

An Improved Case of LASER Sintered One-Piece Dental Implant with Early Failure Signs

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ABSTRACT

Early loading of dental implants can simplify treatment and increase patient's satisfaction. In a study designed to evaluate laser-sintered early-loaded one-piece implants, in the mandibular premolar area, early signs of implant failure were noticed in one patient (out of 30 cases), based on clinical and radiographic evaluation. A piece of amalgam restoration had fractured during implant site preparation and was trapped into the peri-implant tissue. The case was followed up frequently and the preimplant tissue was irrigated with saline at each follow up visit. Antibiotic (Amoxicillin; 500 mg 3 times/day; for one week) was prescribed in an attempt to prevent the development of soft tissue infection and subsequent bone resorption. Then, the patient was maintained on a combination of 20 mg sub-antimicrobial dose doxycycline and 30 mg Coenzyme Q10 twice/day for 3 months. The patient was instructed to adhere to strict oral hygiene measures and come for follow up every month. At 3 and 6 months of follow up, there was minimal additional bone loss of 0.01 mm, negative bleeding index, periotest reading was -1, thus, the case considered successful. The patient was followed up at 12 and 24 months and the implant is stable and functioning well. The outcomes of the administration of both drugs might reflect their synergistic action.

KEYWORDS: Coenzyme Q10, Laser Sintered Implant, Periotest, Sub-antimicrobial dose doxycycline

INTRODUCTION

The success of an implant-supported prosthesis depends on evaluation of the risk factors including periodontal, endodontic or non-implant prosthetic treatments. Laser sintering is an additive method of implants surface treatment to produce high degrees of surface purity and roughness that are necessary for good osseointegration.¹ One-piece implant was designed to prevent the marginal bone loss based on the fact that the causes of initial bone loss are the contamination of the implant-abutment junction, the presence of microgaps and the biological width

violation.² The current article reports a case of dental implant that showed early signs of implant failure following insertion, but was improved with adequate treatment and follow up for 24 months. Patient management following implant placement is critical and implant success is dependent on coordination between the surgeon and the periodontist. This patient's management involved; strict oral hygiene measures, scaling and root planning, administration of antibiotics (Amoxicillin, 500 mg 3 times/day) for one week, then the patient was maintained on a combination of 20 mg

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subantimicrobial dose doxycycline and 30 mg Coenzyme Q10 twice/day for 3 months. The patient was followed up for 24 months.

CASE DESCRIPTION & RESULTS

History and Examination

A 30 years old male patient was admitted to our clinic with missing mandibular left second premolar. He was willing to restore this missing tooth with an endosseous implant. The teeth adjacent to the edentulous area were tilted. The patient had previous endodontic treatment and amalgam restoration in the lower left first premolar. Treatment options and the possibility of implant failure were discussed with the patient, however, he insisted to have an implant-supported restoration. This reported case was part of a study that was performed at the Oral and Maxillofacial Surgery Department, Faculty of Dentistry, Mansoura University. The study followed the Declaration of Helsinki on medical protocol and ethics and was approved by the Regional Ethical Review Board of Mansoura University. All the patients participated in this study had signed an informed consent.

Investigations

Blood analysis, preoperative radiographs and diagnostic cast were performed for this patient and others participating in the main study. Alveolar ridge width and length of the available bone were evaluated. Because of the limited mesiodistal width of the alveolar ridge, we decided to use mini-implant (a screw-shaped single-piece titanium implant; Implant Leader System, Milano, Italy) that is 3.2 mm in diameter and 11.5 mm in length.

Surgery

The patient was instructed to follow oral hygiene procedures and scaling was performed before surgery. Mepevacaine/ Levonordefrin (Alexandria Co. for Pharmaceuticals and Chemical Ind., Alexandria, Egypt) anesthetic was used to induce local anesthesia by inferior alveolar and long buccal nerve block technique. Crestal and vertical incisions were made to obtain a better accessibility, the full-thickness mucoperiosteal flap was reflected and

traction sutures were placed to expose the alveolar bone. The mandibular left second premolar site was prepared following the instructions of the implant manufacturer and under abundant saline solution irrigation. Initial preparation was performed through the surgical guide while the subsequent drilling was performed after guide removal. Initial drilling was performed with 1.8 mm pilot drill and subsequent drilling was completed with 2, 2.5 and 3 mm drills under constant saline irrigation. After irrigation of the osteotomy site with saline, the one-piece dental implant was placed and secured in place with a hand driver (Figure A). The flap was replaced and sutured without tension with 3/0 silk suture. An acrylic temporary crown was fabricated and cemented with temporary cement. The patient was instructed to have soft diet for the first 3 days and to return after one week for suture removal and secondary impression. The patient was prescribed an antibiotic (Amoxicillin, 500 mg 3 times/day) for a week and Oflam 50 (Diclofenac Potassium; MephaPharma, Alexandria, Egypt) was prescribed to the patient when needed. Early loading with provisional restoration was performed within 48 hours after surgery and immediate postoperative periapical radiographs were taken to act as baseline for measurements of marginal bone loss at follow up periods (Figure B). After a healing period of 4 weeks, the implant was functionally loaded with its permanent crown. The patient was recalled for regular follow up appointments for evaluation; at 1, 3, 6, 12 and 24 months after implant loading.



Fig A: A photograph shows a raised flap and two retraction sutures with the implant in place

Initial Case Outcomes

The immediate postoperative periapical radiograph (Figure B) showed a small piece of amalgam, most

probably from the adjacent first premolar, trapped subgingivally at the implant site. Frequent irrigation with saline was performed to remove this trapped piece of amalgam, however, all attempts failed. We decided not to do further intervention to remove it; to avoid disruption of tissue healing and osseointegration. Four weeks after initial implant placement, the patient showed signs of implant failure that included gingivitis, gingival recession (Figure C) and positive gingival bleeding index. The periostest was used to measure the implant stability and the recorded reading was +2. Periapical radiographs analysis showed 2 mm mesial marginal bone loss and 0.5 mm distal marginal bone loss (Figure D). The patient stated that he did not take the medication prescribed to him after surgery and was neglecting all oral hygiene measures instructed to him. The case was considered a failed implant and we expected more bone loss, however, the patient decided to keep the implant and follow up on it.



Fig B: A periapical radiograph shows the implant after initial placement.



Fig C: a photograph shows the permanent prosthetic restoration in place and in occlusion, 4 weeks after initial implant placement, the patient shows signs of gingivitis and gingival recession around the implant and the first premolar



Fig D: A periapical radiograph shows levels of marginal bone loss around the implant after 1 month; 2 mm mesial and 0.5 mm distal.

Case Management & Final Case Outcomes

The temporary crown was removed to avoid irritation of the soft tissue with acrylic crown. A permanent metal ceramic crown was placed to check occlusion and cemented, then the patient was instructed to use soft diet. The patient was prescribed an antibiotic (Amoxicillin, 500 mg 3 times/day) for a week and chlorhexidene mouthwash 3 times/day and he was referred to a periodontist to evaluate his periodontal condition. The periodontist performed necessary scaling and root planning. The patient was maintained on a combination of 20 mg sub-antimicrobial dose doxycycline (SDD; Alexandria Co. for Pharmaceuticals and Chemical Ind, Alexandria, Egypt) and 30 mg Coenzyme Q10 (CoQ10; BioMerieu SA, Marcy-l'Étoile, France) twice/day for 3 months. The patient was instructed to adhere to strict oral hygiene measures and come for follow up every month.

At two month of follow up the patient showed positive bleeding index but less gingival inflammation. The periostest reading was zero and no more bone loss was observed. Therefore, we decided to leave the permanent crown in place and in occlusal contact with the opposing teeth. At 3, 6, 12 and 24 months of follow up, there were no signs of gingivitis (Figure E; after 24 months) and minimal additional bone loss of 0.01 mm (Figure F; after 24 months). The bleeding index was negative and the periostest reading was -1.



Fig E: A photograph shows the permanent prosthetic restoration in place and in occlusion, 24 months after initial implant placement.



Fig F: A periapical radiograph shows the minimal additional marginal bone loss of 0.01 mm levels around the implant, 24 months after initial implant placement.

DISCUSSION

The placement of an implant in this case was expected to be associated with marginal bone loss; therefore, we decided to use one-piece dental implant to minimize the marginal bone loss.³ The microgap between a fixture and an abutment has been speculated to adversely affect the marginal bone level.^{4, 5} To enhance osseointegration, we chose a laser sintered implant with highly pure and rough surface. Gaggle et al (2000) analyzed four different implant surfaces; implant surfaces were either machine roughened or titanium spray coated or aluminum oxide treated or laser treated. They reported that laser treated titanium implant surfaces showed higher purity with enough roughness for satisfactory osseointegration.¹ Laser sintered implants were proved to increase bone-to-implant contact ratio.⁶ Rong et al (2009) reported a mean bone-to-implant contact percentage for laser treated

implants to be $49.71 \pm 9.12\%$.⁶ The observed gingival inflammation in the case we report here may be related to the presence of a fractured piece of amalgam. However, we decided not to make an incision to remove this piece of amalgam to avoid exposure of the roughened implant surface. Although surface roughness may have a positive effect on the submucosal tissue response, any soft tissue retraction and exposure of the rough surface to the oral environment would increase the risk of plaque accumulation, which in turn might lead to soft and bony tissue pathology.⁷ It might be possible that contamination of the roughened implant surface took place while making the temporary crown for this case; during impression taking or prosthesis cementation; either situation would cause the observed marginal bone loss.⁸ However, great care was given to protect the surgical wound with a rubber dam during temporary crown fabrication procedures.

Scaling and root planning and other oral hygiene measures were performed before surgery, however, the patient was not compliant with the oral hygiene instructions after implant placement and did not take the medications prescribed to him. Therefore, referral to a periodontist was a must in this case and the coordination among the surgeon and the periodontist was critical in such situation. The re-evaluation of the patient's oral hygiene by a specialist rescued the implant in perfect timing. The pathogenic burden to the gingival and periodontal tissues has been eliminated or at least minimized. The combination of 20 mg SDD and 30 mg CoQ10 twice/day for 3 months was efficient and rescued the implant. Satisfactory outcomes were evident with resolution of gingival inflammation, marked reduction in the bleeding index and the implant stability that was improved from +2 to -1 in few weeks. Walker et al (2000) stated that SDD has anti-inflammatory and anti-collagenase effects that enhance the healing of periodontal tissues.⁹ SDD has high affinity to bone and soft tissues, thus, its accumulation in the periodontium would further enhance its curative effect.¹⁰ CoQ10 has an antioxidant effect that minimizes tissue destruction by removal of free radicals and maintaining the cellular energy.¹¹ McRee et al (1993) reported that

CoQ10 has a partial bacteriostatic effect on subgingival microorganisms.¹² Matthews-Brzozowska et al (2007) and Babbush et al (2010) reported decreased gingival bleeding, pain and itching in patients with periodontitis and gingivitis following administration of CoQ10.^{13, 14} These two administered drugs provided a satisfactory control on the patient's periodontal condition and rescued the implant.

CONCLUSION

The outcomes of the administration of both drugs might reflect their synergistic action. The patient was followed up for 24 months and the implant is stable and functioning well.

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