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Brasseler EdgePRO™ Endodontic Laser
Er,Cr:YSGG Laser Technology – Research Bibliography

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1. Mechanism of Action: Cavitation, Fluid Dynamics & Apical Vapor Lock Removal

- Peeters HH, De Moor RJG, Suharto D. *Visualization of removal of trapped air from the apical region in simulated root canals by laser-activated irrigation using an Er,Cr:YSGG laser*. Lasers Med Sci. 2014.
  - Demonstrated that laser activation disrupts surface tension via cavitation, eliminating apical vapor lock and enabling irrigant penetration to working length.
- Peeters HH, Gutknecht N. *Efficacy of laser-driven irrigation versus ultrasonic in removing an airlock from the apical third of a narrow root canal*. Aust Endod J. 2014.
  - Laser-driven irrigation shown to be **completely effective** in removing apical air entrapment compared to ultrasonic activation.
- Zhu L, Tolba M, Arola D, et al. *Evaluation of effectiveness of Er,Cr:YSGG laser for root canal disinfection: theoretical simulation of temperature elevations in root dentin*. J Biomech Eng. 2009.
  - Demonstrates laser-induced thermal and fluid dynamics capable of influencing deep dentinal disinfection when properly applied.

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2. Irrigant Activation & Enhanced Cleaning Efficiency

- Seet AN, Zilm PS, Gully NJ, Cathro PR. *Qualitative comparison of sonic or laser energisation of NaOCl on Enterococcus faecalis biofilm*. Aust Endod J. 2012.
  - Laser activation produced **greater bacterial reduction and cleaner dentin surfaces** vs sonic and syringe irrigation.
- Peeters HH, Suardita K. *Efficacy of smear layer removal at the root tip using EDTA and Er,Cr:YSGG laser*. J Endod. 2011.
  - Laser activation significantly improved cleaning and smear layer removal compared to ultrasonic methods.
- Montero-Miralles P, et al. *Comparative study of debris and smear layer removal with EDTA and Er,Cr:YSGG laser*. 2018.
  - Demonstrates enhanced debris removal when laser activation is used adjunctively with irrigants.

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3. Smear Layer Removal & Dentinal Tubule Exposure

- Silva AC, et al. *Analysis of permeability and morphology of root canal dentin after Er,Cr:YSGG laser irradiation*. Photomed Laser Surg. 2010.

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  - Laser irradiation increases dentinal permeability and modifies canal wall morphology to improve penetration of medicaments.
- Kimura Y, et al. *Effects of Er,Cr:YSGG laser irradiation on root surface morphology*. 2001.
  - Demonstrates morphological changes and smear layer removal effects on dentin surfaces.
- Yamazaki R, et al. *Effects of Er,Cr:YSGG laser irradiation on root canal walls: SEM and thermographic study*. 2001.
  - Confirms surface modification and smear layer disruption without significant thermal damage.

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4. Antibacterial / Disinfection Efficacy

- Wang QQ, Zhang CF, Yin XZ. *Evaluation of the bactericidal effect of Er,Cr:YSGG and Nd:YAG lasers in infected root canals*. J Endod. 2007.
  - Er,Cr:YSGG achieved up to **96% bacterial reduction**, demonstrating strong antimicrobial potential.
- Yavari HR, et al. *Effect of Er,Cr:YSGG laser irradiation on Enterococcus faecalis in infected root canals*. Photomed Laser Surg. 2010.
  - Laser showed antibacterial effects, though less effective than NaOCl alone—supports use as **adjunctive technology**.
- Schoop U, et al. *Bactericidal effect of different laser systems in the deep layers of dentin*. Lasers Surg Med. 2004.
  - Demonstrated laser penetration and bacterial reduction in **deep dentinal layers**, beyond reach of conventional irrigants.
- Kasic S, et al. *Efficacy of three different lasers on eradication of Enterococcus faecalis and Candida albicans biofilms*. 2017.
  - Confirms laser effectiveness against resistant biofilms.
- Eldeniz AU, et al. *Bactericidal efficacy of Er,Cr:YSGG laser vs NaOCl irrigation*. 2007.
  - Supports adjunctive role of laser alongside chemical irrigation.
- El Gendy AA, et al. *Antibacterial effect of Er,Cr:YSGG laser under various irradiation conditions*. 2017.
  - Highlights importance of parameters in optimizing antimicrobial outcomes.

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5. Cleaning, Shaping & Canal Morphology

- Soares F, et al. *Impact of Er,Cr:YSGG laser therapy on cleanliness of root canal walls of primary teeth*. J Endod. 2008.

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  - Laser achieved cleanliness comparable to rotary instrumentation and superior to manual techniques, with reduced treatment time.

- Jahan KM, et al. *Assessment of root canal preparation by Er,Cr:YSGG laser in straight and curved roots*. 2006.
  - Demonstrates feasibility of laser-assisted canal preparation.
- Matsuoka E, et al. *Morphological study of Er,Cr:YSGG laser for root canal preparation*. 2005.
  - Shows laser capability for shaping and modifying canal walls.
- Minas K, et al. *Evaluation of Er,Cr:YSGG laser in root canal preparation (in vitro studies)*. 2009–2010.
  - Confirms ablation capability and interaction with dentin.

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6. Laser-Assisted Obturation & Sealer Penetration

- Varella CH, Pileggi R. *Obturation of root canal system treated by Er,Cr:YSGG laser irradiation*. J Endod. 2007.
  - Laser-treated canals demonstrated **greater obturation of accessory canals and isthmuses**, suggesting improved 3D sealing.

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7. Bond Strength & Post Retention

- Quinto J Jr, et al. *Evaluation of intra root canal Er,Cr:YSGG laser irradiation on prosthetic post adherence*. J Prosthodont Res. 2017.
  - Laser treatment improved bond strength of certain resin cements to dentin.
- Mohammadi N, et al. *Effect of Er,Cr:YSGG pretreatment on bond strength of fiber posts*. 2013.
  - Supports improved adhesion following laser treatment.
- Parcina Amizic I, et al. *Influence of laser-activated irrigation on bond strength of fiber posts*. 2016.
  - Laser activation enhances dentin surface conditions for bonding.

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8. Clinical Outcomes & Case-Based Evidence

- Martins MR, et al. *Outcome of Er,Cr:YSGG laser-assisted treatment of teeth with apical periodontitis*. 2014.
  - Randomized clinical data supporting improved healing outcomes with laser-assisted protocols.

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- Martins MR, et al. *Rationale for using a double wavelength laser in endodontics*. 2018.
    - Provides clinical framework for laser integration into endodontic workflows.
- Polonsky M. *Successful endodontic treatment using Er,Cr:YSGG and diode lasers: 3-year follow-up case report*. Oral Health. 2017.
    - Demonstrates clinical success in complex cases using laser-assisted disinfection.

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9. Safety, Thermal Effects & Tissue Interaction

- Zhu L, et al. *Thermal simulation of Er,Cr:YSGG laser in root dentin*. 2009.
    - Identifies safe operating parameters to avoid thermal damage while achieving disinfection.
- Wallace JA. *Effect of Waterlase laser on integrity of root apices*. Aust Endod J. 2006.
    - Demonstrates minimal cracking and safe hard tissue interaction during endodontic procedures.
- Ishizaki NT, et al. *Thermographic and morphological studies of Er,Cr:YSGG laser irradiation on root canal walls*. 2004.
    - Confirms controlled thermal effects and surface modification.