Use of Er:YAG laser in daily dental omnipractice

author_S. Maamary, S. Makhan, S. Nammour, Belgium

_Introduction

Dentistry is slowly evolving. Primitive dental drills were used in 18th and early 19th centuries. In the early 20th century the first electric burring instrument was created. In the 1970s, the turbine was introduced. The use of Er:YAG laser in dentistry laser began in the 1990s. Nowadays, this laser is highly appreciated in daily dental practice. Numerous manufacturers and engineers have fought to create more compact and efficient machines in order to respond to the needs of practitioners. The Er:YAG laser was submitted to loads of research thus resulting in many yearly scientific publications.

The Er:YAG laser's efficiency in the ablation of hard dental tissues has continuously improved thanks to the development of pulse technology software. The microsecond long pulses coupled with high peak powers, enable rapid and quite painless hard dental tissue ablation as in enamel, dentine and bone. The time imputable to cavity preparations becomes comparable to conventional techniques (eg, turbine). There is no direct contact, hence no more vibrations which increases the comfort of the patient and the use of anesthetics becomes superfluous in certain cases.[1-3] The laser hand pieces are more and more ergonomic, easy to sterilize and maintain. The manufacturers having developed new tips, the therapeutic fields have increased, allowing easy access to deep distal cavities, periodontal pockets, etc.

The Er:YAG laser is also a proven tool for soft tissue surgery applications: frenectomy, gingivectomy, gingival pigmentation, periodontal treatments, tumor removal, etc.[4-5, 6-9] A bloodless surgery can be performed by the suppression of the air-water spray.

The Er:YAG laser has become a helpful tool for the omnipractioner. In this paper we will try to describe some Er:YAG laser uses in daily dental practice.

_1. Applications in conservative dentistry

Case 1: Caries removal children dentistry

Nine year old boy with an occlusal caries of the upper left deciduas molar (Fig. 1). The treatment was done without anesthetic. The non sustained enamel and the carious tissue were removed by the Er:YAG laser (Fig. 2) with the following settings: synthetic sapphire tip, spot diameter: 0.8 mm, VSP mode (pulse width: 100 µs) with cooling spray, Energy per pulse: 140 mJ, Frequency: 15 Hz, Fluence: 27.85 J/cm^2, Power density: 417.78 W/cm^2, Total number of pulses: 1,230. Figure 2 shows the laser etching aspect of the lased enamel. The cavity was filled with composite resin (Fig. 3).

_Case 1


Fig. 1


Fig. 2


Fig. 3

_Case 2



Case 2: Caries removal adult dentistry

Thirty nine year old man with two cervical caries of the lower right canine and lower right premolar (Fig. 1). The treatment was done without anesthetic. The non sustained enamel and the carious tissue were removed by the Er:YAG laser (Fig. 2) with the following settings: synthetic sapphire tip, spot diameter: 0.8 mm, VSP mode (pulse width: 100 µs) with cooling spray, Energy per pulse: 200 mJ, Frequency: 15 Hz, Fluence: 39.79 J/cm^2, Power density: 596.83 W/cm^2, Total number of pulses: 1,779. Figure 4 shows the laser etching aspect of the lased enamel. The cavity was filled with composite resin (Fig. 5).

Case 3: Caries removal adult dentistry

Thirty six year old woman with a mesial interdental caries of the upper right first incisor (Fig. 1). The treatment was done without anesthetic. The non sustained enamel and the carious tissue were removed by the Er:YAG laser (Fig. 2) with the following settings: synthetic sapphire tip, spot diameter: 0.8 mm, VSP mode (pulse width: 100 µs) with cooling spray, Energy per pulse: 250 mJ, Frequency: 15 Hz, Fluence: 49.74 J/cm^2, Power density: 746.04 W/cm^2, Total number of pulses: 867. The cavity was filled with composite resin (Fig. 3).

_2. Applications on oral soft tissues

Case 4: Child lower labial frenectomy

Nine year old child with a bad insertion too close to the lower incisors (Fig. 1). The treatment was done with anesthetic. The frenulum was removed by the Er:YAG laser (Fig. 2) with the following settings: hand piece with non contact mode, spot diameter: 0.8 mm without water, LP mode (pulse width: 600 µs), Energy per pulse: 130 mJ, Frequency: 15 Hz, Fluence: 25.86 J/cm^2, Power density: 387.94 W/cm^2, Total number of pulses: 643. Figure 3 shows a satisfactory healing aspect at 8 days.

Case 5: Gingivoplasty

Twenty seven year old woman with a local gingival infection (Fig. 1). The treatment was done with anesthetic. Teeth were protected by means of metallic matrix to avoid damage of the enamel (Fig. 2). The gingival plasty was done by the Er:YAG laser (Fig. 3) with the following settings: hand piece with non contact mode, spot diameter: 0.8 mm with cooling spray, LP mode (pulse width: 600 µs), Energy per pulse: 250 mJ, Frequency: 15 Hz, Fluence: 49.74 J/cm^2, Power density: 746.04 W/cm^2, Total number of pulses: 637. Figure 3 shows a satisfactory healing aspect at 8 days.

Case 6: Implant operculation

Twenty eight year old man was treated (Fig. 1).

_Case 3



_Case 4



The treatment was done with topic anesthetic only. The gum was removed in order to expose the implants by means of Er:YAG laser (Fig. 2) with the following settings: hand piece with non contact mode, spot diameter: 0.8 mm with cooling spray, VSP mode (pulse width: 100 µs), Energy per pulse: 300 mJ, Frequency: 10 Hz, Fluence: 59.68 J/cm^2, Power density: 596.83 W/cm^2, Total number of pulses: 615. Figure 3 shows a satisfactory healing aspect at 15 days. In this case we used VSP mode to avoid an overheating of the implant surface.

_Discussion

The 2,940 nm wavelength of the Er:YAG laser is highly absorbed by water. Thus, the heat generated in the underlying tissue layer is neglectable which results in better postoperative comfort for the patient.[10] Following caries treatment, the patient suffers less from pulpal hyperhemia and dental hypersensitivity. Oral soft tissue surgery will produce less inflammation than with other wavelengths. Concerning the soft tissue oral surgery, some of the treatments necessitate a drug prescription (anti-inflammatory and analgesic) for a shorter period.[1, 10]

The caries treatment with Er:YAG laser respects the minimal invasive principle. A selective ablation of caries tissues can be done with minimal ablation of sound dentine under specific irradiation parameters.[11- 13]

The non contact mode offers better comfort to the patient with less anxiety. Furthermore, many conservative dental treatments and some oral surgeries can be performed without anesthetics which improves the psychological impacts on the patients.[1- 3]

Er: YAG laser allows practitioners to perform various treatments in different fields of daily dental practice, eg, apicectomy, bone graft, osteotomy for removal of impacted teeth, gingival and periodontal treatments and decontamination of laser tissues.[4, 6-9, 14, 15]

Unfortunately, the financial impact of the laser apparatus can slow down the diffusion of this promising technique.[11]

To conclude, the Er:YAG laser technique increases the therapeutic clinical applications of practitioners and improves the relation between patients and practitioners.

_Abstract

The Er:YAG laser system was developed for cutting hard dental tissue and has been approved as a useful alternative method for cavity preparation. This new technique has a good percentage of acceptance and tolerance. A high success rate for hard and soft tissues treatment is obtained without anesthesia. The Erbium lasers are very effective in pediatric dentistry and are good treatment options. Cavity preparation with the Er:YAG laser would seem to be an option for fearful children, since, without anesthesia, it produces less pain and has acceptable efficiency compared to the conventional mechanical preparation.

The Er:YAG laser can provide caries removal and cavity preparation in an adequate preparation time respecting the minimal invasive theory in conservative dentistry with minimal patient discomfort.

In this paper, we tried to describe some clinical applications on hard and soft dental tissues.

To conclude, we believe that Er:YAG technique is very helpful in our daily dental practice and enlarges our therapeutic possibilities._

The literature list can be requested from the editorial office.

_Case 5


Fig. 1

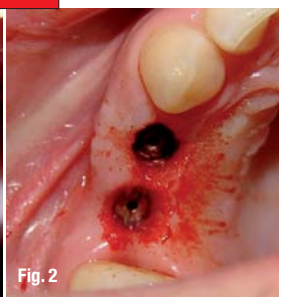

Fig. 2

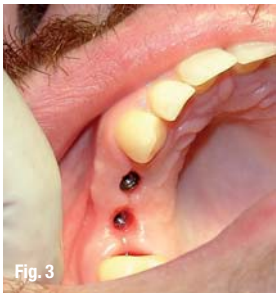

Fig. 3


Fig. 4

_Case 6


Fig. 1


Fig. 2


Fig. 3

_contact laser

S. Maamary
Rue Paul Spaak, 3
1000 Brussels, Belgium
E-mail: sammy_maamary@hotmail.com