Vol. 12, No. 1, January - March 2020

COMPLETE HEALING OF A LARGE PERIAPICAL LESION FOLLOWING CONSERVATIVE ROOT CANAL TREATMENT IN ASSOCIATION WITH PHOTODYNAMIC THERAPY: A CASE REPORT WITH 5TH-YEAR FOLLOW-UP.

Cristian Giuroiu[1], Tudor Hamburda[1], Anca Melian[1]*, Claudiu Topoliceanu[1]*, Sorin Andrian[1], Mihaela Salceanu[1]

[1.]University of Medicine and Pharmacy ,,Grigore T. Popa" –Iassy, Romania, Faculty of Dental Medicine, Department of Odontology, Periodontology and Fixed Prosthesis.

*Corresponding author: *1.* **Anca Melian *** Department of Odontology, Periodontology, and Fixed Prosthesis, Faculty of Dental Medicine, University of Medicine and Pharmacy "Grigore T. Popa", 16 University Street, 700115, Iaşi, Romania.

2. **Claudiu Topoliceanu *** Department of Odontology, Periodontology, and Fixed Prosthesis, Faculty of Dental Medicine, University of Medicine and Pharmacy "Grigore T. Popa", 16 University Street, 700115, Iaşi, Romania.

Abstract

The aim of this case report was to assess the effectiveness of antimicrobial photodynamic therapy when associated with non-surgical endodontic treatment of large periapical cyst. Case report: A 52-years-old female patient complained of sharp pain in the upper maxillary anterior area of the mouth. The clinical exam showed for tooth 1.2. moderate dental dyschromia, slightly positive axial percussion and loss of hard bone substance of about 0,5 cm^2. As well as negative response to thermal tests. The non-surgical endodontic treatment was associated to photodynamic therapy performed by diode laser 808nm following the irrigation with. Theroot canals were filled with $Ca(OH)_2$ paste for 14 days. The paste was changed after 14 days, and the root canal photodynamic therapy was repeated. In the third session it was performed the definitive root canal filling and coronal-radicular reconstruction. Results: check-ups performed at 6 months, 12 months, 2 years and 5 years, demonstrated progressive healing of treated large periapical cyst, with total absence of signs or symptoms. Conclusion: the addition of photodynamic therapy to conventional endodontic treatment can increase the reduction of microbial load in the endodontic space and the long-term success rate in non-surgical treatment of large periapical cysts.

Key words: *nonsurgical root canal treatment, perapical kyst, photodinamic therapy, root canal disinfection, complete healing.*

Introduction

Large periapical cyst lesions represent a challenge both for general dental practitioners and endodontics specialists.

The diagnostic of periapical cyst can be made based on the size of lesion (>200mm^2), the involvement of one or more non-vital teeth, circumscribed, well-defined radiolucent area bound by a thin radiopaque line, and the presence of straw-colored fluid during aspiration or drainage through the root canal system (1). The infection of the canal systems has a major role in the onset and progression of the cyst periapical lesions (2). Regarding the therapeutic approach, at baseline it is based

on cleaning and shaping of root canals system, to eliminate necrotic tissue and infective bacteria (3). The extension of periapical lesion and the type of periapical cysts influence the success of therapy. The non-surgical approach can be used for large periapical lesions of inflammatory origin and apical true cysts and should be treated initially with a nonsurgical approach (4). The non-surgical therapeutic management of these periapical lesions can include decompression technique, aspiration-irrigation technique, endodontic treatment with calcium hydroxide paste, lesion sterilization by various techniques, repair therapy and the apexum procedure (5). When non-surgical endodontic therapy fails, the traditional surgical endodontic therapy (apical resection) is recommended (6). Literature data show that microsurgical endodontic treatment is a is more effective than conventional non-surgical endodontic treatment (7, 8). Monitoring of large periapical cysts is essential, as a research found within 2 years of non-surgical endodontic treatment, complete healing in 73.8% and incomplete healing in a further 9.5% of cases (9). The use of CBCT is essential as it contributes to the therapeutic success, as a tool for accurate proper diagnosis, endodontic treatment, surgical stage as well as follow-up (10).

Despite the effectiveness of surgical endodontic approach in the treatment of large periapical cysts, endodontic specialists must consider dentists the patients' demands for less trauma and discomfort offered by non-surgical approach (11). In this context, photodynamic therapy was proposed to increase the effectiveness of root canal decontamination.

Case report

Anamnesis. C.C., female, age 52, din Iași, referred from general dentist to endodontic specialist for 1.2 endodontic treatment.

Patient simptomatology. Patient complains for deep carious cavity located near to 1.2. composite resin filling.

Medical history. Patient smokes 30-35 cigarettes daily; not affected by systemic diseases

Dental history. Tooth 1.2. was treated for medium dental caries located in mesial surface; a year ago secondary dental caries located in mesial area was observed by patient. Patient complains by pain spurts (sharp, continuous, spontaneous pain that is not arrested after administration of analgesics). The patient took antibiotics (1000 mg amoxicilline at every 12 hours for 5 days).

Clinical exam. The intraoral exam recorded numerous esthetics fillings located to anterior teeth as well as plaque and tartar accumulation to anterior mandibular dental group.

Causative tooth and adjacent teeth. Neighboring tooth 1.3. was radicular filled eight years ago and 1.4. was coronal-radicular reconstructed in classic way and coronal filled with composite resin. Second maxillary premolar 1.5. is unaffected and 1.6. presents a radicular fill and coronal-radicular reconstruction (IOS) covered by prosthetic crown. a coronal-root reconstruction with a viper wire was applied after root obturation and coronary obturation with physiognomic material. The second maxillary premolar of quadrant I is integral

and 1.6. a root obturation is observed with a coronal-root reconstruction - IOS covered with ceramic crown. Teeth had no pathological dental mobility. The exploration of the gingival sulcus reported a depth between 0.3 mm and 0.5 mm (circumferential) in neighboring teeth with 1.2. At inspection the tooth 1.2. presents moderate dental dyschromia. The axial percussion was slightly positive and on palpation in the buccal vestibule a loss of hard bone substance of about 0,5 cm^2 was observed. The responseto the vitality tests (electric) to 1.2. was negative and to 1.1. and 1.5. was positive – ***figure 1***.

Diagnostic and treatment plan. Chronic periapical periodontitis- periapical cyst 1.2.

Figure 1. Baseline radiographic aspect. Chronic periapical periodontitis - periapical cyst 1.2.

Treatment options:

- non-surgical endodontic treatment and esthetic coronal filling;
- surgical endodontic treatment (periapical resection) and esthetic coronal filling;
- wait-and-see attitude;
- dental extraction.

Plan for endodontic treatment:

The dental prognostic was poor due to the aggravation of endodontic pathology. The patient demands the tooth preservation while avoiding surgical endodontic treatment. The proposed non-surgical endodontic treatment had favourable effects and positive prognostic on medium term.

The dental extraction of tooth 1.2. would impaire the esthetics, favourises extrusion of 3.2., the closure of interdental space by 1.3. and would impose high costs by implant therapy.

The wait-and-see attitude was discussed with patient with their negative consequences (the extension of periapical lesion, the decrease of tooth implant level, the extension of the infection area to ORL, halitosis).

Figure 2. Rx. 14 days after the first session of endodontic treatment associated to laser decontamination and root canal filling with temporary $Ca(OH)_2$ paste.

Stages of endodontic treatment:

First session:

- management of periodontal support (supra and subgingival descaling, prophy-jet, tooth brushing instructions, rinsing with antibacterial solutions, interdental flossing);
- preliminary endodontic treatment such as: isolation of the operating field with rubber dam; determination of the working length – 22 mm with apex locator (Raypex, VDW), mechanical-chemical debridement – preparation of the root canal to the apical foramen with the completion of the apical stop (dimension 35-40 Kerr and Haedstrom files using Crown Down technique), use of EDTA 17% Cerkamed, irrigation with 20 ml of 3% soadium hypochlorite, each intracanal irrigation was performed concomitant with antimicrobial photodynamic therapy through the debridemnt function CW 2 Watts (wavelength working beam: 8-8 nm $^{+}/_{-}$ 5 nm, Sol, Denmat USA – ***figure 3***).

Figure 3. Dental laser Sol, Denmat USA.

An optical fiber 400 μm in diameter was inserted into the root canal 3 mm short of the working length. The irradiation was repeated four times at 15-s intervals. The end of chemical treatment was followed by irrigation with EDTA 17% for 2 minutes. This stage was followed by 15 second of photodynamic therapy alternatively in continuous mode CW-2W and pulse mode-1,5 W in coronal-apical direction (circumferential). At the end of therapeutic session the root intracanal space was filled with temporary medication $Ca(OH)_2$ paste for 14 days – ***figure 2***.

Second session:

-removal of the $Ca(OH)_2$ paste was performed with ultrasonic activated

isopropyl alcohol with Endoactivator (Dentsplay Maillefer) for 3 minutes, irrigation with physiological serum 0,9% and application of 2 minutes of EDTA 17% Cerkamed. The treatment was repeated with size 35-40 Kerr and Haedstrom files to the apical stop; the paper cones (0,4% tapered) were used to dry the root canal;

-the definitive root filling was performed by using vertical compaction technique of warm gutta percha (Fast Fill System, Eighteeth China) associated with a bio-ceramic sealant Bio-C Sealer (Angelus, Brazil);

-temporary coronary filling was performed with Dent-a-Cav (W-P Dental) followed by a dental control x-ray;

-the end of the therapeutic session was followed by application of an intracanal glass fiber and coronary reconstruction with a composite resin-***figure 6***;

-check-ups were performed to evaluate the signs and symptoms of periapical healing by clinical and radiographic exams of the patient at 6 months, 12 months, 2 years and 5 years – ***figure 7***.

Endodontic treatment

Making of the cavity access:

It was first achieved by removing the coronary filling and the carious dentin to 1.2. A rubber dam was applied to isolate the operating field at 1.2.

Intracanal modeling and decontamination

1. accomplishing the access path, by removing the esthetic coronary filling that obstructs the correct approach of the pulp chamber and the canal orifice;

2. use of Gates-Gliden drills no. 4, 3, or 2 for enlargement of coronal third of the root canal entrance hole in the root canal followed by irrigation with saline (Medimfarm 90 mg / 10ml) - 5 ml;

3. broadening of medium third to apical third, using endodontic files while decreasing size + irrigation with physiological serum (Medimfarm 90 mg / 10ml) - 5 ml;

4. exploration of the root canal to the apical foramen with low diameter endodontic files (no. 10 or 15) in order to establish the working length; X-ray and apex locator (Raypex, VDW®) were used to determine the working length (1.2. - 22 mm working length) + physiological irrigation (Medimfarm 90 mg / 10ml) - 5 ml as accurately as possible;

5. manual instrumentation of the canal throughout the working length with files of increasing diameter, in order to create the apical stop + irrigation with physiological serum (Medimfarm 90 mg / 10ml) + sol EDTA 17% Cerkamed®.

6. the use of endodontic files with large diameter into the coronary area of the root canal and its instrumentation until the sensation of resistance to the apical area + irrigation with EDTA 17% Cerkamed® + irrigation with saline (Medimfarm 90 mg / 10ml).

7. the change of endodontic file with the next file with smaller size and repeating of the maneuver moving towards the apical; the removal of endodontic file from root canal + irrigation with saline (Medimfarm 90 mg / 10ml) + irrigation with EDTA 17% Cerkamed® + irrigation with saline (Medimfarm 90 mg / 10ml) + irrigation with 3% sodium hypochlorite Cerkamed®, with 20 ml.

8. determination of the final size for the preparation of the root canal apical third + irrigation with 3% sodium hypochlorite

Cerkamed®, with 20 ml concomitantly with antimicrobial photodynamic therapy by using debridement function in continuous mode CW 2 Watts (wavelength working beam: 808 nm +/- 5 nm, SOL , Denmat®-USA) an optical fiber 400 μm in diameter was inserted into the root canal 3 mm short of the working length. The irradiation was repeated four times at 15-s intervals.

9. completing and finishing the preparation to obtain the desired conical shape.

10. at the end of the chemical treatment was applied for 2 minutes EDTA 17%. In dried root canals was used for 15 seconds CW-2W antimicrobial photodynamic therapy alternatively in continuous mode and pulse mode -1.5 W in coronal-apical direction (circumferential). At the end of therapeutic session,the root canal was dried with VDW paper cones (0,4% tapered) and then the root canal was filled with temporary $Ca(OH)_2$ paste was for 14 days, followed by temporary coronary filling.

Definitive root canal filling

Two weeks later, bad smelling secretion it was observed inside the root canal. Inside the root canal it was applied a second intracanal medication $Ca(OH)_2$ paste for another 26 days – ***figure 4***. After one month, the root canal tooth was cleaned and irrigated with NaOCL 3% and EDTA 17%. The therapeutic session included a session of photodynamic therapy by using alternatively the debridement function in continuous mode CW 2 Watts and pulse mode - 1,5 W in coronal-apical direction for 3 sessions of 15 seconds. At the end of the therapeutic session the root canal was filled by vertical compaction of warm gutta percha technique (Fastfill, EighteethChina) associated with bioceramic cement Bio-C Sealer (Angelus, Brazilia) – ***figure 5***.

Figure 4. Rx. 30 days after the first session of intracanal temporary filling.

Figure 5. Rx. 40 days following the endodontic therapy.
Partial regeneration of periapical bone. Root canal filling.

Figure 6. Intracanal insertion of glass fiber extended to apical third of root canal. Rx 60 days following the endodontic therapy.

Coronal restoration

The esthetic definitive coronal restoration was performed following the insertion of glass fiber in the root canal.

Figure 7. Control Rx 5th years after definitive endodontic treatment.
The periapical bone was completely regenerated to 1.2.

Discussions

The root canal decontamination relate both to mechanical treatment and the degree of decontamination of endodontic space provided by chemical irrigation agents and $Ca(OH)_2$ paste. Literature data are controversial regarding the resistance of some microorganism against calcium hydroxide. One study reported effective antibacterial action of irrigation with sodium hypochlorite and intracanal filling with $Ca(OH)_2$ paste (12). However, other studies found resistance against $Ca(OH)_2$ of bacteria such as: *F. nucleatum ssp. Vincentii, Enterococcus faecium* (13), *Enterococcus faecalis* (14, 15). In this context, both the results of our case presentation and those provided by some research groups showed the benefits of photodynamic therapy (PDT) in the treatment of large periapical lesions. Garcez et al (2008) compared the degree of root canals decontamination obtained by conventional chemo-mechanical manual endodontic therapy with a group of patients treated by combined conventional

endodontic therapy and photodynamic therapy (16). The effectiveness of PDT was proved as conventional endodontic therapy alone conducted to 87% reduction in bacteria while its combination with PDT was followed by 95% reduction in bacteria. The microbiological findings were associated to 32% higher reduction of radiographic transparence in the lesion area in PDT group. Asnaashari et al (2017) compared the antimicrobial effect of photo activated disinfection when using toluidine blue as photosensitizer and a LED lamp following conventional endodontic treatment, with calcium hydroxide therapy *in vivo*(17). Comparing with calcium hydroxide therapy, photodynamic therapy provided greater reduction of *E. faecalis* number in the infected root canals. A review performed by Siddiqui et al (2013) found that 20 studies reported PDT as more effective in eliminating *E. faecalis* from infected root canals and only 4 studies reported that conventional root canal decontamination is more efficient in elimination of *E. faecalis* than PDT (18). Continuity with regard to the prophylaxis of general and oral conditions in the lasi County in both rural and urban areas is a must, health education being essential for improving population health (19, 20).

Conclusions.

The success of this clinical case as well as literature data sustain the addition of photodynamic therapy to conventional endodontic treatment by chemical antimicrobial agents to increase the reduction of microbial load in the endodontic space favoring the regression of the periapical alterations providing excellent clinical and radiographic results in short time.

References

1. Eversole LR. Clinical outline of oral pathology: diagnosis and treatment. 2nd ed. Philadelphia: Lea and Febiger; 1984. pp. 203–259.
2. Croitoru IC, Craitoiu S, Petcu CM, et al.: Clinical, imagistic and histopathological study of chronic apical periodontitis. Rom J MorpholEmbryol. 2016, 57:719-728.
3. Abbott PV: The periapical space--a dynamic interface. Aust Endod J. 2002, 28:96-107.
4. Santos Soares SM, Brito-Junior M, de Souza FK, et al.: Management of cyst-like periapical lesions by orthograde decompression and long-term calcium hydroxide/chlorhexidine intracanal dressing: a case series. J Endod. 2016, 42:1135-41.
5. Sood N, Maheshwari N, Gothi R, Sood N. Treatment of Large Periapical Cyst Like Lesion: A Noninvasive Approach: A Report of Two Cases. Int J Clin Pediatr Dent. 2015;8(2):133–137.
6. Lin LM, Ricucci D, Lin J, Rosenberg PA: Nonsurgical root canal therapy of large cyst-like inflammatory periapical lesions and inflammatory apical cysts. J Endod. 2009, 35:607-15.
7. Kang M, In Jung H, Song M, Kim SY, Kim HC, Kim E: Outcome of nonsurgical retreatment and endodontic microsurgery: a meta-analysis. Clin Oral Investig. 2015, 19:569-82.
8. Song M, Chung W, Lee SJ, Kim E: Long-term outcome of the cases classified as successes based on short-term follow-up in endodontic microsurgery. J Endod. 2012, 38:1192-6.
9. Calişkan MK. Prognosis of large cyst-like periapical lesions following nonsurgical root canal treatment: a clinical review.IntEndod J. 2004 Jun; 37(6):408-16.
10. Walewski LA, Bin LR, Veltrini VC, Pavan Aj. Role of cone beam computed tomography in evaluation

of a large cystic lesion. Journal of clinical and diagnostic research 2018; 12 (12). doi: 10.7860/jcdr/2018/37397.12345.

11. Fernandes M, de Ataide I.Nonsurgical Management of Periapical Lesions. J Conserv Dent. 2010 Oct; 13(4):240-5.
12. Valera MC, Silva KCG da, Maekawa LE, Carvalho CAT, Koga-Ito CY, Camargo CHR, et al. Antimicrobial activity of sodium hypochlorite associated with intracanal medication for Candida albicans and Enterococcus faecalis inoculated in root canals. J Appl Oral Sci. 2009;17(6):555–9.
13. Ferreira NS, Martinho FC, Cardoso FGR, Nascimento GG, Carvalho CAT, Valera MC. Microbiological profile resistant to different intracanal medications in primary endodontic infections. J Endod. 2015 Jun;41(6):824-30.
14. Rosa RA da, Santini MF, Figueiredo JAP de, Visioli F, Pereira JR, Vivan RR, et al. Effectiveness of photodynamic therapy associated with irrigants over two biofilm models. PhotodiagnosisPhotodynTher. 2017;20:169–174.
15. Tonea A, Badea M, Oana L, Sava S, Vodnar D. Antibacterial and antifungal activity of endodontic intracanal medications. Clujul Med. 2017;90(3):344-7.
16. Garcez Aguinaldo S., Nunez Silvia C., Hamblin Michael R. et al. Antimicrobial comparison on effectiveness of endodontic therapy and endodontic therapy combined to photo-disinfection on patients with periapical lesion. A 6-month follows up. Conference: Conference on Mechanisms for Low-Light Therapy III Location: San Jose, CA. 2008. Mechanisms for low-light therapy III. Book Series: Proceedings of SPIE; Volume: 6846; Article Number: 68460G.
17. Asnaashari M, Ashraf H, Rahmati A, Amini N. A comparison between effect of photodynamic therapy by LED and calcium hydroxide therapy for root canal disinfection against Enterococcus faecalis: A randomized controlled trial. Photodiagnosis Photodyn Ther. 2017 Mar;17:226–32.
18. Siddiqui SH, Awan KH, Javed F. Bactericidal efficacy of photodynamic therapy against Enterococcus faecalis in infected root canals: a systematic literature review. Photodiagnosis Photodyn Ther. 2013 Dec;10(4):632-43.
19. Forna NC, Dascalu C, Forna D, Antohe ME. Incidence and prevalence of dental-periodontal conditions and edentation in Moldavia. Rev Med Chir Soc Med Nat Iasi. 2013 Jan-Mar; 117(1): 205-211.
20. Scutariu MM, Ciurcanu OE, Forna DA, Forna NC. Importance of dental maxillofacial aesthetics in dental therapy. Rev Med Chir Soc Med Nat Iasi. 2016 Oct-Dec; 120(4): 926-931.