

Immediate Implants Placed Into Infected Sockets: Clinical Update with 3-Year Follow-Up

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Abstract: *Dental implants can be placed immediately into healthy extraction sites with high success and survival rates. It has been suggested, however, that immediate placement of implants into infected extraction sites is contraindicated due to the pathology interfering with osseointegration resulting in decreased implant survival and success. With many potential implant sites presenting with a preexisting periapical or periodontal infection, treatment protocols have been advocated for immediate placement of implants in these infected sites. Advancements in surgical techniques and implant surface technology have made immediate placement of implants a more predictable and accepted treatment option; however, there is still debate about whether infected extraction sites should be used for immediate implant treatment approaches. The purpose of this clinical update is to report on the success and survival of implants placed immediately into infected extraction sites.*

Keywords: *dental implant, immediate implant, infected sockets*

I. Introduction

The concept of osseointegration was first introduced by Brånemark in 1964, and the guidelines for obtaining a direct connection between bone and titanium were described in 1977 by the same author [1]. A stress-free healing period is generally recommended to achieve osseointegration of dental implants without interposition of fibrous scar tissue [1]. In addition, the traditional guidelines recommend a six- to twelve-month healing period for the alveolar bone following tooth extraction [2, 3].

Protocols that involve immediate implant placement and provisionalisation following tooth extraction. [2,3] Although high survival rates for implants with these operative protocols are reported in several studies, postoperative complications such as gingival shrinkage and bone resorption in aesthetically important areas are an important limitation. Continued bone and soft tissue loss may also cause exposure of the implant surface resulting in a compromised aesthetic outcome [4, 5,6]. These techniques make it possible to reduce the time required to restore a lost tooth from 9 to 18 months. The advantages of immediate implant placement include a reduction in treatment time, a reduction of surgical procedures and a reduction of aesthetic rehabilitation time [6, 7,8,9].

Primary implantation is fundamentally indicated for replacing teeth with pathologies not amenable to treatment, such as caries or fractures. Immediate implants are also indicated simultaneous to the removal of impacted canines and temporal teeth. [2,3] Immediate implantation can be carried out on extracting teeth with chronic apical lesions which are not likely to improve with endodontic treatment and apical surgery. Novaes et al. , in a study in dogs, inserted immediate implants in locations with chronic periapical infection. These authors reported good results and pointed out that despite evident signs of periapical disease, implant placement is not contraindicated if pre- and postoperative antibiotic coverage is provided and adequate cleaning of the alveolar bed is ensured prior to implantation. [10]

While immediate implantation can be indicated in parallel to the extraction of teeth with serious periodontal problems, Ibbott et al. reported a case involving an acute periodontal abscess associated with immediate implant placement, in a patient in the maintenance phase. [11] The geometric discrepancy between the extraction socket and implant design, immediate placement frequently requires bone augmentation. Larger diameter implants, possibly combined with guided bone regeneration, have been advocated to address this discrepancy [12]. The alveolar socket is generally filled with the dental implant, deproteinised heterologous bone and autologous bone obtained during alveolus preparation; the graft is necessary to reduce the gap between the implant and the alveolar bone and to accelerate the new bone apposition process [12]. Conical implants with internal hexagonal extensions present many advantages: the internal hexagon is an aesthetic solution because it allows the placement of a smaller abutment upon a larger implant, permitting a thicker layer of ceramic crown and a better filling of the alveolar socket, respectively. [12,13,14] The conical design induces tight contact with the adjacent bone tissue and osseointegration with intimate bone contact over the whole length of the implant. The placement of larger diameter implants requires the positioning of a smaller amount of autologous or heterologous material, and facilitates the compression and condensation of the graft on the walls of the alveolar socket [15, 16,17,18].

The purpose of this clinical update is to report on the success and survival of implants placed immediately into infected extraction sites.

II. Case Report

48-year-old male patient presented for routine checkup. Health history of the patient was relatively sound. Intraoral examination of the patient revealed presence of root piece with maxillary left first premolar (FIG. 1).



Figure 1. Panel of clinical and radiographic images of the case

Clinical and radiological evaluation revealed adequate alveolar bone, the teeth had been treated endodontically due to development of periapical lesions with no lesion regression. Endodontic surgery had also failed. Clinical examinations revealed level 2 mobility and a scar on the soft tissue above the maxillary anterior teeth. radiographic examinations confirmed the presence of chronic periapical lesions associated with teeth 24, . So it was decided to extract the root piece and place implant immediately and place provisional restoration to avail the benefits like preservation of bone and emergence profile. Therefore, with the patients consent treatment planned for the patient included, extraction of the root piece and placement of immediate implants. After administering appropriate antibiotic and analgesic, induction of local anesthesia was carried followed by placing sulcular incisions around the premolar. As preservation of alveolar bone is key to success of immediate implants, extraction of tooth has to be atraumatic, so by using periostomes periodontal ligament fibers are dissected and by using small periosteal elevators, the fragment was luxated without excessive enlargement of the socket and root piece was extracted (FIG. 2). Following root piece extraction the extraction socket is thoroughly curetted and irrigated to remove any remnant tooth fragments and after extraction of the teeth, sockets were examined for any fracture of the walls of the socket. An implant was planned with dimensions 4.5 x 15 mm. Primary stability was achieved by wrenching the implant into the bone beyond the apex of the socket. The cover screw was placed and interrupted sutures were placed. Postoperative radiographs were taken (FIG. 3).

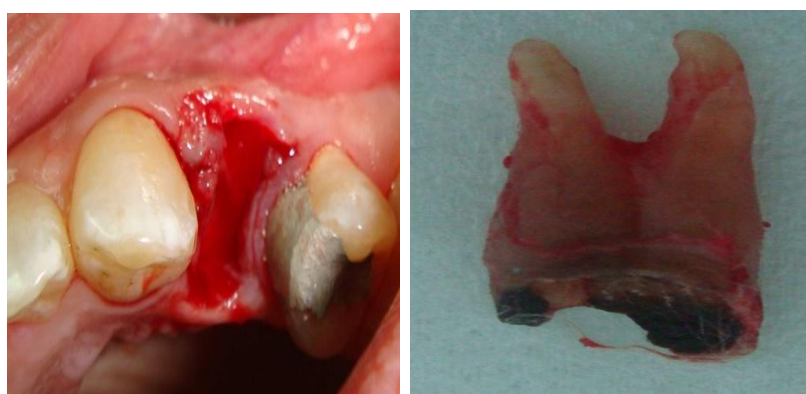


Figure 2: Case flapped with elevation of tooth. Tooth extracted

Postoperative instruction and medication were given. Amoxicillin (Augmentin 675mg thrice a day) was prescribed for 5 days. Sutures were removed after 8 days and the patient received temporary acrylic crown bonded to the adjacent teeth with fiber-reinforced composite on the same day. After the initial healing phase of 4

months, Stage 2 procedure of uncovering the implant was undertaken. Healing abutment (gingiva former) was screwed in. 2 weeks later, healthy gingival collar was evident and abutment was screwed. Impressions were made with the open tray technique using rubber based impression material. Cement retained final porcelain fused to metal (PFM) prosthesis was placed. The following clinical parameters were checked: pain, occlusion, and prosthesis mobility. Success criteria for implant survival were accepted as the presence of implant stability, absence of a radiolucent zone around the implants, no mucosal suppuration, and no pain. Follow-up examinations were performed at baseline and 12, 24 and 36 months.



Figure 3: implant in palatal root, 4.5 x 15 mm Maxi Z implant

Patient was put on the maintenance schedule of 4 months interval and was followed up to 3 years with clinical and radiographic evaluation. The clinical and radiographic appearances at 3 years show good esthetics, osseointegration and maintenance of bone around the implant with a stable perimplant crestal bone on the site. (FIG. 4)



Figure 4: Panel of clinical and radiographic images of the case, Clinical aspect at the 3-year follow-up visit

III. Discussion

Dental implants can be placed immediately into healthy extraction sites with high success and survival rates.[19, 20] It has been suggested, however, that immediate placement of implants into infected extraction sites is contraindicated due to the pathology interfering with osseointegration resulting in decreased implant survival and success.[21] With many potential implant sites presenting with a preexisting periapical or periodontal infection, treatment protocols have been advocated for immediate placement of implants in these infected sites.[19,20,21]

Novaes Jr. and Novaes reported that, in immediate implant placement for replacement of teeth with periapical lesions, success can be achieved if certain preoperative and postoperative measures are followed before surgery, such as antibiotic administration, meticulous cleaning, and alveolar debridement. In histomorphometric evaluations of immediate implantations in dogs with induced periapical lesions, osseointegration occurred in both the experimental and control sites.[10,22] This clinical case shows that an immediate implant restoration placed in a post-extraction site can constitute a safe and successful treatment procedure. Correct clinical, prosthetic and surgical management of endosseous implants replacing missing teeth in the anterior maxilla enables the dental surgeon to achieve predictable aesthetic outcomes. The immediate placement in post-extraction sites is a surgical option capable of ensuring ideal peri-implant tissue healing,

while at the same time preserving the pre-surgical gingiva and bone [1,2,11,12] The advantages of placing implants in fresh extraction sockets and putting them in immediate/early function are many. A predictable protocol affords the possibility of performing a single surgical procedure and minimising the shrinkage of hard tissue and soft tissue recession [13]. There is a risk of mucosal recession and adverse soft tissue aesthetics with immediate implant placement. However, this risk may be reduced by avoiding a buccal position of the implant in the extraction socket [14]

Controlling gingival contour with available metal alloy abutments may be technically challenging and time consuming. Several techniques have been proposed to restore esthetically pleasing soft tissue phenotype. The customization of healing abutment served as scaffold to support the surrounding mucosa and papillae, thus contributing to peri-implant aesthetics. It is relatively easy, precise and predictable method for accurate duplication of soft tissue profile. It also helps in remodeling the soft tissue during healing process. To allow for the exact transfer of soft tissue architecture that has remodeled around the customized healing abutment, the fabrication of customized impression coping is inevitable.[2,3,4,5]

Studies have suggested that immediate loading with platform switching promotes greater stability of the soft and hard tissues surrounding the implant.[2] In situations of immediate loading following tooth extraction in an undamaged socket, the implant should be inserted beside the palatine wall of the socket because of the greater bone anchorage, better three-dimensional positioning for spreading the occlusal forces and greater bone availability and quality. This positioning is directly related to the diameter of the implant and the size of the socket opening. The amount of space will define whether filling with particulate bone is needed. Such filling would preferably be autogenous, since this presents the best results with regard to bone healing. The biological changes that occur when an implant is put into use at an early stage are of great importance in bone repair. Early low-intensity stimulation increases the local blood flow and the contact osteogenesis, thereby accelerating the process of bone graft repair. Implants of conical shape are the ones most indicated for receiving immediate loading. They adapt better to the socket, have a greater contact surface with the bone, increase the initial stability and make it possible to spread the occlusal load better. Conical implants compact the trabecular bone laterally, thereby increasing bone density. [2.3.4.5,6]

The morphology of damaged sockets immediately after tooth extraction generally presents greater involvement of the vestibular cortical bone, because of its smaller thickness and lower vascularization and because it is subject to occlusal forces. Since the vestibular wall of the socket is fragile, total loss of this cortical bone can often be seen, without involvement of the other walls. The maxillary tuberosity is an excellent choice of donor area for small reconstructions. It has a limited quantity of bone material available for grafting and presents low bone density and difficulty of surgical access. On the other hand, it has the advantages of excellent postoperative recovery and ease of harvesting the graft material and adapting it in the receptor region because of its bone malleability. One study has indicated that the maxillary and mandibular periosteum and the maxillary bone marrow may effectively serve as reliable and easy-to-harvest intraoral sources of osteoprogenitor cells.³⁰ It is known that the vascularization pattern is vital for bone grafting success. Because of the trabecular nature of grafts coming from the maxillary tuberosity, they have a high capacity for revascularization and release of growth factors to the receptor site. Thus, they need to be manipulated quickly, such that the graft is exposed for as little time as possible, in order to keep the cells alive. [12,23]

Stabilization and close contact between the bone graft and the receptor site facilitates the revascularization process and favors early incorporation of the graft into the host's vascular bed. Immediately after implant insertion and dentoalveolar restoration, coagulum and a fibrin network form and fill the remaining spaces between the implant and the grafted bone. With the passage of time and with appropriate mechanical stimulation, the resistance of the grafted area will tend to increase. After a four-month period of osseointegration, it was observed that the vestibular bone wall had thickened due to palatine anchoring of the implant and the grafting of the bone sliver. Consequent to the greater thickness of the vestibular bone crest, associated with an adequate emergence profile for the prosthetic crown, a greater volume of soft tissue was obtained, thus providing better and more stable gingival margin contour.[23] Controversies exist on whether local pathology has an adverse effect on the outcome. Chronic infection is not an absolute contraindication for immediately placed implants, however, thorough debridement of the alveolus should be made. The use of antibiotics prophylactically, is recommended in medically compromised patients. In the present study no local pathology was present [2,4,5,6,7].

Small gaps between implant surface and socket wall have a potential for spontaneous healing. GBR and grafting perform successfully for augmentation of dehiscences and fenestrations; however, no evidence exists that one technique or material is superior to others. In the present study, no osseous defect had warranted the use of any graft material.[15,16,17,18] Single-tooth implants have shown high success rates in both the anterior and the posterior regions of the maxilla and the mandible.[1–4] Immediate post extraction implant placement has been done since the early years of the clinical application of implants with very good clinical outcomes. Decisive factors for immediate implant placement are lack of infection in the periodontal tissues and

an intact tooth socket. Immediate incorporation of a temporary restoration has been presented in the literature with most encouraging results[7,8,12]. Although clinical experiences have advocated this clinical technique for many years, more extended long term clinical studies are necessary to prove the efficacy of the method and establish a stable clinical protocol[8,13,14].

Fugazzotto completed a retrospective analysis of 64 patients that is the only comparison of immediate implants in healthy and infected sites in the same patient. All patients in this analysis had implants placed immediately in the maxillary anterior region with at least one implant placed into a healthy extraction site and at least one implant placed into a site exhibiting periapical pathology. Twenty-six of the patients had implants placed at the healthy and infected sites at the same visit. The remaining patients had the therapies completed at different visits ranging from 2 to 35 months apart. Implant survival was assessed after implants had been restored and in function for at least 24 months with a mean follow up time of 64 months. No implants were lost during the observation period although one implant in each group exhibited buccal recession > 2mm which was deemed a failure. There was no significant difference in the cumulative survival rates for the infected sites (98.1%) and the healthy sites (98.2%).[24]

Casap placed 30 implants immediately into extraction sites presenting with various types of pathology including subacute periodontal infection, chronic periodontal infection, periodontal cyst, chronic periapical lesion and perio-endo infection. Extraction sites were thoroughly debrided, implants were placed using a two stage approach and pre- and post-surgical antibiotics were administered. Only 1 implant failed to integrate. The remaining implants were in function over a 12 to 72 month follow up period yielding an implant survival rate of 96.7%. [25] In one of the largest reported sample sizes, Fugazzotto reported a retrospective analysis of 418 implants placed immediately in infected sites with periapical pathology. All implants were followed for a minimum of 24 months with a mean follow up time of 67.3 months. Surgical protocol included thorough socket debridement and post-operative antibiotics. Only 5 implants were lost or demonstrated progressive bone loss resulting in a cumulative survival rate of 97.8%. [26]

Marconcini presented a case series of 20 implants placed immediately into sites exhibiting partial or complete loss of the buccal plate in 13 patients. Following socket debridement, primary stability of implants was achieved and buccal bone defects were grafted with corticocancellous porcine bone and a collagen barrier membrane. Implants were restored at 4 months and at 12 months post-treatment implant survival and success were 100% with mean crestal bone loss of 0.5mm. The results show that implants can be successfully placed immediately into extraction sites compromised by both infection and buccal bone loss with acceptable clinical outcome.[27]

Bell reported a retrospective chart review of 655 patients with 922 implants placed immediately into extraction sites. Two hundred and eighty five implants were placed into sites exhibiting chronic periapical infections while the remaining 637 implants were placed in sites exhibiting no periapical pathology. There was no significant difference in implant success between the infected sites (97.5%) and healthy sites (98.7%) over a mean follow up time of 19.75 months. When looking at factors associated with implant failure, it was found that there was a statistically higher failure rate for implants placed adjacent to retained teeth that had residual periapical radiolucencies.[28]

Crespi compared implants placed immediately in healthy sites (n=15) to those placed in sites with periapical lesions but without fistulas or suppuration (n=15). In addition to the use of pre- and post-operative antibiotics, the surgical protocol for all implants required an insertion torque >25Ncm and primary closure after implant placement utilizing a 2 stage surgical approach. Implant survival was 100% for both groups at 24 months and there were no significant differences in bone loss, plaque index, bleeding index, keratinized gingiva or probing depth between the groups[29]

Meltzer attempted immediate implant placement into 77 periodontally and endodontically infected sites with immediate provisionalization of the implants. Extraction sites were thoroughly debrided prior to implant placement and primary stability of all implants was achieved with insertion torques of 90-100 Ncm and implant stability quotients (ISQ) of 72-85. Implant survival was 98.7% over a 3 to 24 month follow up period.[30] Crespi completed a 4 year follow up on implants immediately loaded after placement into healthy (n=78) and infected (n=197) extraction sites. As with previously described studies, thorough debridement of the extraction sites was completed and systemic antibiotics were administered. Primary stability with an insertion torque >35Ncm was achieved for all implants. Patients were placed on a 6 month maintenance recall and at 4 years posttreatment implant survival was 100% in the non-infected group and 98.9% in the infected group. No pain, suppuration or mucositis was present around any surviving implant and mean bone loss was not significantly different between the healthy (0.78mm) and the infected (0.79mm) groups.[31]

On the other hand, Novaes Jr. and Novaes stated that the placement of immediate implants in chronically infected sites may not be necessarily contraindicated if appropriate clinical procedures like antibiotic administration, meticulous cleaning, and alveolar debridement are performed before implant surgical procedure. recently,[10,22] lindeboom et al. carried out a prospective and randomized study of 50 patients aiming to

evaluate the clinical success of immediate implants in periapical infected sites. the results showed a success rate of 92% for the immediate implants and 100% for the delayed implants (placed 3 months post-extraction). those authors concluded that immediate placement of single tooth implants for replacement of teeth with periapical lesions is a predictable treatment and can be indicated.[32]

Considering the results of these studies , the replacement of teeth with endodontic failure history by immediate implant was successfully introduced into debrided infected dentoalveolar sockets in this 3-year follow up evaluation. Based on a protocol that targets the elimination of the contaminated soft and hard tissues by meticulous debridement, this procedure was combined with pre- and postoperative antibiotics, eradicating the infection and establishing a favorable basis for bone healing and osseointegration.[33,34,35,36]

IV. Conclusion

Immediate placement of dental implants into infected sites can be a successful and acceptable treatment option provided there is proper case selection and treatment protocol.As with any dental implant procedure, the systemic health of the patient and smoking status can affect treatment success. Surgical protocols should include thorough debridement of the infected extraction site prior to implant placement and obtaining primary stability of the implant fixture. Additionally, the administration of systemic antibiotics, either preoperatively or post-operatively, has been utilized in all of the published literature. With the desire of both patients and clinicians to expedite treatment and reduce the number of surgical procedures, immediate placement of dental implants into infected sites should be considered as a viable treatment option for selected cases

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