

Aesthetic Rehabilitation with Immediate Dental Implant of the Inflammatory Periapical Cyst Site: A Case Report with Three-year Follow-up

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ABSTRACT

Rehabilitation with immediate implants has gained popularity for restoration in the aesthetic region, but immediate implant placement and function in infected periapical sites are still debatable. The conventional protocol of placing an implant and waiting for it to osseointegrate is time-consuming and compromises patients' aesthetics and psychological comfort. The purpose of this case report is to illustrate the possibility of inserting an immediate implant into a fresh extraction socket in an infected site with the presence of a pre-existing cyst following meticulous protocol, such as antibiotic administration, thorough cleaning, and alveolar debridement. The report depicts the minimal removal of existing bone with a single drill implant protocol, and one abutment at one time concept, with a customised microgrooved abutment for a satisfactory functional and aesthetic outcome after three years.

Keywords: Cone beam computed tomography, Immediate dental implant loading, Odontogenic cysts, Osseointegration, Patient outcome assessment

CASE REPORT

A 43-year-old male patient reported to the outpatient department of the Institute for Dental Implantology with a chief complaint of intraoral swelling and mild intermittent pain in the upper front tooth region for 3-4 days. Patient was in good general health with no systemic diseases, and was a non-smoker without any history of allergies. Clinical examination revealed a noticeable swelling in the alveolar mucosa on the labial side with a sinus opening overlying tooth #11 (FDI tooth numbering system). The surrounding gingiva appeared inflamed but lacked purulent exudation at rest. The patient had undergone root canal treatment 10 years back for tooth #11 and had presented with a Porcelain-Fused-To-Metal (PFM) prosthesis [Table/Fig-1]. Overall hygiene was fair with no generalised gingivitis or periodontitis noted.



[Table/Fig-1]: Preoperative clinical view.

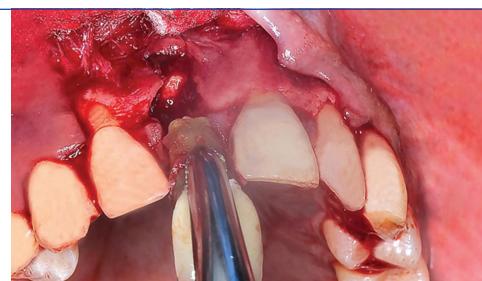
The patient was subjected to panoramic radiography (OPG) and Cone-Beam Computerised Tomography (CBCT) scan, which demonstrated inadequate endodontic treatment for #11 and a unilocular, well-defined radiolucency surrounded by a thin radiolucent border, centred around the apex of tooth #11, extending to #12 and #21, measuring 14 x 10 mm. The bone around the lesion exhibited a complete labial to palatal perforation [Table/Fig-2].



[Table/Fig-2]: Preoperative OPG: (a) Preoperative CBCT; (b) Preoperative CBCT sectional view (c).

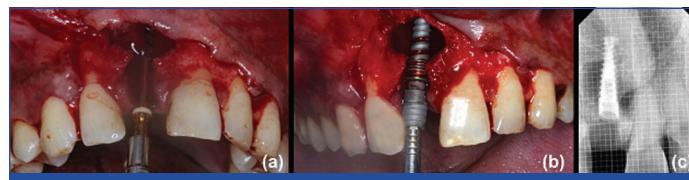
The diagnosis indicated an odontogenic radicular cyst associated with tooth #11, and the prognosis of the tooth was deemed hopeless. Extraction of the tooth and enucleation of the apical lesion were proposed and accepted by the patient, followed by immediate implant placement (Bioline I, BiolineDental GmbH & Co. KG) and loading at the site #11 with tall tilted pin hole immediate loading (TTPHIL: ALL TILT®) Protocol to achieve anchorage from the nasal floor [1].

After obtaining the signed written informed consent for the proposed treatment plan, oral prophylaxis was done. One hour before surgery, Amoxicillin 1 g was given orally so that its peak serum and tissue concentrations coincided with the surgical time, thereby maximising prophylactic coverage against surgical-site infection [2]. It was followed up with 500 mg three times daily for the next five days. Atraumatic extraction was achieved with periotomes and forceps under local anaesthesia (Lignocaine hydrochloride with adrenaline 1:200000, Lignox 2%). A mucoperiosteal envelope flap was raised on the facial and palatal aspects for enucleation of the cystic lesion in toto using surgical curettes, followed by irrigation of the cystic cavity with sterile saline [Table/Fig-3].



[Table/Fig-3]: Atraumatic extraction of tooth #11.

The implant osteotomy was prepared with a 1.4 mm diameter single drill at a low speed of 400-600 rpm for proprioception of nasal cortex engagement. A 3.75x16 mm long implant (Bioline I, BiolineDental GmbH & Co. KG) with a sharp, tapered apex was driven into the drilled course, engaging the nasal cortex, achieving 4 mm subcrestal placement measured from the adjacent cementoenamel junction [Table/Fig-4]. Primary stability with an insertion torque of 40 Ncm was obtained.



[Table/Fig-4]: Single implant drill (a); Implant placement (b); Intraoperative radiograph (RVG) of implant placement (c).

A prefabricated, customised, microgrooved, platform-switched, zirconia abutment (zircoping) was torqued (30 Ncm) to the implant on the day of surgery [1]. A transitional crown was made directly on the screwed abutment using composite restorative material [Table/Fig-5].



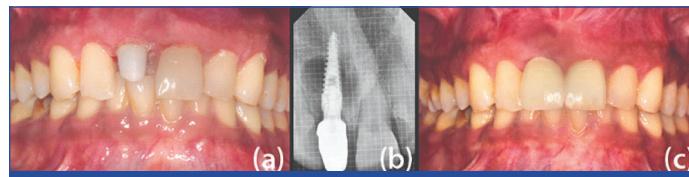
[Table/Fig-5]: Zircoping placement (a); Immediate temporary crown (b); RVG (c).

The cystic cavity, the gap between the buccal wall and exposed surface of the implant at site #11, was filled and augmented using 1 cc of alloplastic bone (PerioGlas®) covered with collagen membrane (Cologide™). The soft tissues were carefully re-approximated and sutured using simple 4-0 vicryl absorbable sutures [Table/Fig-6].



[Table/Fig-6]: Bone grafting for hard and soft-tissue defects.

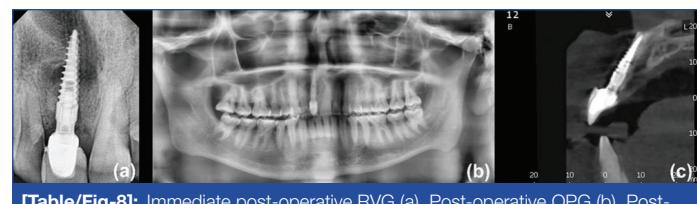
After three months of healing, the temporary crown was removed without unscrewing the zircoping, following the one abutment at one time protocol [1]. Abutment level impression was made using putty and light body addition silicone material for lithium disilicate crown fabrication, which was cemented intraorally onto the zircoping to bring about the required aesthetic outcome [Table/Fig-7].



[Table/Fig-7]: Zircoping modification for final prosthesis (a); RVG for verification of fit (b); Final crown in site #11 (c).

Following fixation, radiographs were taken [Table/Fig-8] and the patient followed regular recall appointments for dental check-ups twice a year. Clinical and radiographic images were collected at follow-up visits [Table/Fig-9,10].

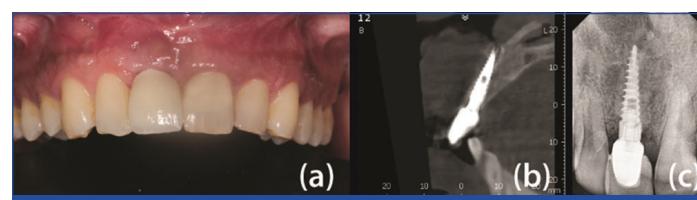
During these appointments, the authors recorded the clinical periodontal parameters and checked the status of the prosthesis. After a 3-year follow-up period, in April 2024, both the implant and the prosthesis met the success criteria [3].



[Table/Fig-8]: Immediate post-operative RVG (a), Post-operative OPG (b), Post-operative CBCT (c).



[Table/Fig-9]: RVG at 6 months follow-up (a); Clinical image at one year follow-up (b); RVG at one year follow-up (c).



[Table/Fig-10]: Clinical image at two years follow-up (a); CBCT section at two years follow-up (b); RVG at two years follow-up (c).

DISCUSSION

The present case underscores the viability of immediate implant placement and loading in sites with infected periapical pathology exhibiting a through-and-through labial-palatal bone perforation, provided that meticulous debridement and strict aseptic surgical protocols are employed. A growing body of literature supports this approach, emphasising that the presence of infection alone is not a contraindication if comprehensive debridement is achieved and primary stability is ensured [4-6]. In a meta-analysis, Lee J et al., affirmed the safety of immediate implants in infected sockets with thorough infection control [4], consistent with findings by Fugazzotto P and Del Fabbro M et al., [5,6]. Comparable outcomes have been reported by Park WB et al., who documented a case involving a radicular cyst encroaching on the sinus, managed successfully with immediate implant placement following enucleation [7], and Mahesh L et al., who reported similar clinical success [8]. These cases align with the current approach, where the residual cystic space was grafted, and nasal cortical engagement provided bicortical stability-demonstrating that even large periapical lesions can be rehabilitated using long implants with strategic anchorage.

Immediate loading in infected sites carries inherent risks such as residual infection, which can impair osseointegration, compromised bone quality impeding primary stability, and micromovement during early function, which may precipitate reinfection or implant failure. Success, therefore, hinges on rigorous debridement, secures bicortical anchorage, and carefully controlled loading protocols. In the present case, all these critical factors were addressed by the TTPHIL: ALL TILT® protocol for the successful rehabilitation of a large anterior radicular cyst defect.

The minimally invasive single-drill osteotomy reduces thermal insult, preserves bone, and minimises surgical trauma [9,10]. The use of long, tapered implants ensures sufficient bone-implant contact while avoiding the complications associated with wide-diameter implants, particularly in sites with limited soft-tissue volume [11]. Additionally, the implant's apically sharpened threads and tapered configuration allow reliable bicortical engagement into the nasal floor, enhancing primary stability and reducing the risk of crestal bone loss [12,13].

Subcrestal placement of implants, combined with customised zirconia abutments featuring microgrooved surfaces, supports soft tissue integration and follows the "one abutment- one time"

concept- minimising microbial leakage and peri-implant inflammation [14-16]. Platform switching was utilised to preserve the biologic width and limit marginal bone remodelling [17]. Prosthetic margins were placed 0.5 mm subgingivally, labially and interproximally, and equigingivally palatally to optimise aesthetics and facilitate hygiene [18]. Literature highlights the risk of residual cement with deeper margins, underscoring the need for customised abutments [18,19].

The novel integration of subcrestal, microgrooved zirconia abutments and comprehensive three-year clinical and radiographic follow-up provides compelling evidence for enduring peri-implant tissue stability and aesthetic excellence in an infected, cystic environment.

At three years, the patient exhibited stable probing depths (≤ 3 mm), no bleeding on probing, and preserved marginal bone levels. Satisfaction was retrospectively rated at 9/10 for aesthetics and 10/10 for function. Owing to the retrospective single-case design, standardised periodontal charting, radiographic calibration, and validated patient-reported outcome measures were not performed; future prospective studies should incorporate precise measurement protocols alongside instruments such as the Oral Health Impact Profile-14 (OHIP-14) to comprehensively evaluate aesthetic and functional outcomes. While this approach demonstrates promising outcomes, particularly in cases with extensive radicular cysts or bone loss, careful case selection is essential, as it may not be suitable for patients with compromised nasal floor anatomy, active systemic infections, or inadequate bone quality for primary stability. Further long-term studies are needed to validate its broader applicability and compare its efficacy with traditional delayed implantation protocols in diverse clinical scenarios.

CONCLUSION(S)

The cumulative findings from this case, in conjunction with contemporary literature, support immediate implant placement in infected periapical and cystic sites when rigorous debridement, strategic implant design, and minimally invasive protocols like TTPHIL: ALL TILT® are employed. The incorporation of advanced prosthetic and biomechanical strategies further optimises outcomes. Nonetheless, future studies should aim to standardise these parameters to establish evidence-based guidelines for clinical practice.

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