CASE REPORT

Optimizing anterior esthetics of a single-tooth implant through socket augmentation and immediate provisionalization: A case report with 7-year follow-up

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Abstract  Tooth extraction inevitably accompanies alveolar ridge resorption with loss of pre-existing tissue morphology. Replacing missing teeth with dental implants has become popular, but restoring anterior teeth with implant-supported restorations is a technique-sensitive task and poses challenges for dentists. With the progress of implant dentistry, the demand for optimal esthetics has become linked with the desire for faster, easier techniques that shorten treatment time and also satisfy patients. Immediate provisionalization of a single-tooth implant provides significant benefits compared with traditional delayed protocols, such as aiding the contouring of peri-implant soft tissue and enhancing patient comfort and satisfaction. This article describes a meticulous approach to a hopeless maxillary central incisor with root fracture. The defect in the extraction socket was reconstructed using autogenous bone harvested from the chin. Four months later, an implant was installed and immediately restored. After another healing period of 6 months, the peri-implant soft tissue had been shaped and matured according to the contours of the provisional restoration. The emergence profile was used to duplicate the definitive restoration. Peri-implant esthetics was achieved through socket augmentation and immediate provisionalization of the implant. This treatment modality attained predictable and maintainable outcomes, both functionally and esthetically.

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Introduction

Tooth extraction is always accompanied by a loss of soft and hard tissues. The subsequent ridge deformity may cause severe functional and esthetic problems, especially in the anterior maxillary region. Socket augmentation techniques were developed to optimize the preservation of the hard and soft tissues of the alveolar ridges immediately following tooth extraction. These techniques have been applied to ridge preservation, late implant placement, immediate implant placement, and pontic site development [1-4]. Immediate provisionalization of single implants may demonstrate a positive effect on peri-implant soft tissue [5-7]. Placement of a provisional restoration following implant surgery can create soft tissue contours that resemble normal gingival topography before placement of the definitive prosthesis.

The purpose of this article is to report on a single implant and successful replacement, both functionally and esthetically, of a failed maxillary central incisor. The paper also describes socket augmentation of the failed tooth in order to establish an adequate implant site and the immediate provisionalization that allows for prosthetic sculpting of the tissue after implant surgery. A detailed treatment process is also described.

Case report

A 24-year-old male presented with a failed left maxillary central incisor. The patient described a history of facial trauma during a basketball game about 5 years previously. His general health history was noncontributory. The clinical evaluation demonstrated that the left maxillary central incisor showed grade II tooth mobility with percussion and palpation pain. A labial sinus tract and deep bone sounding depths of 7-8 mm at the labial aspects were observed. Radiographic examination revealed an obvious oblique root fracture line 3.5-4.5 mm subcementally of the endodontically treated tooth No. 9. The unaesthetic diastema between the maxillary central incisors was also among the patient’s main complaints (Fig. 1).

With the long term failure of tooth No. 9, the labial plate and soft tissue had resorbed, creating a functional and cosmetic defect requiring bone and soft tissue augmentation. The tooth was atraumatically removed with a peri-tome (Nobel Biocare, Yorba Linda, CA, USA), which preserved the gingival and osseous architecture. A periodontal probe was used following tooth extraction to verify the integrity of the bony plate, and a 5 mm labial bone dehiscence was detected.

The socket was thoroughly debrided and reconstructed using autogenous bone harvested from the chin region. The chin bone graft was ground into particles and placed into the prepared socket. A subepithelial connective tissue graft simultaneously harvested from the maxillary right palatal region was inserted on the labial and coronal aspects of the socket to augment the labial thickness of the soft tissue and to fabricate primary closure for long-term maintenance and esthetics. The crown of the extracted tooth was reshaped and bonded to adjacent teeth with a palatal fixed retainer to serve as the fixed provisional prosthesis during the healing stage (Fig. 2).

Four months after socket augmentation of tooth No. 9, the recipient site was developed into proper contours for implant placement. An MIS tapered implant (3.75 mm x 13 mm; MIS, Shlomi, Israel) was installed into the prepared site with an insertion torque of 35 Ncm. A prefabricated plastic temporary abutment (MIS) was connected to the implant and prepared intraorally to a desired form. A provisional acrylic resin crown was then bonded to the plastic temporary abutment and adjusted. The screw of the temporary abutment was torqued to 25 Ncm. Any occlusal contact was avoided, permitting immediate but reduced functional loading of the implant (Fig. 3). Two months after the immediate provisionalization of the implant, the provisional crown was contoured again to expand the peri-implant soft tissues for the final restorative phase.

After another healing period of 4 months, when soft tissue shaping was achieved with the provisional restoration, a customized impression coping was connected to the implant, and a final implant impression was made. Occlusal adjustment was performed to attain even centric occlusal contacts and subsequently reduce anterior guidance of the fig. 1. Pretreatment photograph (A) and periapical radiograph (B) of the failed left maxillary central incisor.
implant. After this, a screw-retained, metal-ceramic crown was delivered and torqued to 40 Ncm.

The 7-year follow-up demonstrated that the gingival architecture maintained the form as the definitive implant-supported crown was delivered. Radiographic examination revealed the stable marginal bone level (Fig. 4). Peri-implant esthetics was achieved and maintained, which also satisfied the patient’s expectations.

Discussion

Various bone grafting materials have been suggested for socket augmentation, including autogenous bone, demineralized freeze-dried bone allografts (DFDBA), freeze-dried bone allografts, xenografts, bioactive glass, hydroxyapatite, and calcium sulphate. Autogenous bone is regarded as the “gold standard” for bone grafting and is a reliable option for patients with insufficient bone [8].

Becker et al. [9] compared DFDBA with autogenous bone at seven paired sites, reporting that, after 3 months, new bone was formed at sites where autogenous bone was placed, but not in sites using DFDBA. A study by Froum et al. [10] also showed little new bone formed around DFDBA in healing extraction sockets. In this case, the use of autogenous bone might induce considerable bone formation. Patients should be informed before any surgical procedure that post-surgery discomfort may be experienced at the donor site.

Soft tissue coverage is considered to retain, stabilize, and protect grafting materials. Numerous techniques have been proposed, inclusive of displacing neighboring tissue to cover the socket, such as coronal advancement of a buccal flap, rotating grafts from adjacent tissue to cover the defect, and using free gingival or subepithelial connective tissue grafts [11,12]. Coronally advanced flaps need to be undermined and advanced a relatively great distance to completely cover an extraction socket. This may cause complications such as altering the mucogingival line and creating a shallow vestibule, either of which may require subsequent surgery to correct them. These problems can be avoided by using a subepithelial connective tissue graft taken from the palate [13].

In this case, the subepithelial connective tissue graft served as socket coverage of the bone graft and labial soft tissue augmentation for esthetic purposes. The hard and soft tissue augmentation created sufficient volume and contours to permit subsequent implant placement allowing for acceptable esthetic results. Although this staged approach took more time and an additional surgical procedure, it allowed for a more predictable and maintainable long-term functional and esthetic reconstruction [8,14,15].

Ideally, implant placement should be based on a restoration-driven treatment plan with correct three-dimensional positioning of the implant [16,17]. In this case, the implant axis came through the cingulum area just lingual to the incisal edge with vertical depth placement of the fixture platform of approximately 3 mm from the natural cementoenamel junctions of the adjacent teeth. The well-planned implant location allowed for predictable and maintainable long-term functional and esthetic outcomes.

Figure 2. (A, B) The interim prosthesis at tooth No. 9 following site development. (C) The chin bone was grafted inside the socket.

Figure 3. Four months after site development. (A) The prefabricated temporary plastic abutment was connected to the implant fixture. Immediate provisionalization of the implant-supported fixed provisional crown: (B) clinical; (C) periapical.
Contours of the implant abutment and restoration dramatically affect sulcular form. A well-designed provisional crown aids in developing the gingival tissue from a narrow cylindrical implant to the three-dimensional gingival form of a tooth as the implant emerges from the sulcus [18]. The benefits of immediate implant provisionalization are better clinical efficiency, optimized gingival form before definitive restorations, fewer surgical interventions, and shortened treatment time.

One of the main prerequisites for immediate loading is sufficient initial implant stability. Immediate implant provisionalization has been suggested when optimal primary stability is reflected by a placement torque greater than 30 Ncm or resonance frequency analysis demonstrates an implant stability quotient greater than 60 [19,20]. Good surgical techniques and proper occlusal schemes are also essential to the success of immediate implant provisionalization [21,22].

Accomplishing an optimal emergence profile with a metal alloy temporary abutment may be technically challenging and time-consuming. Furthermore, the temporary metal abutments have some limitations. They are not easily prepared, are difficult to mask behind translucent temporary acrylic resins, and may cast a gray hue through the peri-implant gingiva [23]. Several manufacturers have recently introduced plastic and polymer temporary abutments to solve these problems.

The temporary plastic abutment used in this case was easily customized to the patient’s tissue contours and anatomic profile. Intraoral preparation was completed more quickly than with metal alloy temporary abutments because the plastic component was much easily prepared with high-speed burs, and there was no danger of heat transmission to the fixture and surrounding bone. Because of the elimination of the gray-colored metallic components, the yellowish plastic components showed a natural color through the gingival tissues.

In this case, the use of bone and soft tissue grafting for socket augmentation before implant placement appeared to be critical to the long-term stability and esthetics of the gingival tissues, as previous studies have described [8,14,15]. The immediate implant provisionalization served as scaffold to support the surrounding mucosa and papillae, thus contributing to the peri-implant esthetics.

Disclosure of Conflicts of interest

The authors do not have any financial interests in any of the companies or products listed in this article.

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References

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