Academic year 2021./2022.

Course title: Clinical and experimental evaluation of lasers and activated irrigation techniques in endodontics

Department: Department of Endodontics and Restorative Dental Medicine

Adress: School of Dental Medicine University of Zagreb, Gundulićeva 5, 10 000 Zagreb

Total ECTS points: 3.0

Course leader : Associate Professor Ivona Bago

Course associates: Assistant Professor Marko Katić

Teaching plan

	No. classes
Lecture	2
Seminar	9
Practical	5
Total	16

1 class = 45 minutes

Course description

The aim of endodontic therapy is eradication of bacterial biofilms and their byproducts from the endodontic space in order to enable healing of periapical lesion. This is traditionally achieved by mechanical instrumentation and chemical treatment of endodontic space using irrigants. The mechanical instrumentation is not sufficient enough to remove the bacteria from the root canal. The reason is an irregular root canal anatomy, for which a large part of the intracanal areas (lateral canals, isthmuses) remained filled with bacterial biofilms, pulp tissue and debris. The course introduces students to the problem of root canal disinfection and debridement as well as study models in this area. The theoretical and seminar's part of the course covers the past knowledge on intracanal bacterial biofilm and primary and persistent endodontic infection; the influence of root canal anatomy on the efficacy of canal debridement; conventional and advanced irrigation techniques and their limitations; hydrodynamic activated irrigation; the efficacy and safety of laser-activated techniques (laser-activated irrigation, thermal lasers and photodynamic therapy). The participants are introduced to in vitro and ex vivo study models; application of micro-CT in endodontic research; creation of in vitro and ex vivo biofilms are explained in detail; advantages and limitations of microbiological methods (molecular and standard cultivation techniques) are critically considered; evaluation of the effect of various irrigants and lasers on dentinal tissue using scanning electron microscopy (SEM) and Fourier transform infrared spectroscopy (FTIR). Participants are introduced with the work on micro-CT, and perform root canal disinfection in extracted teeth using activation and laser protocols.

Learning outcomes

1. Define limitations of conventional disinfection techniques of endodontic space
2. Explain advantages of active root canal irrigation techniques
3. Select adequate microbiological method for clinical, in vitro and ex vivo studies on root canal disinfection techniques

4. Apply active irrigation techniques (laser activated and sonic activated irrigation, passive ultrasonic irrigation) and photodynamic therapy in root canals

5. Select adequate protocol of chemical preparation of root canal depending od the type of endodontic infection

Course contet

Lecture

	Lecture topics	Number of classes/hours
1.	Biofilm in endodontics	1
2.	Primary, secondary and persistent endodontic infection	1
3.		-
4.	-	-
5.	-	-
6.	-	-
7.	-	-
8.	-	-
9.	-	-
10.	-	-

1 sat = 45 minuta

Seminari

	Seminar topics	Number of classes/hours
1.	Micro-CT technology in endodontic studies	1
2.	Root canal anatomy of permanent teeth based on micro computed tomography (micro-CT)	1
3.	Chemical disinfection of the endodontic space	1
4.	Research on root canal irrigation: methods and models	1
5.	Activation techniques and hydrodynamic effect of irrigation	1
6.	Use of lasers in root canal treatment	1
7.	In vitro and ex vivo creation of mono- and multi-bacterial biofilms: standardization of biofilm	1
8.	Microbiological methods (cultivation and molecular techniques) in the evaluation of endodontic infection	1
9.	Evaluation of the effect of chemical irrigants on dentine tissue	1
10.	-	-

1 sat = 45 minuta

Vježbe

	practicals topics	**Number of classes/hours**
1.	Analysis of extracted human teeth using micro-CT	1
2.	Use of photodynamic therapy in root canal disinfection	1
3.	Use of the activation systems, Er:YAG laser and Nd:YAG laser in root canal disinfection	1
4.	Photodynamic therapy/Photoactivated disinfection	1
5.	Laser activated irrigation (Shock Wave Enhanced Emission Photoacoustic Streaming, SWEEPS)	1
6.	-	-
7.	-	-
8.	-	-
9.	-	-
10.	-	-

1 class = 45 minutes

Literature

1. Basrani Bettina. Endodontic Irrigation: Chemical disinfection of root canal treatment. London: Springer; 2015.

2. Jose F. Siqueira Jr. Treatment of Endodontic Infection. Berlin: Quistennece Pusblishing; 2011. Str. 95-137, 235-311.

3. Giovanni Olivi, Roeland De Moor, Enrico DiVito. Lasers in Endodontics: Scientific Background and Clinical Application. London: Springer; 2016. Str. 45-73, 145-157, 193-219.

4. Siqueira JF Jr, Rocas IN. Exploiting molecular methods to explore endodontic infections: Part 1-Current molecular technologies for microbiological diagnosis. J Endod. 2005;31(6):411-23.

5. Bago Jurič I, Anić I. The use of lasers in disinfection and cleaning of root canals: a review. Acta Stomatol Croat. 2014;48(1):6-15.

6. Tartari T, Bachmann L, Zancan RF, Vivan RR, Duarte MAH, Bramante CM. Analysis of the effects of several decalcifying agents alone and in combination with sodium hypochlorite on the chemical composition of dentine. In Endod J. 2018;51:e42-e54.

CV (*curriculum vitae*) and bibliography of course leader

Ivona Bago was born on July 19, 1980 in Zagreb, where she finished primary and secondary school. She enrolled at the School of Dental Medicine University of Zagreb in 1999, where she graduated in 2005. During her studies, she was awarded with the Rector's Award for scientific research. In 2007,

she started a specialization in Family Dentistry at the University Hospital Center Zagreb, and in 2010 she became a specialist in Family Dentistry.

Since March 2010, she has been employed as a young researcher at the scientific project "Experimental and Clinical Endodontics" led by Professor Ivica Anić at the Department of Endodontics and Restorative Dentistry, School of Dental Medicine, University of Zagreb. In 2012, the Society of University Teachers and Other Scientists in Zagreb awarded her the Best Scientific Work Award.

She received her PhD in 2013 at the School of Dental Medicine University of Zagreb with the topic "Efficiency of sound, ultrasound and laser-activated root canal cleaning techniques", under the mentorship of Professor Ivica Anic.

In 2014, he completed a two-year postgraduate course EMDOLA (European Master Degree in Oral Laser Application) at the Sophia Antipolis University in Nice, France. She won a scholarship from the French government to study in France in 2012.

In 2013 she became a research associate, and in 2019 a senior research associate.

In 2015, she completed a specialization in endodontics with restorative dentistry and has become a specialist in Endodontics and Restorative Dentistry.

In 2016, he received the scientific teaching title of Assistant Professor and in 2019 of Associate Professor at the Department of Endodontics and Restorative Dentistry, School of Dental Medicine, University of Zagreb.

So far, she has mentored 15 graduate theses and two doctoral theses.

Since 2019, she has been the head of the course at the postgraduate PhD study Dental Medicine at the School of Dental Medicine in Zagreb entitled " Clinical and experimental evaluation of lasers and activated irrigation techniques in endodontics."

Since 2020, she has been the project manager of the Croatian Science Foundation project "Clinical and experimental evaluation of laser activated photoacoustic streaming and photoactivated disinfection in endodontics" at the School of Dental Medicine, University of Zagreb.

She is a reviewer in the journals: Journal of Endodontics (Q1), Lasers in Medical Science (Q1), Brazilian Oral Research (Q1), Lasers in Surgery and Medicine (Q1), Journal of Oral-Maxillo-Facial Surgery (Q2), Photobiomodulation, Photomedicine and Laser Surgery (Q3), Photodiagnosis and Photodynamic Therapy (Q2), Acta Stomatologica Croatica (Q3).

She has won several awards for her scientific work:

- 2021. Recognition for the most successful scientific work in 2020, School of Dental Medicine, University of Zagreb

- 2020. Recognition for the most successful scientific work in 2019, School of Dental Medicine, University of Zagreb

- 2013. Firts prize of the best research awarded by the scientific committee, World Federation for Laser Dentistry

- 2013. Recognition annual award to a young researcher for 2012, School of Dental Medicine, University of Zagreb

- 2013 Annual Award of the Society for Young Scientists and Artists, Society of University Teachers and Other Scientists in Zagreb

Since 2014, she has been the secretary and representative of the Croatian Endodontic Society at the European Endodontic Society.

She is the author of several scientific and professional papers in domestic and international journals. She has actively participated in domestic and international congresses as an invited lecturer. She was a guest lecturer at the 2014 World Congress of Lasers in Dentistry in Paris.

Since 2012, he has been a regular lecturer at the Annual Congresses of the Croatian Endodontic Society and actively participates in continuing education courses at the School of Dental Medicine and courses in the use of lasers in endodontics.

Link to CROSBI profile (scientific number 31573):
https://www.bib.irb.hr/pretraga?operators=and|Bago,%20Ivona%20%2831573%29|text|profile