

Case Report

Apical Surgery and Guided Bone Regeneration for Immediate Implant Placement and Provisionalization: A Case Report

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Abstract

When planning to place an implant after the extraction of a failing tooth with an apical lesion, it should be noted that the performance of a series of soft and hard tissue reconstruction efforts by the clinician can cause considerable patient distress. This case report describes an alternative strategic approach that combines apical surgery with guided bone regeneration for immediate implant placement and provisionalization. This approach can not only preserve the architecture of the hard and soft tissue, but can also achieve esthetic and functional outcomes and increase patient satisfaction.

Key words: apical surgery, guided bone regeneration, immediate implant placement, immediate provisionalization

Introduction

A tooth with a combined periodontal and periapical infection often results in defective buccal bone. Such infections also affect the success rate of implant and bone augmentation surgery, as the removal of the source of an infection of the teeth will cause horizontal and vertical bone loss followed by soft tissue atrophy. According to one previous study¹, the width of alveolar bone is reduced by an average of 50% within one year of losing a tooth, with two-thirds of the bone resorption occurring in the first three months. Meanwhile, the reconstruction of hard and soft tissue is often laborious, time-consuming, and unpredictable. With these issues in mind, this report presents a case in which a technique combining apical surgery with guided bone regeneration was used to achieve esthetic and functional outcomes in the presence of a failing infected tooth.

Case report

The present case involves a 35-year-old non-smoking male who denied having any systemic diseases or drug allergies. A clinical examination revealed no tooth attrition or other abnormal oral habits. However, the patient reported having suffered from gum swelling over the right upper posterior tooth for one month. A gumboil over his right maxillary second premolar was noted. The apical lesion measured approximately 9 mm × 9 mm in size according to the periapical film taken during the examination (Fig. 1.). No gingival swelling, inflammation, or deep probing above 3 mm were observed in the clinical examination. Furthermore, a bone sounding examina-

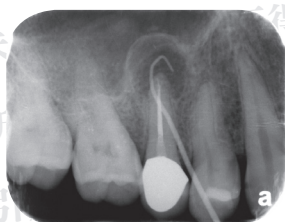


Fig. 1. Periapical film: GP tracing to apex of the right maxillary second premolar

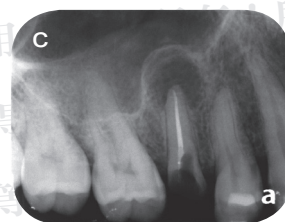


Fig. 2. Clinical examination after PFM crown removal. (a) buccal intra-oral view; (b) occlusal intra-oral view; (c) periapical film



Fig. 3. Provisional crown fabrication



Fig. 4. Root canal retreatment

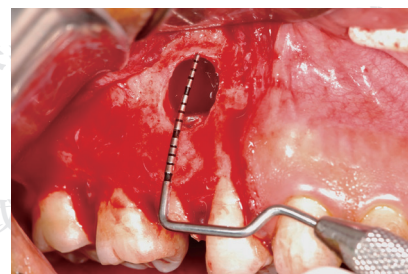


Fig. 5. Apicoectomy



Fig. 6. Guided bone regeneration. (a) Bio-oss; (b) resorbable collagen membrane; (c) suture with 5-0 Nylon

tion indicated that the buccal bone crest remained intact. The clinical diagnosis was an apical cyst with a previously treated root canal. After removal of the PFM crown and dental caries, tooth extraction was indicated because there was a lack of sufficient tooth structure for tooth restoration (Fig. 2.). The suggested treatment plans called for a single implant replacement or 14 × 16 FDP. After discussion with the patient, a definitive treatment plan of implant placement was decided upon. To prevent collapse of the buccal bone after tooth extraction and subsequent patient embarrassment due to the missing tooth, the following treatment steps were proposed: (1) fixed provisional crown fabrication (Fig. 3.), (2) root canal retreatment (Fig. 4.), (3) apical surgery combined with guided bone regeneration, (4) tooth extraction, immediate implant placement, and

provisionalization, and (5) final implant-supported crown delivery.

Apical surgery and guided bone regeneration

For the apical surgery, cyst enucleation, apicoectomy of 3 mm of root apex, retrograde preparation, and retrograde filling with MTA (mineral trioxide aggregate) were performed (Fig. 5.). At the same time, guided bone regeneration was performed in the apical bony defect with xenograft (Bio-Oss®, Geistlich) and resorbable collagen membrane (EZ Cure™, Biomatlante) (Fig. 6.).

Immediate implant placement and provisionalization (IIPP)

After 6 months of bone healing time (Fig. 7.), the right maxillary second premolar was extracted



Fig. 7. Periapical film: apical surgery and GBR 6 months later



Fig. 8. Periapical film: immediate implant placement in fresh socket



Fig. 9. Titanium temporary abutment was hand tightened onto the implant

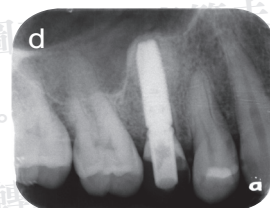


Fig. 10. (a) provisional implant supported crown; (b) buccal intra-oral view; (c) occlusal intraoral view; (d) periapical film

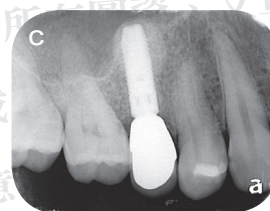


Fig. 11. Provisional implant supported crown after 3 months healing time

Fig. 12. Final restoration (a) buccal intra-oral view; (b) occlusal intra-oral view; (c) periapical film

with periostome in a less traumatic approach. The placement of a flapless implant (OsseoSpeed TX, 4.0 × 13 mm, Astra Tech AB; Mölndal, Sweden) was then performed (Fig. 8.). Due to the primary stability of the implant, a titanium temporary abutment was hand tightened onto the implant (Fig. 9.). The provisional crown was fabricated with light cured resin (Protemp™ 4, 3M ESPE) with the assistance of a surgical stent (Fig. 10.). The gap between the implant and the bony socket was filled with bone graft (FDBA, LifeNet®). The screw-retained implant-supported provisional crown was adjusted to clear all centric and eccentric functional contacts, and an appropriate antibiotic (amoxicillin 250 mg, 4 times daily) and analgesic (acetaminophen 500 mg, every 4 to 6 hours as needed for pain) were prescribed. The patient was instructed not to brush the surgical side, but rather to rinse with 0.2% chlorhexidine gluconate (Parmason, PBF). The patient was

also asked to maintain a soft diet for 2 weeks. After 3 further months of bone healing time (Fig. 11.), a final impression was taken and the final screw-retained implant supported crown (monolithic zirconia occlusal surfaces: Ceramill Zi, Amann Girrbach AG; veneer porcelain: Vita VM9; Vita Zahnfabrik, Bad Säckingen, Germany) was delivered (Fig. 12.). There were no biological or mechanical complications upon clinical and radiographic examinations at the 1-year follow-up visit (Fig. 13.).

Discussion

The standard approach is to eliminate the infection via tooth extraction when a hopeless tooth with an apical infection. Once the tooth is extracted, the buccal plate and bundle bone that had been adjacent to it prior to its removal will resorb. This bone resorption will then result in vertical and/or horizontal bone and soft tissue loss, and that loss, in

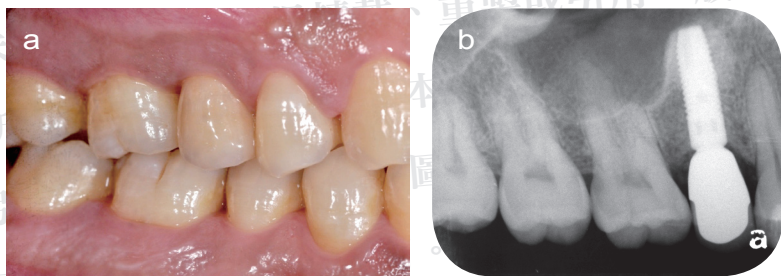


Fig. 13. 1-year follow (a) buccal intra-oral view; (b) periapical film

turn, will necessitate a combination of soft and hard tissue augmentation. However, these reconstruction procedures are usually strenuous and time-consuming, and yield unpredictable results. In this early implant placement approach, the patient is effectively required to experience a period time of during which the extracted tooth is simply missing or, alternatively, the patient wears a removable appliance that can possibly interfere with the masticatory function, alter the alignment of the dentition, and decrease the patient's quality of life. In contrast, the IIPP approach presented in the current case can provide better patient comfort, offer good esthetics², and eliminate the inconvenience of a second surgery for the placement of a healing abutment. This often leads to early soft tissue healing and stabilization of the peri-implant mucosa³.

Recently, many studies have shown that an apical lesion is a risk factor for IIPP, but not a contraindication⁴. If chronic infection of the alveolar bone is treated with appropriate debridement, preoperative and postoperative antibiotic use, and the case is carefully selected, the survival rate can reach 92%–100%⁵. However, all of these studies excluded teeth without primary stability, whereas the key factor in IIPP is the primary stability of the implant. It is generally recommended that the implant should extend at least 4 to 5 mm into the root apex to obtain primary stability². In this case, the patient was diagnosed with an apical cyst with a previously treated root canal, and the inflammation was confined only to the apical part with no involvement of the periodontal tissue. The periodontal pocket probing depth of the tooth was 3 mm. Therefore, considering the patient's desire not to experience an extended period of time with a missing tooth, we performed apical surgery to remove the apical infection, including the root tip up to 3 mm, in addition to performing guided bone regeneration surgery in the apical area to increase the bone volume. These actions in turn increases the

primary stability of the implant that was then placed.

IIPP is a predictable surgery with a high success rate. According to a study by Kan et al. from 2011⁶, an average of four years (2 to 8.2 years) prospective study of 35 single anterior teeth immediate implant placement and provisionalization, the cumulative success rate was 100%. The IIPP procedure is performed with a less traumatic form of tooth extraction and immediate placement of the implant in order to retain the alveolar crest and maintain the gingival architecture surrounding the implant^{7,8,9}. This likewise provides early healing of the soft tissue surrounding the implant. In this case, we present an alternative treatment option that combined apical surgery with guided bone regeneration to replace an unrestorable and apically infected failing tooth with implantation in a staged approach. Although the overall treatment time for this approach is not faster than that for early implant placement, we propose that it constitutes a predictable method for not only maintaining the hard and soft tissue around the implant site but also results in high patient satisfaction while allowing the implant prosthesis to be effective in both esthetic and functional regards¹⁰.

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