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Case Report
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Er:YAG Laser-Assisted Debridement for Postoperative Infection of Dental Implant at the Mandibular Anterior Region: A Case Report

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Abstract

Early postoperative infection is an unusual complication of implant placement that can lead to bone resorption, inflammation, and ultimately implant failure. Treatment of such infections is still challenging in clinical work. An Erbium-doped Yttrium Aluminum Garnet (Er:YAG) laser is reported efficient in disinfection and decontamination. This case report describes a patient with early post-implantation infection that caused severe bone resorption in the right mandibular anterior region 2 months after the implant surgery. Complaint of pain was recorded. After reasonable decontamination and debridement using Er:YAG laser, Guided Bone Regeneration (GBR) was performed. Six months after the surgery, CBCT was taken which indicated that the infected implant achieved re-osseointegration and no lucency around the fixture. Debridement with Er:YAG laser is promising in treating the infected implant.

Keywords: Er:YAG laser; Post-implantation infection; GBR

Introduction

Early infection after dental implantation is not a common complication. Factors are mainly related to patients' systemic problems, such as untreated diabetes and heavy smoking, technical problems such as bone overheating during drilling and inaccurate implant inserting, compromised operation sterility, and poor oral hygiene [1]. Severe and acute infection can result in alveolar bone resorption, implant exposure and osseointegration failure. Due to the excessive dense bone, the risk of early implantation failure was 2.7 times higher when implants were placed in the anterior mandibular region than in the posterior mandibular region [2]. The wavelength of the Er:YAG laser is 2,940 μm, which happens to be at the highest peak of water absorption, so it can be absorbed extraordinarily by water to produce a "microexplosion" effect. An Er:YAG laser can act on the deep of implant threads and produce less heat, so it is one of the ideal treatment modalities for decontamination and debridement of an infected implant and for promoting implant re-osseointegration.

In this case report, by using Er:YAG laser for decontamination and debridement, the implant was saved with sufficient bone support. Favorable restorative results and excellent implant osseointegration were achieved.

Case Presentation

A 38-year-old female patient was received implant placement 2 months ago at mandibular right central incisor region. The patient suffered persistent swelling of the gingiva and pyorrhea with pain for about 1 months. No improvement was achieved after local irrigation with chlorhexidine. The patient denied a medical history with systematic disease, such as hypertension, diabetes and heart disease; no drug allergy; no bisphosphonate treatment; and no smoking.

A healing abutment was placed on the implant without mobility. The gingiva of the implant was showing hyperemia, swelling, and hemorrhage. A fistula was observed at the apical of the implant of the labial mucosa. Discomfort occurred when palpating the labial gingiva around the implant. CBCT images showed that the implant was present without the labial bone (Figure 1).

Under local anesthesia, a full-thickness flap was reflected to expose the implant. Labial bone was completely resorbed and the exposure of implant threads were observed. There was a large amount

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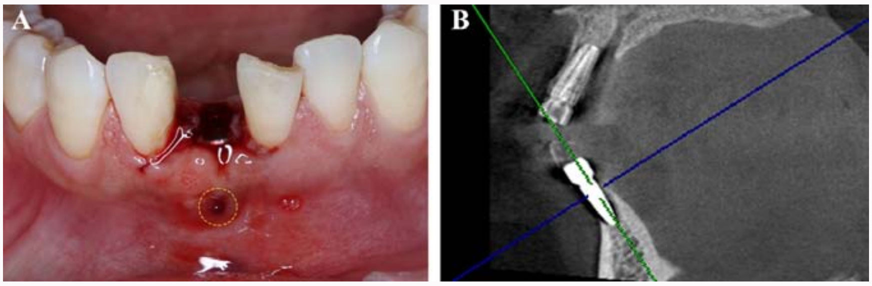

Figure 1: A) Pre-operation clinical examination of the patient. B) CBCT of the patient.

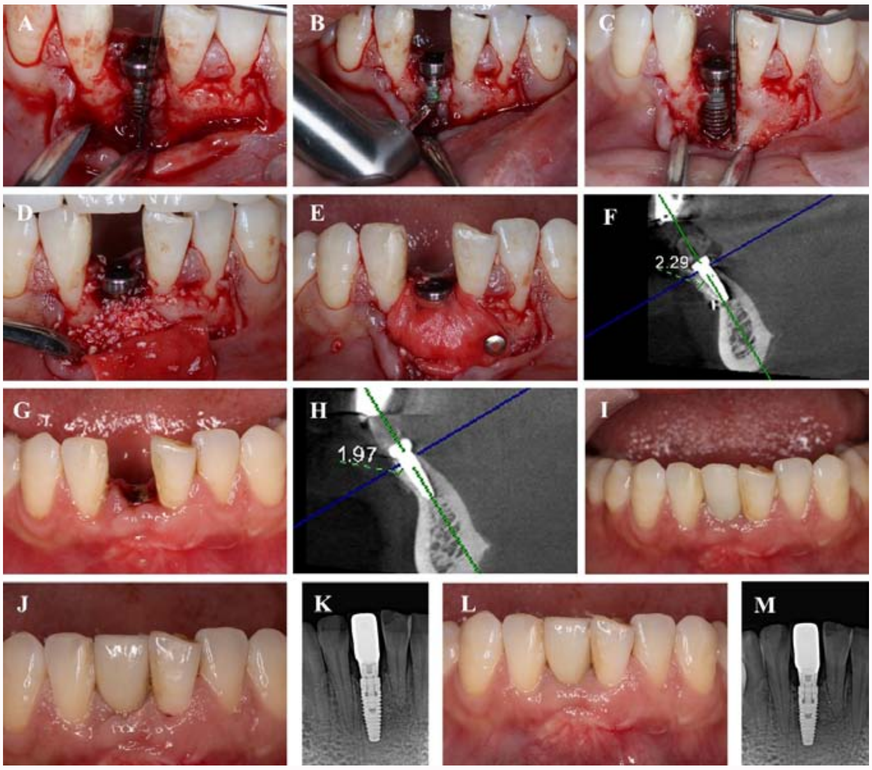

Figure 2: A) Flap was elevated. B) Debridement with Er:YAG laser. C) Measurement of bone defect. D) Bone graft. E) Membrane was placed. F) CBCT after the surgery. G) Six months after the surgery. H) CBCT 6 months after the surgery. I) Provisional prothesis. J) Final prothesis. K) X-ray showed osteointegration of the implant. L) 2 years after the surgery. M) X-ray 2 years after the surgery showed stable bone level.

of granulation tissue distal to the implant. The vertical absorption of the labial bone was approximately 10 mm.

Granulation tissue was completely removed with an Er:YAG laser (parameter settings: SP, 80 mJ, 30 Hz, and water/air: 5/2). Infected implant surface decontamination and debridement were achieved with an Er:YAG laser (parameter settings: SP, 50 mJ, 30 Hz, and water/air: 5/2). After debridement, there was a bone defect in the distal area of the implant.

After decortication, bone graft (0.5 g, Bio-Oss, Geistlich) was filled into the bone defect. A resorbable collagen membrane (13 mm × 25 mm, Bio-Gide, Geistlich was placed upon the bone graft. Wound closure without tension was achieved by interrupted sutures. Postoperative CBCT images showed that bone graft with a thickness of 2.2 mm was observed on the labial aspect of the implant. Two weeks after the operation, the surgical area healed uneventful without membrane exposure or obvious abnormal secretions. A Maryland Bridge was placed as a temporary prosthesis.

Six months after surgery, CBCT images revealed that there was new bone formation on the labial aspect of the implant, and the implant was achieved osseointegration. A screw retaining temporary prosthesis was made to shape the gingival soft tissue. After 3 months, the final prothesis was produced. X-ray images revealed that the crown was seated well. The patient was satisfied with the effect of therapy (Figures 2A-2K).

Results

At the 24-month follow-up, the implant prostheses showed good function and no noticeable soft-tissue recession was observed. The radiologic examination showed satisfactory preservation of marginal bone (Figure 2L, 2M).

Discussion

The mandibular anterior region generally has the densest bone, mostly consisting of type I and II bone qualities [3]. Although the primary stability of the implant is excellent in this region, but risk of implantation failure was increased due to the friction and bone necrosis induced by high local temperature during surgical drilling [4]. Studies have reported that when exposed to a temperature of 47°C for half an hour, local osseous necrosis, soft tissue wrapping around the implant, and osseointegration failure can occur, so the area is more susceptible to bacterial infection [5]. Sufficient bone, which can provide a rich blood supply to maintain the processes of regeneration and reconstruction of peri-implant bone, is required for the implant success. When the facial bone thickness was more than 2 mm, bone loss of the implant decreased significantly [6]. When labial bone thickness was insufficient, bone resorption was more likely to occur in the mandibular anterior region with dense bone and poor blood supply.

A large number of studies have shown that implants can still achieve re-osseointegration following local debridement and decontamination of the infected implant [7]. It was demonstrated that implants with smooth surfaces were more likely to re-osseointegrate than implants with rough surfaces [8-10]. This may be due to the ease of decontamination of smooth implant surfaces. However, more bone regeneration was observed for implants with rough surfaces than that for implants with smooth surfaces when re-osseointegration occurred [10]. Therefore, how to achieve effective decontamination of implants with rough surfaces are urgently needed in the clinic.

At present, various methods, including mechanical curettes, ultrasonic devices, mechanical sandblasting, titanium brushes and irrigation with chlorhexidine, are commonly used for implant surface decontamination. The wavelength of the Er:YAG laser is the same as the highest peak of water absorption, producing a "microexplosion" effect for tissue cutting, debridement and sterilization, which causes little damage to the implant. *In vitro* experiments showed that, compared with other mechanical methods, the Er:YAG laser had the best decontamination effect on the rough surface of the implants because Er:YAG laser light can irradiate the deep areas of the threads [11]. Animal study has demonstrated that an Er:YAG laser can effectively treat infected implants and promote implant osseointegration [12]. In a prospective clinical cohort study, 20 patients with peri-implantitis were treated with an Er:YAG laser (initial settings of 50 mJ and 25 pps). After 1 year of treatment, CBCT images revealed that the infrabony defects around the implants disappeared [13]. However, different Er:YAG laser parameters had different effects on the implant. The application of a high-level Er:YAG laser (150 mJ/10 Hz) decreased the proliferative ability of osteoblasts on the SLA surface [14]. The application of an Er:YAG laser (80 mJ/20 Hz) changed the surface topology structure of implants with SLA surface [15]. Low energy level of Er:YAG lasers (50 mJ, 60 mJ, 120 mJ) were sufficient for debridement and decontamination of the implant surface [16]. Moreover, Er:YAG lasers had different therapeutic effects on implants with different surfaces [17].

Conclusion

Decontamination and debridement with an Er:YAG laser were promising in treating the infection of the implant. Satisfactory therapeutic effects were obtained in a short period of time, but further review is still needed in the long term especially for the optimum parameters of the Er:YAG laser.

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