Original Article

Assessment of primary stability of the implant placed in prepared infected extraction sockets

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ARTICLE INFO

Article history:

Received 31 July 2016

Accepted 5 October 2016

Available online 2 November 2016

Keywords:

Immediate implants

Infected sockets

Debridement

ABSTRACT

Background: Dental conditions like periodontal, periapical pathologies and failed endodontically treated teeth are one of the commonest reasons for tooth removal. These conditions also contraindicate replacement of such teeth with immediate implant procedures.

Aim: This study aimed to evaluate the clinical and radiological fate of immediately placed dental implants in debrided infected dentoalveolar sockets.

Materials and methods: A total of 24 implants were immediately placed into prepared infected sockets. The pathology at the receptacle sockets included subacute periodontal infection, perio-endo infection, chronic periapical infection, periodontal cyst and traumatic infected teeth. The treatment protocol emphasized on meticulous debridement of the infected sockets under pre- and post-surgical antibiotic therapy. Follow up of at least 24 months was done to evaluate the survival of implants.

Results: At the end of follow up time period of 24 months, all 24 implants were stable with no signs of clinical mobility and infection. However, on radiological examination, crestal bone loss was observed during the osseointegration periods which settled at the level of first thread.

Conclusion: Survival of immediately placed implants in infected sockets is predictable and depends on the meticulous debridement of dentoalveolar sockets along with adequate pre- and post-operative antibiotic coverage.

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1. Introduction

Over the last 4 decades with the advent of implant dentistry, ideas about tooth replacement therapies have changed remarkably. Branemark discovered that rehabilitation of fully edentulous patients could be done using machined screws of commercially pure titanium which osseointegrate to jaw bone thus enabling the attachment of a fixed prosthesis.^{1,2} Since then, endosseous dental implants of various shapes and surface textures have been used in partially edentulous patients, achieving a success rate of 96.7%.³ To achieve this safe, predictable and cost effective mechanism of rehabilitation, Branemark and co-workers developed a list of recommendations regarding the treatment protocol. According to

one of these recommendations, a waiting time of 12 months following tooth extraction is necessary to allow resolution of any hard and soft tissue pathology in a proposed recipient site before an endosseous dental implant could be installed.⁴

Several investigators have evaluated the undesirable effects of tooth extraction on dimensional changes in hard and soft tissues like post-extraction resorption, by means of cephalometric analysis, study cast measurements and subtraction radiography.^{5,6} Keeping in view that this post-extraction resorption could adversely affect the availability of bone for implant placement, clinicians started inserting dental implants immediately following tooth extraction. The first case was reported in 1976 by Schulte who used polycrystalline aluminum surface and since then numerous clinical reports have been published.

However, one of the clinical requirements that needs to be fulfilled for success of immediate implant therapy is absence of infection at the recipient site, which limits the use of this technique

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for replacement of only those teeth which have healthy alveolus.⁷ This implies that the teeth that require extraction due to unresolved periapical pathology or chronic periodontal infections/inflammation of periodontium cannot be restored by immediate implant placement, hence, a delayed implant placement procedure is recommended.

There are studies in orthopedic literature concerning the treatment of severe vertebral osteomyelitis with titanium cages which show clinically and radiologically that the titanium cages fuse well when meticulous debridement is done under proper antibiotic cover.⁸ These observations encouraged us to apply the same principle for immediate placement of dental implants in debrided infected dentoalveolar sockets which reduces the need of hard and soft tissue grafting procedures, shortens the treatment time, reduces cost and helps achieve superior esthetic results.⁹

We assessed the primary stability of the implant in the extraction socket and radiographically observed the appearance of healthy bone immediately adjacent and surrounding the implant at post-operative 3rd and 6th month.

2. Materials and methods

Among the cases which reported to the Department of Oral and Maxillofacial Surgery at K.L.E.V.K. Institute of Dental Sciences from 2007 to 2010, 15 patients presenting with traumatic teeth having secondary infection, periapical/periodontal pathology and requiring extraction were selected for immediate placement of dental implants.

The inclusion criteria included (a) patients aged above 18 years needing single/multiple extractions because of subacute periodontal infection, perio-endo lesion and chronic periapical infection, (b) failed endodontic treatment of traumatic teeth with secondary infection and mobility (Fig. 1A) and (c) presence of adequate bone in periapex region within anatomical limits to establish primary stability of implant. Implants were not placed for replacements of malposed teeth, 3rd molars and in patients with medically compromised status.

A consent and approval from the Institute's Ethical committee was obtained for the study. Also, a written informed consent for the procedure was obtained from all the patients enrolled for the study. All patients underwent the required routine laboratory investigations and radiological examination with Intraoral Periapical Radiographs and Orthopantomograph, prior to the surgery.

Antibiotic prophylaxis with daily dose of 1.5 g of amoxicillin or 0.9 g clindamycin in penicillin sensitive patients was given 4 days prior to the surgical procedure and 7 days post operatively. Routine aseptic techniques were used. 2% lidocaine with 1:200,000 adrenaline was administered to achieve local anesthesia for the extraction and immediate implant placement. A full thickness mucoperiosteal flap was reflected at the surgical site and the involved tooth/teeth were extracted with minimal trauma to the cortical plates. The extraction socket was meticulously debrided and curetted to remove all detectable granulation and infected tissue (Fig. 1B). In such sockets, a moderate peripheral intrasocket osteotomy of the alveolar bone was accomplished using an oval bur to ensure complete elimination of all contaminated soft and hard tissue (Fig. 1C). The procedure was concluded with vigorous irrigations of the surgical sites using a sterile saline solution.

The resultant socket was then prepared with drill under controlled torque and speed with coolant irrigation, to receive the implant (Grade II Titanium machined (Biomicon; Italy) self-taping; tapered implants of 9–13 mm length and 3.75–5.2 mm diameter) which was extended 2–4 mm apically within the anatomical limits to achieve primary stability for the implant (Fig. 1D). Residual defect of more than 2 mm between the implant surface and the bone was filled with Freeze Dried Bone Graft (Tata Memorial Hospital, Tissue Bank, Mumbai). A release incision was placed on the mucoperiosteal flap and the flap was advanced for primary closure of the surgical site.

The post-operative assessment was carried out at post-operative 0, 3, 6, 12, 18, 24 months and included evaluation of implant position and crestal bone level both clinically and radiographically.

The clinical parameters included absence of clinical mobility of the immediately placed implant with no pain or sign of infection. For radiological parameters, intraoral periapical radiographs (IOPAR) were taken to evaluate the crestal bone level and for appearance of bone adjacent and surrounding the placed implant.

3. Results

A total of 24 implants were placed immediately following extraction or avulsion of tooth/teeth. Out of the 24 implants, 18 implants were placed in maxillary incisal and premolar region and the remaining 6 implants were placed in mandibular incisal, premolar and molar regions (Table 1).

Fig. 1. Clinical photograph showing (A) surgical protocol; (B) atraumatic tooth extraction and debridement; (C) intrasocket osteotomy; (D) immediate implant placement.

Table 1

Details of total 24 implants placed in extraction socket.

S. no.	Age/gender	Dentoalveolar pathology	Implant site	No. of implants	Implant dimension (mm; D/L)	Complications	Follow-up period (months)
1	38/F	Infected traumatic tooth	Anterior Maxilla	2	4.2 × 12	–	28
2	58/M	Chronic periodontal infection	Anterior Mandible	1	4.2 × 12	Pus exudation from pocket	24
3	28/M	Perio-endo lesion	Anterior Maxilla	1	4.2 × 12	–	24
4	22/F	Perio-endo lesion	Anterior Maxilla	1	3.8 × 15	–	24
5	30/F	Traumatic infected teeth	Anterior Maxilla	1	3.8 × 15	–	24
6	22/M	Periapical lesion	Posterior Mandible	1	4.2 × 12	–	24
7	26/F	Avulsion and secondary infection	Maxillary anterior	1	3.75 × 15	–	24
8	45/M	Chronic periodontal infection	Posterior mandible	1	5.2 × 9	–	24
9	26/M	Avulsion and secondary infection	Maxillary Anterior	1	4.25 × 12	–	24
10	19/M	Avulsion and secondary infection	Maxillary Anterior	1	4.25 × 14	–	24
11	27/M	Periapical infection	Posterior mandible	1	5.25 × 9	–	24
12	30/F	Avulsion and secondary infection	Anterior maxilla	2	4.25 × 14, 4.25 × 14	–	24
13	47/M	Chronic periodontal infection	Posterior mandible	1	5.25 × 9	–	24
14	22/M	Periapical infection	Posterior mandible	1	5.25 × 9	–	24
15	55/M	Chronic periapical infection	Anterior maxilla and posterior mandible	8	3.75–4.25 × 12–14, 4.25–5.25 × 9–14	–	24

All implants fulfilled the clinical and radiological criteria of survival at the end of post-operative 6 months. There was absence of clinical mobility, pain/mobility in all implants except for one implant placed in the anterior mandible which had pus exudation from the socket at 8th follow-up month which was managed with local therapy. Crestal bone level was evaluated at post-operative 0, 3, 6, 12, 18, 24 months for all the 24 implants. It was observed that the crestal bone level for all the 24 implants settled at the level implant crestal module at the end of 6 months.

Outcome at the time of final prosthesis placement was satisfactory and without any signs of inflammation. This reflects a 100% survival rate of immediately placed implants in this study. All the 24 implants placed had a minimum follow up of 24 months which favored early results of minimal crestal bone loss in all the cases.

4. Discussion

There are several advantages of the immediate implant placement procedures like optimal implant placement and alveolar ridge preservation due to prevention of the post extraction resorption which permits the use of longer and wider implants.¹⁰ Other benefits include¹ minimal possibility of injury to anatomical landmarks,² limited bone resorption due to reduction of heat generation during drilling at the osteotomy site,³ and reduced treatment time. Additionally, there is a positive psychological impact on the patient in relation to dental implants, since immediate replacement of the extracted tooth takes place without the patient going through a waiting period for socket healing.^{11–13}

Several studies show success rates of using immediate implants as compared to implants inserted in healed sites. However, teeth which require extraction are often involved with inflammatory and infectious processes which contraindicates their immediate replacement with endosseous dental implant.^{14,15}

However, taking into consideration the orthopedic studies which report radiographic bone fusion of titanium cages in severe vertebral osteomyelitis and regarding such cases equivalent to implant fixation dentistry, the contraindication of implant placement in infected sockets can be judged as a misconception.

In this study, we have tried to overcome this conventional concept by proper antibiotic coverage at least 4 days prior to extraction, immediate implant placement only after meticulous debridement of the extraction socket and continuation of postoperative antibiotic therapy for 10 days which eliminates the infection and establishes a favorable environment for

healing and osseointegration.¹⁶ The presurgical administration of antibiotic is vital for the reduction of the microorganism load which is supported by previous reports of immediate implant placements in presence of periapical pathosis. But in cases where an acute infection persists in spite of the presurgical antibiotics for 4 days, the immediate implant placement should be postponed. In this study, in cases of avulsion, the dentoalveolar socket was evaluated for any fractured wall, and the implant placement was done after 4 days of antibiotic cover.

At all post-operative follow-ups of 0, 3, 6, 12, 18, 24 months, the clinical examination and radiographs did not reveal any signs of infection. The expected crestal bone loss was evident on radiographs which settled at the implant crestal module at the end of 6 months.

This study details our clinical experience with 15 patients in whom 24 implants were placed immediately into debrided infected dentoalveolar socket. Our results reveal favorable outcome with 100% survival rate of these implants, when the described clinical protocol of pre and post-operative antibiotic combined with meticulous debridement of dentoalveolar socket is followed. However, the patients in this study had a maximum follow up of only 24 months, which is not sufficient enough to meet the 'success criteria'. Though a larger group of patients and implants are required for assessment of success criteria and to provide strong evidence, but the early results of this study are encouraging.

5. Conclusion

Implants can be placed immediately into infected extraction sockets but the success rate depends entirely on the meticulous debridement of dentoalveolar sockets and adequate pre and post-operative antibiotic coverage. Also, predictable outcome in terms of criteria for survival of the implant, as delineated by the author, can be achieved only if the described protocol is followed.

Conflicts of interest

The authors have none to declare.

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