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Case Report

Simultaneous Perio-endo Surgery with ER:YAG Laser and Bone Xenograft. A Case Report

Bogdan Krastev, Ivan Filipov

Department of Operational Dentistry and Endodontics, Faculty of Dental Medicine, Medical University of Plovdiv, Plovdiv, Bulgaria

Corresponding author: Bogdan Krastev, Department of Operational Dentistry and Endodontics, Faculty of Dental Medicine, Medical University of Plovdiv, 3 Hristo Botev Blvd., 4000 Plovdiv, Bulgaria; E-mail: drbkrastev@gmail.com; Tel.: +359 897 988 845

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Abstract

Periodontally affected teeth with periapical lesion indicated for periapical surgery have a poor prognosis. Using Er:YAG lasers to perform simultaneous surgery on both defects may increase their survival rate. Preparing a retrograde cavity on affected teeth and obturating it is still a matter of debate among clinicians. The purpose of this case report was to describe the simultaneous use of Erbium-doped Yttrium Aluminium Garnet Er:YAG (2,940 nm) laser in the treatment of periapical granuloma and infraossal defect and the achieved results. The Er:YAG laser was used to perform flap dissection, granulation tissue removal, osteotomy and root-end resection except for initial flap incision and reflection. The cystic cavity was filled with Bio-Oss Collagen® xenograft. Results were followed up for 18 months with the help of radiographic orthopantomographic images. The outcome of this clinical case indicates that the use of Er:YAG laser could be considered a suitable method to perform simultaneous periodontal and endodontic surgery.

Keywords

infraossal defect, lasers, periapical surgery, xenograft

INTRODUCTION

About 15% – 30% of apical lesions do not regress after nonsurgical endodontic treatment and periapical surgery is indicated. Its purpose is to remove all pathological tissues, seal the root canal and regenerate the periodontium. Surgery faces a few issues: choice of access flap, size of ostectomy, length of root resection, retrograde preparation, micro-permeability, material for retrograde obturation, periodontal bone loss. They complicate the procedure, increase mobility and worsen prognosis (Kim S, Kratchman S, 2006). Major problem is the difficult access for root observation and preparation, haemostasis, placement of obturating material. The classical rotary technique is more damaging in periodontally affected teeth due to bur vibration destabilising the tooth. It leads to lower clinical survival.[1] Lasers may enhance periapical surgery[2,3] and periodontal therapy[4], by requiring less tools,[5] less time, providing surgical field disinfection, sealing of tubules[1,6-10], enhanced bone healing, and a shorter recovery period.[11-13] We present a case with a periapical cyst and multiple infarossal defects simultaneously treated with erbium doped yttrium aluminium garnet-Er:YAG laser.

CASE REPORT

A 36-year-old male patient presented to the department with complaints of mobile teeth and bleeding gums. Exam showed presence of moderate to severe, chronic periodontitis, infraos-

sal defects, and a cyst >10 mm in diameter on tooth 12 ***(Figs 1, 2)****. The tooth had mobility grade 2, according to the Miller index of mobility. Teeth 12, 13, 14, 15, 24, 25 also had infraossal defects. Initial nonsurgical periodontal therapy was performed with Piezon Master 400® (EMS®, Switzerland), tip P3 and hand Gracey Curretes (Hu Friedy®, USA). Root canal treatment was performed on tooth 12, the canal was cleaned and shaped up to size 40 K file (Denstply®, Switzerland) using standard technique. Working length was 21 mm. The canal was sealed with epoxy resin ADSEAL® (Meta Biomed CO, Ltd®, Republic of Korea) and a single guttapercha cone. No rubber dam was used as treatment was performed by a student. After 3 months there was bleeding on probing on teeth 12, 14, 15, 24, 25, probing pocket depth (PPD) of 8 mm, 4 mm deep infraossal defect, and no resolution of periapical lesion on tooth 12* ***(Fig. 3)****. Decision was made to continue treatment with simultaneous periodontal and periapical surgery with Er:YAG (wave length 2940 nm, LiteTouch™, Syneron®, Israel) laser. Safety goggles were used adjusted to the power density and wavelength of LiteTouch™. Bilateral infraorbital block and anterior middle superior alveolar palatal nerve block anaesthesia was administered. Surgery was performed in the following manner: sulcular incisions with a scalpel blade N 15* ***(Fig. 4)****.*

Full thickness flap with no vertical incisions was reflected mainly on the buccal from the distal gingival margin of tooth 15 up to the distal of 25 to allow access to infraossal defects and periapical lesion of 12. Treatment protocol is similar to that described by Reyhanian A, et al. (2008). Laser is regularly calibrated and metered by the manufacturer. During the surgery, laser was used in a pulse mode. Impulses were 100-200 μs in width. Spot size was dependent on the sapphire

Figure 1. Preoperative condition of tooth 12. Periapical X-ray.

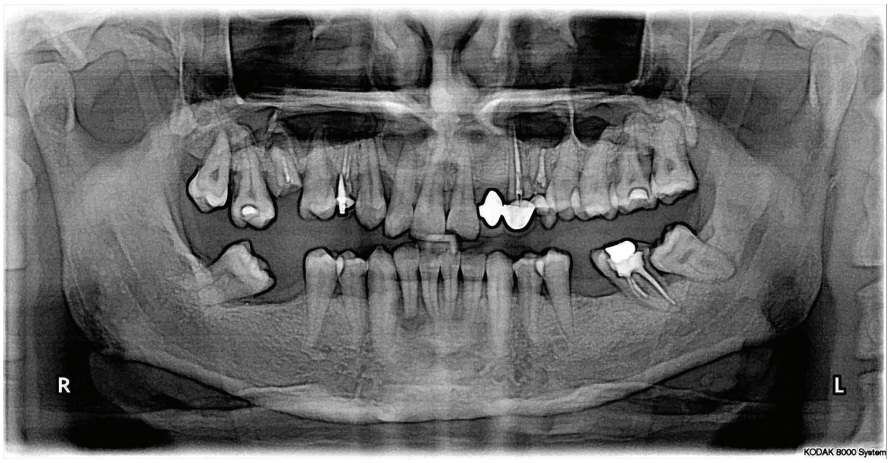

Figure 2. Preoperative condition of teeth on OPT.

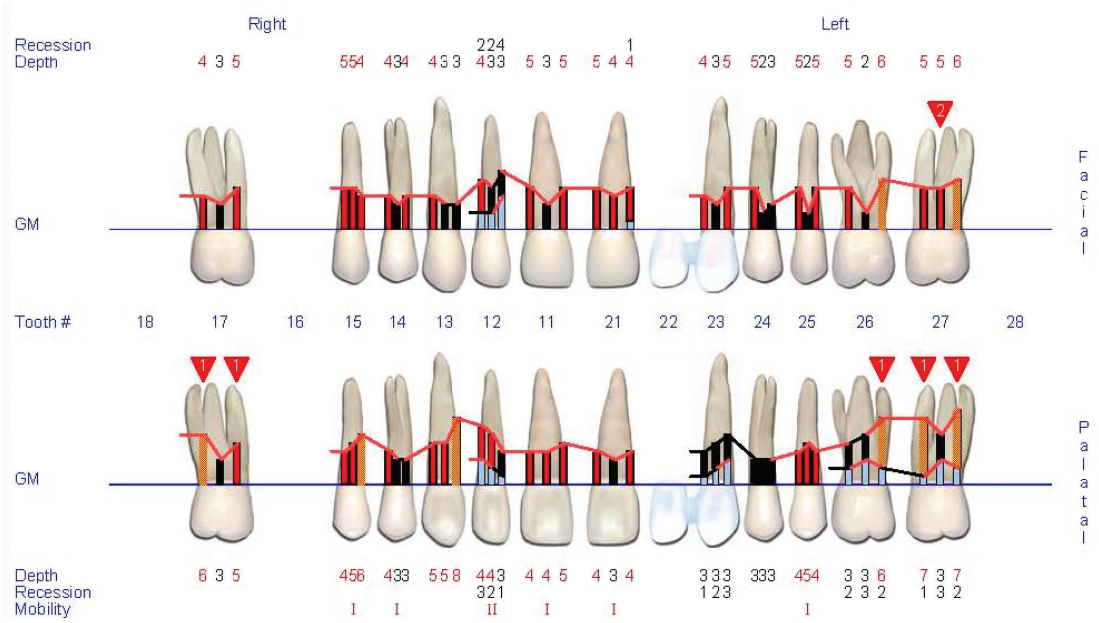

Figure 3. Peridontal condition at start of treatment.

Figure 4. Intrasulcular incisions from tooth 16 to tooth 25.

tip diameter. Flap dissection continued with tip for incision (50°-70°, contact mode; 200 mJ/35 Hz; 7 W; 0.4×17 mm tip; water level 5-6) ***(Fig. 5)****.*

Calculus was removed with Piezon Master 400®, tip P3 and hand Gracey Curretes. Initially, we treated the inner surface of the flap and all infraossal defects by removing granulation tissue with flat cylindrical tip for ablation (non-contact mode; 400 mJ/20 Hz; 8 W; 0.8×14 mm tip; water level 4) ***(Fig. 6)****.*

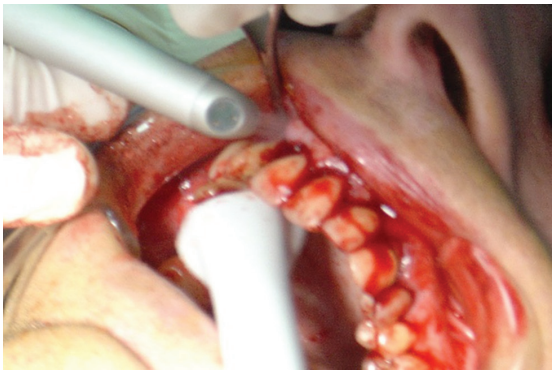

Figure 5. Flap dissection tip for incision, 500-700, contact mode; 200 mJ/35 Hz; 7W; 0.4×17 mm tip; water level 5-6.

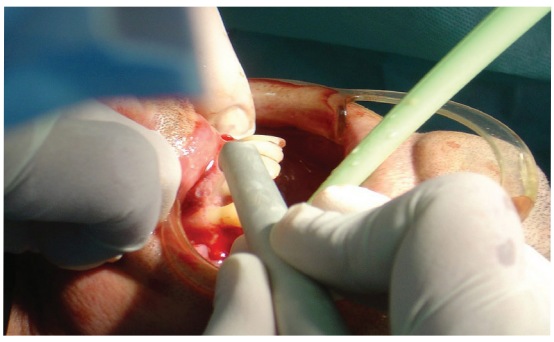

Figure 6. Granulation tissue ablation with flat cylindrical tip for ablation (non-contact mode; 400 mJ/20 Hz; 8 W; 0.8×14 mm tip; water level 4).

In non-contact mode, the tip was 1-2 mm away from the tissue. Cyst had resorbed vestibular cortical plate but not enough for straight access so the cavity was widened, ostectomy (non-contact mode; 300 mJ/25 Hz; 7.5 W; 1.3×19 mm tip; water level 8) ***(Fig. 7)****.*[11] *The cyst was dissected from the walls and removed with tweezers and cavity ablated.*

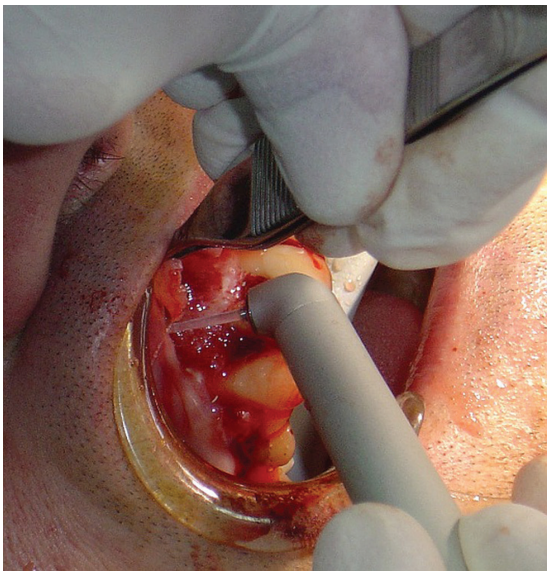

Figure 7. Bone removal (non-contact mode; 300 mJ/25 Hz; 7.5 W; 1.3×19 mm tip; water level 8).

Bone edges were shaped and smoothed (non-contact mode; 150 mJ/50 Hz; 7.5 W; 1.3×19 mm tip; water level 8). Root end was resected perpendicular to root surface 3 mm from the apex tip (non-contact mode; 400 mJ/20 Hz; 8 W; 0.8×14 mm tip; water level 8).[8] *Grafting material Bio-Oss collagen® (Geistlich®, USA) was placed inside the cavity.*[14] *No retrograde cavity was prepared on the root end of tooth 12. Surgery finished with passive flap adaptation and single interrupted sutures interdentally with resorbable 3.0 Vicryl® (Ethicon Inc. Cornelia, GA). The patient was given instructions as to how to keep oral hygiene and included in a supportive maintenance program with 0.2% chlorhexidine solution for a period of four weeks. Seven days after surgery, the sutures were removed. The case was followed up with periapical x-rays E speed films at the beginning of treatment and at 6 months. Orthopantomography (OPT) images taken with Kodak Dental Imaging Software® (Kodak®, USA) at the beginning, at 6 months and at 18 months. Bone density measurements were done with application of Isodensity and Densitometric analysis available with the software, calibrated by the manufacturer at installation. A region of interest was 3 mm from the apical tip of tooth 12 and between periodontal ligaments of teeth 11 and 13. OPT images were taken with the same settings each time 73 KVp/10 mAs 13.9 s with maximum of 30 μSv radiation dose as per Kodak 8000 Panoramic x-ray machine.*

X-ray observations at 6 months showed complete resolution and fill up of both bone defects ***(Fig. 8)*** *and physiological PPD* ***(Fig. 9)****.*

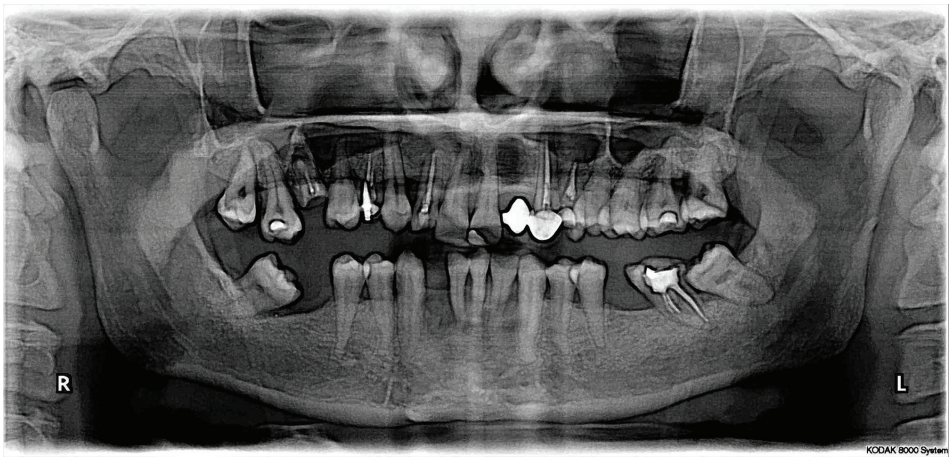

Figure 8. OPT of patient after 6 months.

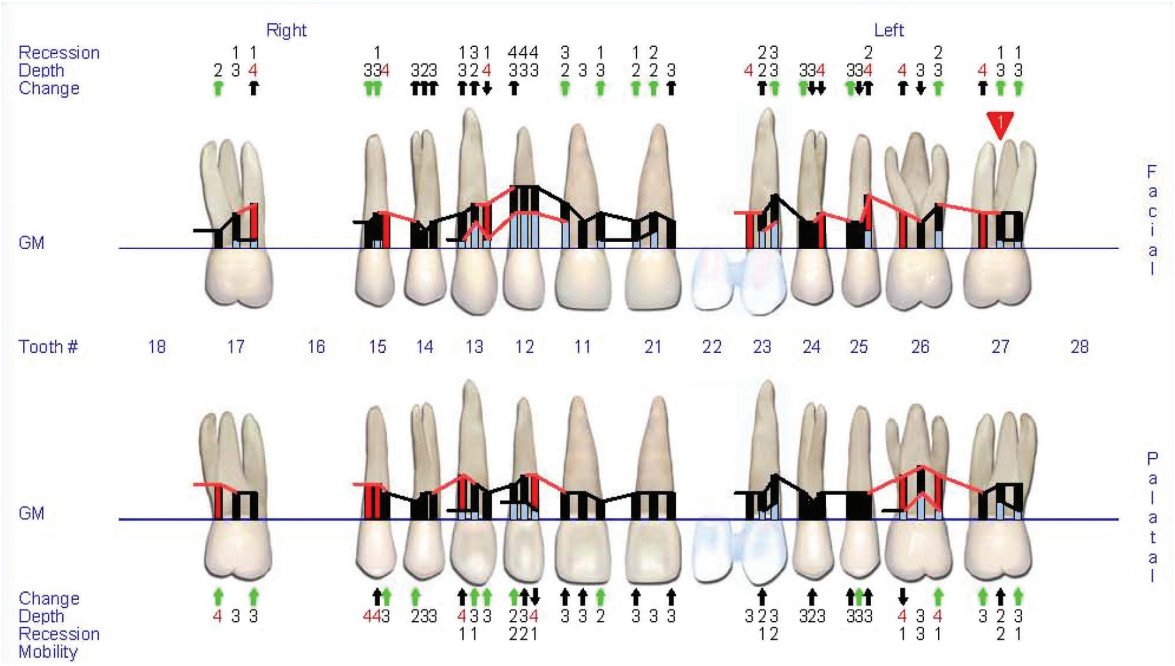

Figure 9. Periodontal condition at 6 months.

Initially, the density in the range of cystic cavity on the OPT image was 30-129 isodensity units/ average 26; densitometric analysis average 75 ***(Fig. 2)****. After a period of 6 months density was 40-114 isodensity dots/ average 29* ***(Fig. 10)****; densitometric analysis average 62. Eighteen months later density was 49-156 isodensity dots/ average 81; densitometric analysis average 72* ***(Fig. 11)*** *evaluated with Kodak Dental Imaging Software®.*

Eighteen months after surgery, tooth 12 is still in the patient's mouth with a first degree of mobility according to Miller index of mobility ***(Fig. 12)****. Soft tissues healed with minimal scarring and recession, and there was complete bone fill of infraossal and periapical bone defects* ***(Fig. 13)****.*

Figure 10. Periapical X-ray of tooth 12 after 6 months.

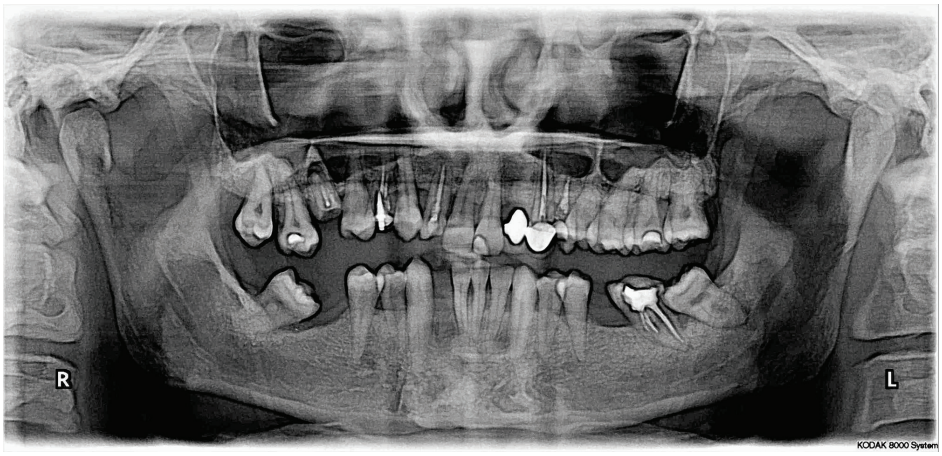

Figure 11. OPT of patient at 18 months.

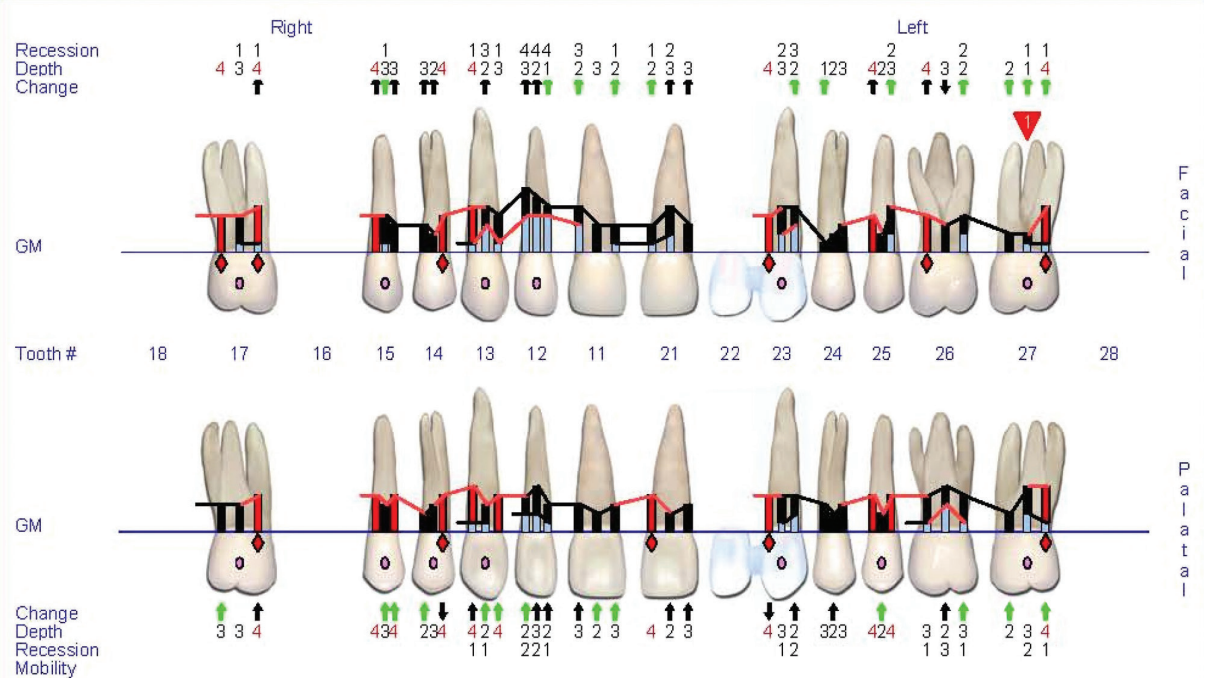

Figure 12. Periodontal condition at 18 months.

Figure 13. Intraoral view of patient at 18 months.

DISCUSSION

Lasers can be used for every step of surgery.[2,4,5,7,11-15] Results are monitored for a period of 90[13], 180[5], days up to 3[7] to 10 years and show preservation of treated teeth. Er:YAG lasers have less thermal effects[10], cause no carbonisation,[15] improve sealing between dentin and epoxy sealer[10], have fewer cracks, chippings, and burning effects when compared to Nd:YAG, CO_2 lasers[1,7-9] or ultrasonic tips.[2] Lasers produce smoother resected root surfaces[1,6], less vibration – 1.5 W power[11], and less chipping compared to diamond burs[4] but are inferior to carbide burs.[6] Some authors believe that the use of burs is the best way to perform periapical surgery[5] because it leads to less inflammation[13], has more bone fill, and takes less time.[3] Epoxy sealers lased with Er:YAG have less apical micro-leakage, compared to

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zinc oxide eugenol (ZEO) cements and root end prepared with ultrasonic tips. Some authors find no difference in permeability between roots resected with burs or lasers. Different power modes[6], especially higher 400 mJ [8,9], lead to different dentin sealing ability, different methylene blue permeability, irrespective of retrograde cavity materials like mineral trioxide aggregate (MTA), super ethoxy benzoic acid (SuperEBA), intermediate restorative material (IRM). Results are better, compared to retrograde cavities prepared with ultrasonic tips. We believe that laser incision is not beneficial[15] and leads to shrinkage, unlike other researchers who find less pain and inflammation.[2,5] Use of microscope could increase treatment time[11], cause less inflammation and have more predictable results[15] compared to standard rotary technique. Er:YAG lasers bone ablation led to defect resolution, which may be due to stimulated platelet derived growth factor (PDGF) secretion[11,12], which is supported and achieved by some authors[8,11] but not all agree.[8,12] Bio-Oss collagen® was used as a grafting material due to the size of the lesion ≥10 mm which may have improved results with or without a membrane. Taschiery et al. (2007), however, believe that there is no beneficial effect from grafts compared to cases without graft or a membrane.[14] Von Arx T, Cochran DL (2001) believe that using collagen membranes alone will lead to significantly better results. Using lasers leads to greater accuracy and reduces the tools needed for periapical surgery. This is contrary to the opinion of other researchers who find less control over depth of preparation. Bone healing and fill shows that enough disinfection and sealing of the root tip and infraossal defect has been achieved. Whenever possible, we should use cone beam computed tomography (CBCT) for best dimensional image and follow up investigation of treatment results while following the ALARA (as low as reasonably possible) principle (Maia Filho EM, et al., 2018) as OPG images are not the best for follow-up investigations of apical periodontitis (Nardi C, et al., 2017). However, CBCT is not very good for bone density measurements. Our case report is similar to the studies of Leonardi DP et al. (2005) (in vitro)[8], Marques AM et al. (in vitro)[10], Li Ling Yu (in vivo)[5], and Kruse et al. (2016) (in vivo) who do not use retrograde preparation and obturation in their methodology. However, some of them do not follow up their results for 18 months or use a laser. Kruse et al. (2016) after 6 years found 55% success in the no retrograde obturation group which may not be directly related to the endodontic treatment.

CONCLUSION

Based on previous research and the case described, we believe that simultaneous periodontal and endodontic surgery performed with Er:YAG laser with xenograft and without retrograde filling, is suitable for similar cases. Further randomised controlled clinical studies are needed to confirm stable and predictable results.

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Одновременная пародонтальная и эндодонтическая хирургия с использованием лазера ER: YAG и костного ксенотрансплантата. Клинический случай

Богдан Крастев, Иван Филипов

Кафедра оперативного зуболечения и эндодонтии, Факультет дентальной медицины, Медицинский университет – Пловдив

Адрес для корреспонденции: Богдан Крастев, Кафедра оперативного зуболечения и эндодонтии, Факультет дентальной медицины, Медицинский университет – Пловдив, бул. „Христо Ботев“ № 3, 4000 Пловдив, Болгария; E-mail: drbkrastev@gmail.com; Tel.: +359 897 988 845

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Резюме

Зубы с периодонтальным поражением и периапикальным поражением с показаниями к периапикальному хирургическому вмешательству имеют неблагоприятный прогноз. Использование Er: YAG-лазера для одновременного хирургического вмешательства по поводу обоих дефектов может увеличить их выживаемость. Подготовка ретроградной полости поражённых зубов и её пломбирование до сих пор остаётся спорным вопросом среди клиницистов. Целью этого клинического случая было описание одновременного использования Erbium-doped Yttrium Aluminium Garnet Er:YAG-лазера (2,940 nm), при лечении периапикальной гранулёмы и внутрикостного дефекта и достигнутых результатов. Er: YAG-лазер использовался для рассечения лоскута, удаления ткани гранулёмы, остеотомии и резекции конца корня без первоначального разреза лоскута и рефлексии. Кистозную полость заполняли ксенотрансплантатом Bio-Oss Collagen®. Результаты контролировались в течение 18 месяцев с помощью рентгенографической ортопантомографии. Результат этого клинического случая является показателем того, что использование Er: YAG-лазера можно считать подходящим методом для одновременного проведения пародонтальной и эндодонтической хирургии.

Ключевые слова

внутрикостный дефект, лазеры, периапикальная хирургия, ксенотрансплантат