



CASE REPORT

Recovery of endoperiodontal lesions upon Nd:YAG laser application: a case report

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ARTICLE INFO

Article history:

Received 28 June 2013

Accepted 23 September 2013

Keywords:

Endoperiodontal lesion

Nd:YAG laser

Laser in dentistry

ABSTRACT

Treatment modalities of combined periodontal-endodontic lesions should eliminate pathogens from the infected area and prevent their re-colonization. The aim of this case report is to explore the effects of Nd: YAG laser on the healing of endoperiodontal lesions (EPLs). A patient with clinically diagnosed EPLs on teeth 33-34 and 35 was assigned to root canal treatment, removal of bacterial plaque by scaling and root planning and Nd:YAG laser applications. The assessment of healing was performed by measuring the clinical parameters and radiographic follow-up of lesions before and after the treatment. The clinical index values of the patient decreased significantly compared to baseline assessments and full recovery was observed in a relatively shorter time. Nd: YAG laser is a promising tool for successful treatment of EPL with immediate pain relief and reduced treatment time. Treating severe EPLs with Nd:YAG laser can lead to immediate pain relief and reducing treatment time.

INTRODUCTION

The periodontal ligament and root canal system have a common developmental, anatomic, and functional relationship.¹ They are connected by anatomic structures such as apical foramina, accessory canals, and dentinal tubules.² These pathways can lead to the transmission of an infection from the root canal system toward the periodontium and vice versa.^{1,2} This relationship promotes

the spread of infection, potentially resulting in typical manifestations of endoperiodontal lesions (EPLs).

Treatment modalities of EPLs should eliminate pathogens from the infected area and prevent their re-colonization.² At present, root canal treatment and the removal of the bacterial plaque by scaling and root planing (SRP) for controlling subgingival microflora is accepted as the traditional approach.^{1,2}

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Lasers, particularly Nd:YAG lasers have been used for a wide-range of dental applications.³ Depending on several critical factors such as the energy level, the efficacy of wavelength absorption by target tissues, and surface temperatures, lasers can stimulate or inhibit growth of bacteria or may have bactericidal effects.³ Owing to this bactericidal potential, Nd:YAG lasers have a possible adjunctive role in traditional mechanical periodontal therapy⁴, although the technique has not been used for the treatment of EPL so far. The aim of this case report is to explore the effects of Nd:YAG laser on the healing of EPLs.

CASE REPORT

A 26-year-old male patient attended our faculty with the chief complaint of pain of left mandibular canine, first and second premolar teeth and recurrent swelling around teeth. Teeth had composite filling in the occlusal area. However, secondary carries were detected and the history had not revealed any traumatic injuries in the past few years. Gingival edema and swelling were observed around the marginal area of the teeth. Severe pain was reported as a sequel of vertical and lateral percussion. The teeth had deep periodontal pockets and when a periodontal probe was inserted from the buccal pockets, bleeding and pus discharge occurred. An electric pulp test indicated that left mandibular canine and first premolar teeth were non-vital; second premolar tooth was vital, although the response was weaker than in control teeth. Radiological examination revealed horizontal bone loss and periapical radiolucency on the teeth.

For these reasons our diagnostic hypothesis was true combined diseases. This diagnosis was reinforced by the typical morphology of the defect, the wide extension of the probing site all along the buccal and distal aspect of the teeth,

the presence of secondary caries and the positivity of percussion test.

Patient received oral hygiene instructions, root canal treatment, supragingival and subgingival scaling with ultrasonic and hand instruments, and laser treatment using a Nd:YAG laser (Smarty A10; DEKA, Firenze, Italy: free-running pulsed wave laser with a wavelength of 1064 nm under air cooling) after recording baseline parameters. During endodontic treatment, access cavities were prepared and the root canal systems were shaped using step-back technique with K-type endodontic files. This shape was prepared by using conventional files from #10 to #40 coupled with 5.25% buffered *sodium hypochloride* (NaOCl) (10 ml) irrigation between the uses of each endodontic instrument. The last irrigant applied was 10 ml saline solution. For root canal laser irradiation, the settings were power output (1 W), energy (100 mJ), time (90 sec), and frequency (10 Hz). Likewise, the delivery contact optic fiber (200 μ m) was continuously moved up and down to cover all surfaces in each root canal. Throughout the treatment, the teeth were restored with a temporary filling material (Cavit G - 3M ESPE, Germany). Finally, the root canal systems were filled with vertically condensed gutta percha with a sealant (Sealapex - Kerr, Romulus, MI USA).

The standardized settings for subgingival irradiation were power output (2 W), energy (100 mJ), time (120 sec), and frequency (20 Hz). The delivery contact optic fiber (320 μ m) was continuously moved back and forth to cover all surfaces in each periodontal pocket. Treatment was performed under local anesthesia. *Articain* 4% with a 1:200000 *epinephrine* (Ultracain D-S forte; Aventis Pharma, Istanbul, Turkey) was infiltrated around the lesion.

As a summary:

- First visit: Root canal treatment and removal of bacterial plaque by scaling-

root planning and laser applications (subgingival laser irradiation 20 Hz, 100 mJ for 120 sec and root canal laser irradiation 10 Hz, 100 mJ for 90 sec).

- Second visit: (After 1 week) Root canal treatment, again laser applications and performing the final endodontic treatment by filling the root canal system with vertically condensed gutta percha with a sealant.

CLINICAL OUTCOMES

The periodontal outcome, clinical symptoms of the patient are shown in Table 1. The clinical index values decreased significantly compared to the baseline values. Percussion assessments showed a significant improvement in reduction of

pain as early as the first week. One week after the initiation of the treatment, the patient had no further complaints concerning discomfort in the involved regions and all treatments were completed. Radiographic evaluations revealed full recovery of the periapical lesions in the subject and the periapical lesions disappeared in 2 months after treatment, which could be regarded as considerably shorter period of time in comparison to the traditional approach (Figure 1).

DISCUSSION

In the current case report, diagnosis of a true combined EPL and recovery of EPL upon Nd:YAG laser application was described. The use of lasers for endodontic and

Table 1. Clinical dental variables and symptoms

	1 th visit (baseline)			2 nd visit (after 1 week)			Control (after 1 month)		
Clinical									
PI	1.71			0.39			0.44		
GI	1.80			0.65			0.14		
*Teeth parameters									
Tooth	33	34	35	33	34	35	33	34	35
PI	1.75	2	1.75	0	0.25	0.25	0.25	0.25	0.25
GI	2	2.5	2.25	1	1.25	1	0	0	0
PD	4 4 5 7	5 5 5 8	4 5 4 7	3 3 5 6	3 5 5 6	3 5 3 6	2 2 3 3	2 3 3 4	2 3 2 3
Pus discharge from root canals	+	+	+	-	-	-	-	-	-
Percussion pain	+	+	+	-	-	-	-	-	-

PI: Plaque index; GI: Gingival index; PD: Probing depth (mm)

*The clinical parameters of endoperiodontal lesions area

33, 34, 35: Left mandibular canine, first and second premolar teeth

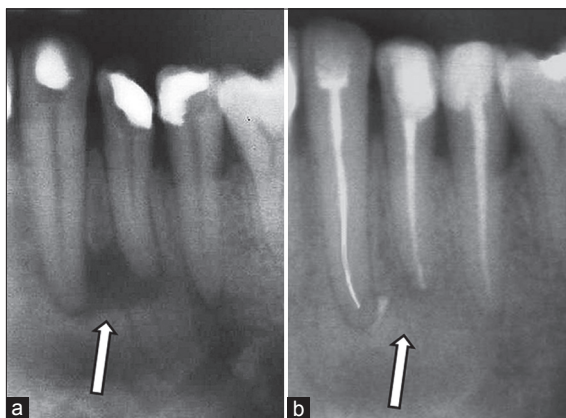


Figure 1. The initial radiograph showing periapical radiolucency (a) and 2-month follow-up radiographic evidence of bone healing in a laser-applied patient (b).

periodontal purposes has been the subject of several studies.^{5,6} Since lasers were first introduced into dentistry, laser treatment has been expected to serve as an alternative or adjunct treatment to conventional and mechanical therapy in dentistry due to its various advantages, such as vaporization, hemostasis, sterilization, and analgesic effect.³

In the treatment of EPL, the tooth requires both endodontic and periodontal treatments. Clinical success in the treatment of EPL is based on sterile endodontic canals and periodontal areas.¹ Although removal of subgingival debridement from the deep periodontal pockets using conventional hand instruments has been reported to be incomplete and rather time-consuming⁷, to improve the effectiveness and efficiency of root surface debridement, various devices such as sonic and ultrasonic scalers and, more recently, lasers have been used. Depending upon the energy level, the efficacy of wavelength absorption by target tissues, surface temperatures and various other parameters, lasers have the ability to either stimulate or inhibit the growth of bacteria or to be bacteriocidal.³ The Nd:YAG laser effectively evaporated and removed dental plaque. Accordingly, a major advantage of Nd:YAG laser is

reducing the subgingival bacterial flora and vaporizing the inflammation.⁶ Owing to this bacteriocidal potential, it has been suggested that lasers could be used to reduce the microbial population of periodontal pockets and thereby be used in an adjunctive capacity during periodontal therapy.³

In this case report, all clinical values decreased significantly higher when compared to the initial values. The healing of periodontal pockets was faster and this enhanced healing indicated the bacteriocidal potential and evaporator effect of the Nd:YAG laser irradiation in the periodontal treatment part of the EPL therapy.

Conventional procedures used in root canal system preparation result in the creation of a smear layer and smear plug composed of organic tissue remnants, dentin shavings, and microorganisms.⁸ For this reason, the primary irrigant used in root canal system preparation is NaOCl. It is used either alone or in combination with other chemical agents.⁸ In the present case, the rationale for using laser in the endodontic part of EPL treatment was based on the fact that it has been shown to effectively kill bacteria.⁹ Indeed, the American Association of Endodontists¹⁰ recognized that laser energy can reduce the quantity of microorganisms, remove the smear layer and dentin from the canal wall, melt and resolidify the dentin to close tubular openings, may aid in welding tooth-like materials to the resolidified walls resulting in denser root canal packing, and is able to eliminate endodontic infection. In this report, a substantial and immediate reduction of pain was reported after the first application. One week after the first laser application, the patient reported complete relief of the enduring pain and therefore, endodontic treatment (root canal filling) was completed. Our findings suggest that the performance of the biomechanical preparation with antimicrobials would be

increased in conjunction with the Nd:YAG laser applications. In addition, Nd:YAG laser would be useful for pain relief in endodontic treatment by eradicating the inflammation. In line with our observations, Koba *et al.*¹¹ showed that after the treatment of the teeth diagnosed with chronic periapical lesion, percussion pain was significantly less in the laser-treated group than in the control group, both 1 week and 3 months. Koba *et al.*¹² also found that Nd:YAG laser was useful for one-visit root canal treatment of infected teeth with apical lesions.

Despite the common use of this laser, there is another useful area, low-level laser therapy, that the basic principle is based on the biostimulation or the biomodulation effect¹³, meaning that irradiation at a specific wavelength is able to alter cellular behavior.¹⁴ Laser photobiomodulation is effective in reducing inflammatory processes, accelerating soft tissue healing, and stimulating the formation of new blood vessels.¹⁵ Additionally, ALP activity, which is a marker of osteoblast differentiation and is expressed in premature and mature osteoblasts, appears to be increased with LLLT irradiation.¹⁶ In the case, the periapical lesions disappeared in 2 months after treatment, which could be regarded as considerably shorter period of time in comparison to the outcome of the traditional approach. This could be an evidence of Nd:YAG laser's antimicrobial, eliminating infection, and biostimulation effect to the lesion area.

However, dental phobia and dental anxiety are usually seen in childhood and adolescent and severe oral inflammation and long treatment time may cause psychological problems and apathy on these patients in the future. For these reasons, treating severe endoperiodontal lesions with Nd:YAG laser can lead to immediate pain relief and reducing treatment time. As a conclusion, Nd:YAG laser is a promising tool for successful treatment of EPL

with immediate pain relief and reduced treatment time.

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How to cite this article: Nihal Beldüz Kara, Ceren Gökmenoğlu, Gülhan Kocaman, Cankat Kara . Recovery of endoperiodontal lesions upon Nd:YAG laser application: a case report. *Cumhuriyet Dent J* 2014;17(Supp 1):47-52.