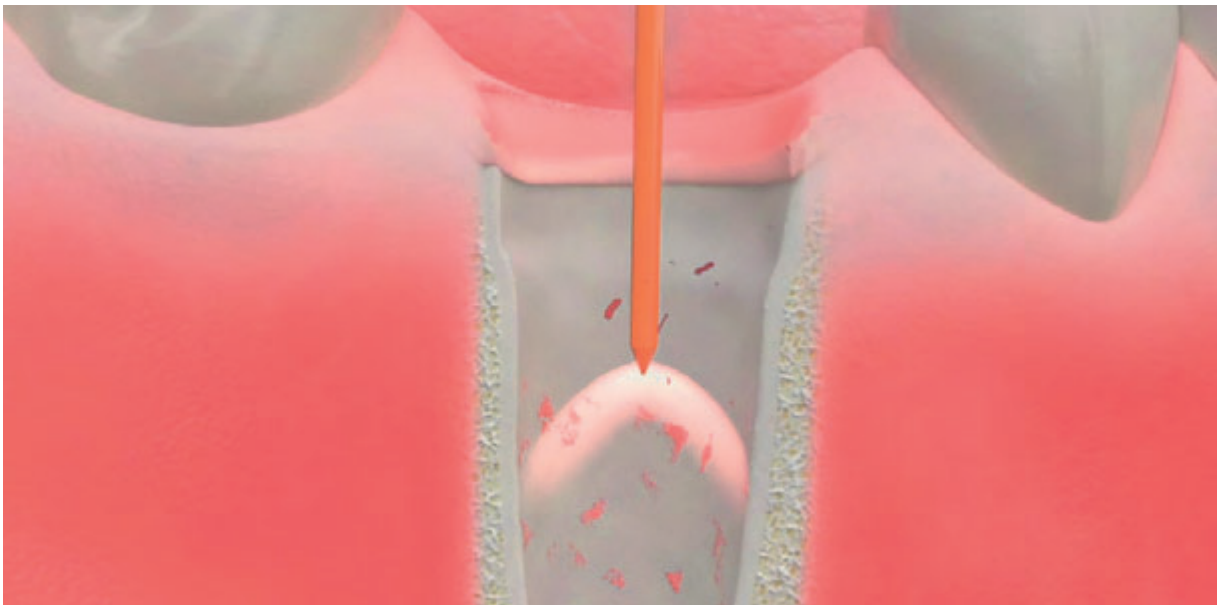
# LASER-ASSISTED SURGERY BEFORE IMPLANT PLACEMENT

## A Clinical Case Report

*By Dr. Ariel Savion*



## INTRODUCTION

The various applications of lasers in implant dentistry are dependent on the wavelength and laser–tissue interactions. Lasers have been used for many years in oral surgery and implant dentistry. In some cases, laser treatment has become 'state of the art', compared to conventional techniques. To understand the indications for lasers in surgery, it is necessary to know the fundamental principles of laser light.

Erbium lasers, such as Er:YAG and Er,Cr:YSGG wavelengths, have two main chromophores, water or the hydroxide ion (OH-) as primary, and mineral Hydroxyapatite as a secondary. They emit in the mid-infrared range at wavelengths of 2,940 nm for Er:YAG and 2,780 nm for Er,Cr:YSGG, respectively. Due to their significant absorption in water, their penetration depth can be as shallow as 5µm[1]. Erbium laser systems have free-running pulsed emission modes with peak powers measuring thousands of watts. Thus, they offer ablation with minimal thermal side effects. The photonic energy of both the Er:YAG and Er,Cr:YSGG lasers can be delivered in either a contact or non-contact mode. In contrast, diode lasers emit wavelengths of 445, 810, 940 and 980 nm, have default continuous wave emission mode, deliver energy in contact mode only and, therefore, have higher thermal side effects on the soft tissues.

Unlike other light sources, lasers emit coherent, monochromatic and collimated electromagnetic radiation which enables their use in unique surgical applications. Whether a laser system is suitable for incisions, vaporization or coagulation is determined by the wavelength, the energy density (fluence), the optical characteristics of the tissues and mode of operation. In continuous mode, the laser provides a constant and stable delivery of energy. Pulsed laser systems, in contrast, provide bursts of energy.

Lasers in the ultraviolet region (100 to 380 nm) are capable of ionizing tissues, a process known as photochemical desorption. Lasers of longer wavelengths, especially those within the infrared part of the spectrum (700 to 11,000 nm), cause significant tissue heating.

## CASE REPORT CANINE #13

### CLINICAL EXAMINATION

A 66-year-old female, presented with broken old PFM crown on tooth #13, without minimum ferrule and resistance form. Her chief complaint was the crown falling out often. Her demand was new restoration on this tooth.

In clinical investigation, her medical history was non-contributory, she was a non-smoker or alcohol consumer. Dental history was significant for poor oral hygiene with localized areas of dental plaque-induced gingival inflammation. Normal thickness and width of keratinized mucosa was noted with deep occlusion. On CBCT observed long root with periapical lesion and thin buccal plate < 1 mm (Figure 1).

### SUGGESTED TREATMENT PLAN

**A.** Laser-assisted partial tooth extraction performing socket shield technique[2] to avoid buccal plate dehiscence.

**B.** Laser-assisted apical resection.

**C.** Laser disinfection and guided implantation (immediate implant placement using surgical guide). (Figure 2).

## TREATMENT PLAN

Based on our clinical findings, performing crown lengthening surgery and crown replacement will extend the life expectancy of the tooth, but will cause unaesthetic appearance. Moreover, minimal remaining tooth structure and presence of periapical lesion will reduce success rate and restoration durability. In esthetic zone, we must preserve both hard and soft tissues and, therefore, the preferred treatment plan will be to perform immediate extraction and implant placement with loading for soft tissue seal and emergence profile.

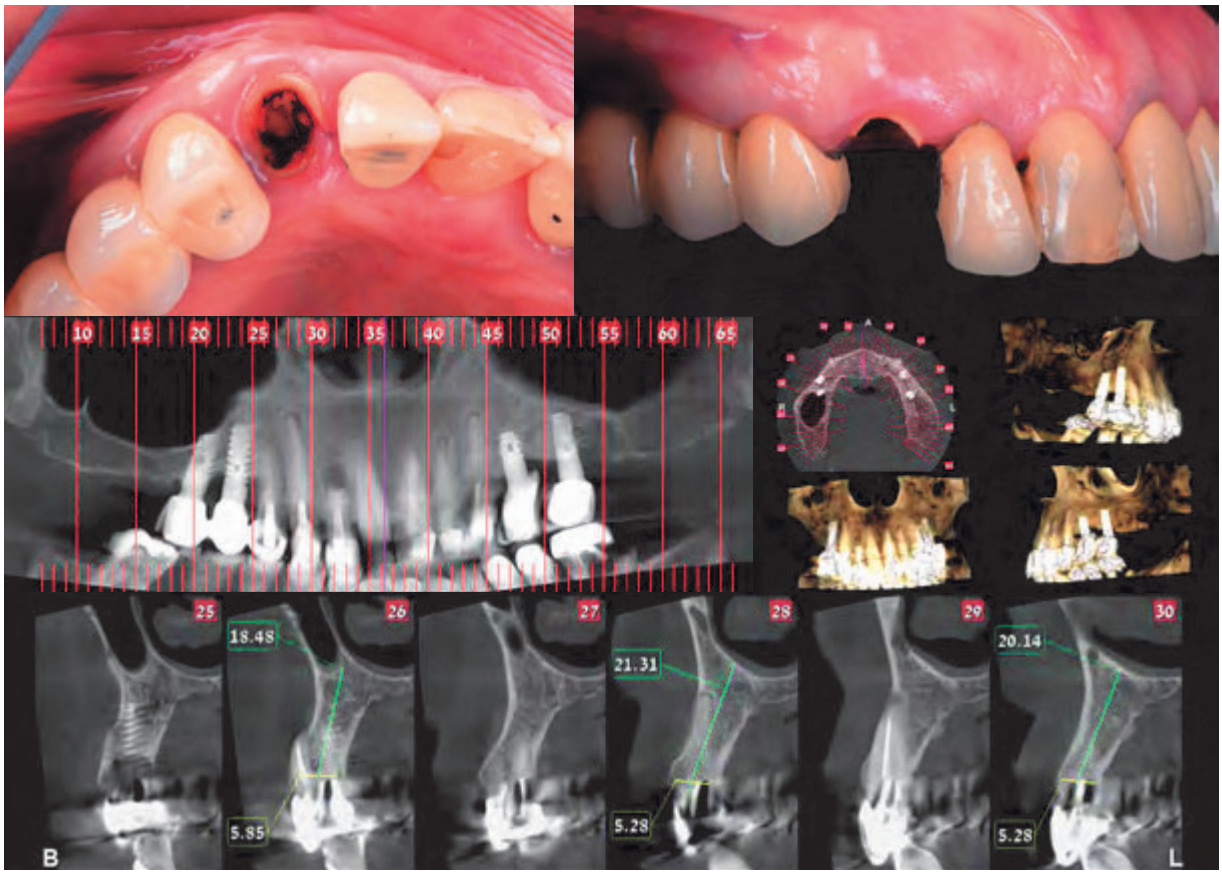



**Fig. 1** Pre-operative CBCT of tooth 1.3 with periapical lesion and thin buccal plate.

## SURGICAL PROCEDURE

1. Extraction of tooth #13. No antibiotics were prescribed prior to or after the surgery[3]. Local infiltrative anesthesia was administered (Lidocaine 2%, Epinephrine 1:100,000).

2. Mucoperiosteal flap was performed without full papillae elevation with 2 vertical incisions.

3. Partial tooth extraction was performed following granulation tissue removal with Er,Cr:YSGG laser. Debridement time was proportional to the amount of pathological tissue and bone volume, while ensuring no physical contact between the laser tip and the hard tissues. (Figure 3)

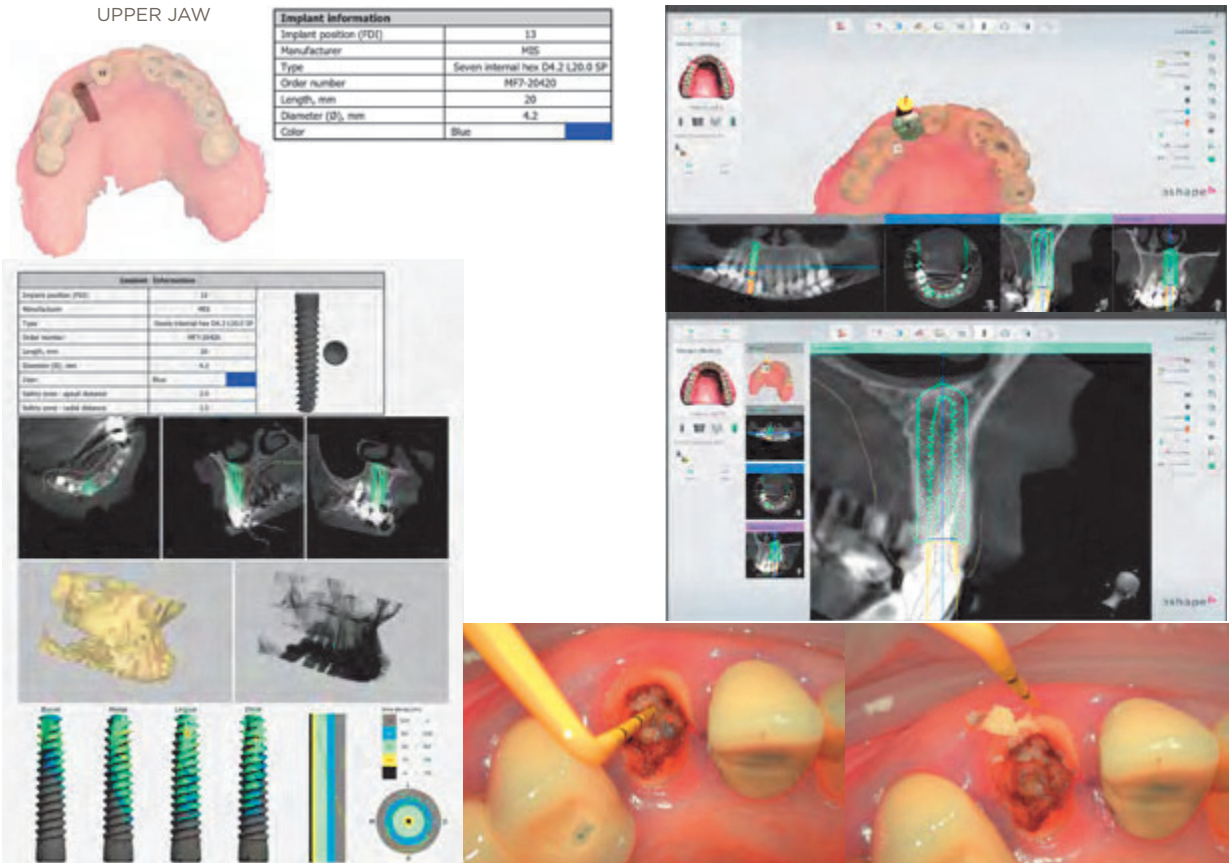



Fig. 2 Surgical Guide – long root with very thin buccal plate.

## ER,CR:YSGG LASER TISSUE INTERACTIONS

The proposed advantage of the use of lasers in implant dentistry is improved hemostasis, precise incision margin, minimal damage to the surrounding tissues, and reduced postoperative swelling.[4]

A laser device emits light through a process called stimulated emission. Laser irradiation is mainly characterized by wavelength, exposure time, pulse frequency, pulse duration, spot size, power, and energy density. Tissue properties are characterized by optical, chemical, mechanical, and thermal qualities.[5] Among optical qualities especially coefficients for absorption, reflection, refraction, and scattering are important in determining laser beam transmission and, therefore, absorption.[6]

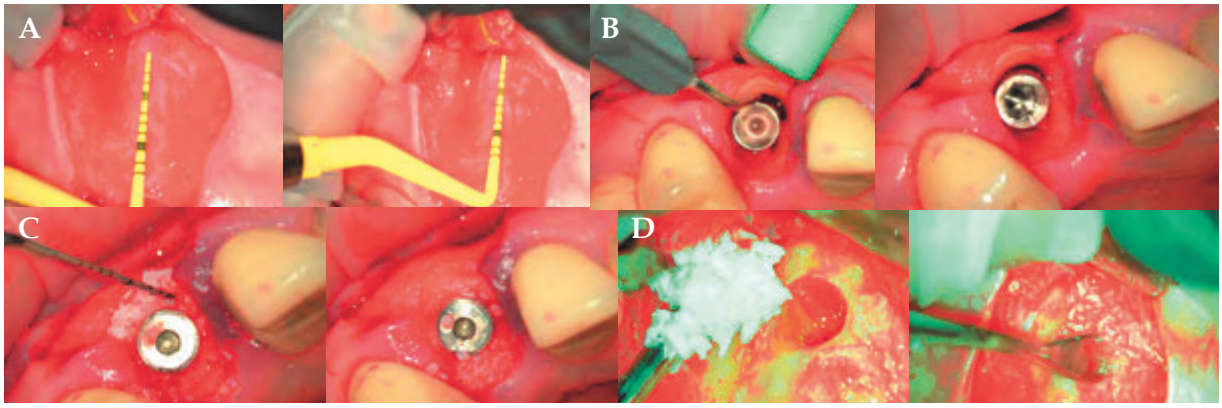



**Fig. 3** Surgical phase A: long root with thin buccal plate and periapical lesian. B: implant insertion, perserving space between root and implant. C: xenograft particles gap filling. D: after laser-assisted tooth resection, xenograft bone augmentation.

## LASER PARAMETERS

In this case report, has been applied laser erbium, chromium: yttrium scandium gallium garnet (Er,Cr:YSGG) 2780 nm (Waterlase iPlus®, BIOLASE, Irvine CA, USA), Waterlase Gold Handpiece, new tip MZ-6, 17 mm length. The laser parameters utilized as follows:

- Granulation tissue removal - the average output power 2.0 W, pulse duration of 60 µm (H-mode), pulse repetition rate of 30 Hz under water spray (air: 20%, water: 40%.)
- Osteotomy - average output power of 6 W, pulse duration of 60 µm (H-mode), pulse repetition rate of 50 Hz under water spray (air: 40%, water 90%)
- Laser-assisted root resection - output power 7 W, pulse duration of 60 µm (H-mode), pulse repetition rate of 20 Hz under water spray (air: 50%, water: 90%)

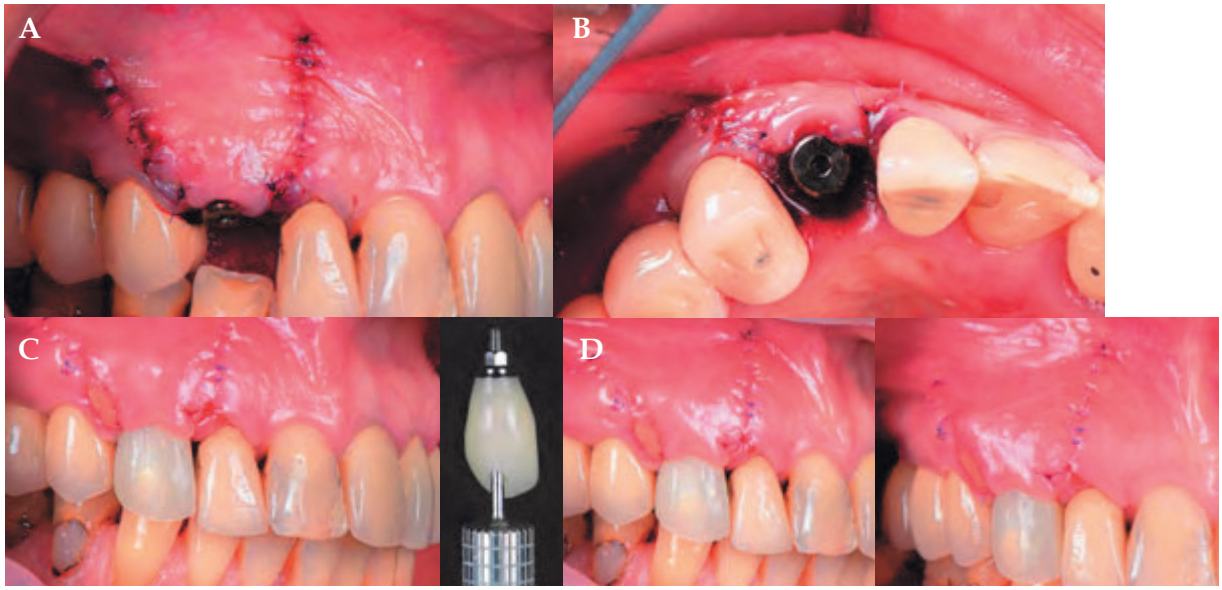



**Fig. 4** Follow up and immediate loading A: sutures monofilament 7.0 on surgery day. B: occlusal view, volume preservation with partial tooth extraction. C: healing process after 5 days. Insertion temporary PMMA screw retained crown. D: immediate loading after 5 days. Lateral view.

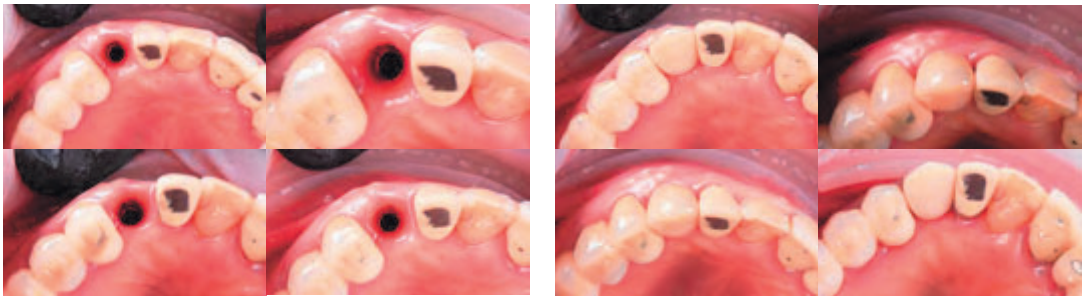


**Fig. 5** *From left to right* — Emergence profile before final restoration. Final zirconia crown cemented on zirconia abutment.

## PROSTHETIC PHASE |

Esthetic compromise can present itself as vertical recession in the mid-facial or interdental areas, loss of facial contours in the horizontal dimension and differing tissue color and surface texture.[7] These consequences of tooth extraction are caused by mechanical trauma, microorganisms in the socket exposed to the oral cavity, disruption of the periosteal blood supply after flap elevation and patient-related risk factors such as smoking or plaque accumulation,[8] thickness of the buccal bone wall and the loss of periodontium.[9] (Figure 4-8)

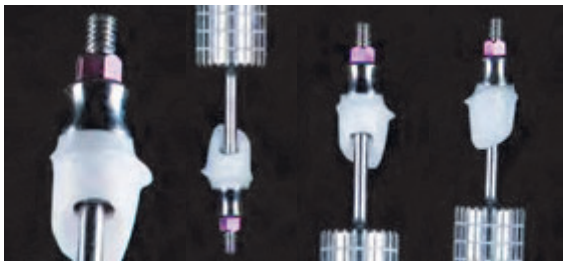


**Fig. 6** Custom designed and milled zirconia abutment on T-Base before insertion.

An esthetic implant-supported restoration emerges through the surrounding tissues mimicking a natural tooth.[7] The transition between the restoration and the soft tissues must appear natural and the emergence profile (EP) often requires customized modification.[10] The correct contour of the provisional restoration is essential to achieve an esthetic result.[11] Development of the emergence profile by manipulating the peri-implant tissues should be performed at the temporization stage.

The peri-implant tissue complex varies based on implant design, position, soft tissue quality, and the osseous structures, and it is impossible to standardize abutment designs for all cases.[12]

## DISCUSSION

### ER,CR:YSGG LASER IN IMPLANT DENTISTRY.

Crippa et al. evaluated the feasibility of YSGG laser irradiation on infected and/or inflamed post-extraction sites for the immediate placement and, when possible, immediate loading of endosseous implants.[13] It was found that the combination of mechanical, chemical, and laser treatment

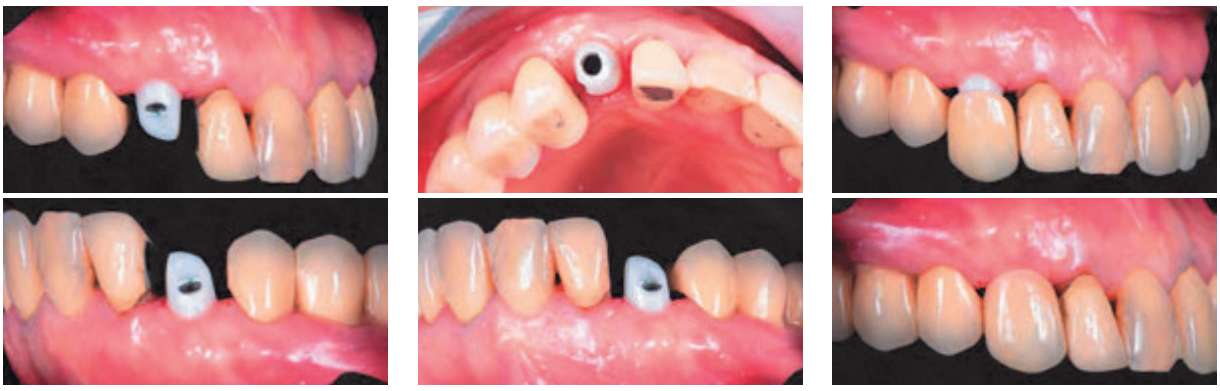


**Fig. 7** *From left to right* — Insertion of zirconia abutment before final restoration. Final zirconia crown cemented on ziconium abutment.

was highly effective for the disinfection of post-extraction sites. YSGG laser is useful not only as a surgical device but also as a disinfection tool, ensuring optimal results after implant surgery.

In the review of current literature, along with clinical procedures, outcomes and incidence of complications associated with placement of immediate implants into infected post-extraction sites, Crippa et al. found the YSGG laser was able to significantly reduce the bacterial concentration following extraction of compromised teeth.[15] It was concluded that the use of YSGG laser has ensured success of implant therapy performed in an infected site and prevented complications such as peri-implantitis. The implant achieved good primary stability, immediate placement into an infected site did not increase complications and the 5-year follow-up confirmed the treatment success.

Gutknecht et al.[3] noted that in the presence of chronic periodontal disease prior to tooth extraction, YSGG laser produced very high bactericidal effect and made the laser treatment an indispensable part of periodontal treatment. This approach can be used in flapless technique when we extract the tooth and disinfect the infected socket with this laser before implant placement without raising the flap. A 360-degree radial firing tip can significantly reduce pathogenic microorganisms in the periodontal environment. Microbiological examinations showed a strong reduction of the entire bacterial burden in the pocket as well as each separate periodontal pathogen which persisted up to six months after treatment. The pocket depths of the treated sites showed greater reduction after using the laser than in the non-lased sites.

For the improvements in the treatment outcome of surgical therapy, including regenerative surgery, preparation of the diseased site by better decontamination methods and activation of the surrounding tissues/cells may be required. High-level power and low-level power lasers offer promise in this regard by helping inflamed and/or damaged tissues to rapidly move into the healing and regenerative phases by thorough debridement and decontamination and by modulation of cellular metabolism in the surrounding tissues. [16]

With respect to the implant site preparation, Er,Cr:YSGG laser application has been proven to facilitate implant placement and achieve faster osseointegration with less osseous tissue damage when compared to conventional bur drilling.[17]


**Fig. 8** Final outcome, treat duration 3 months from surgery day. LANCE implants (MIS, Israel), diameter 3.75 mm, length 16 mm for promary stability and immediate loading.

## CONCLUSION

In this case report presented, immediate dental implant placement has numerous advantages. Laser assisted surgery reduced treatment time, and cost and enhanced patient comfort with less morbidity. Less extensive surgical interventions needed. Likewise, using advanced laser technology in implantology decreased bone resorption, preserved soft and hard tissue volume, and offered the ability to deliver natural-looking of final esthetic restoration in short period time. Furthermore, minimal invasive approach encouraging anxious patients be treated with advanced laser technology.

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## ABOUT THE AUTHOR

**Ariel Savion, DMD, LLB, MSc, MSc, ICOI**

Ariel Savion is a board certified diplomate in oral Implantology (ICOI - USA),

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Dr. Savion a board member of the International Association Microscopic Dental Club that promotes microscopic dentistry worldwide. Dr. Savion is the owner of the “Savion Study Club”, a learning platform in “laser assisted microscopic surgery & dentistry”. In his private clinic, he focuses in laser assisted Implantology and aesthetic dentistry in a minimally invasive approach. Moreover, Dr. Savion is a dental photographer under microscopic magnification that highlights his passion and precision in the dental and surgical field.

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