International Journal of Dental Sciences and Research, 2016, Vol. 4, No. 3, 58-61
Available online at http://pubs.sciepub.com/ijdsr/4/3/6
© Science and Education Publishing
DOI:10.12691/ijdsr-4-3-6

Single-visit Apexification Using Biodentine and Er,Cr:YSGG Laser: A Case Report

Sarika Chaudhry[1,*], Sudha Yadav[1], Gunpreet Oberoi[2], Sangeeta Talwar[1], Mahesh Verma[3]

[1]Department of Conservative Dentistry and Endodontics, Maulana Azad Institute of Dental Sciences, New Delhi, India
[2]New Delhi, India
[3]Director- Principal, Maulana Azad Institute of Dental Sciences, New Delhi, India
*Corresponding author: dr.sarika@ymail.com

Abstract An immature tooth with pulpal necrosis and periapical pathology imposes a great difficulty to the endodontists. Endodontic treatment options for such teeth consist of conventional apexification procedure with and without apical barrier. An open apex tooth with pulpal necrosis and periapical pathology is a challenge for restoration as it is loaded with too much of bacteria. The complete elimination of debris and achievement of a sterile root canal system is very challenging in open apex cases because of the complexity of the root canal system. The use of lasers in the field of endodontology represents an innovative and new approach to match these requirements. In general, dental lasers provide greater and safer accessibility of formerly unreachable parts of the tubular network, due to their better penetration into dentinal tissues. This article describes the successful management of an open apex tooth with large periapical pathology using Er,Cr:YSGG AS an adjunct to conventional root canal preparation that resulted in remarkable and faster healing of the periradicular lesion in one year follow up. **Conclusion**: Single-visit apexification with biodentine following Er,Cr:YSGG laser disinfection for management of open apex cases having a very poor prognosis can be considered a predictable treatment.

Keywords: *apexification, Er,Cr:YSGG laser, Biodentine, periradicular healing*

Cite This Article: Sarika Chaudhry, Sudha Yadav, Gunpreet Oberoi, Sangeeta Talwar, and Mahesh Verma, "Single-visit Apexification Using Biodentine and Er,Cr:YSGG Laser: A Case Report." *International Journal of Dental Sciences and Research*, vol. 4, no. 3 (2016): 58-61. doi: 10.12691/ijdsr-4-3-6.

1. Introduction

Bacteria are the primary causative agents in pulpal and periapical pathosis. [1] The challenge of nonsurgical endodontic treatment is to achieve complete disinfection and elimination of bacteria from the root canal system. Endodontic procedures rely on mechanical instrumentation, intracanal irrigants and medicaments are required to disinfect the root canal system [2]. Irrigants such as sodium hypochlorite and chlorhexidine also have demonstrated useful antimicrobial effects; however, here too, infection of the root canal and adjacent dentin may persist owing to the inability of these agents to reach all the infecting microorganisms. [3] The use of intracanal medicaments such as calcium hydroxide typically requires multiple patient visits, since short-term application of less than one week has been found to be ineffective in eliminating endodontic infection[4]However, the multiple visits required for effective treatment with calcium hydroxide increases treatment time and reduces patient compliance, thus increasing the risk of treatment failure. The task of cleaning and disinfecting a root canal system which contains microorganisms gathered in a biofilm is very difficult; certain bacterial species become more virulent when harbored in biofilm, demonstrating stronger pathogenic potential and increased resistance to antimicrobial agents.

*Enterococcus faecalis*is a gram-positive facultative anaerobic bacterium infect dentinal tubules up to 800 micrometers and found in endodontic cases requiring retreatment [5]. *E. faecalis* is resistant to calcium hydroxide treatment. [6] Sodium hypochlorite and chlorhexidine have proved to be effective against *E. faecalis* but they require direct contact. [7] Periapical lesions of endodontic origin may develop asymptomatically and become large requiring surgical approach. However non-surgical approach should be attempted first as many newer endodontic disinfection and instrumentation modalities are available to eradicate the existing microflora of infected root canal systems. Many studies confirm that such lesions can respond favourably to non-surgical treatment [8]. The presence of open apex along with periapical lesion makes sterilization of canal difficult as we have to be very cautious regarding the choice of irrigant we use. Consequently there is always the need for alternative and effective disinfection technique. Since the introduction of lasers in endodontics during the early 1970s, there have been several studies regarding the application of this technology as an aid in cleansing and disinfection of the root canal system [9]. The erbium, chromium:yttrium-scandiumgallium-garnet (Er,Cr:YSGG) laser is a laser system unit approved by the U.S. Food and Drug Administration for cleaning, shaping and enlarging the root canal as well as for use in osseous, apical and periodontal surgery [10]. In this case report, laser therapy was used as an adjunct to endodontic irrigants and biomechanical preparation for complete disinfection of root canal system. The use of laser also overcomes the fear of extrusion of irrigant into the periapical area especially in case of open apex cases. This resulted in adequate healing even in the presence of large periapical lesion and good one year follow up.

2. Case Report

A 11-year-old female patient reported with a chief complaint of pain and swelling in relation to maxillary right central incisor. On clinical examination the patient had fractured tooth 11 and missing 21. Patient had undergone the root canal opening for pain with respect to 11. History revealed that the patient had suffered trauma at the age of 8 years. Radiographic examination revealed an immature tooth 11 with a wide open apex and a radiolucent area in proximity of the apex of the tooth 11 (Figure 1). There was a presence of foreign body like a pin lodged in canal with respect to 11.The 21 was impacted with dilacerated root. The prognosis of the tooth 11 was highly unfavourable as there was no tooth structure remaining with very thin enamel wall present. The canal of the tooth was irrigated and pin like structure was removed. (Figure 1b) .To understand more of the internal morphology of 11 CBCT was planned. The axial section of cbct confirms that there was no perforation detected in the tooth with very less dentine remaining. (Figure 1). The Patient was not willing for extraction or any surgical procedure. Patient was too young for us to plan a definitive restoration. The strategy for the treatment was to save 11 to plan it for provisional restoration along with good RPD for missing 21. In spite of all shortcomings and seeing patient willingness the restoration of 11 was planned and patient was informed regarding the risk of failure of treatment. After taking consent from the patient endodontic access opening was done under local anesthesia, and a periapical radiograph was taken to determine the working length (Figure 2A). Biomechanical preparation was done using size 80 K-file in a circumferential filing motion. Root canal debridement was done using alternate irrigation with 0.5% NaOCl and saline. C100-Z3-25 mm endo tips in a sterilized laser handpiece were used to disinfect the root canals. Disinfection phase (0.75 W; 20 Hz; 10 % air; 0 % water) of Er,Cr:YSGG laser was employed for the same. We moved the laser tip by hand up and down in the canal in a cervical-apical and apical-cervical direction at a rate of 1 mm per second (that is, 10 seconds to traverse the full 5mm length of the canal in both directions). During this procedure, we kept the tip as close to the canal wall as possible.

Figure 1. A. Preoperative radiograph, B. Radiograph after removal of pin, C. CBCTaxial section showing entact cemental wall

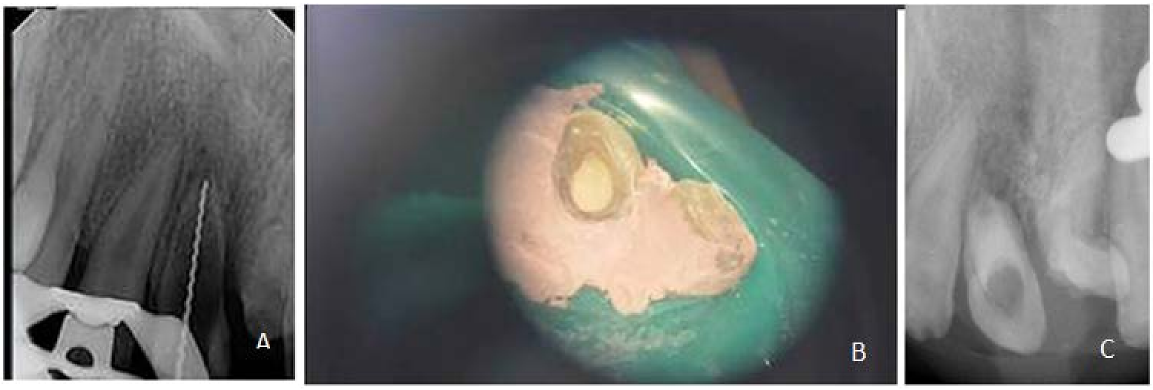

Figure 2. A. Working length determination of 11, B. Biodentine obturation under microscope, C. Radiograph after obturation with Biodentine

The root canal was then dried with sterile paper points. Biodentine capsule™ (Septodont, St. Maur-des-Fossés, France) was gently tapped on a hard surface (to diffuse powder), five drops of liquid from the single-- ‑ dose dispenser were poured into the capsule, after which the latter was placed in a triturator for 30 seconds. The mixture of Biodentine™ was hence prepared. The first increment of BioDentine was inserted into the canal using a curved needle of the largest diameter fitting into the canal (MAP-system, PDSA, Vevey, Switzerland). The material was then delicately pushed towards the apex with a root-canal plugger under endodontic microscope... The material was adapted to the walls by applying indirect ultrasonic vibration through an ultrasonic tip placed on the plugger touching the material. After verifying that the material was hard-set, and waiting for additional few minutes, and the access cavity was sealed using composite resin. A radiograph confirmed the completion of the endodontic therapy (Figure 2b). R PD was delivered for missing 21 and patient was very satisfied. (Figure 2c)

A 3-month follow- up revealed good periapical healing and bone formation (Figure 3B).The clinical follow-up at 18 months showed the patient functioning well with no reportable clinical symptoms and an absence of any sinus tract formation. The radiographic follow-up at 18 months (Figure 3C) showed complete healing of the periapical radiolucency and regeneration of the periradicular tissues.

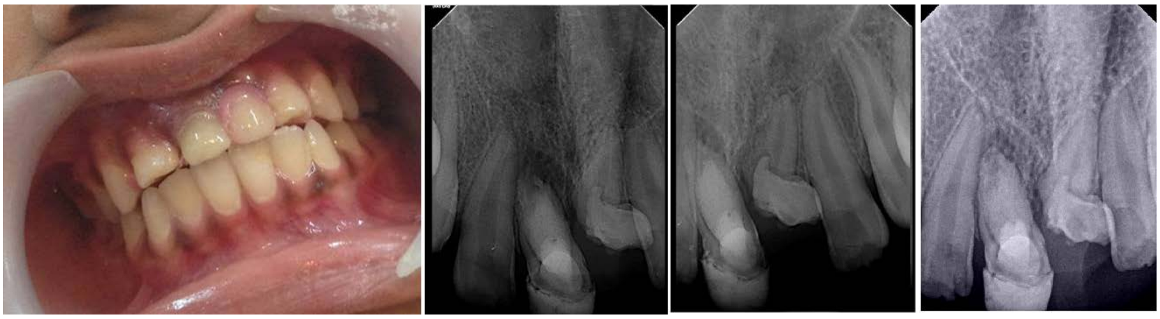

Figure 3. A. Patient after RPD delivery, B. Radiograph after obturation with Biodentine and coronal restoration, C, Radiograph after 3month follow up obturation with Biodentine, D. Radiograph after 18month follow up obturation with Biodentine

3. Discussion

When single-visit apexification with Biodentine is the preferred treatment protocol, the major problem is ensuring sufficient canal disinfection with respect to the exposed periapical tissue. A low-concentration sodium hypochlorite (0.5%) was selected in this case for irrigation owing to the open apex. Higher concentrations with more cytotoxicity that extrude even slightly beyond the apex can cause severe damage to the periapical tissue and irritation, with the resultant pain and swelling. Improper use of hypochlorite at high concentrations and high pressure can lead to complications during root canal irrigation may lead to air emphysema, and allergic reactions. This is especially true for open apex as many of these kinds of accidents have been reported [11].

Copious irrigation was used during instrumentation to compensate for the low concentration used. Conventional irrigation has some limitations however. The high surface tension of the chemical solutions (even with ultrasonic activation) plays a role in the incomplete cleaning of dentinal tubules The pathogenic microorganisms are able to penetrate the root dentin up to a depth of more than 1mm, whereas disinfection solutions only reach a depth of 100μm. [12] The presence of complex structures like accessory canals, anastomoses and fins, makes complete eradication of bacteria impossible. Due to the adjustable penetration depth of the laser irradiation, lasers can result in better access to complex regions of the root canal system, compared with rinsing solutions laser has great potential for use as an antimicrobial in endodontics [13]. It is one of the most powerful antimicrobial agents with enormous capacity to reduce the number of micro-organisms (planktonic and organised in biofilm) in the root canal [14].·Erbium wavelengths can also be used in cleaning, shaping, and enlarging the root canal system and also is an efficient method to remove the smear layer [15]. The Er,Cr:YSGG laser underwent further improvement with radial firing tips (RFT) to allow a more homogeneous irradiation of root canal walls. Modifications resulted with the ends of the RFT showing a conical outline with an angle of 60°. The outcome of this meant the laser light expanded to form a broad cone, facilitating an even and better coverage of the root canal wall [16]. This effect could increase the probability that the emitted laser energy will enter the dentinal tubules and have an effect on bacteria that are at some distance from the canal. [17] Silva et al concluded that 120 seconds application of laser had greater disinfection effect than with NaOCI .The root canal surfaces were free of smear layer and dentinal tubules were opened at power settings of 1.5 and 2W with no signs of melting and carbonization when 120 seconds application of laser [18]. In this case, significant bactericidal effect and disinfection of the root canals were achieved using Er,Cr:YSGG laser, that resulted in substantial healing in a short period of time. The large periapical lesion present was hence dealt with nonsurgical management, which was otherwise deemed for surgical intervention. Apexification using Biodentine was used in this case as it lessens the treatment time between the patient's first appointment and the final restoration. The importance of this approach lies in the effective cleaning and shaping of the root canal, followed by apical seal with a material that favors regeneration. In addition, there is reduced potential for fracture of immature teeth with thin roots, because of immediate placement of bonded core within the root. Biodentine™ is a new calcium silicate based cement of the same type as MTA®. It exhibits physical and chemical properties similar to those described for certain Portland cement derivatives [19]. This case report has introduced a new concept of using Biodentine for canal obturation and canal sterilization using Er,Cr:YSGG laser. Even after 1 year follow up, tooth was functional and asymptomatic. It can be attributed to the biocompatibility and good physical properties of Biodentine which might have resulted in reinforcement of weakened tooth structure. Also thorough disinfection achieved using laser may be the reason for long term survival of the tooth.

4. Conclusion

Single-visit apexification with Biodentine was ideal for this case. Disinfection with Er,Cr:YSGG laser was chosen to avoid using high concentrations of NaOCl. Intra-canal disinfection using laser and the use of Biodentine as an apical plug achieved a positive initial clinical outcome for the immature tooth. The 12-month follow-up also showed clinical and radiological signs of healing. Long-term follow-up is however necessary to ensure success.

References

[1] Parirokh M &Torabinejad M. Mineral Trioxide Aggregate: A comprehensive literature review—Part III: Clinical applications, drawbacks, and mechanism of action. JEndod2010; 36:400-413.

[2] Wang X, Sun H & Chang J. Characterization of Ca3SiO5/CaCl2 composite cement for dental application. Dent Mater2008; 24: 74-82.

[3] Wongkornchaowalit N &Lertchirakarn V. Setting time and flowability of accelerated Portland cement mixed with polycarboxylate superplasticizer. J Endod. 2011; in press: 1-3.

[4] Maroto M, Barbería E, Planells P, Vera V. Treatment of a non-vital immature incisor with mineral trioxide aggregate (MTA). Dent Traumatol 2003; 19:165-169.

[5] Vahdaty A, Pitt Ford TR, Wilson RF. Efficacy of chlorhexidine in disinfecting dentinal tubules in vitro. Endod Dent Traumatol 1993; 9:243-248.

[6] Stabholz A, Sahar-Helft S, Moshonov J. The use of lasers for cleaning and disinfecting of the root canal system. Alpha Omegan 2008; 101(4):195-201.

[7] Wang QQ, Zhang CF, Yin, XZ. Evaluation of the bactericidal effect of Er,Cr:YSGG and Nd: YAG lasers in experimentally infected root canals. J Endod 2007; 33:830-832.

[8] Altundasar E, Ozcelik B, Cehreli ZC, Matsumoto K. Ultramorphological and histochemical changes after Er,Cr:YSGG laser irradiation and two different irrigation regimes. J Endod 2006; 32:465-8.

[9] WangX, SunY, KimuraY, KinoshitaJ, IshizakiNT, MatsumotoK. Effects of diode laser irradiation on smear layer removal from root canal walls and apical leakage after obturation. Photomed Laser Surg 2005; 23: 575-81.

[10] Oztan MD. Endodontic treatment of teeth associated with a large periapical lesion. IntEndod J. 2002; 35(1):73-8.

[11] M. Hülsmann and W. Hahn, “Complications during root canal irrigation—literature review and case reports.,” International Endodontic Journal, vol. 33, pp. 186-193, 2000.

[12] E. Berutti, R. Marini, and A. Angeretti, “Penetration ability of different irrigants into dentinal tubules,” Journal of Endodontics, vol. 23, no. 12, pp. 725-727, 1997.

[13] T. M. Odor, N. P. Chandler, T. F. Watson, T. R. Pitt Ford, and F. McDonald, “Laser light transmission in teeth: a study of the patterns in different species,” International Endodontic Journal, vol. 32, no. 4, pp. 296-302, 1999.

[14] A. Stabholz, S. Sahar-Helft, and J. Moshonov, “Lasers in endodontics,” Dental Clinics of North America, vol. 48, no. 4, pp. 809-832, 2004.

[15] A. C. B. Silva, C. Guglielmi, D. T. Meneguzzo, A. C. C. Aranha, A. C. Bombana, and C. de Paula Eduardo, “Analysis of permeability and morphology of root canal dentin after Er,Cr:YSGG laser irradiation,” Photomedicine and laser surgery, vol. 28, no. 1, pp. 103-108, 2010.

[16] U. Schoop, A. Barylyak, K. Goharkhay et al., “The impact of an erbium, chromium:yttrium-scandium-gallium-garnet laser with radial-firing tips on endodontic treatment,” Lasers in Medical Science, vol. 24, no. 1, pp. 59-65, 2009.

[17] W. Gordon, V. A. Atabakhsh, F. Meza et al., “The antimicrobial efficacy of the erbium, chromium:yttrium-scandium- gallium-garnet laser with radial emitting tips on root canal dentin walls infected with Enterococcus faecalis,” Journal of the American Dental Association, vol. 138, no. 7, pp. 992-1002, 2007.

[18] A. C. B. Silva, C. Guglielmi, D. T. Meneguzzo, A. C. C. Aranha, A. C. Bombana, and C. de Paula Eduardo, “Analysis of permeability and morphology of root canal dentin after Er,Cr:YSGG laser irradiation,” Photomedicine and laser surgery, vol. 28, no. 1, pp. 103-108, 2010.

[19] Saidon J, He J, Zhu Q, Safavi K, Spångberg LS. Cell and tissue reactions to mineral trioxide aggregate and Portland cement. Oral Surg Oral Med Oral Pathol Oral RadiolEndod 2003;95:483-9.