special features of dental radiography (RVG) and CBCT. Intraoral radiographs, bitewing radiographs, periodontal and apical radiographs, occlusal radiographs of the jaw.	1	MS Teams
L5	Systems DICOM. Evaluation of radiographs, artifacts and their prevention on dental radiographs.	1	MS Teams
L6	Anatomical details of maxilla and mandible on radiographs. Tooth development and age determination.	1	MS Teams
L7	Anomalies and disorders in the development of teeth and jaws.	1	MS Teams
L8	Radiological control of teeth before, during and after endodontic treatment. Foreign bodies in the teeth and surrounding structures. Pathological changes of the alveolar process of the jaw. Physiological and pathological resorption.	1	MS Teams
L9	Radiological symptoms of pathological changes in the jaw and teeth. Abrasion, wear, caries, degenerative changes of the pulp, root resorption, root debris, accumulations of mineralized plaque.	1	MS Teams
L10	Disorders of nutrition and internal secretion affecting the dentoalveolar system: avitaminosis, metabolic, hormonal and psychological disorders.	1	MS Teams
L11	Periapical and periodontal lesions. Clean jaws.	1	MS Teams
L12	Odontogenic expansive lesions of the jaw and teeth.	1	MS Teams
L13	Non-odontogenic expansive lesions of jaws and teeth.	1	MS Teams
L14	Inflammatory and radiation-induced changes of jaws and teeth.	1	MS Teams
L15	Odontogenic and nonodontogenic changes of the paranasal sinuses. Foreign bodies in the paranasal sinuses. Temporomandibular joints.	1	MS Teams
	TOTAL TEACHING HOURS	15	



	SEMINARS (Topics)	Teaching hours	Location/Lecture room
S1	Generation of x-rays. Biological effect of X-rays. Protection against ionizing radiation. Dosimeter	1	
S2	Production of X-ray images, exposure, exposure duration, technical characteristics of X-ray images, artifacts, contrast and resolution of X-ray images. Representation of dental structures on a radiograph.	1	
S3	Traumatic changes in teeth and jaws (Le Fort) and their consequences (ankylosis, dilation, angulation of teeth, resorption - internal and external), pulp space, deposition of reactive dentin, disappearance of pulp space and pulpitis.	1	
S4	Diseases of the bone system affecting the jaws and teeth.	1	
S5	Radiology and pathology of maxillary sinuses with reference to maxillary sinus, relation to teeth, mucosal changes, floor of maxillary sinus.	1	
S6	Pathological changes at the base of the skull with special attention to cranial nerve lesions, neuralgias, injuries n. VII, perineural spread of tumor.	1	
S7	Radiology of the pharynx with special attention to the epipharynx and palatal arches.	1	

S8	Radiological anatomy of the neck and lymphatic region of the neck, mineralization of blood vessels and ligaments and representation in radiographs.	1	
S9	Radiology and pathology of salivary glands.	1	
S10	Radiology of the floor of the mouth and tongue.	1	
S11	Radiology of the temporal bone and temporomandibular joint (TM).	1	
S12	CBCT examination method, indications and possibilities.	1	
S13	CBCT in endodontics and surgery - differences in radiation dose and resolution.	1	
S14	The role of radiographs in periodontology (CBCT, panoramic radiograph and retroalveolar radiograph).	1	
S15	CBCT in orthodontics and in planning and monitoring the effect of therapies.	1	
TOTAL TEACHING HOURS		15	

	PRACTICALS (Topics)	Teaching hours	Location/Lecture room
P1	Practicals 1 covers the topics of lectures P1 - 4.	5	Dep. of Radiology
P2	Practicals 2 covers the topics of lectures P5 – 7.	3	Dep. of Radiology
P3	Practicals 3 covers the topics of lectures P8 – 11.	3	Dep. of Radiology



P4	Practicals 4 covers the topics of lectures P12-13.	2	Dep. of Radiology
P5	Practicals 5 covers the topics of lectures P14 – 15.	2	Dep. of Radiology
TOTAL TEACHING HOURS		15	

	FINAL EXAM DATES
1.	13.2.2025.
2.	14.3.2025.
3.	17.6.2025.

	Lectures	Seminars	Practicals	Total
Total number	15	15	15	45
On-line	15	15	0	30
Percentage	100	100	0	