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The use of dental lasers in new therapeutic approaches

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ABSTRACT

The present paper highlights the multiple use of the modern lasers in dentistry, trough a complex clinical case. A soft tissue laser and a hard tissue laser, at different wave length, were used in order to treat all the dental problems of a 21 year old patient, such us: endodontic treatment, apical cyst treatment without a surgical procedure, gingivectomy. Due to their already well-known advantages (increased patients' acceptance of the treatment plan; increased comfort for the patient – less pain, no post-op edema, time and costs efficiency, due to less and shorter clinical appointments). The treatment was completed by a Maryland bridge and no prep veneers on 1.1-1.4. Due to these advantages and considering the outgoing development of technology, this case demonstrates that the use of various types of lasers in dentistry is undoubtfully necessary and oblige the dentists to become more familiar with procedures.

Keywords: dental lasers, endodontic and prosthetic treatment

INTRODUCTION

The use of lasers in dentistry has increased over the past years (1). Modern dental lasers, developed exclusively for this field, are therapeutic and surgical devices used in periodontology, implantology, prosthodontics, restorative odontology, endodontics, oromaxillary surgery, pedhodontics, orthodontics (2) and also non-surgical devices such as diagnostic, composite and photo disinfection. Low- and high- power lasers have been used in oral surgery, endodontics, periodontology, and restorative dentistry, among other specialties. Soft tissue surgery using a variety of laser wavelengths has been reported (3,4). Because of their many advantages, lasers are indicated for a wide variety of procedures (5,6,7).

Traditionally, lasers have been classified according to the physical construction of the laser (e.g., gas, liquid, solid state, or semiconductor diode), the type of medium which undergoes lasing (e.g., Erbium: Yttrium Aluminium Garnet (Er:YAG) (Table 1) (7) and the degree of hazard to the skin or eyes following in advertent exposure (Table 2) (8).

TABLE 1. *Wavelength of laser light used and target tissue (7)*

Type of lasers	Wavelength (nm) Pulse mode	Chromophores used	Target tissue
Diode	850-1064	Pigments	Gingiva, mucosa
		Haemoglobin	
		Melanin	
Nd: YAG	1064	Pigments	Gingiva, mucosa
		Haemoglobin	
		Melanin	
Er: YAG	2940	Water	Gingiva, mucosa
		Hydroxyapatite	Enamel, dentin, bone
Er, Cr: YSGG	2860	Water	Gingiva, mucosa
		Hydroxyapatite	Enamel, dentin, bone
CO2	10640	Water	Gingiva, mucosa
			Enamel, dentin, bone

TABLE 2. *Classification based on light spectrum (8)*

Classification based on light spectrum		
UV Light	100 nm - 400 nm	Not used in dentistry
Visible light	400 nm to 750 nm	Most commonly used in dentistry (Argon & Diagnodent Lasers)
Infrared light	750 nm to 10,000 nm	Most dental lasers are in this spectrum

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The therapeutic lasers are divided in 2 groups: soft tissue lasers and hard tissue lasers, depending on the patient s target tissue, each of them having a specific chromophore (the substance that serves as an attractant for a laser photon) (3). Thus, to treat the soft tissue, only the diode laser is utilized having as chromophores pigmented tissue (melanin, haemoglobin and oxyhaemoglobin). For the hard tissue, the erbium lasers are the only ones available (they can work on soft tissue too). They use as chromophores the water, but also can be absorbed in hydroxyapatite form the bone structure.

In complex dental cases; the use of different laser wavelengths in combination offer a high level of care.

The current paper presents a clinical case report highlighting aspects related to the use of lasers in solving the complex dental cases.

CASE REPORT

In some complex cases, with more than two dental problems, the dentist needs to use more than one type of laser for different procedures. We will present the clinical approach performed for patient S.T., 21 years old, presented in our dental office with an abscess in 1.1 (fig. 1). The retro alveolar Rx highlighted an apical cyst and an incomplete endodontic filling. The patient presented also a single tooth absence, with the loose of 1.2 and 13 a nanic tooth, situation that does not offer a correct canine guidance. The cause of 1.2 lost was the occlusal trauma due to the absence of the canine guidance.

FIGURE 1. *Presentation in the dental office*

First stage of the treatment was the endodontic treatment, with the trepanation and channel enlargement followed by the sterilization of the apical cyst on 1.1. With the use of Waterlase (Chromium: Yttrium – Scandium – Gallium – Garmet, Cr: YSGG) which has water absorption, the ablation is done throughout a thermo- dynamic – ablative mechanism (T.M.A.). At 2780 nm we can detach the smear layer off the tooth walls and obtain the sterilisation of the dentinal tubules. With the use EPIC Laser at 940 (Biolase diode laser), which has a haemoglobin and pigment absorption we performed the cyst sterilisation around the tooth apex. The treatment protocol consisted in 5 sessions, between june and august, lasted 3 months, with 1 week between the first and the second one and 2 weeks between the next sessions. After the second session, a sterile cotton ball was applied and closed with phosphate cement (fig. 2 and fig. 3).

As it is well known, for the endodontic treatment, the lasers can be used as an adjunctive tool during the initial phase of endodontic therapy. During routine endodontic procedures, the 810 nm diode laser can be used to eliminate bleeding from the pulpal room (9). This process takes advantage of the diode laser's inherent haemostatic action and bactericidal properties and aids with overall healing. This procedure was done at a lower power setting (2 W, .1/.1 repeat pulse mode) in a wet field with water only.

After the 5 endodontic treatment sessions the case was completed and the filling was performed by lateral condensation with Sintex as filling material. In fig.4 and fig.5 (the X ray performed after 6 months) the reduced volume of the cyst can be observed.

FIGURES 2-5. *Treatment stages*

With the use of 2,780 nm Er,Cr:YSGG Waterlase, a gingivectomy was performed. One of the most common dental procedure, the gingivectomy, first introduced by Mester (10) and his colleagues was performed following the protocol with low-level Laser (also called 'soft laser therapy) for aesthetic and prosthetic purpose (11).

As final prosthetic treatment, a minimally invasive prosthetic treatment was performed, a Maryland bridge, from 1.4 to 1.1, with veneers, cemented with CHOICE 2 (Bisco), a light-cured luting cement designed specifically for cementation of porcelain and composite veneers. The final result was optimal, appreciated by the patient and dentist as a very good one (fig. 6).

FIGURE 6. *The final result*

DISCUSSION

Laser therapy has a lot of useful applications in dentistry, as shown in the clinical case presented, that undoubtfully, recommend it in every dental office nowadays. Regarding the endodontic treatment provided to the patient, according to the newest research in the field, the sterilisation mechanism of the radicular walls, and of the interior of the dentinal tubules up to 1000nm is performed. Classical endodontic treatment provides the tubules decontamination only up to 100 nm.

In this way, some protocols for specialties like endodontics, periodontology, treatment of decay, the soft tissue ablation, prophylaxis with anti-inflammatory role where provided. Nevertheless due to the cost of instrumentation, surgical lasers are still not yet widely employed in private practice (9,11). The clinician should consider a number of factors when deciding whether to incorporate laser systems into their practices. First, they should realize that several types of lasers exist, with certain lasers approved for certain uses in dentistry and some lasers specific to soft- or hard-tissue applications (12).

The advantages of using a 2,780 nm laser for this clinical case were: no anaesthesia required; minimally invasive procedure; protective with the dental pulp, preserving teeth vitality; teeth surface remains sterile, with no smear layer; minimal bleeding and quick heeling after gingivectomy. and minimal postoperative comfort. It gave also an increased comfort for the for the patient; decreased working-time and costs efficiency for medical staff for the final impression and for obtaining the temporary restorations (2).

Since the discovery of laser, its research has given different improved laser types, specialized for different targets, like new wavelength bands, maximum peak pulse energy, output power, minimum cost and maximum efficiency. Based on its development and its improved efficiency, laser technology application may revolutionize traditional dental treatment methods.

Regarding the endodontic treatment, the final result were excellent, as can be seen in the above Rx, but the scientific literature on this subject consider several limitations that may be associated with the intracanal use of lasers such us the impossibility to obtain uniform coverage of the canal surface using a laser, the safety for the periapical tissue because of the transmission of irradiation (13,14).

In the past decades, especially in the last 10 years, much experience and knowledge has been gained in the use of lasers, in all the dental fields, in which we moved from mechanical age'' to the ''adhesive age'' and from „steel (scalpel) age“ to the „laser age“ (15).

CONCLUSIONS

Our clinical case is only one example for the wide range of dental procedures theta can be done by the use of modern dental lasers.

All the dentists should adapt and do the transition from the „steel (scalpel) age“ to the „laser age“ (15) in order to provide for the patient all the advantages of a modern treatment.

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