Preservation of Existing Soft-Tissue Contours in the Transition from a Tooth to an Implant Restoration in the Esthetic Zone Using a Flapless Approach: A Clinical Report

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Abstract

Two-stage placement of a dental implant is a well-established method for restoring a missing anterior tooth; however, replacement of an anterior tooth by using two-stage implant surgery may result in changes in the interdental papilla height and loss of alveolar bone with compromised esthetic results. Alternatively, the use of a one-stage minimally invasive surgical technique followed by immediate provisionalization may facilitate achievement of esthetic and functional success with minimal discomfort and clinical time. This article presents a clinical case with a single anterior tooth replacement, illustrating ridge preservation with healing, delayed implant placement with immediate provisionalization of the implant to support the soft tissue, and a method of recording the soft-tissue contour in the final impression to achieve an optimal esthetic result.

Esthetic demands are increasing in contemporary dentistry, and patient expectations become higher every day. In no place is it more difficult to meet these expectations than in the esthetic zone. To produce an esthetically successful result, the dentist must create a perfect harmony among multiple factors, including scalloped gingival margins, pyramid-shaped interdental papillae, tooth position and form, and proximal contacts.

The conventional staged technique has been well documented in the dental literature as a valid and safe treatment method for restoring missing anterior teeth.[1-3] This method involves placing the implant first and later restoring it with an appropriate material; however, the final esthetic result of this approach is not always predictable because of uneven healing of the soft tissue and underlying bone. The presence of additional complications, such as fractured teeth, internal/external root resorption, or infection, increases the possibility of additional soft and hard tissue loss.

The importance of maintaining the buccal plate cannot be overemphasized.[4-6] Successful single-tooth implant treatment requires buccal bone sufficiently thick to avoid any implant dehiscence.[7-9] The dental literature has documented that the more invasive the surgical procedure, the higher the likelihood of losing both alveolar bone and soft tissue, including the dental papilla.[10-13]

In contrast, the use of a flapless implant placement technique would minimize trauma to both the bone and gingiva, and restoring this implant with an immediate interim prosthesis could increase the likelihood of obtaining an optimal esthetic result.[14-18] The following clinical report illustrates this technique.

Clinical report

A 48-year-old female patient presented complaining of dull pain, swelling, and mobility of her maxillary right central incisor. Upon clinical examination, the presence of a fistula, gingival inflammation with exudate, and +3 mobility was evident (Fig 1). Radiographic evaluation revealed a periapical radiolucency, incomplete endodontic obturation, and bone loss (Fig 2). It was determined that the tooth had a hopeless prognosis related to failed endodontic treatment. After evaluating the local and systemic factors, the patient was advised of treatment options and elected to have the tooth extracted and replaced with a dental implant. Based on the diagnostic findings, the patient was categorized as an ACP PDI Class II completely dentate patient, due to the esthetic component.[19]

Figure 1 Edema of the soft tissue with a fistula of the maxillary right central incisor was evident at the initial appointment.

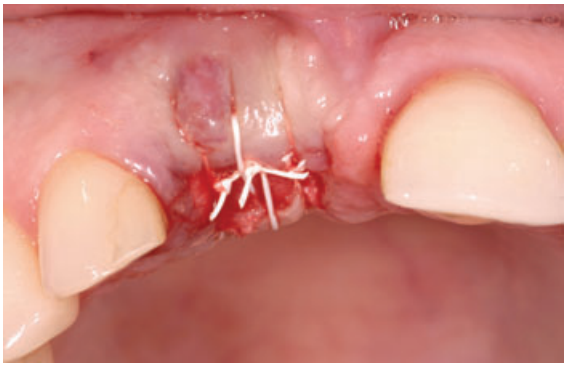

Figure 3 Extraction site following grafting and placement of GTR membrane.

Treatment was divided into three stages:

Stage I: Extraction, socket preservation, and placement of an interim acrylic resin removable partial denture.
Stage II: Placement of the implant, provisional abutment, and provisional crown.
Stage III: Placement of the definitive abutment and crown.

Stage I

Local anesthesia was administrated (2% lidocaine, 1:100,000 epinephrine). A simple extraction of the maxillary right central incisor was performed without raising a mucoperiosteal flap and using caution to minimize trauma to the surrounding tissues. A surgical curette was used to debride the socket of all granulation tissue. A 0.12% chlorhexidine gluconate rinse (Peridex, Procter & Gamble, Cincinnati, OH) was applied to the tissue to decrease microorganisms in the area of surgery and allow for more uneventful healing. Immediately after extraction, a socket-preservation procedure was performed using particulate cancellous bovine-derived bone xenograft (Bio-Oss, Osteohealth, Shirley, NY) and a guided-tissue regeneration membrane[20–22] (Bio-Gide, Osteohealth). The membrane was placed under the margin of the gingival tissue and extended down. The area was sutured with GORE-TEX sutures (W.L. Gore and Associates, Flagstaff, AZ) without achieving primary closure (Figs 3 and 4).

After an initial healing period of 1 week, an interim removable maxillary partial prosthesis was inserted to replace the extracted tooth temporarily.[23–26] The acrylic resin tooth was modified to an ovate contour on the tissue surface to maintain the appropriate soft-tissue architecture. Slight pressure was

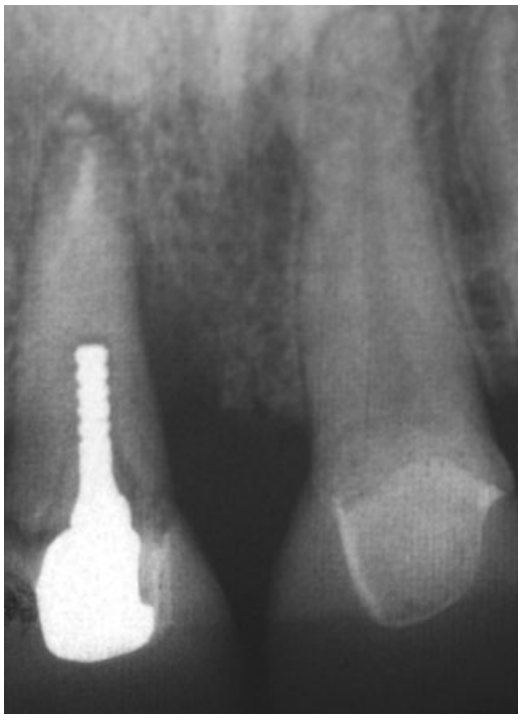

Figure 2 Preoperative radiograph.

Figure 4 Radiograph following extraction with graft in place.

Figure 5 The site, 1 week postoperative.

Figure 7 Eight weeks postoperative view.

applied mesially and distally to form the dental papilla on both sides (Figs 5 and 6).[27,28] Broad-spectrum antibiotics (amoxicillin 500 mg, QID) and antiinflammatory analgesics (ibuprofen 800 mg, PRN) were prescribed for 1 week, and the patient was instructed to use 0.12% chlorhexidine gluconate rinse twice per day for 2 weeks.

Multiple follow-up appointments confirmed that the site was healing properly (Fig 7). During these appointments, the partial denture was adjusted as needed, both adding and removing acrylic resin at various points.

Stage II

Four months later, a simple bone-sounding technique was used at three levels of the edentulous space (crestal, midway through the ridge, at the base of the ridge) to verify that the buccal-lingual thickness of the alveolar bone was sufficient. The bone sounding was used because the patient had limited financial resources and could not handle the additional financial burden of a cone beam computed tomographic (CBCT) scan. A radiographic template was fabricated and subsequently used as an implant surgical guide. Based on the bone sounding and the radiographic findings, a calcium-phosphate-surfaced root-form implant (Nano-Tite, Biomet 3i, Palm Beach Gardens, FL), 3.25 mm in diameter and 13 mm in length, was selected for the placement.

Under local anesthesia, the center of the ridge was marked by using the surgical guide, and the site was sequentially widened with round, 2.0 mm, and 2.75 mm twist drills (Fig 8), and the osteotomy was verified for position and trajectory with a periapical radiograph (Fig 9). The implant was placed without reflecting a flap. A space of 1.5 mm to 2.0 mm away from the buccal plate was allowed to avoid any bone resorption.

A provisional abutment (PreFormance, Biomet 3i) was hand-torqued to the implant and prepared to the proper length and shape (Fig 10). A provisional crown was fabricated with autopolymerizing acrylic resin and modified to the proper contour (Fig 11). The facial surface was slightly flattened at the cervical third to prevent the soft tissue from retracting. Occlusion was adjusted to eliminate any centric or eccentric contacts. The proximal contacts were eliminated to avoid any micromovement generated or allowed by the PDL of adjacent teeth. The crown was cemented on the abutment with temporary cement. The implant was allowed to osseointegrate for a 4-month period.

Stage III

The provisional crown and abutment were removed, and an impression coping was connected to the implant. Flowable composite resin material (Tetric Flow, Ivoclar Vivadent, Amherst, NY) was then injected around the impression coping and light

Figure 6 An interim removable partial denture was inserted, and pressure was applied to form the dental papillae.

Figure 8 The implant site after preparation with a 2.0-mm twist drill.

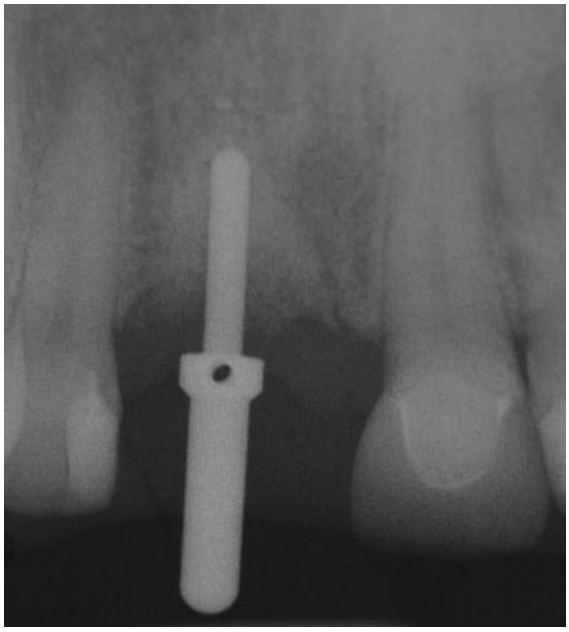

Figure 9 The osteotomy site was verified for postion and trajectory.

Figure 10 A provisional abutment was connected and prepared to the proper height.

Figure 11 The provisional crown in place.

Figure 12 An impression was made at the implant level using a customized impression coping to record the soft-tissue position.

cured (Fig 12). The composite resin supported the soft tissue to maintain the contours created with the provisional crown. An impression was made with a poly(vinyl siloxane) material and sent to the laboratory for fabrication of the definitive abutment and crown.

A definitive custom abutment was fabricated with high noble metal, and a layer of opaque porcelain was added to the surface of the metal. A thin collar of pink opaque porcelain was applied subgingivally at the cervical section of the abutment, and it was polished with porcelain-polishing points (Dialite, Brasseler, Savannah, GA). The abutment was torqued to the implant at 30 Ncm. The final crown was fabricated with a Procera all-zirconia ceramic material (Nobel Biocare, Yorba Linda, CA). It was then cemented definitively with resin-modified glass ionomer cement (RelyX, 3M ESPE, St. Paul, MN). Follow-up through 1 year showed no change in the final results (Figs 13 and 14).

Discussion

Numerous reports have described the rationale for using provisional crowns on implants immediately after placement.[16,17,29] This approach significantly diminishes overall treatment time. Moreover, if appropriately indicated, immediate provisionalization also can optimize the final gingival contours around the

Figure 13 The definitive crown in place at the 1-year follow-up.

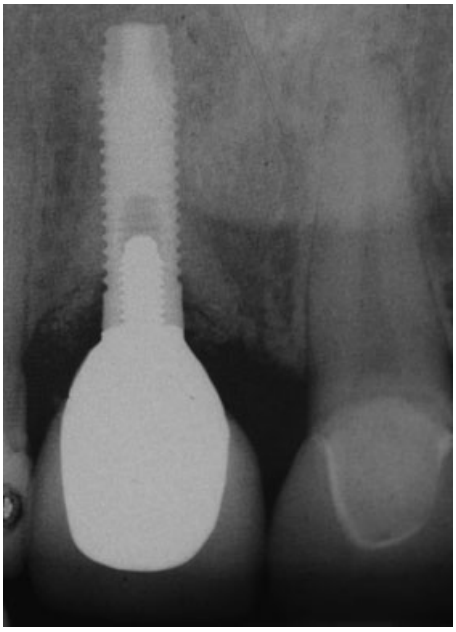

Figure 14 Postoperative radiograph at the 1-year follow-up.

implant without jeopardizing implant survival rates. Drago and Lazzara[30] reported a 97.4% success rate when using provisional crowns instead of healing abutments on newly placed implants. In a study of 65 implants placed in 55 patients, Jemt[31] obtained faster healing and better esthetic results after 2 years of follow-up when he used provisional crowns rather than healing abutments.

In the present report, immediate restoration with a provisional crown was combined with flapless implant placement to achieve predictable esthetic results. A number of mechanical and biological factors must be considered in determining whether the flapless technique is appropriate. These include diagnostic factors that have been described as being predictive of the final esthetic result,[32] including a thick gingival biotype with flat gingival contours, a low smile line, and square-shaped teeth. A maximal distance of not more than 5 mm between the proximal tooth contacts and the crestal bone results in predictable formation of papilla regeneration between an implant and a natural tooth.[33] Contraindications to flapless surgery include bony undercuts, a lack of keratinized attached mucosa, close proximity to any major anatomical structures, and lack of bucco-palatal dimension of the ridge.

Although the buccal-lingual thickness of the bone can accurately be determined with a 3D CBCT radiograph, relatively good information about the bone thickness can also be obtained from a simple bone-sounding technique.[34–36] If sufficient bone is present, accurate 3D placement of the implant in the bone is essential. Such placement determines the emergence profile of the restoration, ensures the long-term preservation of the buccal plate, and provides the primary stability needed for the provisionalization period.

Primary stability is defined as the resistance of the implant to micromovement immediately after placement.[37,38] Primary stability is essential for all implants, but most important for immediately restored implants, and as such, has little loss of bone contact or bone support during the healing phase (4 to 6 weeks), if in adequate contact with the bone. Levels of torque can be much greater than 45 Ncm. Rather, 65 Ncm to 100 Ncm can be achieved for primary stability for implants immediately restored. This stability is entirely mechanical and depends on the bone quality, length and geometery of the implant, and precision of the surgical technique employed. Primary stability should usually last until the actual biological process of osseointegration occurs. The duration of that process is determined by the surface treatment and implant body design, as well the individual patient's bone-modeling and remodeling processes. Different implant manufacturers have different recommendations for the healing times.

When immediately provisionalizing implants, an understanding of the patient's occlusion is crucial. Even when centric and eccentric contacts are eliminated, bruxism and parafunctional habits such as nail biting or pencil chewing can overload the implant and lead to its failure, especially during the initial healing period. In some instances, depending on the individual occlusal scheme, it may be good practice when replacing a missing canine to change the patient's occlusal scheme from canine-protected to a group function, sharing or moving the load to the first premolar or more. Unfortunately, only limited discussion of the relationship of dental implants to occlusion is available in the dental literature.

In the authors' opinion, provisional crowns could be better termed "anatomical healing abutments," since they function as healing abutments but lead to a more esthetic gingival anatomy. They create a proper emergence profile, allowing the gingival tissue to be restored to its original architecture, in harmony with the teeth, and they are kept out of occlusal contact to avoid excess distribution of stress to the implant.

Conclusion

A well-planned flapless implant placement is a good technique for obtaining superior esthetic results, especially when combined with immediate provisionalization. Meticulous patient evaluation and treatment planning are crucial to success when using these techniques. Communication between the dentist, surgical dentist, and laboratory technician during the treatment planning stage is also essential to meeting the esthetic and functional expectations of both the patient and dentist.

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