ISSN 1855-9913

Journal of the Laser and Health Academy
Vol. 2014, No.1; www.laserandhealth.com

CASE REPORT: The Use of 2940 nm Er:YAG Laser in Cavity Preparation

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I. INTRODUCTION

The pulsed Er:YAG laser (2940 nm) has been recognized as the first choice for ablation of human hard tissues with minimal side effects [1,2,3]. This is due to the properties of the Er:YAG laser wavelength, which provide the strongest absorption in water. The water content in enamel is lower than in dentin, which is why we use higher energy and frequency settings to remove carious enamel. Laser energy is absorbed by water molecules, rapidly heating a small volume. The vaporization of the water creates high subsurface pressure and leads to an explosive removal of the surrounding mineral [18,19]. It is easier to work conservatively with the laser than with the conventional burr. The water content in carious tissue is higher than healthy tissue, which means that for the same settings, the laser ablation rate will be higher in carious tissue than in healthy tissue. This is also clearly audible during laser ablation, the individual laser pulses in carious tissue are more muted, and as you pass over healthy tissue the pulses make a sharper, more crisp or high-pitched sound. As we move in to the dentin we lower our energy and frequency settings since ablation is faster in dentin because of its higher water content. Even lower energy and frequency parameters are required for the final modification to create a retentive surface for the filling material. The surface should be exposed to a few shots while the laser beam is continuously moved across the treatment area. Laser surface modification results in a good adhesion of the filling material, eliminating the need for acid etching [4-12]. After the modification, dry the surface with air and then apply the adhesive and composite material.

Article: J. LA&HA, Vol. 2014, No.1; pp.39-41.
Received: April 11, 2014; Accepted: May 12, 2014

II. MATERIALS AND METHODS

We used a dual-wavelength laser system (LightWalker AT S, Fotona) the Er:YAG laser was used for cavity preparation and the Nd:YAG laser for the disinfection of the cavity [13,14,15]. During all phases of the preparation we used water and air spray to avoid desiccation of the tissue and maintain ablation efficiency. For the modification of dentin and enamel with all the prepared cavities, we used QSP mode, 120 mJ energy and 10 Hz frequency [15-17].

III. CASES

a) Case 1:

The patient was a 35-year-old female with good medical history and moderate oral hygiene. She visited our dental clinic for the first time and complained about pain when eating something cold. After examination, we noticed that we had to replace four old fillings and make two new fillings for the neighboring teeth. Testing all the teeth, we saw that the most sensitive was 46. We started to remove the old filling using MAX mode with 10 Hz frequency, and after removing the old filling, we used 200 mJ and 10 Hz with QSP mode for carries removal. As seen in the picture IV (Fig. 2), the cavity was very deep, and in the interdental area we had bleeding, so at this point we used Nd:YAG, 5W, 30 Hz and 100 µs pulse duration for hemostasis. It was impressive that the patient felt slight pain only while using the Nd:YAG (without anesthesia). At the end, we irradiated all of the dentin and enamel area with QSP mode at 120 mJ and 10 Hz, without the need of acid etching. As can be seen in the final picture VII (Fig. 3), we performed the same procedure on the neighboring tooth 45.

Fig. 1: Picture I

Fig. 3: Pictures II - VII

b) Case 2

The patient was the same as in the first case. She was so enthusiastic about the use of the laser that she asked if it would be possible to perform the same procedure to improve the aesthetics of her smile by repairing the two incisors, 11 & 21. We used 300 mJ at 10 Hz with QSP mode to create roughness on the teeth surface, and after that, with modification settings in order to achieve better retention (Fig. 4).

Fig. 4: Case 2

c) Case 3:

The patient was a 55-year old female with poor oral hygiene. She complained of sensitivity and also bleeding gums in the area of teeth 43 and 44. After examination we determined that we had to do two fillings on those teeth. We performed a gingivectomy in order to uncover the cavities of the decayed teeth using 120 mJ and 10 Hz with VLP mode. Also, we used Nd:YAG at 5 W and 30 Hz at MSP mode for better hemostasis. Afterward, we used 200 mJ and 10 Hz with QSP mode for carries removal. And in the same session, after using the QSP mode at 120 mJ and 10 Hz for modification, we filled the two cavities (Fig. 5).

Fig. 5: Case 3

IV. CONCLUSIONS

The Er:YAG laser is the first choice and an ideal tool for performing any cavity preparation without anesthesia, and with great precision and safety. We have also found that we can work more selectively by fine-tuning the laser to the exact requirements of the tissue we are working in, and that the quality of our work has improved in terms of being more conservative. All patients were pleasantly surprised with the use of laser and felt very happy and comfortable during the procedure.

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