

**DESCRIPTION OF COURSE UNIT FOR DOCTORAL STUDIES
AT VILNIUS UNIVERSITY**

Scientific Area, Field of Science	Medical and Health Sciences (M 000): Odontology (M 002); Medicine (M 001); Public Health (M 004)			
Faculty, Institute, Department/Clinic	Faculty of Medicine Institute of Odontology			
Course unit title (ECTS credits, hours)	Application of Regeneration Techniques in Odontology 8 credits (212 hours)			
Study method	Lectures	Seminars	Consultations	Self-study
Number of ECTS credits	-	1	1	6
Method of the assessment (in 10 point system)	<p>Presentation evaluation. Presentation topic should be discussed and decided with the lecturer coordinating the unit. Student should review, analyze, and present the newest research findings that are related to the topic. The following aspects are evaluated:</p> <ul style="list-style-type: none"> - Structure of the presentation, comprehensiveness, and quality of the material (2 points); - Clear presentation of knowledge, argumentation, critical thinking (2 points); - Conclusions and limitations (2 points); - Clinical recommendations, evidence-based statements (2 points); - Discussion, ability to answer questions (2 points). <p>Minimal passing score – 5.</p>			
PURPOSE OF THE COURSE UNIT				
<p>Purpose: to get knowledge about the regeneration methods and their application in the treatment of jaw and teeth pathology.</p> <p>Modern dentistry aims to preserve the natural process of tissue development. It is necessary to know not only the traditional treatment methods, but also the implementation of the latest techniques which will allow to restore the natural tooth, pulp structure and alveolar bone in the future. Regeneration in dentistry is applied in various fields. In order to apply these methods in treatment practice, it is necessary to understand the biological aspect of the regenerative process.</p>				
THE MAIN TOPICS OF THE COURSE UNIT				
<p>1. Pulp tissue regeneration.</p> <p>Regeneration in endodontics is one of the newest treatment strategies which application in clinical practise is very important. The process of pulp regeneration is related to the principles of tissue engineering. It defines the formation of new tissues and cells that guarantee the restoration of the tissue's original anatomy and function. The regenerative process is determined not only by the variety of cells, but also growth factors and formation of matrix inside of the root canal. Wide variety of methods are used during in vivo or in vitro studies such as: root canal revascularization, stem cell therapy, pulp cells implantation, matrix implantation, 3-D cell printing, layered cells on hydrogel, injectable matrix, gene therapy.</p> <p>The regenerative direction in endodontology is very important to maintain the apexogenesis of the tooth, as it usually affects children with unformed roots and thin walls of the root canal.</p> <p>2. Bone regeneration.</p>				

Bone defects are formed after the removal of teeth, tumors, after trauma, osteolysis, due to aging processes or may be congenital. Bone regeneration is a complex physiological process, during which new tissue is formed at the site of the defect, and at the same time the impaired or lost function is restored.

Bone defects can be restored by distraction osteogenesis, performing bone augmentation with autogenous, allogeneic, xenogeneic or inorganic material grafts and bone substitutes. New alternative treatment methods are being sought in order to reduce the number of possible complications, control the recovery of the bone defect, simplify the course of treatment, increase the availability of services and the quality of life of patients. Tissue engineering, a multidisciplinary branch of science that includes cell biology, materials science and regenerative medicine, studies and searches for new ways to replace autogenous graft.

In order to restore a bone defect, it is necessary to create the most favorable conditions for osteogenesis, the most important components of which are the framework, cells and growth factors. The main requirements for frameworks are biocompatibility, three-dimensional, porous structure, resorption, osteoconductive, osteoinductive properties, mechanical resistance, easy manipulation and manufacturing method.

3. Periodontal tissue regeneration.

The causes of soft tissue defects can be anatomical, developmental, traumatic or disease. The lack of soft tissues usually leads to aesthetic problems, increased sensitivity of the teeth and carious and non-carious cervical lesions. A lack of soft tissue quantity or quality around the implant can lead to further damage to the tissues surrounding the implant. A wide variety of substitute materials and methods exist for the regeneration of soft tissue defects without the use of autograft from the donor area. These are allografts, xenografts, directional tissue regeneration methods, fibrin enriched with platelets, pinhole technique. Most of the techniques require fitting a graft or replacement regenerative material to the desired defect. This is usually done during surgical intervention. Often the latter aspects limit the control of the future soft tissue contour. In a case presentation by Rasperini and co-authors, 3D printing technology was applied to the restoration of lost periodontal tissues.

RECOMMENDED LITERATURE SOURCES

1. Cohen S, Hargreaves KM, eds. Pathways of the pulp, 12th ed. St. Louis: Mosby, 2021. (Clinicalkey duomenų bazė).
2. Regenerative Endodontic Procedures in Traumatized Immature Permanent Teeth: Interappointment Dressing or Single-Visit? JOE Volume 47, Number 10, October 2021.
3. Kim SG, Malek M, Sigurdsson A, Lin LM, Kahler B. Regenerative endodontics: a comprehensive review. International Endodontic Journal, 51, 1367–1388, 2018.
4. Regenerative Endodontics: Burning Questions Anthony J. Smith, PhD, and Paul R. Cooper, PhD Endod 2017;43:S1–S6)
5. C. Bottino, Divya Pankajakshan, Jacques E. Nör. Advanced Scaffolds for Dental Pulp and Periodontal Regeneration Marco Dent Clin N Am 61 (2017) 689–711.
6. Hengameh Bakhtiar, Amir Mazidi, Saeed Mohammadi Asl, M. R. Ellini, · A. Moshiri, M. H. Nekoofar, P. M. H. Dummer. The role of stem cell therapy in regeneration of dentine-pulp complex: a systematic review Progress in Biomaterials (2018) 7:249–268.
7. Laureys WG, Cuvelier CA, Dermaut LR, De Pauw GA. The critical apical diameter to obtain regeneration of the pulp tissue after tooth transplantation, replantation or regenerative endodontic treatment. J Endod 2013 Jun;39(6):759-63.
8. Asa'ad F, Pagni G, Pilipchuk SP, Gianni AB, Giannobile WV, Rasperini G. 3D Printed Scaffolds and Biomaterials: Review of Alveolar Bone Augmentation and Periodontal Regeneration Applications. Int J Dent. 2016;2016:1239842. doi: 10.1155/2016/1239842. Epub 2016 Jun 5. Review.

9. Vertical and Horizontal Ridge Augmentation New Perspectives. Urban, Istvan. 2017. Quintessence publishing. ISBN 978-1-78698-000-7
10. 3D printed bone models in oral and cranio-maxillofacial surgery: a systematic review. Meglioli M, Naveau A, Macaluso GM, Catros S. 3D Print Med. 2020 Oct 20;6(1):30. doi: 10.1186/s41205-020-00082-5.

CONSULTING LECTURERS

1. Coordinating lecturer: Vytautė Pečiulienė (Prof. Dr.).
2. Vygandas Rutkūnas (Prof. Dr.).
3. Renata Šimkūnaitė-Rizgelienė (Prof. Dr.).
4. Saulius Drukteinis (Assoc. Prof. Dr.).

APPROVED:

By Council of Doctoral School of Medicine and Health Sciences at Vilnius University:
29th of September 2022

Chairperson of the Board: Prof. Janina Tutkuvienė