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CASE REPORT: Laser Applications with an Er:YAG Dental Laser and X-Runner Handpiece

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ABSTRACT

Preparation of an enamel tooth surface by Er:YAG laser enables a strong adhesion similar to acid etching. The advantage with using a laser with the X-Runner handpiece is the ability to prepare a very small surface area by pre-selecting the exact size and shape of the ablation area. The X-Runner handpiece is similar to a standard non-contact Er:YAG laser handpiece, but with the addition of a digitally controlled scanning mechanism to automatically guide the laser beam. The X-Runner handpiece can be used for all kinds of treatments by switching back and forth between the automated modality and the classic handpiece modality without the need for changing handpieces. The shape (circular, square, rectangular, etc.) and size of the desired scanning area (width and length of the rectangle, diameter of the circle) can be adjusted. In this case presentation, applications of the Er:YAG laser with X-Runner handpiece on both hard and soft tissue will be presented.

Key words: Er:YAG laser, enamel, orthodontics, implant.

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I. INTRODUCTION

The first use of lasers in dentistry was reported in 1964 [1]. Since then, lasers have increasingly been used for the treatment of soft and hard tissue lesions [2,3]. In recent years, different dental laser systems have been used for curing, whitening, and soft- and hard-tissue operations [4].

One of the uses of lasers in orthodontics is based on previous laser studies conducted with hard dental tissues. Laser irradiation causes structural changes on the enamel surface; it causes surface irregularity and roughening, similar to acid etching, to a depth of 10 to 20 μm depending on the type of laser and energy. Enamel conditioning by laser is a process of vaporization and micro explosions in the hydroxyapatite matrix [5].

The etching of enamel by laser provides a fractured and rough surface and fully open dentin tubules, conditions which are ideal for adhesion [6]. The surface prepared with laser is acid resistant because of the changed mineral content, thus susceptibility to acid attack and caries is reduced [7,8]. Laser-induced caries resistance may be important in orthodontics [9]. Preparation of the enamel surface by Er:YAG laser alone gives a strong adhesion, similar to acid etching [10]. Moreover, lasers increase the resistance of enamel to demineralization [11]. Another advantage of working with a laser is the ability to prepare a very small tooth surface area by selecting the size and shape of the scanning area.

The digitally controlled X-Runner handpiece is similar to standard non-contact Er:YAG laser handpieces, however, a digital laser beam control mechanism has been added via a small box attached to the device, with an electrical cable providing the digital connection between the laser device and the scanning beam mechanism. Usage is similar to other non-contact handpieces; the only difference is that it is a little bigger than other units. The X-Runner handpiece can be used for all kinds of treatments by switching from the digitally controlled modality to the classic handpiece modality, without having to change handpieces. The shape (circular, square, rectangular, etc.) and size of the scanning area (width and length of the rectangle, diameter of the circle) can be easily adjusted. In this case presentation, applications of the Er:YAG laser combined with the X-Runner handpiece on both hard and soft tissue will be presented.

II. CASES

a) Case 1: Enamel conditioning for orthodontic bracket bonding

Laser conditioning was performed on the teeth of an 11-year-old female patient receiving fixed orthodontic treatment. The system used was a LightWalker AT, Fotona (Fig. 1).

Fig. 1: LightWalker AT laser and X-Runner handpiece.

The parameters were determined according to the current literature for optimal enamel conditioning: 120 mJ, 10 Hz, QSP mode, using an X-Runner handpiece with air and water cooling. The dimensions of the irradiated area were 4x4 mm (for the anterior part) and 4x5 mm (for the posterior part) and were adjusted according to bracket dimensions (Fig. 2). The enamel conditioning was performed precisely in several seconds without any bad aftertaste of acid material, and the patient was very comfortable. Then the teeth were dried with air spray, bonding material (Transbond XT, 3M Espe, CA, USA) was applied only to the treated area and braces were placed and cured within 20 seconds.

Fig 2: During laser irradiation.

The buccal surfaces of the teeth in the maxillary right part were etched with 37% phosphoric acid, washed with water, dried with air, bonding material was applied and braces were placed and cured (Figs. 3-6).

Fig 3: During acid etching.

Fig 4: After enamel preparation.

Fig 5: Bonding material application.

Fig 6: Bonding completed.

b) Case 2: Uncovering implant surfaces

A procedure to uncover an implant surface was performed using Er:YAG laser with air cooling (X-Runner handpiece, 200 mJ, 15 Hz, LP mode). The dimension of the irradiated area was 5 mm in diameter (Figs. 7, 8). The removal of gingiva covering the implant surface was removed in a few seconds without anesthesia or bleeding (Fig. 9).

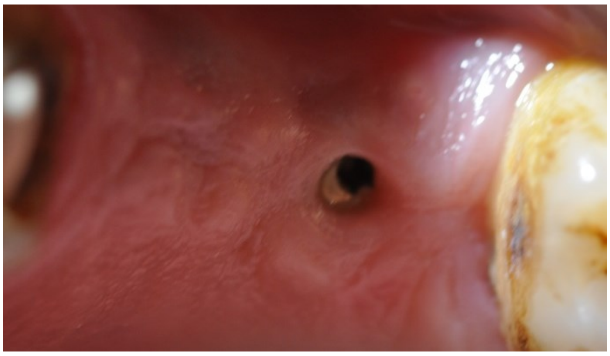

Fig 7: Before uncovering of implant surface.

Fig 8: During laser irradiation.

Fig 9: Final good result without any bleeding.

III. CONCLUSIONS

Since lasers were introduced in dentistry, a continuing interest has been shown by clinicians and researchers. The introduction of the Er:YAG laser made it possible to perform treatments in both hard and soft tissues. The X-Runner digitally controlled handpiece now provides an even higher precision of irradiation and depth of ablation, with reduced treatment time.

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