SOCKET CLASSIFICATION/MANAGEMENT

Subclassification and Clinical Management of Extraction Sockets with Labial Dentoalveolar Dehiscence Defects

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Abstract: Immediate implant therapy involving implants placed into intact Type 1 extraction sockets has become a consistent clinical technique. The classification of Type 2 extraction sockets, where the mucosal tissues are present but there is a midfacial osseous dehiscence defect, has been described according to the extent of the buccal bone plate absence. The literature has offered different techniques in the treatment of Type 2 sockets; however, the extent of the defect has never been defined or delineated. In this article, the authors describe a subclassification of Type 2 sockets: Type 2A presents with a dehiscence defect roughly 5 mm to 6 mm from the free gingival margin (FGM) involving the coronal one-third of the labial bone plate; Type 2B presents with a dehiscence defect involving the middle one-third of the labial plate, approximately 7 mm to 9 mm from the FGM; and in Type 2C the dehiscence defect involves the apical one-third of the labial osseous plate roughly 10 mm or greater from the FGM. The authors also offer a protocol and technique employing immediate implant placement, guided bone regeneration, and bone graft containment with a custom two-piece healing abutment that can lead to consistent and satisfactory clinical outcomes in low-smile-line patients. The treatment protocol and sequence is outlined in a clinical case presentation involving a Type 2B socket.

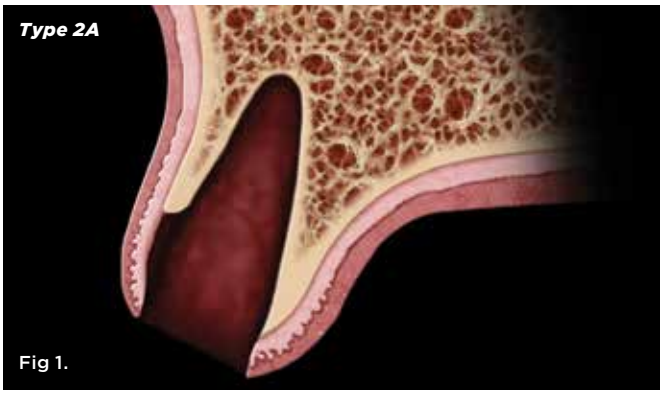
Immediate implant placement concurrent with provisional restoration (IIPP) into fresh extraction sites has been advocated to improve the esthetic–restorative outcome for patients.[1] This procedure was first described in the late 1980s and has gained popularity and support in the dental literature as a predictable treatment option for single tooth replacement with an immediate dental implant in the esthetic zone.[2-10]

When performing IIPP, achieving successful outcomes depends on multiple variables. These include: pre-treatment gingival health; morphology and dimensions of the bone and soft tissues; primary implant stability; spatial positioning of the implant; and the fabrication of a properly contoured provisional restoration. Increased understanding of each of these factors is important to developing an effective protocol for IIPP. The use of IIPP will continue to expand as clinicians gain a greater comprehension of the variables that can lead to success.

Residual bone socket morphology after tooth removal prior to immediate implant placement has been identified as a critical factor when performing IIPP.[5,11] Establishing an accepted classification of residual bone socket morphology allows clinicians to efficiently communicate and collect important clinical data that can lead to establishing more predictable treatment protocols in the future.[12,13]

Elian et al previously provided a defect classification in the literature that identified the problems associated with horizontal and vertical hard- and soft-tissue loss.[11] This classification delineated the midfacial horizontal component and the potential risk of midfacial recession associated with labial bone plate loss after tooth extraction. The following socket classification was described:

- Type 1—Labial bone plate and associated soft tissues are completely intact.



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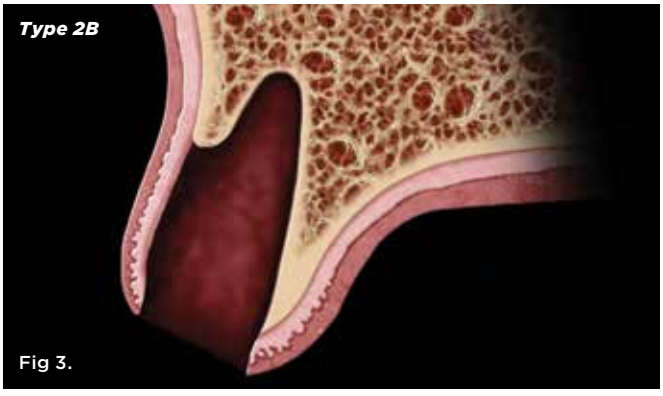

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Fig 4.

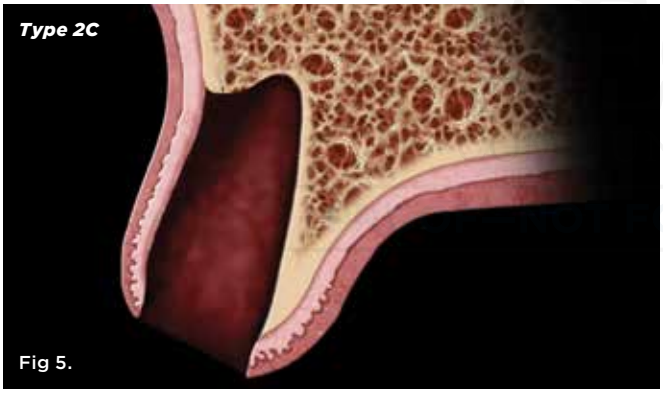


Fig 5.

Fig 6.

Fig 1. Diagrammatic sagittal view of a Type 2A socket, where the coronal one-third of the buccal bone plate is absent, yet the soft tissues are completely intact. **Fig 2.** Diagrammatic labial view of a Type 2A socket, where the coronal one-third of the buccal bone plate is absent, yet the soft tissues are present. **Fig 3.** Diagrammatic sagittal view of a Type 2B socket, where the middle one-third of the buccal bone plate is absent, yet the soft tissues are completely intact. **Fig 4.** Diagrammatic labial view of a Type 2B socket, where the middle one-third of the buccal bone plate is absent, yet the soft tissues are present. **Fig 5.** Diagrammatic sagittal view of a Type 2C socket, where the apical one-third of the buccal bone plate is absent, yet the soft tissues are completely intact. **Fig 6.** Diagrammatic labial view of a Type 2C socket, where the apical one-third of the buccal bone plate is absent, yet the soft tissues are present.

- Type 2—Soft tissue is present, but a dehiscence osseous defect exists that is indicative of the partial or complete absence of the labial bone plate.
- Type 3—Midfacial recession defect is present, representing the loss of the labial bone plate and soft tissues.

In this basic midfacial classification, Type 1 and Type 3 sockets are adequately described. However, the present authors have determined that the Type 2 residual extraction socket—that in which the gingival soft tissue is found to be intact and there is partial or complete bone resorption of the facial cortical plate of bone—requires more detailed description when determining the course of treatment for the Type 2 socket, even though treatment and outcomes of these defect types have been described in the literature.[14] Prior case reports describe immediate implant placement into extraction sockets with dehiscence defects and placement of a bone graft, whether autogenous blocks, chips, or particulate allograft with or without a membrane for guided bone regeneration

(GBR). A full provisional restoration or custom healing abutment is also placed at the time of surgery to contain the bone graft, support the peri-implant gingival tissues, and restore the esthetic loss of the tooth.[15-18] In addition, several authors have also suggested that the size, extent, and shape of the osseous defect can affect the short-term esthetic outcomes of treating such defects.[19]

Therefore, the purpose of this article is to identify a subclassification of Type 2 sockets categorizing the dimensions and volume of the labial plate dehiscence defect, as well as to provide a clinical scenario exemplifying the protocol and sequence of therapy in the correction of the dehiscence labial defect.

Subclassification

As previously cited, Elian et al[11] described a classification of Type 2 extraction sockets where the soft tissue is present but the labial bone plate is absent. However, the following subclassification of Type 2 sockets when the soft tissues are intact is used to quantify the absence of the labial bone plate:

- Type 2A—absence of the coronal one-third of labial bone plate of the extraction socket 5 mm to 6 mm from the free gingival margin (FGM) (Figure 1 and Figure 2).
- Type 2B—absence of the middle to coronal two-thirds of the labial bone plate of the extraction socket approximately 7 mm to 9 mm from the FGM (Figure 3 and Figure 4).
- Type 2C—absence of the apical one-third of the labial bone plate of the extraction socket 10 mm or more from the FGM (Figure 5 and Figure 6).

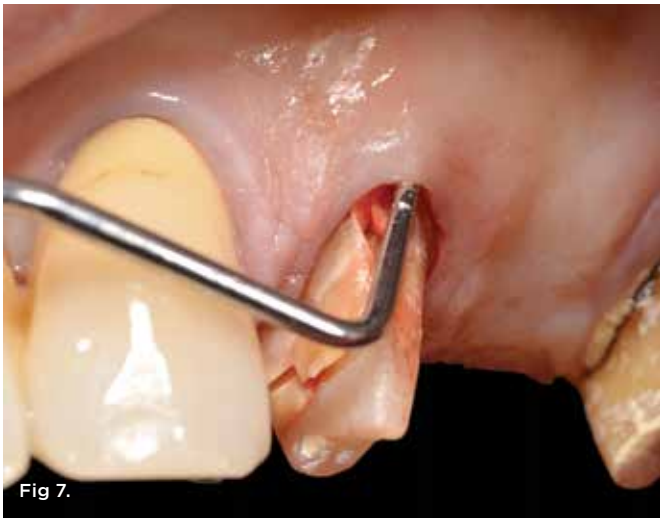
Clinical Technique

A technique employing immediate implant placement, GBR, and bone graft containment with a custom-healing abutment that is conducive

TABLE 1

Summary of Treatment Sequence and Clinical Steps

TREATMENT STEP	CLINICAL PROCEDURE
1	Place implant with a palatal bias, engaging the proximal walls of the socket, leaving a buccal gap.
2	Construct custom two-piece, screw-retained healing abutment.
3	Remove custom healing abutment.
4	Fit and place absorbable membrane for GBR. Membrane should cover defect at least 2 mm circumferentially and extend to the level of the FGM midfacially.
5	Place bone graft material buccal to the implant surface and palatal to the absorbable membrane.
6	Re-place prior fabricated custom healing abutment.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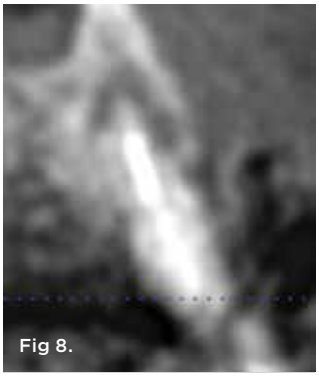
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Fig 9.


Fig 10.


Fig 11.

Fig 7. Clinically, the midfacial dehiscence bony defect was diagnosed using a periodontal probe and sounding to the apex of the lesion. A sounding depth of 9 mm was recorded for tooth No. 12. **Fig 8.** The preoperative CBCT showed the apical extent of the osseous defect in this particular situation; the middle one-third of the labial plate was absent, indicative of a Type 2B socket. **Fig 9.** A surgical spoon excavator was used to thoroughly debride the extraction socket after sharp dissection of the gingival fibers prior to tooth removal. Note that with the buccal extension of the excavator the labial plate was absent. **Fig 10.** The engagement of the lateral walls of the first bicuspid socket was used for primary stability. Implant was placed with a palatal bias no less than 3 mm and no deeper than 4 mm from the labial FGM to allow greater vertical distance for proper submergence profile of the custom healing abutment. **Fig 11.** A prefabricated cervical root former or "shell" was used to capture the subgingival shape of the peri-implant mucosal tissues. This acrylic shell was subsequently luted to a pre-manufactured PEEK (polyether-ether-ketone) implant abutment.

to consistent clinical outcomes is described below. A summary of the treatment sequence and clinical steps is provided in Table 1.

First, because the implant is used to retain the custom healing abutment, the treatment protocol requires a minimum of 25 Ncm of implant insertion torque for primary stability at the time of placement to safeguard survival.[20] In premolar sites, the socket anatomy allows implant stability through engagement of the lateral walls, since bicuspids are greater in dimension buccolingually than mesiodistally. In anterior sockets, engagement of the palatal and apical bone is strategic to ensure not only proper implant placement but also primary stability.

A custom-contoured healing abutment is fabricated using provisional material such as acrylic, bisacryl, or flowable composite. It is then removed prior to the placement of an absorbable membrane. The absorbable membrane should cover and extend beyond the lateral walls of the defect by a few millimeters, mimicking its shape and form as well as extending to the level of the FGM midfacially.

The bone graft material is then placed between the palatal aspect of the membrane and the labial surface of the implant up to the level of the FGM.

The custom two-piece healing abutment is then re-placed, thereby containing, protecting, and maintaining the membrane and graft material throughout the healing phase. Excess bone graft material that was expressed into the gingival sulcus is removed.

Finally, the patient is instructed to not rinse or brush the area for at least 2 days to allow the blood clot to stabilize.

Clinical Case Report

An 87-year-old Asian male patient presented with pain to percussion of the maxillary left first bicuspid (tooth No. 12), which served as an anterior abutment of a fixed dental prosthesis (FDP) replacing tooth No. 13. Upon clinical examination with a periodontal probe, a sounding depth of 9 mm was recorded on the direct midfacial aspect of the crown abutment, which was indicative of a vertical root fracture (Figure 7). This diagnosis was also confirmed through periapical and cone-beam computed tomography (CBCT) radiographs (Figure 8). The subclassification defect type in this clinical scenario was a Type 2B socket.

The posterior FDP with full crown retainers on teeth Nos. 14 and 15 and an internal interlock attachment to an anterior FDP from teeth Nos. 6 through 11 had been placed with provisional cement and was maintained for several years with periodic recementation. The provisional removal of the posterior FDP not only allowed treatment of tooth No. 12, but also maintained a fixed transitional restoration for the patient during surgical healing and non-occlusal loading of the implants placed in Nos. 12 and 13.

Surgical treatment required atraumatic tooth removal without flap elevation, thereby maintaining the periosteal blood supply to the interproximal and residual labial bone plate. Sharp dissection of the supracrestal fibers was performed with a 15c scalpel blade prior to tooth extraction, and the socket was thoroughly debrided with a surgical spoon excavator (Figure 9). The partial absence of the labial bone plate was evident (Figure 9), yet the soft tissue was completely intact. A tapered platform-switched internal connection-type implant (Biohorizons Plus, Biohorizons, biohorizons.com) was placed 4 mm below the FGM to allow greater vertical distance


Fig 12.


Fig 13.


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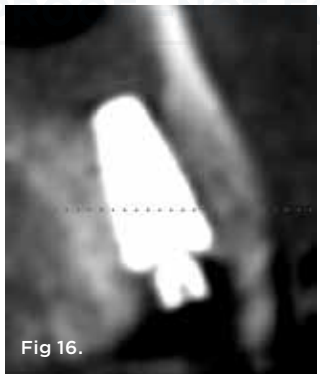


Fig 16.

Fig 12. The custom healing two-piece abutment with voids filled in with acrylic resin, fully contoured and polished prior to insertion; while in place, healing was allowed to occur for 6 months before first disconnection. **Fig 13.** Absorbable collagen membrane was shaped to extend beyond the lateral walls of the defect and subsequently placed into the socket to the level of the FGM. Only the "cone" portion of the "ice cream cone" membrane was used. **Fig 14.** The bone graft was placed between the labial aspect of the implant and palatal to the absorbable collagen membrane. **Fig 15.** The previously constructed two-piece custom healing abutment was reinserted to contain, protect, and maintain the bone graft material during the healing phase of treatment. **Fig 16.** 8-month post-surgical–healing CBCT showed radiographic re-establishment of the buccal bone plate prior to first disconnection and impression-making.

(ie, running room) for the proper submergence profile of the custom two-piece healing abutment (Figure 10). Primary stability was achieved through engagement of the lateral proximal walls of the first bicuspid socket and confirmed with hand-torque of 50 Ncm to facilitate immediate fabrication of a custom healing abutment.

A screw-retained, two-piece custom healing abutment was fabricated prior to the placement of the bone graft material. Polyether-ether-ketone (PEEK) internal-hexed connection temporary cylinders (Biohorizons), a preformed polymethylmethacrylate (PMMA) submergence profile root-form shell (Figure 11) specific for tooth No. 12 (Specialized Dentistry of New York Dental Lab, sdnyonline.com), and autopolymerizing acrylic resin (Super-T, American Consolidated Mfg. Co.) were used to construct the custom healing abutment.[21] This custom healing abutment possessed the subgingival contours that conformed to the pre-extraction state of the tooth root cervix, thereby supporting the soft-tissue emergence profile to help protect the blood clot and contain the bone graft particles during the healing phase of treatment (Figure 12).

An absorbable collagen membrane (BioMend® Extend, Zimmer Dental, zimmerdental.com) was trimmed and contoured conforming to, yet extending beyond, the size and shape of the labial bone deficiency previously assessed (Figure 13). The membrane was placed against the internal surface of the residual labial socket wall, and the "gap" was filled with small-particle (250 to 1000 microns) bone allograft (Puros® Cortico-Cancellous Particles, Zimmer Dental) at the time of implant placement (Figure 14). Once this was accomplished, the previously fabricated two-piece custom healing abutment was reinserted using hand-torque while ensuring adequate support of the soft tissues and gingival architecture (Figure 15).

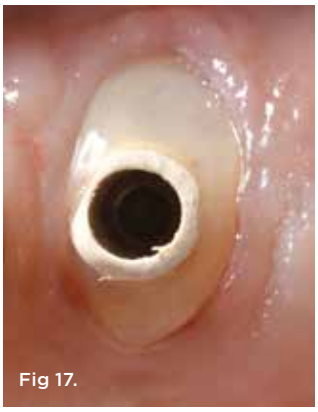
The patient was given post-surgical antibiotic therapy and seen about 1 week postoperatively for healing during clinical follow-up.

A healing period of 8 months was specified for this patient to allow the reconstitution of the buccal plate before final impression-making of implants Nos. 12 and 13. A CBCT was also taken to confirm radiographic healing of the newly generated buccal bone plate (Figure 16). After first disconnection of the two-piece custom healing abutment, the anatomy of the reconstituted and maintained gingival architecture of the extraction socket was evident (Figure 17 and Figure 18). Single-unit, screw-retained, ceramic-metal implant restorations were fabricated for implants Nos. 12 and 13, as well as full-coverage crowns for natural teeth Nos. 14 and 15 (Figure 19 and Figure 20). A final periapical radiograph was taken after insertion of the definitive single-unit restorations on the upper left sextant of the patient's dentition (Figure 21).

Discussion and Clinical Significance

This article has presented a subclassification of Type 2 socket defects where the soft tissue is present but a dehiscence osseous defect exists, which is indicative of the partial or complete absence of the labial bone plate.

Of equal importance is that the case report presented denotes a shift in conventional thinking where traditional clinical techniques would have warranted treating a Type 2 defect in a delayed-approach protocol—ie, tooth extraction with or without socket preservation, healing of the socket, implant placement, healing of the implant, provisional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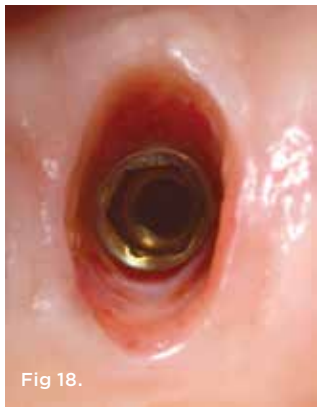
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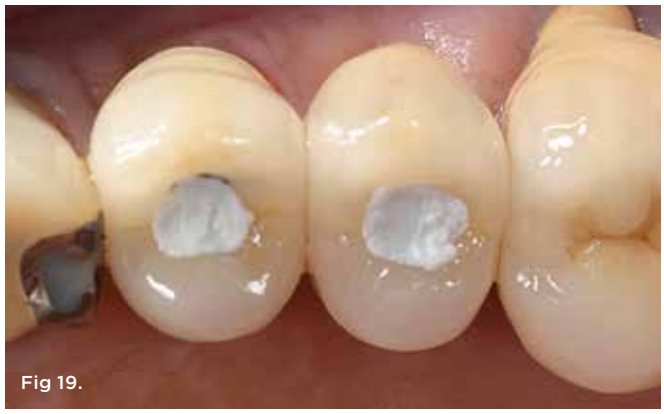
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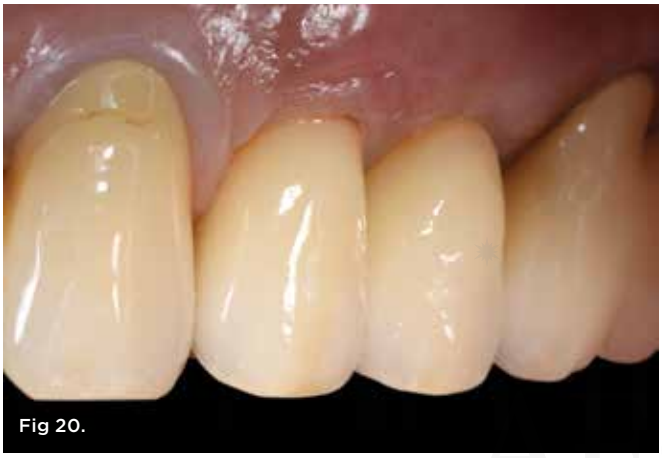
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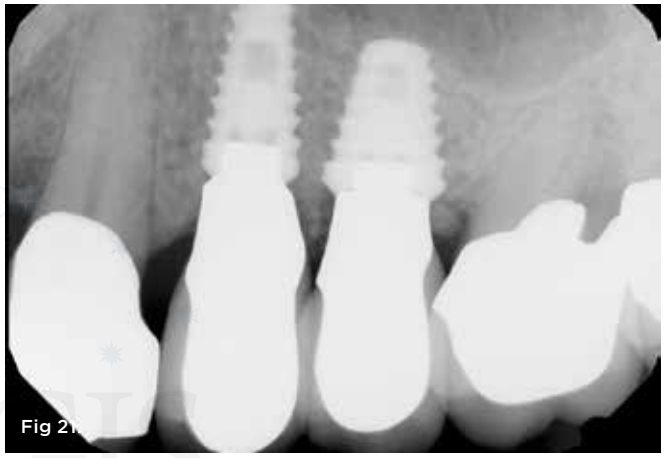
Fig 21.

Fig 17 and Fig 18. Clinical appearance of the gingival tissues around the custom healing abutment 8 months post-surgical healing (Fig 17). First disconnection of the healing abutment at tooth No. 12 showed anatomic shape of the socket and buccal ridge maintenance (Fig 18). **Fig 19 and Fig 20.** Occlusal–buccal view (Fig 19) and facial view (Fig 20) of the definitive screw-retained implant crowns for teeth Nos. 12 and 13. **Fig 21.** The definitive periapical radiograph of implant restorations Nos. 12 and 13 showing more than adequate bone levels around both implants 10 months after implant surgery.

restoration of the implant, final impression-making, and then delivery of a definitive restoration. Such a delayed-approach treatment sequence encompasses several steps over an extended period of time and appointments, not only for the practitioner, but also for the patient.

The clinical significance of this described technique, where immediate implant placement into a fresh extraction socket with partial or complete loss of the buccal bone plate is combined with guided bone regeneration, has significant benefits for both the clinician and patient. These include: 1) treatment procedures are condensed into fewer appointments; 2) the overall treatment time is reduced; 3) the gingival architecture of the soft tissues is maintained; and 4) the opportunity and ability to regenerate the lost labial bone plate is viable. Type 2A and Type 2B defects can be treated with consistent aforementioned results,[18] however Type 2C defects present with a greater degree of difficulty in therapy[19] and should be approached with caution, especially in the esthetic zone.

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