The influence of calcium hydroxide paste change on repairing of extensive periapical lesions: Cases report

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ABSTRACT

Introduction: In this paper we describe the endodontic treatment of teeth with extensive periapical lesions through case reports. **Objective:** Analyze the effectiveness of change the intracanal medication with calcium hydroxide, reducing or eliminating the surgical procedures and still observe, by follow up, the periapical repair. **Results:** After clinical and radiographic examination and found the need for endodontic treatment, was performed the coronal opening, irrigation with sodium hypochlorite 1% and biomechanical preparation with manual endodontic files. The EDTA 17% was used for 3 minutes with manual shaking before application of the medication in all the sessions as well as all sessions before the final filling. Thus, the medication with calcium hydroxide and propylene glycol was inserted in the root canal and replaced whenever the medication had been partly resorbed. After the beginning of periapical repair, the filling of the root canals was performed by the technique of horizontal and vertical condensation and radiographic controls were performed according to the availability of the patients. **Conclusion:** In these case reports, the renovation of calcium hydroxide as root canal dressing showed efficient in the treatment of extensive chronic periapical lesions, repairing the bone and periodontal tissues and eliminated the need for surgical intervention.

Keywords: Calcium hydroxide. Periapical abscess. Propylene glycol.

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Introduction

In the last decades, the evolution of biological knowledge has been a remarkable phenomenon in healthcare. This development occurs in both the scientific and technological areas and intensifies in dentistry with the enhancement of existing resources and creating new ones, whose goal is the preservation of the dental element in its original position, allowing it to exercise its functions accordingly.[1] According to Dotto et al,[2] endodontics aims to cleaning, disinfecting and shaping of the root canal system to obtain the desired sanitization and provide conditions for the involved tissues to return to its normal state maintaining the health of the periapical tissue.

Specifics studies show that bacteria represent one of the main factors of the pulp changes,making it necessary to use antimicrobial agents during endodontic therapy.[3] However, other studies show that dental trauma, extensive restorations and periodontal lesions also contribute to these pulp changes.[4,5,6]

The biomechanical preparation, aided by copious irrigation, represents the stage of greatest impact on the root canal microbiota, but its antiseptic efficiency is partial and temporary. The microorganisms presents in the root canal system, represented by the secondary and accessories canals, isthmus, dentinal tubules, apical cemental gaps or cementoplasts must be eliminated or inactivated, whereas recolonize the root canals after biomechanical preparation[7] and potentially after the complete filling.[8]

Within the biological advances of endodontic treatment, there is a greater concern in selecting substances that provide the best type of repair. Thus,add with the need of decontamination, not only dentinal canal but also cemental canal, the use of an intracanal medication has been considered important by some researchers.[9] These studies analyzed histologically the results and showed that it favors the periapical repair. Thus, the intracanal medication most widely used since 1920 is the calcium hydroxide, associated with various vehicles, which requires cleaned canals and biomechanically prepared for effectiveness.

The calcium hydroxide medication has been prepared with various vehicles, such as methyl cellulose aqueous solution, distilled water, saline solution, anesthetic, polyethyleneglycol, propylene glycol, parachlorophenol, olive oil, lipiodol.[10]

Different methods have been described to carry the paste to the root canal. Some include the use of syringes with needles of different calibres,[11] guns[12] or amalgamators with endodontics condensers.[13] Others use Lentulo, McSpadden or similar,[14] endodontic instruments and gutta-percha.[15]

Despite the calcium hydroxide being used since 1920, its mechanism of action was first described by Holland et al,[16] in 1978, which claimed that the calcium hydroxide in contact with periapical tissue, which has water and carbon dioxide, dissociates into calcium and hydroxyl ions. The calcium ions react with the carbon from tissues, originates calcium carbonate in the form of calcite crystals. And this mechanism is complemented by Seux et al, [17] in 1991, who claim that these granulations has a great accumulation of fibronectin that provides adhesion and cell differentiation with subsequent hard tissue deposition.

Therefore the calcium hydroxide biological action is closely related to the ionic dissociation in Ca++ and OH- that occurs in the presence of water and its high alkalinity, which allows change the dentin pH and preventing the survival of most endodontic microorganisms (bacteriostatic power promoted by enzymatic inhibition of these microorganisms).[18]

Therefore this study was conducted using clinical case reports, in order to verify the effectiveness of the intracanal medication with calcium hydroxidein extensive chronic periapical lesions, reducing or eliminating surgical procedures and still observe through follow up the periapical repair.

Case reports

Case 01

A 20-year-old girl was referred for endodontic treatment of teeth 11 and 12, in May 2002, by her orthodontist. During the interview there was no history of systemic disease, but in dental history, the patient reported being in orthodontic treatment and that about 5 years ago, had an accident with skateboard and broke the crown of these elements. At the time, after being examined by the dentist, there was no need of endodontic treatment, being realized only dental esthetics. The intraoral clinical examination showed absence of swelling, sinus, percussion or palpation pain, tooth mobility. The teeth did not respond

to pulp sensitivity tests and it was possible to note color change of dental crown. The periapical radiographs showed the presence of a periapical radiolucent, with approximately 20 mm, involving the apical third of both dental elements and suggested a clinical diagnosis of periapical chronic abscess (Fig 1A).

The patient was informed about the various treatments for this case and the option chosen was endodontic treatment without surgery with only frequent changes in intracanal medication in order to obtain periapical repair. Therefore, it was requested disrupting orthodontic treatment in these dental elements, i.e., it was not applied orthodontic force until it was observed early or complete repair of the periapical region.

After anesthesia, rubber dam and canals access, the shaping was done with manual endodontic files and sodium hypochlorite 1%. During the preparation the odontometry was performed (Figs 1B and C). Because it was a necropulpectomia case, then patency was done. After biomechanical preparation of each canal, it were dried with sterile paper cones and the EDTA 17% was used for 3 minutes, with manual agitation for better cleaning of the canals. After EDTA removal with new hypochlorite irrigation and new drying canals, a calcium hydroxide with propylene dressing was applied (Fig 1D), and that being replaced whenever it was radiographically verified that it had been partially removed.

After a period of 6 months it was radiographically observed early repair apical neoformation of periapical bone tissue. Then there was a last irrigation of the root canals with hypochlorite 1% and EDTA 17% as described above. In November 2002, the canals were filled with gutta-percha points (Figs 1E and F), and cement based on calcium hydroxide, by lateral condensation followed by vertical condensation (Fig 1G). The pulp chamber was cleaned and temporarily sealed with sterile cotton pellet and Coltosol, asking the patient to return to her dentist so that it accomplished the definitive coronal restoration after endodontic treatment.

After 3 months of the conclusion of the case, the patient was asked to perform the first follow up radiographic, to check the progress of periapical repair and restart orthodontic treatment. In the intraoral periapical radiograph was possible to observe the repair evolution (Fig 1H) and thus released the orthodontic treatment.

In the second control, after 6 years, the periapical repair was complete, but it was possible to observe a mesial apical resorption of the dental element #12, probably resulting from orthodontic treatment (Fig 1I).

In the third control performed after 9 years, beside total repairing, the root resorption present in tooth #12 had stabilized (Fig 1J).

Case 2

A 16-year-old patient attended the private practice with his legal guardian (biological father) in July of 2004, because his orthodontist asked him to perform endodontic treatment in teeth #21 and #22. During the interview, there was no history of systemic disease and in the dental history, the patient reported being in orthodontic treatment. The intraoral clinical examination showed absence of swelling, sinus, palpation or percussion pain, tooth mobility. The pulp sensitivity test showed negative results. In the radiographic periapical intraoral exam it was observed a periapical radiolucent with size approximately 16 mm involving the apical third of both dental elements, suggesting probable clinical diagnosis of chronic periapical abscess (Fig 2A).

The patient and the responsible were informed about the different ways to conduct this case, and it was chosen to perform endodontic treatment with regular change of calcium hydroxide dressing. For this case, it was also asked to the orthodontist to stop with the orthodontic forces on these dental elements until it was observed the start or complete repair of the periapical region.

After anesthesia, rubber dam and canals access, the shaping was done with manual endodontic files and sodium hypochlorite 1%. During preparation the odontometry was performed (Figs 2B and C). In this case it was also made apical patency after biomechanical preparation and before the insertion of each intracanal medication and filling procedures, each canal was dried with sterile paper points and flooded with EDTA 17%, for 3 minutes with manual agitation. After EDTA removal with new irrigation of hypochlorite and another canals drying, an intracanal medication composed with calcium hydroxide and propylene glycol was applied, being replaced whenever its resorption was determined radiographically (Fig 2D).

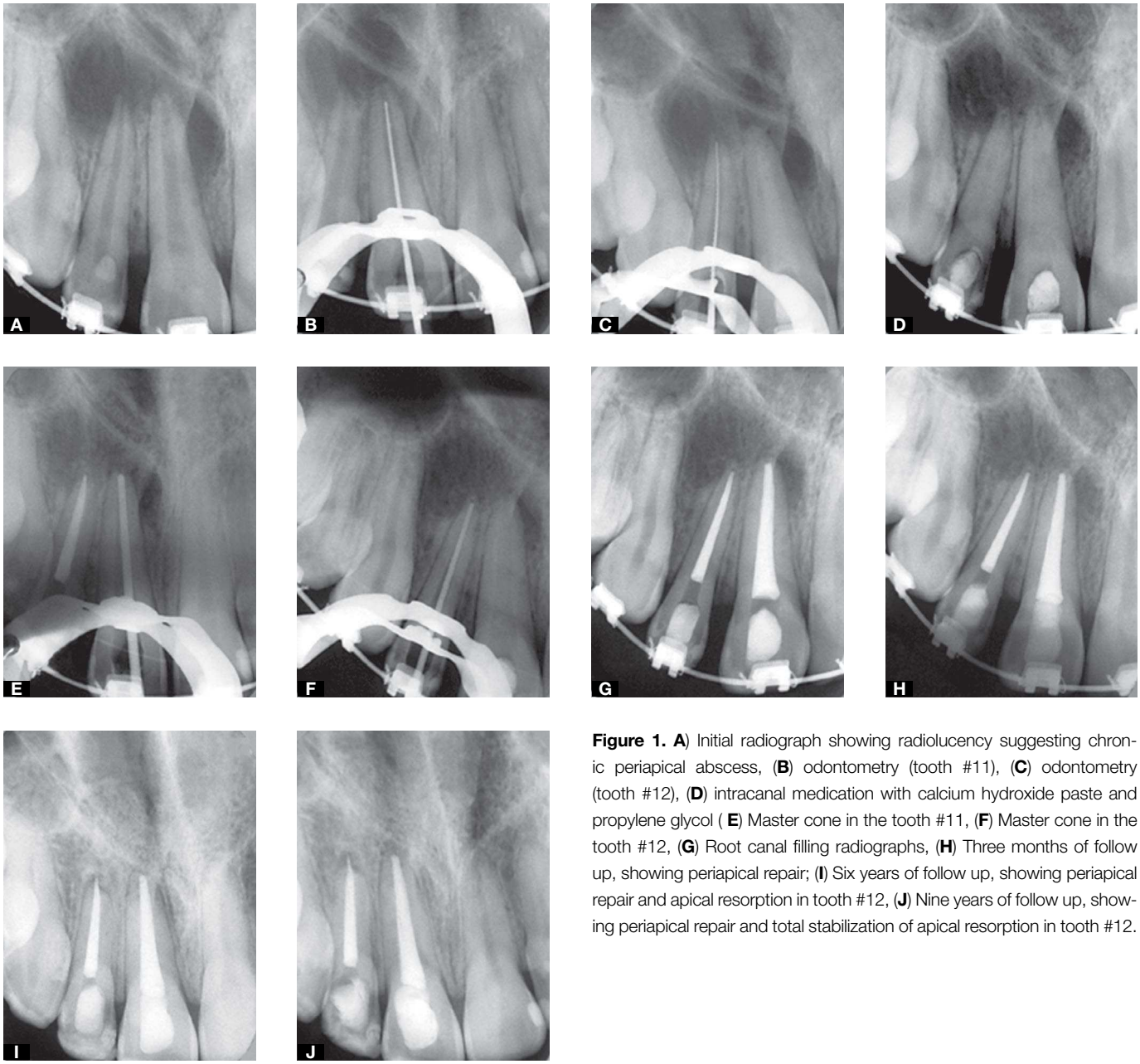

Figure 1. A) Initial radiograph showing radiolucency suggesting chronic periapical abscess, (**B**) odontometry (tooth #11), (**C**) odontometry (tooth #12), (**D**) intracanal medication with calcium hydroxide paste and propylene glycol (**E**) Master cone in the tooth #11, (**F**) Master cone in the tooth #12, (**G**) Root canal filling radiographs, (**H**) Three months of follow up, showing periapical repair; (**I**) Six years of follow up, showing periapical repair and apical resorption in tooth #12, (**J**) Nine years of follow up, showing periapical repair and total stabilization of apical resorption in tooth #12.

After a period of 6 months a partial healing evolution of the apical third was seen. The root canal filling was performed in January 2005, through gutta-percha points and calcium hydroxide cement (Figure 2E and 2F), by lateral condensation followed by vertical condensation vertical (Fig 2G). The pulp chamber was cleaned and temporarily sealed with sterile cotton pellet and Coltosol, asking the patient to return to his dentist so that it accomplished the definitive coronal restoration after endodontic treatment.

In the first follow up performed after 3 years, the periapical repair was complete (Fig 2H).

In the second follow up performed after 6 years, the periapical repair was complete (Fig 2I).

Discussion

In necro-pulpectomy cases usually the pulp stub is necrotic or severely compromised and therefore the main concern during the treatment is bacteria elimination of dentinal tubules and in the periapical zone.[19]

To complement the root canal disinfection during biomechanical preparation it was used sodium hypochlorite 1% as auxiliary chemical substance irrigation, because according to Star et al,[20] the hypochlorite has antimicrobial properties, ability to dissolve organic tissues as well as low surface tension. But there are studies that use chlorhexidine gel as auxiliary chemical substance due to its substantivity properties, antimicrobial properties, broad spectrum of action and good lubrication of the root canal.[21]

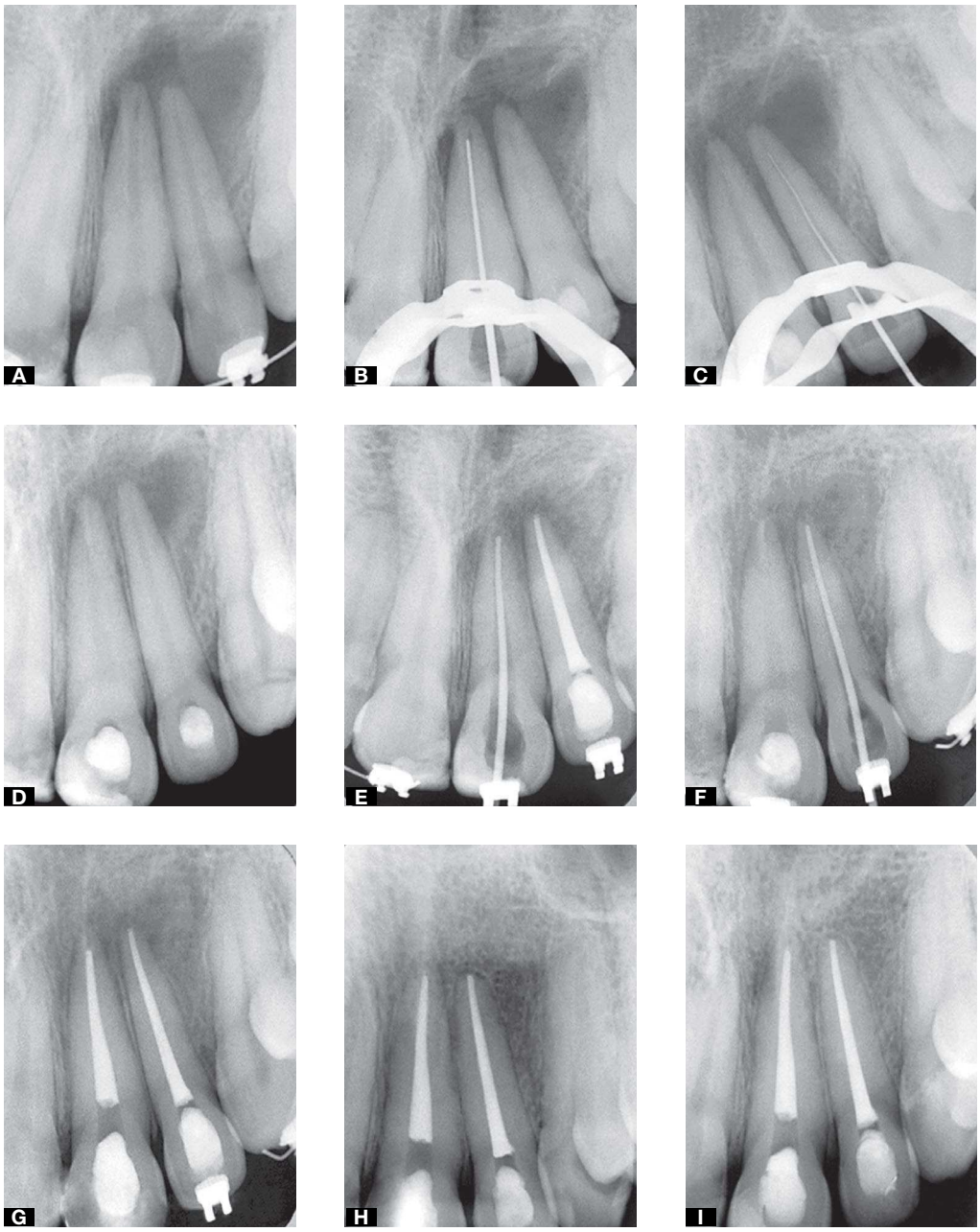

Figure 2. A) initial radiograph showing periapical radiolucent suggesting chronic abscess, (**B**) odontometry (tooth #21), (**C**) odontometry (tooth #22); (**D**) intracanal medication of calcium hydroxide paste with propylene glycol and partially reabsorbed, (**E**) gutta-percha points (tooth #22), (**F**) gutta-percha points (tooth #21), (**G**) root canal filling radiographs, (**H**) radiographs after three years of follow up, showing total periapical repair; (**I**) radiographs after six years of follow up, showing complete periapical repair.

The EDTA was used before the application of the medication in all sessions as well as before the final filling of the root canal in order to increase the permeability of dentin and facilitate the calcium hydroxide ions diffusion in the dentin, it is justified because in the literature is large the number of papers that use of EDTA in different concentrations and associations in order to promote a greater cleaning of the root canal walls, with the removal of the residual layer of dentinal magma.[22,23]

Regarding the root canal sealers, supported on the calcium hydroxide properties, some cements have it as main active component. In our work it was used the Sealapex™ (SybronEndo - SDS) in the root canal filling because of its biological properties and its ability to stimulate deposit of mineralized tissue in the apical third, according to Holland and Souza.[24]

The choice of propylene glycol is due to the fact that this vehicle give a good fluidity that facilitates its handling and deposition within the canal[25] and also because, according to O'Neil,[26] it has a large capacity of solubilization of the organic materials and still because Seidenfeld and Hanzlik,[27] the propylene glycol has approximately the same density as water, and when used as a solvent and vehicle is less toxic and causes no noticeable cumulative effect. In contrast to these results Safavi and Nakayama[28] found that calcium hydroxide is not dissociated in contact with propylene glycol because the calcium hydroxide needs water to dissociate.

Our choice for the treatment of reported cases was relied on evidence presented by Holland et al,[29] and intracanal dressing changes were performed until the final filling of the root canal.

Although various substances have been shown to be intracanal dressing, calcium hydroxide has become widely used, mainly in endodontic treatment of infected teeth, because of its antimicrobial potential, for stimulating periapical repair and also by paralyzing the osteoclasts destructive action found in resorption areas.[29]

Furthermore, its antimicrobial activity quickly eliminates bacteria that come into direct contact with this substance,[30] however, its effect on the microorganisms presented in the dentinal tubules takes longer.[31] According to Oguntebi,[32] the infection in these sites would favor the development of certain types of bacteria that could constitute an important reserve for reinfection of the root canal, during and after endodontic treatment.

Although the highest dentin alkalinization occurs only after 3-4 weeks,[33] in our reports, the dressing was renewed when reabsorption in the root canal was seen radiographically, in agreement with Katebzadeh et al.[34]

The filling of the root canals was performed only when the lesion showed a considerable reduction in its diameter, which disappeared in follow up. This result is very close to that obtained by Souza et al,[35] which noted the repair of large lesions between 6 and 8 months.

The follow up of this work were made with large amount of time due to the difficulty of the patients return to the office.

Conclusion

The results of the reported cases show that the technique of the calcium hydroxide as root canal dressing is an effective alternative for the treatment of teeth with extensive chronic periapical lesions, because it was possible to observe the biological repair of the periapical region, by means of the radiographic follow up reducing or eliminating the necessity for surgical procedures.

References

1. Toledo R, Britto MLB, Pallotta RP, Nabeshima CK. Hidróxido de cálcio e Iodofórmio no tratamento endodôntico de dentes com Rizogênese Imcompleta. Int J Dent. 2010;9(1):28-37.
2. Dotto SR, Travassos RMC, Ferreira R, Santos R, Wagner M. Avaliação da ação antimicrobiana de diferentes medicações usadas em endodontia. Rev Odonto Ciênc. 2006;21(53):266-9.
3. Carvalho MGP, Pagliarin CML, Santos AI, Börondi JB, Batschke MF, Pagliarin CML, et al. Medicamento intracanal. Rev ABO Nac. 2005;13(1):17-21.
4. Burch JG, Hullen SA. Study of the presence of acessory foramina and the topography of molar furcation. Oral Surg. 1974;38(3):451-5.
5. Orucoglu, H. et al. Effect of unintentionally extruded calcium hydroxide paste including barium sulfate as a radiopaquing agent in treatment of teeth with periapical lesions: report of a case. J Endod. 2008;34(7):888-91.
6. Holmstrom SE. Feline Endodontics. In: Harvey CE. The Veterinary clinics of North America. Small Animal Practice; Philadelphia: Saunders; 1992. p.1433-51.
7. Bystrom A, Claesson R, Sundqvist G. The antibacterial affect of camphorated paramonochlorophenol, camphorated phenol and calcium hydroxide in the treatment of infected roots canals. Endod Dent Traumatol. 1985;1(5):170-5.
8. Sundqvist G, Figdor D, Persson S, Sjögren U. Microbiologic analysis of teeth with failed endodontic treatment and the outcome of conservative re-treatment. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 1998;85(1):86-93.
9. Souza V, Bernabé PFE, Holland R, Nery MJ, Mello W, Otoboni Filho JA. Tratamento não cirúrgico de dentes com lesões periapicais. Rev Bras Odontol. 1989;46(2):39-46.
10. Estrela C, Sydney GB, Bammann LL, Felippe Jr O. Mechanism of the action of calcium and hydroxyl ions of calcium hydroxide on tissue and bacteria. Braz Dent J.1995;6(2):85-90.
11. Sigurdsson A, Stancill R, Madison S. Intracanal placement of $Ca(OH)^2$: a comparison of techniques. J Endod. 1992;18(8):367-70.
12. Krell KV, Madison S. The use of the Messing gun in placing calcium hydroxide powder. J Endod. 1985;11(5):233-34.
13. Webber RT, Schwiebert KA, Cathey GM. A technique for placement of calcium hydroxide in the root canal system. J Am Dent Assoc. 1981;103(3):417-21.
14. Kleier DJ, Averbach RE, Kawulok TC. Efficient calcium hydroxide placement within the root canal. J Prosthet Dent. 1985;53(4):509-10.
15. Otani, A.Y. et al. Técnica de inserção da pasta de hidróxido de cálcio com cone de guta-percha calibrado em dentes traumatizados. In: Proceedings of the VIII World Congresso on Dental Trauma, 1997, Guarujá, SP, Brasil.
16. Holland, R. et al. Effect of the dressings in root canal treatment with calcium hydroxide. Rev Fac Odontol Araçatuba. 1978;7(1):39-45.
17. Seux D, Couble ML, Hartmann DJ, Gauthier JP, Magloire H. Odontoblast-like cytodifferentiation of human dental pulp cells in vitro in the presence of a calcium hydroxide-containig cement. Arch Oral Biol. 1991;36(2):117-28.
18. Soares MS, Campos AHCM, Rocha RG, Oliveira MAM. Medicação de uso tópico na odontologia. Odontol Mod. 1988;15(5):35-49.
19. Holland R. Emprego tópico de medicamentos no interior dos canais radiculares. Endodontia, 1994;1(2):23-35.
20. Estrela C, Estrela CRA, Barbin EL, Spano JCE, Marchesan MA, Pécora JD. Mechanism of action of sodium hypochlorite. Braz Dent J. 2002;13(2):113-7.
21. Gomes BPFA, Ferraz CCR, Vianna ME, Berber VB, Teixeira FB, Souza-Filho FJ. In vitro antimicrobial activity of several concentrations of sodium hypochlorite and chlorhexidine gluconate in the elimination of Enterococcus faecalis. Int Endod J. 2001;34(6):424-8.
22. Goldberg F, Spielberg C. The effect of EDTA and the variation of its working time analyzed with scanning electron microscopy. Oral Surg. 1982;53(1):74-7.
23. Aktener BO, Bilkay U. Smear layer removal with different concentrations of EDTA-ethylenediamine mixtures. J Endod. 1993;19(5):228-31.
24. Holland R, Souza V. Ability of a new calcium hydroxide root canal filling material to induce hard tissue formation. J Endod. 1985;11(12):535-43.
25. Felippe WT, Bortoluzzi EA, Felippe MCS. Preenchimento do canal radicular com pasta de hidróxido de cálcio. Uma comparação de técnicas. JBE. 2002;3(8):50-4.
26. O'neil MJ, editor. The Merck index: an encyclopedia of chemicals, drugs and biologicals. 13a ed. New Jersey: Merck; 2001.
27. Seidenfeld MA, Hanzlik PJ. The general properties, actions and toxicity of propylene glycol. J Pharmacol. 1932;44:109-21.
28. Safavi K, Nakayama TA. Influence of mixing vehicle on dissociation of calcium hydroxide in solution. J Endod. 2000;26(11):649-51.
29. Holland R, Estrela C. Calcium hydroxide: study based on scientific evidences. J Appl Oral Sci. 2003;11(4):269-82.
30. Byström A, Claesson R, Sundqvist G. The antibacterial effect of camphorated paramonochlorophenol, camphorated phenol and calcium hydroxide in the treatment of infected root canals. Endod Dent Traumatol. 1985;1(5):170-5.
31. Heling I, Steinberg D, Kenig S, Gavrilovich I, Sela MN, Friedman M. Efficacy of a sustained-release device containning chlorexidine and Ca(OH)2 in preventing secondary infection of dentinal tubules. Int Endod J. 1992;25(1):20-4.
32. Oguntebi BR. Dentine tubule infection and endodontic therapy implications. Int Endod J. 1994;27(4):218-22.
33. Nerwich A, Frigdor D, Messer HH. pH changes in root dentin over a 4- week period following root dressing with calcium hydroxide. J Endod, 1993;19(6):302-6.
34. Katebzadeh N, Hupp J, Trope M. Histological periapical repair after obturation of infected root canals in dogs. J Endod. 1999;25(5):364-8.
35. Souza V, Bernabé PFE, Holland R, Nery MJ, Mello W, Otoboni Filho JA. Tratamento não-cirúrgico de dentes com lesões periapicais. Rev Bras Odontol. 1989;46(2):39-46.