

A COMPARATIVE STUDY OF MICROLEAKAGE OF OBTURATED ROOT CANALS AFTER DISINFECTION WITH Nd:YAG LASER, PDT AND NaOCL AND EDTA

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SUMMARY

Endodontic therapy consists of cleaning and shaping the root canal system, removing organic debris and sealing the intracanal space with permanent filling materials. The use of lasers and photo-activated disinfection in endodontic treatment may cause morphological changes in the dentin of the root canal. The purpose of this laboratory study was to compare the degree of hermetic obturation of root canals after endodontic treatment and disinfection with Nd: YAG laser, photo-activated disinfection with FotoSan, NaOCL 2,5% + EDTA 17% and obturated with AH 26 sealer and gutta-percha. For the laboratory study we used 30 freshly extracted single rooted teeth. After that the teeth are divided into three groups, depending on the mode of additional root canal disinfection and obturated. The leakage was shown using dye penetration test with methylene blue for a period of 3 days at 37°C. Microleakage was observed in all studied groups.

Key words: endodontic therapy, microleakage, dental laser, photo-activated disinfection

INTRODUCTION

Endodontic therapy consists of cleaning and shaping the root canal system, removing organic debris and sealing the intracanal space with permanent filling materials. Microorganisms located in root canals can stay active in dentinal tubules even after abundant rinsing. The obturation must seal the pulp space both apically and laterally, thus preventing further apical irritation from either incomplete elimination of bacteria and their products or communication between apical tissues and oral cavity. The use of lasers and photo-activated disinfection in endodontic treatment may cause morphological changes in the dentin of the root canal. Ultrastructural changes in dentin depend on the parameters used in the laser system, such as output power, frequency and mode of application [1, 2, 3, 4].

OBJECTIVE

The purpose of this laboratory study was to compare the degree of hermetic obturation of root canals after endodontic treatment and disinfection with Nd: YAG laser, photo-activated disinfection with FotoSan, NaOCL 2,5% + EDTA 17% and obturated with AH 26 sealer and gutta-percha.

MATERIALS AND METHODS

For the laboratory study we used 60 freshly extracted single rooted teeth. The coronal part of the teeth is removed, so as to remain 15 mm of root canals. All teeth are prepared with crown-down technique with K3 - endodontic files (Kerr Maillefer Instruments SA, Switzerland). The teeth are prepared to No. 30/06 taper. After each canal instrument the root canals are rinsed with 10 ml 2,5% NaOCl and 10 mL 17% EDTA. After that the teeth are divided into three groups, depending on the mode of additional root canal disinfection: I-group (20 teeth) – root canals are treated with photo-activated disinfection with FotoSan with diode laser with - 660 nm; 100 mW and 200 micrometres optical fiber; II-group (20 teeth) – root canals are treated with Nd: YAG laser-AT Fidelis, Slovenia; optical fiber of 200 micrometers and the following parameters: 1,5 W, 15 Hz; III-group (20 teeth) – root canals are rinsed with 10 ml 2,5% NaOCl and 10 mL 17% EDTA. After that the teeth are dried with sterile paper points and obturated with gutta-percha and AH26 sealer by warm condensation. After that the teeth are isolated with nail varnish, leaving free apical 5mm. The leakage was shown using dye penetration test with methylene blue for a period of 3 days at 37°C. Teeth roots were sectioned longitudinally along canal centers in buccolingual direction and the degree of leakage was measured under stereo microscope at 25x magnification (Carl Zeiss) (penetration in mm).

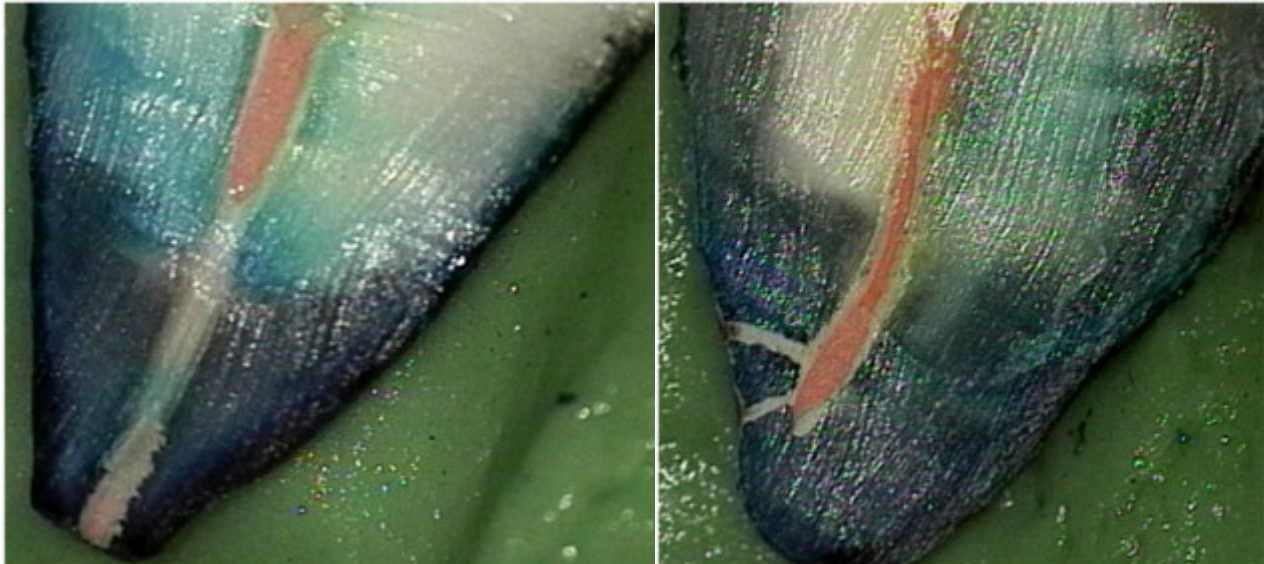
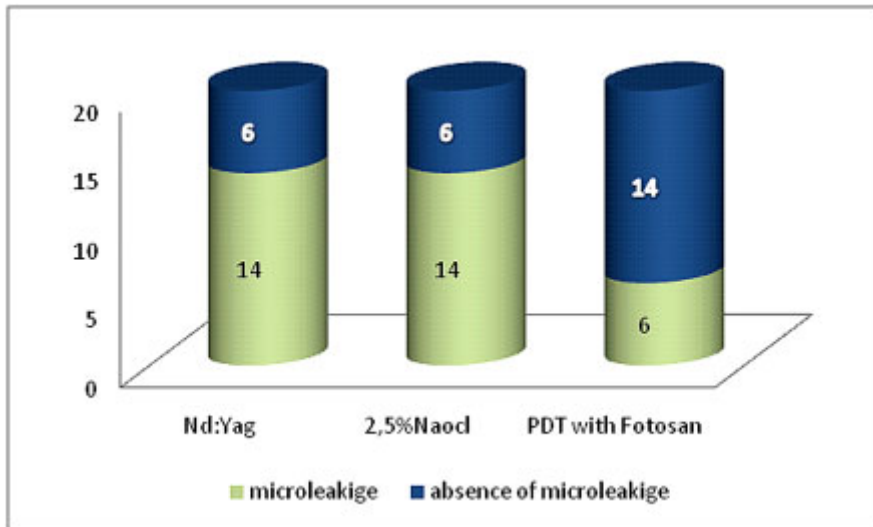
RESULTS

The extent of dye penetration was measured in millimeters in all aspects of the root canal. Microleakage was observed in all studied groups. It has been established a significantly higher proportion of root canals treated with PDT with Fotosan with missing microleakage in comparison

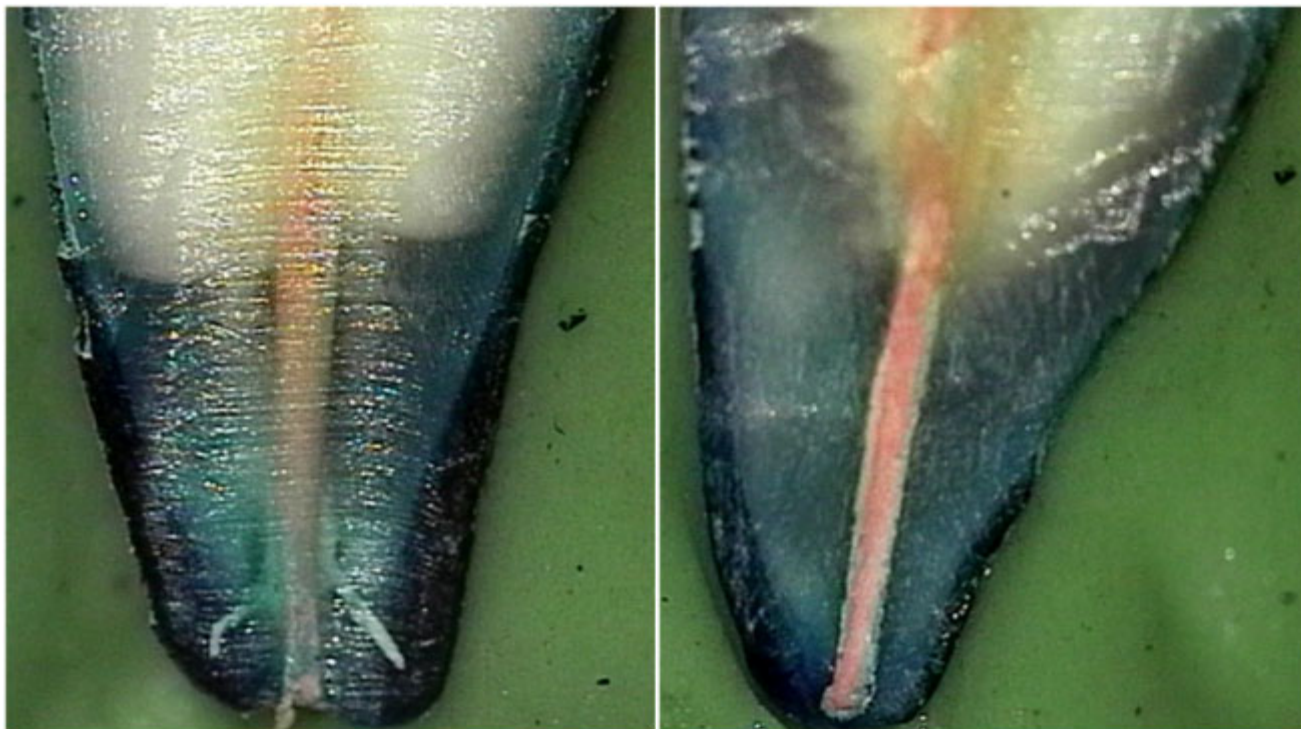
to other methods of treatment (χ^2 , $p=0,012$).

The results are presented in Fig 1. Data were analyzed statistically using SPSS 17.0.1., Analysis of variance (ANOVA), Chi square test and Graphic analysis – for visualizing the results. The level of statistical significance was $P < 0.05$.

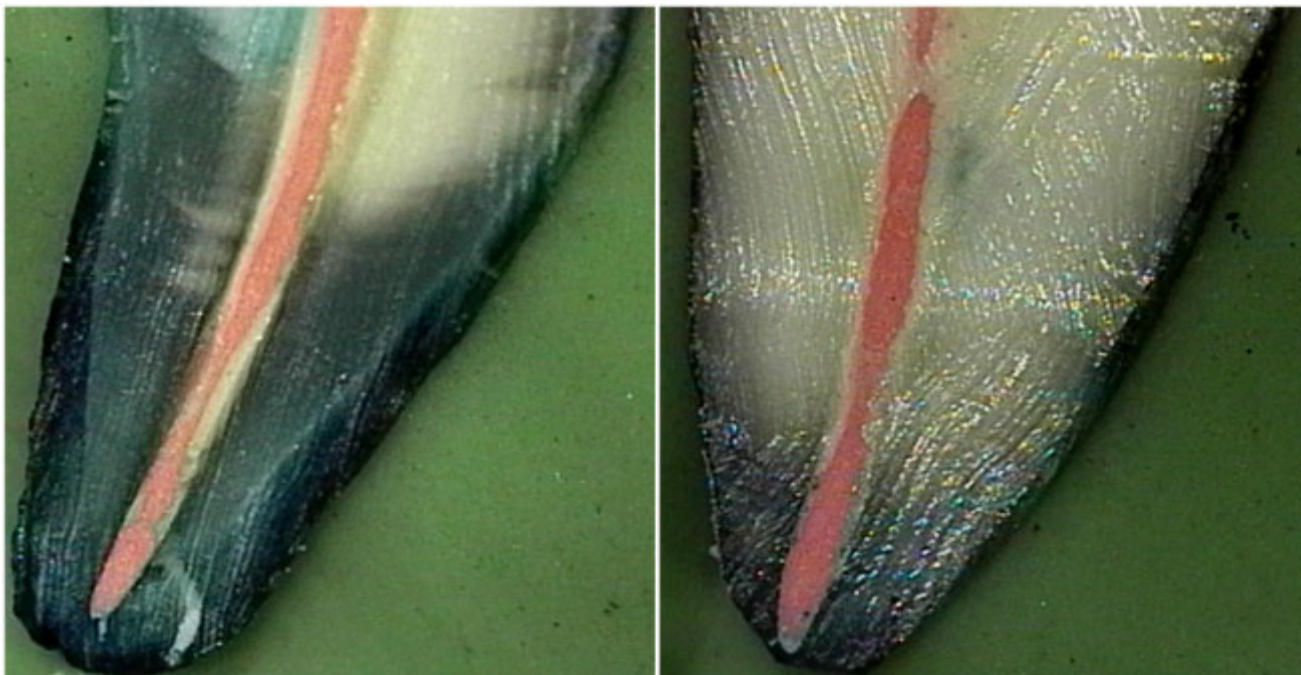
Fig. 1. Microleakage after disinfection with Nd:YAG laser, PDT with Fotosan and NaOCL and EDTA



Root canals treated with Nd:YAG laser



Root canals treated with 2,5% NaOCl and 17% EDTA



Root canals treated with photo-activated disinfection with FotoSan

DISCUSSION

Three-dimensional sealing of the root canal system is one of the main goals of endodontic treatment and is essential for prevention of canal re-infection and maintenance of healthy periapical tissues. The smear layer resulting from root canal instrumentation acts as a physical barrier interfering with the adaptation and penetration of the sealer into the dentinal tubules, which might contribute for increasing micro leakage occurrence [5, 6]. In our study less micro leakage showed the teeth treated with photo-activated

disinfection. Probably the uniform roughened surface of dentin walls after lasing of the smear layer appears to favor cement adhesion, and therefore improves marginal sealing.

CONCLUSION

The treatment of root canals with PDT with FotoSan provides less microleakage compared with two other methods of disinfection. After application of Nd: YAG laser is appropriate to rinse the root canal with a solution of 17% EDTA for better elimination of the smear layer.

REFERENCES:

1. Moura-Netto C, Pinto T, Davidowicz H, de Moura AA. Apical leakage of three resin-based endodontic sealers after 810-nm-diode laser irradiation. *Photomed Laser Surg.* 2009 Dec;27(6):891-894. [[PubMed](#)] [[CrossRef](#)]
2. Dultra F, Barroso JM, Carrasco LD, Capelli A, Guerisoli DMZ, Pecora JD. Evaluation of apical microleakage of teeth sealed with four different root canal sealers. *J Appl Oral Sci.* 2006 Sep-Oct;14(5):341-345. [[CrossRef](#)]
3. Depraet FJ, De Bruyne MA, De Moor RJ. The sealing ability of an epoxy resin root canal sealer after Nd:YAG laser irradiation of the root canal. *Int Endod J.* 2005 May;38(5):302-9. [[PubMed](#)] [[CrossRef](#)]
4. Gergova R, Georgieva Tz, Angelov I, Mantareva V, Valkanov S, Mitov I, et al. Photodynamic therapy with water-soluble phtalocyanines against bacterial biofilms in teeth root canals. *Proc. SPIE 8427, Biophotonics: Photonic Solutions for Better Health Care III*, 842744 (June 1, 2012); [[CrossRef](#)]
5. Meire M, Mavridou A, Dewilde N, Hommez G, De Moor RJ. Longitudinal study on the influence of Nd:YAG laser irradiation on microleakage associated with two filling techniques. *Photomed Laser Surg.* 2009 Aug;27(4):611-6. [[PubMed](#)] [[CrossRef](#)]
6. Sousa-Neto MD, Silva Coelho FI, Marchesan MA, Alfredo E, Silva-Sousa YT. Ex vivo study of the adhesion of an epoxy-based sealer to human dentine submitted to irradiation with Er: YAG and Nd: YAG lasers. *Int Endod J.* 2005 Dec;38(12):866-70. [[PubMed](#)] [[CrossRef](#)]

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