Sveučilište u Rijeci
University of Rijeka

Sveučilište u Rijeci • Fakultet dentalne medicine
University of Rijeka • Faculty of Dental Medicine
Krešimirova 40/42 • 51000 Rijeka • CROATIA
Phone : + 385 51 559 200; 559 202, 559 203

Course: DENTAL RADIOLOGY
Course Coordinator: Assoc. Ph.D. Petra Valković Zujić, MD.
Course Collaborators:
Department: Department of Radiology
Study program: University Integrated Undergraduate and Graduate Study of Dental Medicine
Study year: 3
Academic year: 2023./24.

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 required course in the third year of the integrated undergraduate and postgraduate dental program and consists of 15 hours of lectures, 15 hours of seminars and 15 hours of tutorials, totaling 45 hours (3 ECTS). The course is delivered via the Microsoft communication platform MS Teams.

Aim of the course
Students will learn about the use of ionizing radiation in imaging the jaw and teeth and adjacent regions with conventional radiographic equipment and CBCT technology. The role of computed tomography and magnetic resonance imaging in dental radiology will be presented based on specific indications. Detailed radiologic anatomy and pathology of the dentoalveolar system, artifacts and potential errors, and radiologic imaging of viscerocranial and cervical anatomic structures with common pathologies will be taught. After passing the dental radiology exam, the dental student will be able to independently take a standard radiograph of the jaw and teeth, interpret the radiographs obtained, and match them with the clinical picture so that clinical examination of inaccessible lesions can be diagnosed from the radiograph.

Course content
X-ray equipment in dentistry. X-rays and radiation protection. Formation and interpretation method of radiographs. Radiological anatomy of the jaw and teeth. Intraoral and extraoral radiographs; technique, evaluation, typical errors. CBCT. Computed tomography and magnetic resonance in special indications. Imaging of pathological changes of the teeth, periodontium, alveolar process of the jaw, temporomandibular joints, paranasal sinuses, tissues and organs of the facial skull and neck. Trauma. Radiographic detection of inflammatory, degenerative, and radiation-induced changes. Radiographic evaluation of expansive jaw formations.

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Teaching
Teaching is organized through lectures, seminars and tutorials on the platform MS. The student is encouraged to study and follow the course content continuously, so that he/she can apply the acquired knowledge in the exercises and clarify the doubts that have arisen during the course. To prepare for class, it is recommended to read the appropriate section from the above literature to interpret the visuals in the exercises and to use the knowledge of the exercise instructor. The student is encouraged to actively participate in all forms of teaching and clarify the concepts learned using visual examples of various radiological techniques to fully understand the material provided in the curriculum.

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 radiography, computed tomography, and magnetic resonance in dental radiology and radiology of the neck.
4. Describe the technique of performing panoramic radiographs of the jaw and their application in dental radiology. State the indications for an orthopantomogram. Define the specifics 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 peculiarities of the dental radiographic device. 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. Determine the pathological changes of the alveolar process of the jaw.
8. evaluate the radiological symptoms of pathological changes in the jaw and teeth. Distinguish between pathological conditions of 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. determine and compare periapical lesions and maxillary cysts.
12. describe inflammatory and radiation-induced changes of the jaw and teeth.

LEARNING OUTCOMES RELATING TO CATEGORY II. PSYCHOMOTOR DOMAIN-SKILLS

1. application of protective measures and means in radiographic examination of jaws and teeth.
2. perform a panoramic radiograph of the jaw under supervision. Demonstrate the specifics of the equipment used for panoramic radiography of the jaw.
3. mastering the technique of placing the patient in position for intraoral radiography of the jaw; radiography of the bitewing, periodontal and apical radiography, occlusal radiography of the jaw.
4. mastering the technique of placing the patient in the correct position for extraoral radiographs, craniogram, cephalometric projection, Waters projection and "reverse" Towne projection.
5. recognize the normal and pathological bone structure of the jaws 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.

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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), pulpareal, deposition of reactive dentin,

disappearance of pulpareal 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.

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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):

Student grading is conducted according to the current University of Rijeka Studies and studying regulation.

Other important information regarding to the course:

COURSE SCHEDULE (for the academic year 2023/2024)

Date	Lectures (time and place)	Seminars (time and place)	Practicals (time and place)	Instructor
Mon 5.2.2 024.	**L 1 – 4** 10:00 – 13:00 h MS Teams			Petra Valković Zujić
			P 1 – 4 15:30-19:00h Rijeka	Petra Valković Zujić
			P 1 – 4 15:30-19:00h Sušak	Lovro Tkalčić

Tue 6.2.2024.	**L5 – 6** 10:00 – 11:30h MS Teams			Damir Miletić
	L7- 9 11:30 – 13:45h MS Teams			Petra Valković Zujić
			P 5 – 7 group A 14:30 - 16:30h Rijeka	Petra Valković Zujić
			P 5 – 7 group B 14:30 - 16:30h Sušak	Lovro Tkalčić
Wed 7.2.2024.	**L 10 – 11** 11:00-12:30h MS Teams			Petra Valković Zujić
			P 8 – 11 group A 14:00-17:00h Rijeka	Petra Valković Zujić
			P 8 – 11 group B 14:00-17:00h Sušak	Tin Nadarević
Thu 8.2.2024.	**L 12 – 13** 12:00 – 13:30h MS Teams			Slavica Kovačić
		S1 14:00-14:45h MS Teams		Lovro Tkalčić
		S2 14:45–15:30h MS Teams		Tin Nadarević
			P 12-13 16:00 – 17:30h Rijeka	Lovro Tkalčić
			P 12-13 16:00 – 17:30h Sušak	Slavica Kovačić
Fri 9.2.2024.		**S3** 8:00 – 8:45 h MS Teams		Valković Zujić
		S4 8:45 - 9:30h MS Teams		Valković Zujić
		S5 9:30 - 10:15h MS Teams		Damir Miletić
		S6 10:15 – 11:00h MS Teams		Damir Miletić
		KOLOKVIJ		
Mon 12.2.2024.	L14 – 15 8:00 –9:30h MS Teams			Damir Miletić
		S7 9:30 -10:15h MS Teams		Damir Miletić
		S8 10:15-11:00h		Damir Miletić

		MS Teams		
			P 14 - 15 group A 12:00 – 13:30 h Rijeka	Nina Bartolović
			P 14 - 15 group B 12:00 – 13:30h Sušak	Dina Miletić Rigo
Tuesday 13.4.2024.		**S9** 10:00 - 10:45h MS Teams		Slavica Kovačić
		S10 10:45 – 11:30h MS Teams		Petra Valković Zujić
		S11 11:30 – 12:15h MS Teams		Petra Valković Zujić
		S12 12:15-13:00h MS Teams		Lovro Tkalčić
	POPRAVNI KOLOKVIJ	**14:00h**		Merlin
Wed 14.2.2024.		**S13** 9:30-10:15h MS Teams		Tin Nadarević
		S14 10:15-11:00h MS Teams		Tin Nadarević
		S15 11:00 - 11:45h MS Teams		Petra Valković Zujić
Thursday 15.2.2024.	**Written exam**	**8AM**		**MERLIN**
Friday 16.2.2024.	**Oral exam**	**8AM**		**Petra Valković Zujić**

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	1	MS Teams

	radiology. Interpretation and quality assessment of radiographic images.		
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**	

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	SEMINARS (Topics)	Teaching hours	Location/Lecture room
S1	Generation of x-rays. Biological effect of X-rays. Protection against ionizing radiation. Dosimeter	1	MS Teams
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	MS Teams
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	MS Teams
S4	Diseases of the bone system affecting the jaws and teeth.	1	MS Teams
S5	Radiology and pathology of maxillary sinuses with reference to maxillary sinus, relation to teeth, mucosal changes, floor of maxillary sinus.	1	MS Teams
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	MS Teams
S7	Radiology of the pharynx with special attention to the epipharynx and palatal arches.	1	MS Teams
S8	Radiological anatomy of the neck and lymphatic region of the neck, mineralization of blood vessels and ligaments and representation in radiographs.	1	MS Teams
S9	Radiology and pathology of salivary glands.	1	MS Teams
S10	Radiology of the floor of the mouth and tongue.	1	MS Teams
S11	Radiology of the temporal bone and temporomandibular joint (TM).	1	MS Teams
S12	CBCT examination method, indications and possibilities.	1	MS Teams
S13	CBCT in endodontics and surgery - differences in radiation dose and resolution.	1	MS Teams
S14	The role of radiographs in periodontology (CBCT, panoramic radiograph and retroalveolar radiograph).	1	MS Teams
S15	CBCT in orthodontics and in planning and monitoring the effect of therapies.	1	MS Teams
	TOTAL TEACHING HOURS	**15**	

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	PRACTICALS (Topics)	Teaching hours	Location/Lecture room
	TOTAL TEACHING HOURS		

	FINAL EXAM DATES
1.	
2.	
3.	

	Lectures	Seminars	Practicals	Total
Total number				
On-line				
Percentage				