

University of Groningen

Innovative Insights in Decontamination and Healing During Endodontic Treatment

Feliz Pedrinha, Victor

DOI:

[10.33612/diss.1220804222](https://doi.org/10.33612/diss.1220804222)

IMPORTANT NOTE: You are advised to consult the publisher's version (publisher's PDF) if you wish to cite from it. Please check the document version below.

Document Version

Publisher's PDF, also known as Version of record

Publication date:

2025

[Link to publication in University of Groningen/UMCG research database](#)

Citation for published version (APA):

Feliz Pedrinha, V. (2025). *Innovative Insights in Decontamination and Healing During Endodontic Treatment*. [Thesis fully internal (DIV), University of Groningen]. University of Groningen.
<https://doi.org/10.33612/diss.1220804222>

Copyright

Other than for strictly personal use, it is not permitted to download or to forward/distribute the text or part of it without the consent of the author(s) and/or copyright holder(s), unless the work is under an open content license (like Creative Commons).

The publication may also be distributed here under the terms of Article 25fa of the Dutch Copyright Act, indicated by the "Taverne" license. More information can be found on the University of Groningen website: <https://www.rug.nl/library/open-access/self-archiving-pure/taverne-amendment>.

Take-down policy

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

Downloaded from the University of Groningen/UMCG research database (Pure): <http://www.rug.nl/research/portal>. For technical reasons the number of authors shown on this cover page is limited to 10 maximum.

Innovative Insights in Decontamination and Healing During Endodontic Treatment



Victor Feliz Pedrinha

**Innovative Insights in
Decontamination and Healing
During Endodontic Treatment**

Victor Feliz Pedrinha

Innovative Insights in Decontamination and Healing During Endodontic Treatment



University Medical Center Groningen, University of
Groningen, Groningen, The Netherlands

Copyright © 2025 by Victor Feliz Pedrinha

Cover: Taísa Choi Bustamante

Layout: Victor Feliz Pedrinha

Printed by: Gildeprint



university of
 groningen



Innovative Insights in Decontamination and Healing During Endodontic Treatment

PhD thesis

to obtain the degree of PhD at the
University of Groningen
on the authority of the
Rector Magnificus Prof. J.M.A. Scherpen
and in accordance with
the decision by the College of Deans

and

to obtain the degree of PhD at the
University of São Paulo
on the authority of the
Rector Prof. C.G. Carlotti Junior
and in accordance with
the decision by Pro-Rector of Post-Graduation

Double PhD degree

This thesis will be defended in public on
Wednesday 12 March 2025 at 9.00 hours

By

Victor Feliz Pedrinha

born on 18 November 1992,
in Belém, Pará, Brazil

Supervisors

Prof. P.K. Sharma

Prof. F. Bombarda de Andrade

Co-supervisor

Dr. M.A. Shahbazi

Assessment Committee

Prof. M.S. Cune

Prof. M. Ozcan

Prof. F. Sefat

Prof. M.A. Rabelo Buzalaf

To my family

*“A day may come when the
courage of Men fails, when we
forsake our friends and break all
bonds of fellowship, but it is not
this day.*

*An hour of wolves and
shattered shields when the Age
of Men comes crashing down,
but it is not this day!*

This day we fight!”

J.R.R. Tolkien

Paranymphs

Jhon Alexander Ramirez Idarraga

Liliana Agresti

Publications Supporting the Background of this Thesis

1. Moliz MTA, Zapata RO, Baca P, Ruiz-Linares M, García EG, Duarte MAH et al. Antimicrobial activity of chlorhexidine, peracetic acid and sodium hypochlorite/etidronate irrigant solutions against *Enterococcus faecalis* biofilms. *Int Endod J.* 2015;48(12):1188-93.
2. Pacheco-Yanes J, Provenzano JC, Marceliano-Alves MF, Gazzaneo I, Pérez AR, Gonçalves LS et al. Distribution of sodium hypochlorite throughout the mesial root canal system of mandibular molars after adjunctive irrigant activation procedures: a micro-computed tomographic study. *Clin Oral Investig.* 2020;24(2):907-14.
3. Sluis LW, Versluis M, Wu MK, Wesselink PR. Passive ultrasonic irrigation of the root canal: a review of the literature. *Int Endod J.* 2007;40(6):415-26.
4. Pereira TC, Dijkstra RJB, Petridis X, Sharma PK, Meer WJ, Sluis LWM et al. Chemical and mechanical influence of root canal irrigation on biofilm removal from lateral morphological features of simulated root canals, dentine discs and dentinal tubules. *Int Endod J.* 2021;54(1):112-29.
5. Andrade FB, Arias MP, Maliza AG, Duarte MA, Graeff MS, Amoroso-Silva PA et al. A new improved protocol for in vitro intratubular dentinal bacterial contamination for antimicrobial endodontic tests: standardization and validation by confocal laser scanning microscopy. *J Appl Oral Sci.* 2015;23(6):591-8.
6. Pereira TC, Vasconcelos LRSM, Graeff MSZ, Ribeiro MCM, Duarte MAH, de Andrade FB. Intratubular decontamination ability and physicochemical properties of calcium hydroxide pastes. *Clin Oral Investig.* 2019;23(3):1253-1262.
7. Sirén EK, Kerosuo E, Lavonius E, Meurman JH, Haapasalo M. Ca(OH)₂ application modes: in vitro alkalinity and clinical effect on bacteria. *Int Endod J.* 2014;47(7):628-38.
8. Ordinola-Zapata R, Noblett WC, Perez-Ron A, Ye Z, Vera J. Present status and future directions of intracanal medicaments. *Int Endod J.* 2022;55(Suppl 3):613-636.

9. de Souza V, Holland R. Treatment of the inflamed dental pulp. *Aust Dent J*. 1974;19(3):191-6.
10. Kayaoglu G, Ömürlü H, Akca G, Gürel M, Gençay Ö, Sorkun K, Salih B. Antibacterial activity of Propolis versus conventional endodontic disinfectants against *Enterococcus faecalis* in infected dentinal tubules. *J Endod*. 2011;37(3):376-81.
11. Bardají DK, da Silva JJ, Bianchi TC, de Souza Eugênio D, de Oliveira PF, Leandro LF, Rogez HL, Venezianni RC, Ambrosio SR, Tavares DC, Bastos JK, Martins CH. *Copaifera reticulata* oleoresin: Chemical characterization and antibacterial properties against oral pathogens. *Anaerobe*. 2016;40:18-27.
12. Pizzatto LN, Meneses CCB, Diniz EA, Dionísio TJ, Santos CF, Sipert CR. Angiotensin II Regulates Proliferation and Function of Stem Cells of Apical Papilla. *J Endod*. 2020;46(6):810-817.
13. Tsai CJ, Loh JM, Proft T. *Galleria mellonella* infection models for the study of bacterial diseases and for antimicrobial drug testing. *Virulence*. 2016;7(3):214-29.
14. Rozenbaum RT, Andrén OCJ, van der Mei HC, Woudstra W, Busscher HJ, Malkoch M, Sharma PK. Penetration and Accumulation of Dendrons with Different Peripheral Composition in *Pseudomonas aeruginosa* Biofilms. *Nano Lett*. 2019;19(7):4327-4333.
15. Álvarez-Martínez FJ, Barrajon-Catalán E, Micol V. Tackling Antibiotic Resistance with Compounds of Natural Origin: A Comprehensive Review. *Biomedicines*. 2020;8(10):405.
16. Shahbazi MA, Faghfour L, Ferreira MPA, Figueiredo P, Maleki H, Sefat F, Hirvonen J, Santos HA. The versatile biomedical applications of bismuth-based nanoparticles and composites: therapeutic, diagnostic, biosensing, and regenerative properties. *Chem Soc Rev*. 2020;49(4):1253-1321.

Table of Contents

Chapter 1	General Introduction and Aim of this Thesis	13
Chapter 2	Impact of Irrigation Protocols with Some Chelators and Mechanical Agitation on Intratubular Decontamination Brazilian Oral Research, 2021; 35: e127.	33
Chapter 3	The Vehicles of Calcium Hydroxide Pastes Interfere with Antimicrobial Effect, Biofilm Polysaccharidic Matrix, and Pastes' Physicochemical Properties Biomedicines, 2022; 10: 3123.	61
Chapter 4	Effects of natural antimicrobial compounds propolis and copaiba on periodontal ligament fibroblasts, molecular docking, and in vivo study in <i>Galleria mellonella</i> Biomedicine & Pharmacotherapy, 2024; 171: 116139.	89
Chapter 5	Antimicrobial efficacy of alternative root canal disinfection strategies: an evaluation on multiple working models Biomedicine & Pharmacotherapy, 2025; 183: 117833.	139
Chapter 6	Penetration of PEI-Bi ₂ S ₃ Nanoparticles into Dual-Species Dental Biofilms (Manuscript in preparation stage)	217
Chapter 7	General Discussion and Future Perspectives	257
	Summary	293
	Samenvatting	299
	Sumário	305
	Acknowledgements	311
	Curriculum Vitae and Publications	319

