

29349 - Radiation Safety

Syllabus Information

Academic Year: 2022/23

Subject: 29349 - Radiation Safety

Faculty / School: 229 - Facultad de Ciencias de la Salud y del Deporte

Degree: 442 - Degree in Odontology

ECTS: 3.0

Year: 5

Semester: Second semester

Subject Type: Optional

Module:

1. General information

1.1. Aims of the course

The subject and its expected results respond to the following approaches and objectives:

1. Ability to estimate the doses that patients receive in the different dental examinations with RX;
2. Ability to estimate the doses that can be received in the different areas of a dental service that uses RX equipment;
3. Decision making from the point of view of radiation protection;
4. Ability to classify areas and personnel according to the regulations for sanitary protection against ionizing radiation;
5. Capacity for analysis, synthesis and oral and written communication on topics related to radiation protection;
6. Motivation for quality;
7. Adaptation to new situations and initiatives.

These proposals and goals are aligned with the following Sustainable Development Goals (SDGs) of the 2030 Agenda of the United Nations (<https://www.un.org/sustainabledevelopment/>), in such a way that the acquisition of the learning outcomes of the course provide training and competence to contribute to their achievement:

- Goal 3. Health
 - It is a course within a health degree that studies the protection against ionizing radiation of patients, health workers and the population in general. It shows the correct use of ionizing radiation to protect the health of the different actors involved in its use.
 - The correct diagnosis of patients has repercussions on their future well-being since the most appropriate treatments will be initiated to alleviate or cure their illness or discomfort.
 - The processes of control, optimization and limitation of the doses that workers and the general public may receive contribute to the reduction of radiological risk that could lead to health problems in the future. The same occurs with the processes of justification, optimization and application of reference levels in diagnostic or therapeutic procedures for patients.
- Goal 12. Sustainable consumption and production
 - The application of the principles of justification and optimization in the use of ionizing radiation leads to an education that seeks responsible consumption or use of radiological examinations.
- 17. Partnerships
 - International organizations cooperate and create alliances to draft adequate regulations on the use of ionizing radiation. These standards end up being included in European legislation which, in turn, has to be transposed into the legislation of each country. Within each country, alliances are also created between scientific societies and regulatory bodies (Nuclear Safety Council, Ministry of Industry and Ministry of Health in Spain) to draw up specific procedures on the use of ionizing radiation in all areas and especially in the health field.

- Manufacturers of ionizing radiation emitting equipment also create alliances and cooperate with international organizations and regulators to market equipment with the latest technologies aimed at reducing radiation doses that can be received from all points of view and for the creation of registration and control systems for the doses given to patients.

1.2. Context and importance of this course in the degree

- Provide students with the theoretical and practical knowledge that enables them to run X-ray facilities for dental diagnosis purposes under Spanish law.
- Know the risk posed by the use of ionizing radiation and the biological effects they can produce in living beings, especially in people undergoing diagnostic tests in the dental field.
- Know the operation of the different types of dental X-ray equipment, the rules and legislation that regulates their use both nationally and internationally (technical-legal-administrative requirements).
- Acquire the basic knowledge of radiation protection both from the point of view of the patient and from that of the exposed worker and the public.

1.3. Recommendations to take this course

Contents of the training program for management of x-ray facilities for dental diagnosis purposes, updating INSTRUCTION IS-17, of January 30, 2008, of the Nuclear Safety Council (CSN), on the approval of courses or programs of training for personnel who direct the operation or operate the equipment in the X-ray facilities for the purpose of medical diagnosis and accreditation of the personnel of said facilities.

The subject is homologated according to IS-17 by the CSN so that the students who pass the subject, have attended more than 90% of the theoretical classes, have completed the practices (requirements demanded by the CSN) and are from the last course of studies will be able to receive (upon withdrawing their bachelor's degree) the diploma with the accreditation to DIRECT X-RAY FACILITIES FOR THE PURPOSE OF DENTAL MEDICAL DIAGNOSIS.

2. Learning goals

2.1. Competences

Upon passing the course, the student will be more competent to direct and operate an RX facility for purposes of dental non-diagnosis.

Passing the course, for students in the final year of studies, will lead to obtain the diploma that ACCREDITS TO DIRECT X-RAY FACILITIES FOR THE PURPOSE OF DENTAL MEDICAL DIAGNOSIS, according to the agreement of the Nuclear Safety Council dated January 22, 2009 (according to instruction IS-17 of January 30, 2008).

The Nuclear Safety Council (Consejo de Seguridad Nuclear) requires that the theoretical classes, the practices and the final exam be carried out in person. In the event that the practices and the final exam will not be carried out in person, the Nuclear Safety Council will NOT allow the diploma that ACCREDITS TO DIRECT X-RAY FACILITIES FOR THE PURPOSES OF DENTAL MEDICAL DIAGNOSIS to be delivered.

2.2. Learning goals

To pass this subject, the student must demonstrate the following results:

- Know the Spanish legislation and your responsibility when managing a dental radiodiagnosis facility.
- Know the radiological protection criteria applicable to a dental radiodiagnosis facility.
- Know the risk posed by the use of ionizing radiation and the biological effects that can occur in living beings.

2.3. Importance of learning goals

Compliance with Spanish legislation regarding the use of ionizing radiation in dental radiology.

3. Assessment (1st and 2nd call)

3.1. Assessment tasks (description of tasks, marking system and assessment criteria)

The student must demonstrate that he has achieved the anticipated learning outcomes through the following assessment activities:

Theorists: Final exam type test (60 unique test questions with 4 possible answers). There will be two intermediate exams of 10 short questions each.

Practical: Assistance and Realization of memories.

The subject is approved with a 90% attendance to theoretical classes, attendance to all practices, with at least 45 correct answers in the final exam and with a final grade higher than 5. The final grade of the subject will be the average between the

note of the final exam and the average of the two partial exams.

4. Methodology, learning tasks, syllabus and resources

4.1. Methodological overview

The methodology followed in this course is oriented towards the achievement of the learning objectives. A wide range of teaching and learning tasks are implemented, such as theory sessions, and practice sessions.

After the realization of the course, the student will be able to:

- Promote self-learning new knowledge, skills and motivation in order to get the best quality.
- Be able to share information with other health professionals and to work as a team.
- Understand and recognize the principles of ergonomics and safety at work (including cross-infection control, radiation protection, and occupational and biological diseases).

4.2. Learning tasks

This course is organized as follows:

Theory sessions:

Area 1. Basics: X-ray production and qualities. X-ray nature. X-ray interaction with matter: basic concepts. Attenuation of radiation. Radiological image shaping.

Area 2. Physical features of the equipment and x-ray beams: Generator. Tube. Associated devices. Radiation produced by X-ray tubes imaging systems features.

Area 3. Magnitudes and measurement of radiation: Radiological magnitudes applicable to radiodiagnostic. Dose concept. Radiation detection and measurement. Physical fundamentals. Measurement equipment. Direct beam dose measurement. Dose area measurement. Personal dosimeters.

Area 4. Biological impacts of ionizing radiation: General aspects of the interaction between radiation and the biological environment. Somatic and genetic effects. Stochastic and non-stochastic effects.

Area 5. Radio-diagnostic facilities basic regulations and legislation.

Area 6. Basic Radiological Protection: Goals. Principles: Justification; optimization; Dose limitation system. Operational radiation protection basic standards (Regulation on health protection against ionizing radiation). General criteria for dose reduction.

Area 7. Specific radiological protection in dental or podiatry radiology facilities: General considerations. Facilities design. Diagnostic radiology rooms technical features. Operational radiation protection development. Organization and control. Preventive and corrective maintenance. Methods to reduce dose to patients. Radiation protection considerations on facilities. Using particular techniques: digital radiology: Concept and applications. Fundamentals and techniques of radiological examination using equipment with digital technology. Pediatric techniques. Other diagnostic and interventional techniques. Specific comments regarding the protection of the patient.

Area 8. Quality assurance program.

Area 9. Technical-administrative requirements: Declaration and registration procedure of the equipment and facilities of X-ray medical diagnosis. Technical Specifications Operating Personnel requirements. Performance standards. Logbook. Files and reports. Periodic and special inspections. Devices and protective clothing.

Practice sessions:

Management of different types of radiation monitors used in radiology, interpretation of measurement results. Criteria for the use of suitable equipment in each case.

Estimation of doses that operating personnel and members of the public could receive, considering the weekly workload and the results of measurements of environmental radiation. Use and occupancy factors. Testing the effectiveness of structural armor and personal protection.

Classification and signaling installation areas of radiology.

Checking the variation of dose intensity due to scattered radiation, depending on the size of the irradiated field and operating parameters (kVp, milliamperage, time) and also relative to the operator's position relative to the focus and to the patient.

Applying basic operating procedures involving dose reduction and avoid repetition of plates (collimation, proper technique).

Knowledge of parameters of a processing operation in order to exercise control thereof, such as temperature, pH and regeneration of developer liquids. Interpretation of the results of some basic quality controls (kVp, shooting time, reproducibility, reciprocity, CIA and fields of light and radiation coincide, performance).

Application of criteria to estimate the quality of radiographic images, using suitable patterns. Management of obtaining and recording images systems.

4.3. Syllabus

This course will address the following topics:

Theory:

Topic 1. ATOMIC STRUCTURE AND ELECTROMAGNETIC RADIATION

Topic 2. INTERACTION WITH CHARGED PARTICLE MATTER (1)

Topic 3. INTERACTION WITH CHARGED PARTICLE MATTER (2)
Topic 4. INTERACTION OF photons with matter (1)
Topic 5. INTERACTION OF photons with matter (2)
Topic 6. PHYSICAL FEATURES OF RADIOLOGY EQUIPMENT.
Topic 7. X. RAY BEAM SPECTRUM RX.
Topic 8. QUANTITIES AND RADIATION UNITS.
Topic 9. DETECTION AND radiation dosimetry.
Topic 10. BIOLOGICAL IMPACT OF IONIZING RADIATION.
Topic 11. PROTECTION AGAINST RADIATION.
Topic 12. OPERATIONAL RADIATION PROTECTION.
Topic 13. RADIATION PROTECTION ASPECTS IN VARIOUS DENTAL RADIOLOGY UNITS.
Topic 14. QUALITY ASSURANCE AND QUALITY CONTROL FACILITIES IN DENTAL RADIOLOGY.
Topic 15. ESTIMATED DOSE IN DENTAL RADIOLOGIA.
Topic 16. APPLICABLE SPANISH LEGISLATION TO FACILITIES RADIODIAGNOSTICS (1).
Topic 17. APPLICABLE SPANISH LEGISLATION TO FACILITIES RADIODIAGNOSTICS (2).
Topic 18. PREGNANCY AND MEDICAL RADIATION.
Topic 19. COMPARISON OF RISK.
Topic 20. GUIDELINES, RECOMMENDATIONS AND INTERNATIONAL STANDARDS SCOPE (1)
Topic 21. GUIDELINES, RECOMMENDATIONS AND INTERNATIONAL STANDARDS SCOPE (2)

Practice:

1st SESSION. Radiation monitors and personal dosimeters description and management.

Radiation monitor management. Indications interpretation. Estimation of dose depending on the indications.

2nd SESSION. X-ray tube and control devices operation.

3rd SESSION. Quality control equipment RX (kVp, milliamperes, shooting time, performance, reproducibility, filtration ...).

Checking variation of the dose rate of scattered radiation according to the size of the irradiated field of the operating parameters (kVp, milliamperage, time) and to the operator's position relative to the focus and the patient. Registration systems, visualization and image storage.

4TH SESSION: Radiation protection in a dental radiology facility. Weekly dose assessment in different parts of the room.

Estimation of doses that operating personnel and members of the public could receive, considering the weekly workload and the results of measurements of environmental radiation. Use and occupancy factors. Classification of areas and personnel.

Testing the effectiveness of structural armor and personal protection. Applying basic operating procedures involving dose reduction and avoid repetition of plates (collimation, proper technique).

4.4. Course planning and calendar

Further information concerning the timetable, classroom, office hours, assessment dates and other details regarding this course will be provided on the first day of class or please refer to the Faculty of Health and Sports Sciences website and Moodle.

Theoretical classes will be in the afternoon.

On-site practical classes will be at the RX facility of the San Jorge Hospital on Thursday or Friday afternoons from 4 pm to 8 pm in groups of maximum 6 students.

Seminars will be at the request of the student.

Monitoring on Moodle platform and review of theoretical classes on the teacher's YouTube channel: https://www.youtube.com/channel/UC6f7kTo-GmclNwc7ka_H5DA

4.5. Bibliography and recommended resources

To consult the bibliography and recommended resources, you must access the *Recommended Bibliography* link.