

# Treatment Classifications and Sequencing for Postextraction Implant Therapy: A Review

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Dental implantology has become an acceptable and effective treatment modality for totally and partially edentate alveolar arches. When teeth are extracted due to pathology or trauma, bone and soft tissue resorption often occurs. Either an immediate implant placement must be performed or a more traditional treatment plan must be determined; teeth for extraction or incorporation into the overall treatment scheme must also be selected. Selection of the implant site must reflect the mesiodistal, buccolingual, and apicocoronal dimensions. The responsibility of the implant team is to establish a correct diagnosis, evaluate clinical parameters, and design a comprehensive treatment plan, selecting the optimal time for implant placement. The learning objective of this article is to review three classifications of extraction sites and the time sequences of surgical protocols to implant placement following extraction.

The replacement of missing teeth with implant-supported prostheses has become an effective and predictable clinical procedure. Treatment expectations have progressed from placement of implant fixtures in the fully edentulous healed sites to single-tooth replacement, either in healed immediate postextraction sites.<sup>1</sup> Extraction of teeth results in the loss of hard and soft tissues, a reduction in the circumference of the arch, and deficient width and height of the residual ridge.<sup>2,3</sup> Remaining bone is limited and may compromise implant positioning.

The surgical and restorative team must consider the overall treatment objective and evaluate each tooth for extraction or incorporation into the final restorative treatment plan.<sup>4</sup> The anticipated implant site must maintain adequate mesiodistal, buccolingual, and apicocoronal dimensions. Correct positioning and angulation are required for a functional, aesthetic, and maintainable implant-supported restoration.<sup>5</sup> The inability to achieve any of these initial requisites is now considered a compromised result.<sup>6</sup>

In order to select either an immediate or postextraction implant placement, several factors have to be considered, including the anatomy of the extraction site, the surgical procedure, duration of treatment required, predictability of osseointegration, and the aesthetic result. Other factors, such as the patient's expectations and the skill and experience of the clinician, also contribute to the success of the treatment. Accurate diagnosis must be established in order to evaluate the clinical parameters and determine the optimal time for tooth extraction and implant placement. This article summarizes several classifications of extraction sites and reviews a selection of surgical protocols to facilitate a more expeditious treatment plan.

## CLASSIFICATIONS OF THE EXTRACTION SITE

### Salama Classification

According to this classification,<sup>7</sup> the tooth to be extracted has two definitive

zones — the defect at the coronal aspect of the tooth that extends coronally from the osseous crest and the socket that extends apically from the base of the defect towards the root end. Three types of extraction sites and their implant treatment modalities are present:

- Type I (socket only). The socket predominates, and immediate implant placement is recommended, with or without guided bone regeneration (GBR).
- Type II (socket/defect combined). The optimally placed implant may be exposed on the facial surface. The proper treatment sequence should be an orthodontic extrusion, followed by tooth extraction, implant and barrier membrane placement, and ridge augmentation.
- Type III (defect only). This is the most problematic and least predictable clinical circumstance, with no primary stability for the implant. A staged approach is indicated, including extrusion of the hopeless tooth, barrier membrane placement, ridge augmentation, and implant placement 6 to 12 months following GBR.

### Meltzer Classification

Meltzer<sup>8</sup> presented a four-defect classification, specifying treatment parameters for osseous defects with or without tooth extraction:

- Class I. The defect resides completely within the bony housing, with all

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walls intact; the diameter of the site is greater than that of the implant.

- Class II. The defect has 3 of the 4 walls intact; the fourth wall has either a dehiscence or a fenestration. The defect may still be self-confined.
- Class III. This site is characterized by two defects: Type I has adequate ridge height but inadequate width (ie, the knife-edge width). Type II has 2 of the 4 walls intact, the other two present with either dehiscences or fenestrations.
- Class IV. The defect is the one in which inadequate vertical height is present.

### **Garber and Belser Classification**

The classification system advocated by Garber and Belser<sup>9</sup> is arranged by

**The anticipated implant site  
must maintain adequate  
mesiodistal, buccolingual,  
and apicocoronal dimensions.**

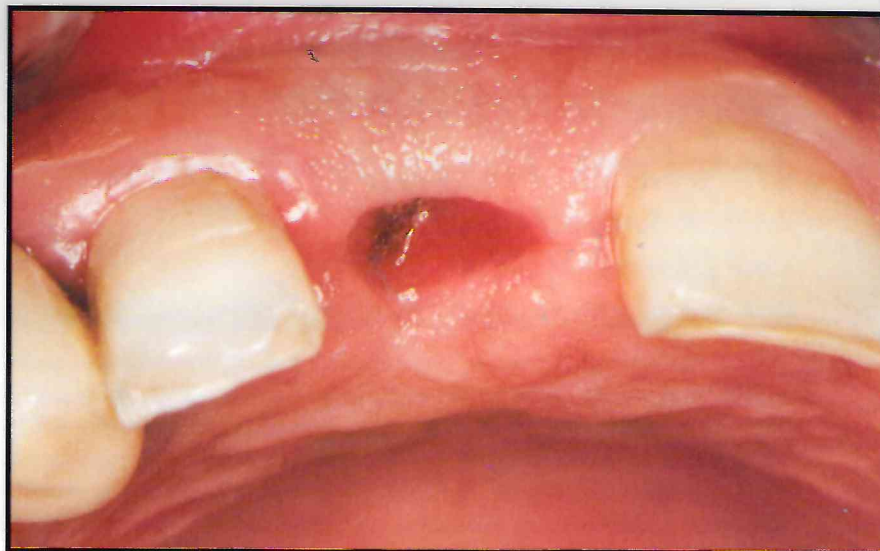
first- and second-phase surgery, immediate versus delayed implant placement, and degrees of dehiscence.

### **First-Phase Surgery (create aesthetics)**

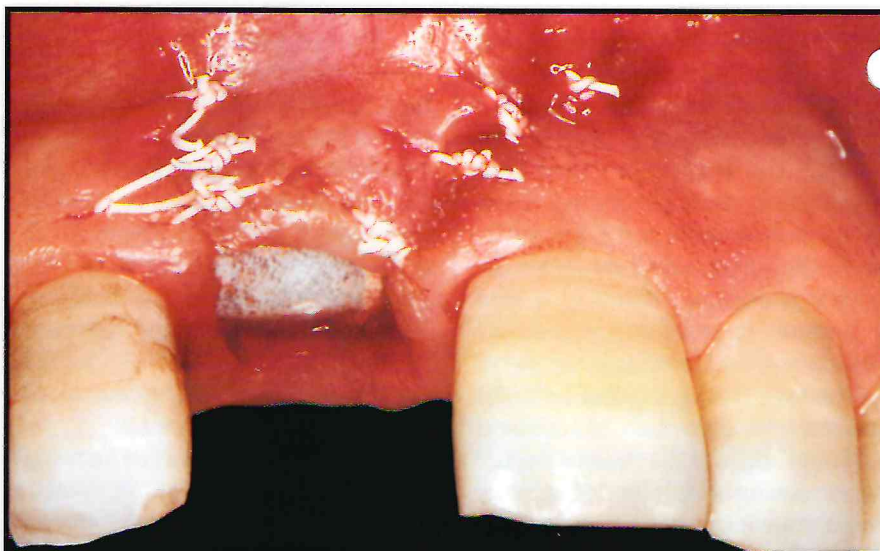
#### **Immediate Implantation**

#### **Postextraction**

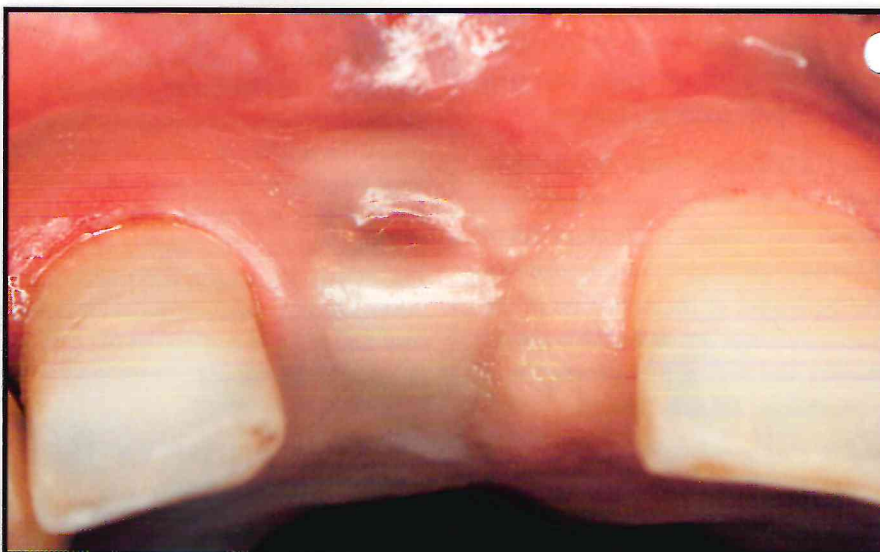
- Class I (dehiscence of less than 5 mm) comprises a normal extraction site and requires the utilization of immediate implant placement in conjunction with GBR.
- Class II (dehiscence equal to 5 mm) is characterized by a reduced extraction site. It is treated with immediate implant placement and GBR utilizing autogenous bone grafting.
- Class III (dehiscence of greater than 5 mm) exhibits a compromised extraction site and, although no buccolingual or vertical bone loss is evident, exhibits no potential for primary stability. The hopeless tooth can be either extruded or a



**Figure 1. Case 1.** Preoperative view of the maxillary right central incisor fractured off below the crestal line.

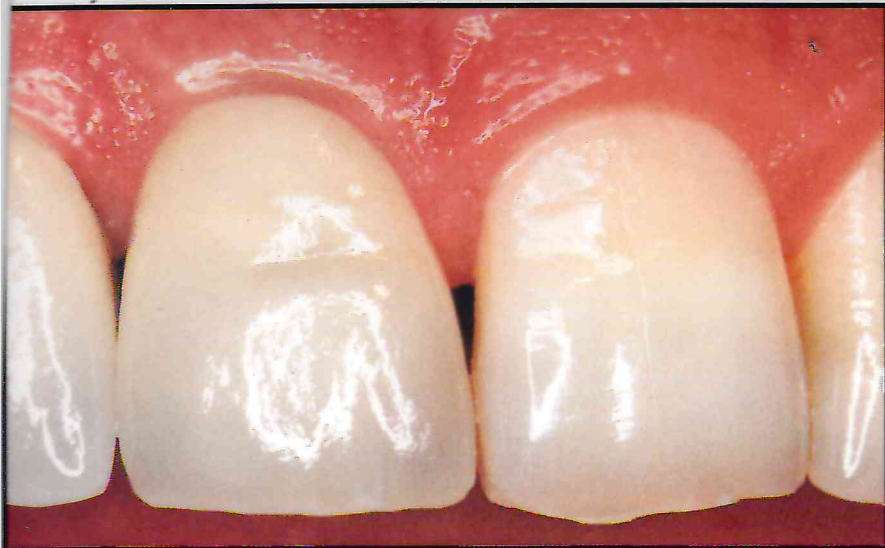


**Figure 2.** The root was extracted and an implant placed immediately. The membrane was left uncovered by the margin of the flap, in place for 6 weeks.

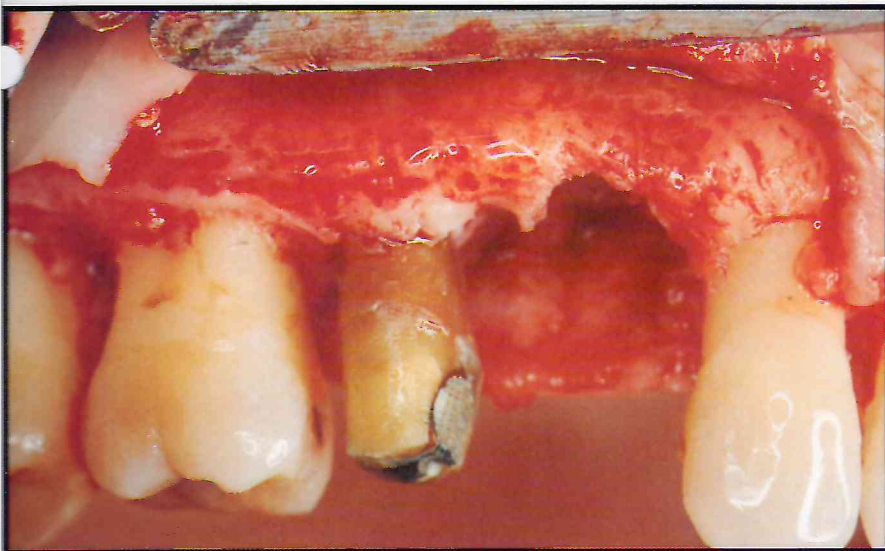


**Figure 3.** Occlusal view of the ridge 4 weeks following membrane removal. Note the optimal soft tissue contour.

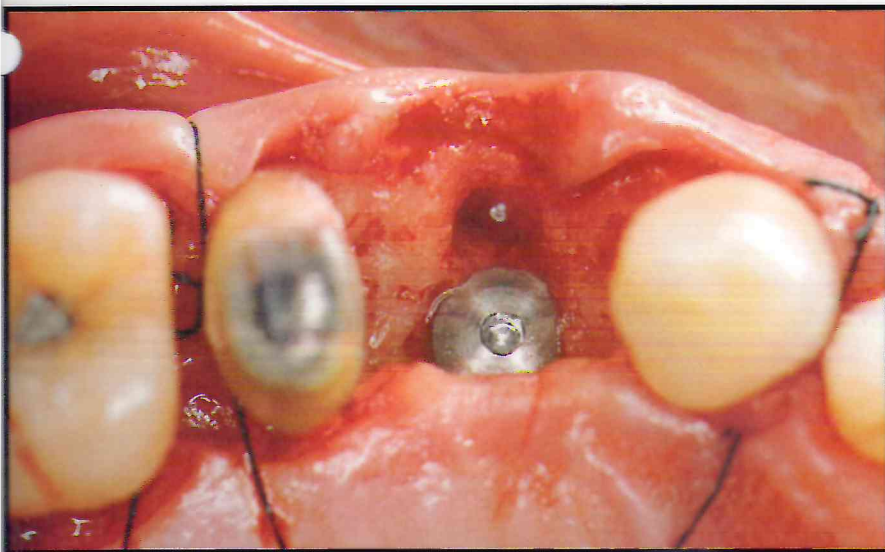




**Figure 4.** Postoperative view of implant-supported all-ceramic restoration in perfect harmony with the adjacent teeth (courtesy: Dr. T. Testori).



**Figure 5.** Case 2. Buccal view of extracted maxillary right first premolar site, following flap elevation.



**Figure 6.** Occlusal view following periodontal surgery and implant placement in the palatal extraction site.

staged treatment plan instituted, encompassing GBR and autogenous bone grafting 6 to 9 months post-surgery.

#### *Delayed Implantation Postextraction*

- Class I (dehiscence of less than 5 mm) presents with no loss of hard or soft tissue, either buccolingually or vertically, and an architecture symmetrical with the adjacent teeth. This defect allows optimal implant placement.
- Class II (dehiscence equal to 5 mm) demonstrates hard and soft tissue collapse in a buccolingual direction only; there is no alteration of the vertical height. The implant placement site is adequate. A connective tissue graft at the coronal aspect may be indicated.<sup>10</sup>

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**In order to select either an immediate or postextraction implant placement, several factors have to be considered ...**

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- Class III (dehiscence of greater than 5 mm) is characterized by notable collapse of the hard and soft tissues buccolingually, with no significant loss of vertical height. The conditions are adequate for implant placement using autogenous bone grafting, a membrane, and a connective tissue graft; soft tissue plastic surgery may be scheduled accordingly.

#### *Staged Implant Placement Postextraction*

- Class IV. This defect exhibits a severely compromised extraction site with insufficient buccolingual bone and no vertical bone loss. A staged approach is required, encompassing autogenous bone grafting and GBR. The delayed implant placement is performed 6 to 9 months postsurgery with connective tissue grafting.



- Class V. The defect exhibits a severely compromised extraction site with insufficient buccolingual bone and vertical bone loss. The staged approach must include GBR, autogenous bone grafting, delayed implant placement (6 to 9 months), and connective tissue grafting.

#### *Second-Phase Surgery (preserve aesthetics)*

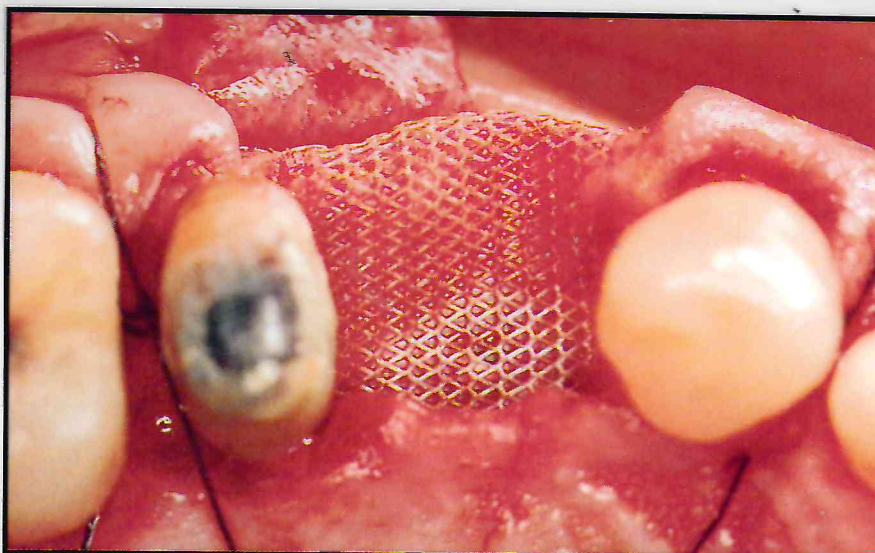
##### *Immediate Implant Placement Following Second Phase Surgery*

- Class I and II (with sufficient keratinized gingiva). Implants are placed with the aid of a tissue puncher.
- Class I and II (with insufficient keratinized gingiva). Implants are placed in conjunction with an apically positioned flap.

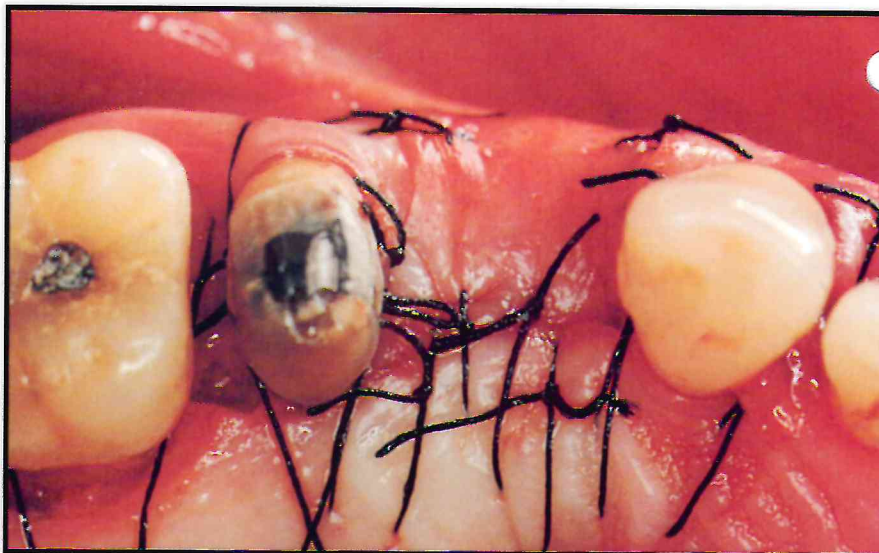
**During the treatment planning, the duration of each operative phase must be determined.**

##### *Delayed / Staged Placement*

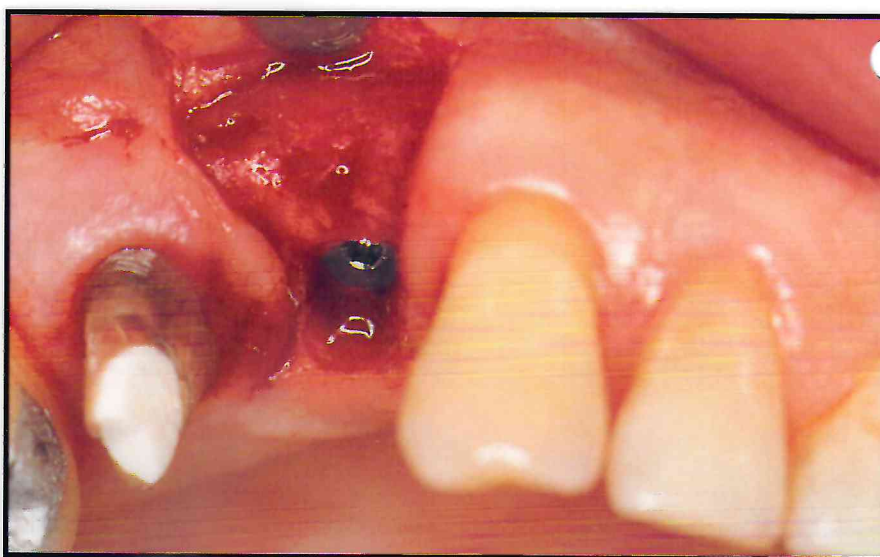
- Class III. The implant is exposed, and a healing abutment or provisional restoration is placed.<sup>11</sup> Mucogingivally, connective tissue grafting is utilized in combination with the roll technique.<sup>12,13</sup>
- Class IV. Following implant integration, the surgical site is reentered and a connective tissue graft is placed. The implant is exposed 8 weeks subsequently and a healing abutment or provisional restoration is placed. Connective tissue grafting is performed using the roll technique.
- Class V. Following implant integration, a healing abutment is placed, flap "dead space"<sup>14</sup> is advanced, and the guided soft tissue regeneration process is initiated. The implant is exposed, mucogingival procedure



**Figure 7.** Autogenous bone graft, collected from the periosteal resection, is placed in the remaining socket and a resorbable membrane covers the grafted site.

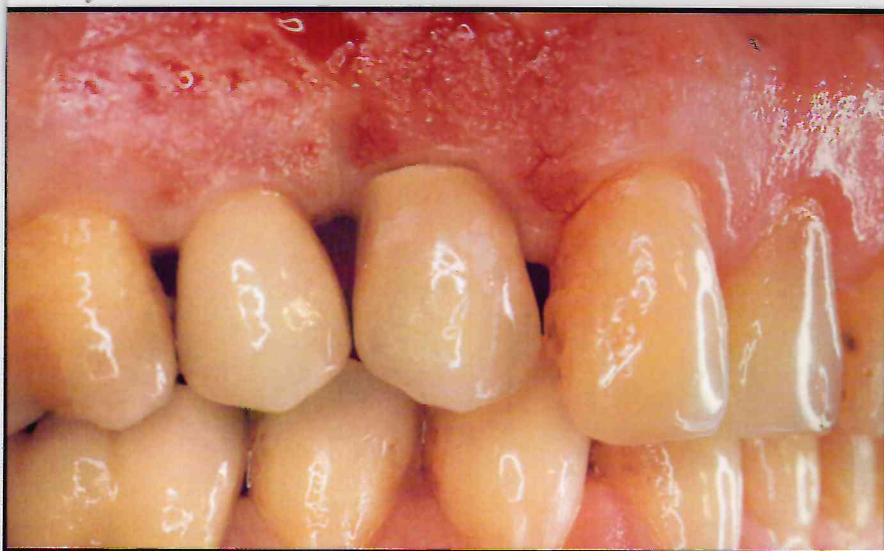


**Figure 8.** A buccal pedicle flap is coronally sutured to close the surgical site.

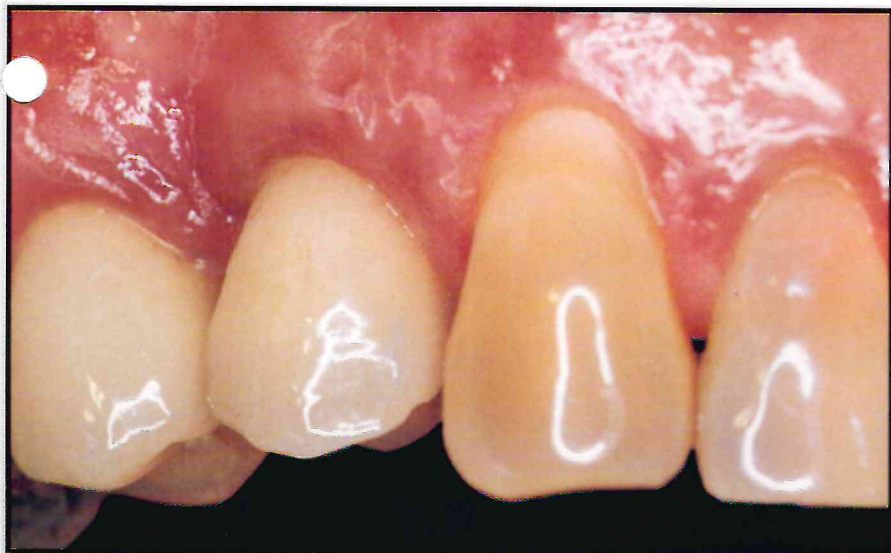


**Figure 9.** Buccal view of the implant exposure, performed 6 months postplacement, exhibits maintenance and regeneration of the alveolar bone.

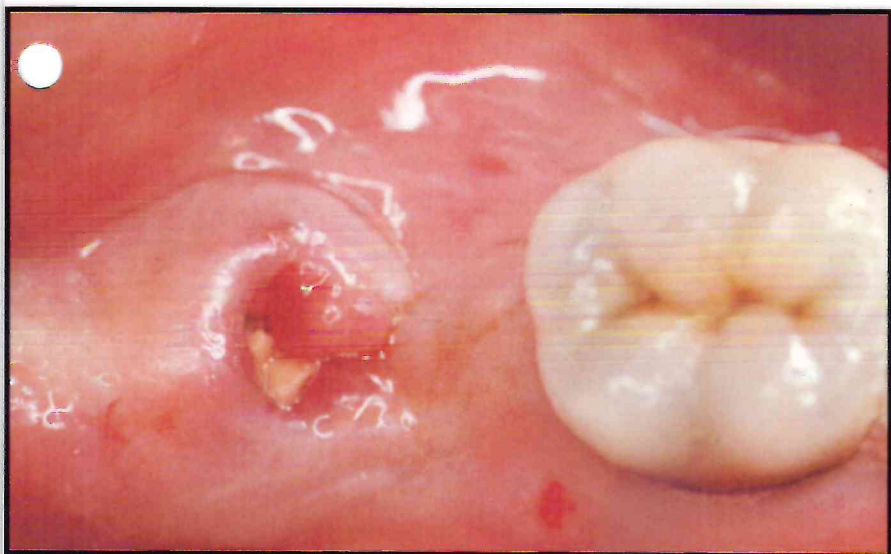




**Figure 10.** Postoperative view of the final ceramic restoration, with gingivoplasty of the gingival contour.



**Figure 11.** Postgingivoplasty view of healing exhibits the ideal form and contour of the marginal gingiva.



**Figure 12.** Case 3. A broken molar is ground below the gingival margin, and the tissue will cover the socket gap.

is completed, a provisional restoration is placed, and soft tissue is augmented under prosthetic guidance.

## **RATIONALE FOR IMPLANT PLACEMENT**

The primary prerequisites for the immediate placement of a single implant include the absence of infection at the extraction site and adequate apical bone to ensure primary stabilization with precise implant placement and sufficient implant soft tissue coverage. Once the root is extracted, it is no longer relevant to implant placement. The only objectives at this point are the function and aesthetics of the anticipated implant-supported prosthesis. Evaluation of the extraction socket in regard to its labial concavities and its position in relation to the adjacent teeth is completed. Where

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**Reconstruction prior to  
implant placement  
optimizes the ridge  
and soft tissue architecture ...**

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an inadequate buccolingual dimension exists or where there has been a loss of labial plate due to a vertical or horizontal fracture, the implant is positioned within apically sound bone for primary stabilization. A deficient labial aspect can be grafted to resemble the root morphology of the adjacent dentition and to simultaneously cover the exposed implant surfaces. The grafting and membrane placement procedures are performed at the time of implant placement. If the labial bone defect is considerable and the primary stability unpredictable, a multistage procedure is required with the augmentation surgery performed following implant placement and osseointegration.<sup>15</sup>

## **TECHNIQUE SUMMARY**

### *Immediate Implant Placement (Figures 1 through 11)*

The implant is placed immediately following tooth extraction using either a coronally advanced flap to cover the



surgical site<sup>16</sup> or a guided tissue regeneration barrier membrane (for hard and soft tissue regeneration). The membrane is removed either 6 to 8 weeks subsequently using the technique reported by Lazzara,<sup>17</sup> or 6 to 8 months subsequently using the protocol favored by Becker et al.<sup>18</sup> Socket seal surgery encompasses immediate implant placement following tooth extraction without flap elevation. Occasionally, a bone graft is placed buccally to the implant. An epithelial connective tissue graft is placed upon the implant head and sutured to seal the socket orifice. Implant exposure and abutment connection are performed 4 to 6 months postplacement.<sup>19</sup> Finally, the implant can be placed immediately postextraction and flap elevation. A connective tissue graft, combined with either a resorbable or nonresorbable membrane, covers the socket site.<sup>20,21</sup>

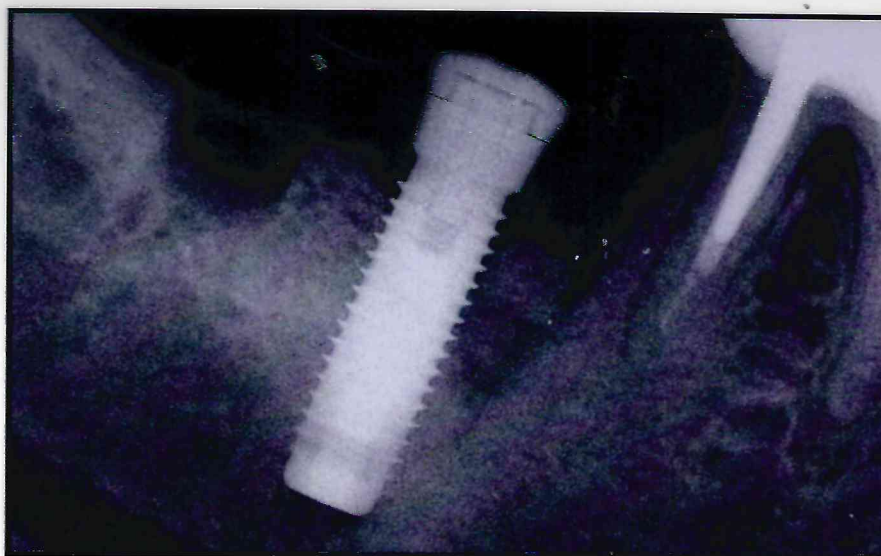
**... when socket seal surgery is implemented, hard and soft tissue augmentation are performed simultaneously.**

#### *Delayed Implant Placement (Figures 12 through 15)*

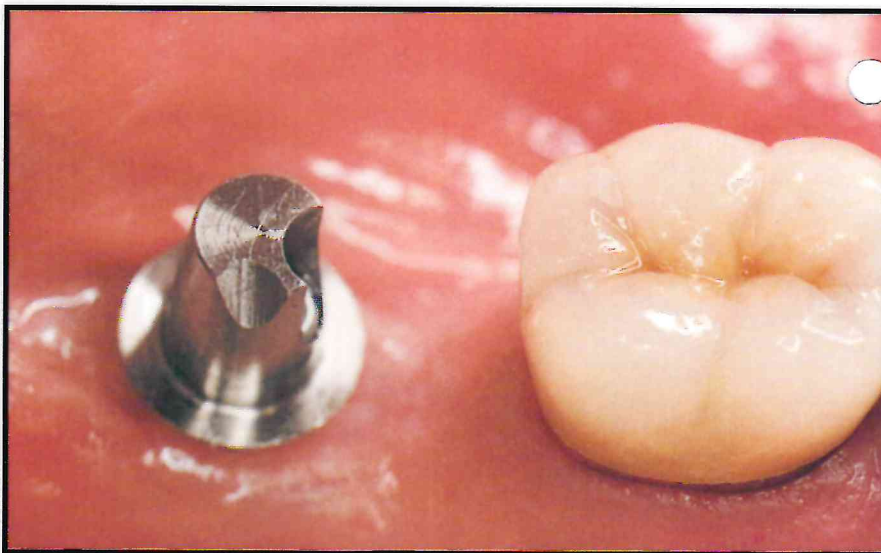
Utilizing this treatment protocol, the implant placement procedure is postponed until the soft tissues have healed. Six to 8 weeks prior to extraction, the broken tooth is cut below the crest of the cervical alveolar bone. Following the initial period of treatment deferral, the tooth is extracted; the implant is placed when the soft tissue has healed to cover the cervical site.<sup>22</sup> Six to 8 weeks postextraction, and subsequent to soft tissue coverage of the extraction site, implant placement and bone regeneration procedures are initiated.<sup>8</sup>

#### *Staged Implant Placement (Figures 16 through 22)*

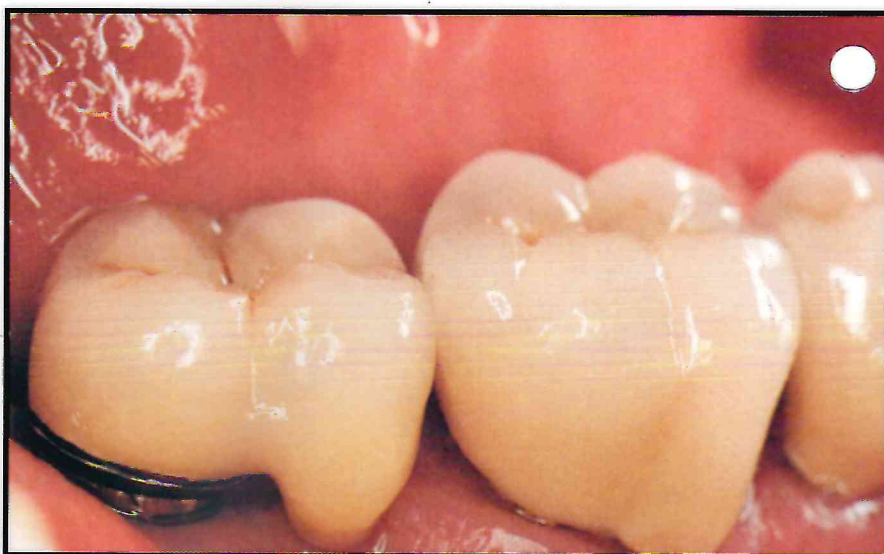
Six to nine months following tooth extraction, a GBR procedure is used to establish a suitable volume of bone for implant placement<sup>23</sup> in an optimal position. Second-stage surgery is performed 3 to



**Figure 13.** Radiograph of the implant confirms mesial placement of autogenous bone from the distal mandibular area.

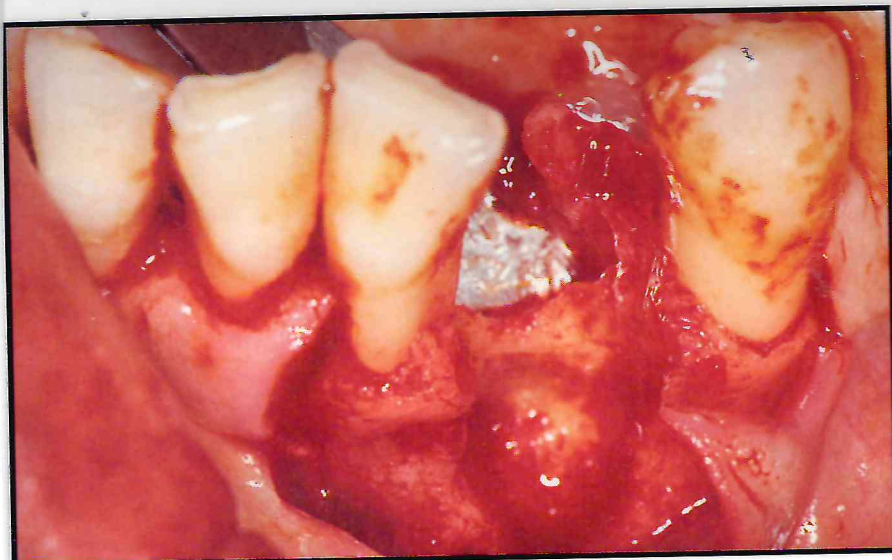


**Figure 14.** Clinical view of the large shoulder abutment in place.

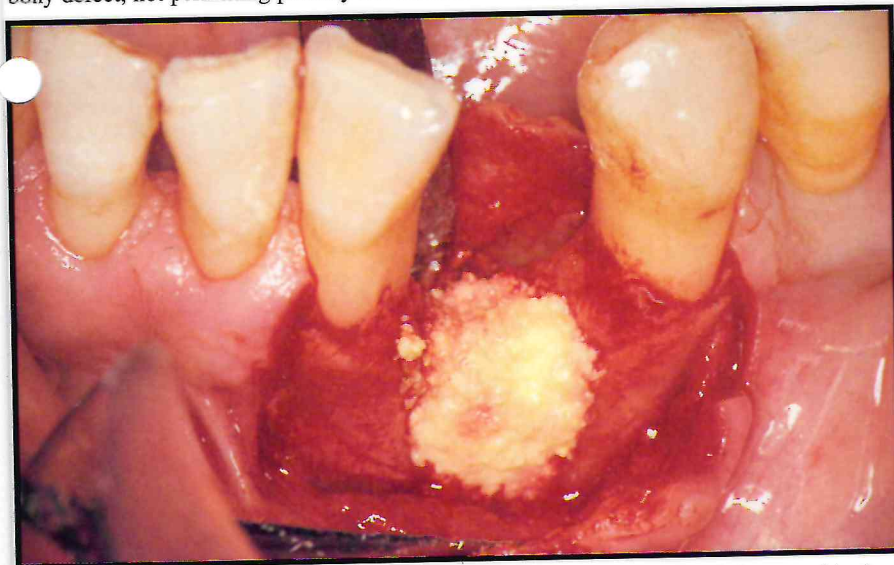


**Figure 15.** Postoperative buccal view of supragingival margin ceramic restoration with a shape of a cleansable Class III furcation.

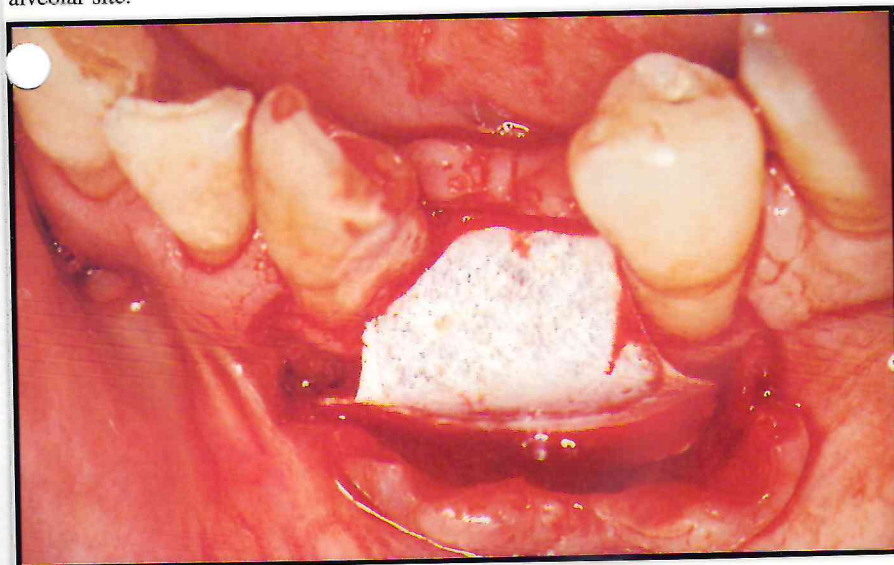




**Figure 16. Case 4.** The extraction of the mandibular left first premolar reveals a large bony defect, not permitting primary stabilization of the implant.



**Figure 17.** Demineralized freeze-dried bone graft mix with tetracycline is impacted in the alveolar site.



**Figure 18.** A nonresorbable membrane is shaped and placed to cover the bone graft.

6 months following implantation. Socket seal surgery<sup>24,25</sup> is performed following tooth extraction without flap elevation, and the socket is grafted with bone tissue and sealed with a soft tissue graft obtained from the palate. The implant is placed 6 to 8 months subsequently; implant exposure and abutment connection are performed 6 to 8 months postplacement—a flap is elevated to displace keratinized tissue buccally for functional and aesthetic enhancement.

## DISCUSSION

A successful implant-supported restoration is not merely integrated into the surrounding hard and soft tissue; it must emulate the replaced natural tooth. The restoration must also possess a form that complements the surrounding tissues and facilitates proper plaque control and occlusal function. The success of the immediate implant placement procedure depends upon the primary stability of

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the implant, attained by drilling the bone 4 mm to 5 mm apically beyond the alveolar socket; total coverage of the alveolar socket by the soft tissue or a membrane, if a submerged technique is utilized; and a healing period of at least 6 months to ensure sufficient bone regeneration around the implant is required.

Since a membrane acts as a mechanical barrier, the blood clot is protected from the overlying tissue, and only bone-promoting cells are allowed to repopulate the bony defect. Studies of immediate implant placement in humans, utilizing e-PTFE membranes for GBR, have demonstrated the technique to be clinically effective.<sup>26-31</sup> Careful management of surgical flaps is of great importance to successful membrane coverage. While some clinical studies and case reports<sup>17,23,32</sup> demonstrate that membrane exposure has a limited effect on the regenerative tissue, other studies emphasize the need to retain the

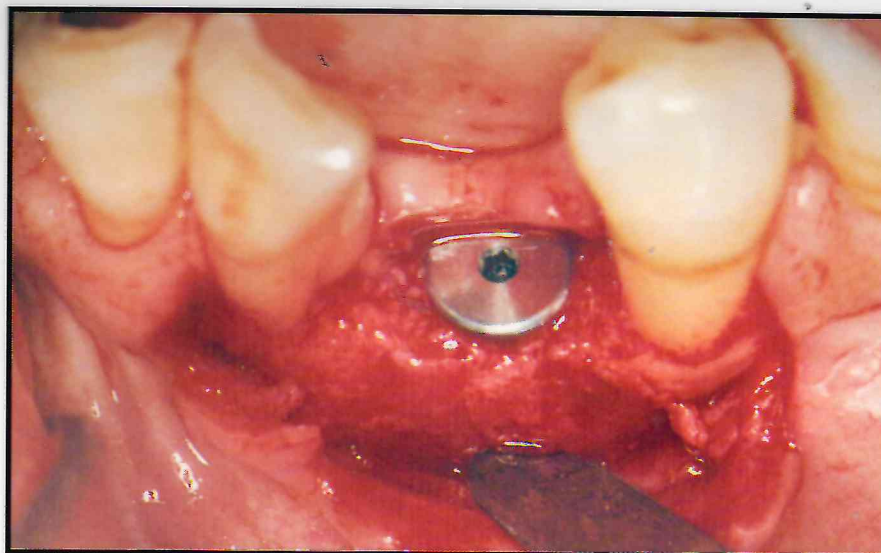


membrane submucosally to prevent physical disturbances and chemical and/or bacterial contamination.<sup>30,33-37</sup>

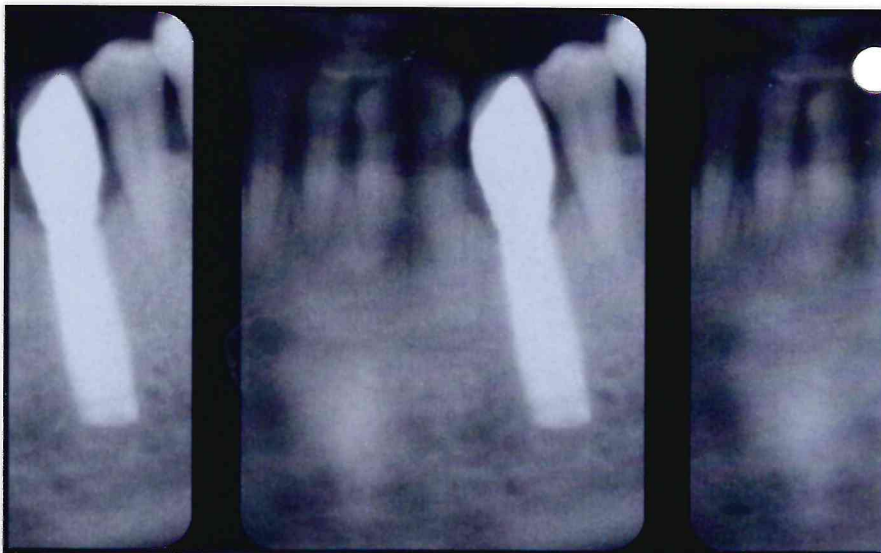
The amount of regenerated bone is limited by the space available beneath the e-PTFE membrane.<sup>38</sup> Autologous<sup>39,40</sup> or other bone substitutes<sup>24</sup> have been suggested to maintain space in order to achieve adequate regeneration and bone growth. The selected site must be capable of supporting an implant of adequate length and angulation to suit the occlusal scheme,<sup>41</sup> and the diameter withstand the occlusal forces to which the restoration will be subjected.<sup>42</sup> Therefore, wide-diameter implants have been suggested for immediate postextraction sites.<sup>43</sup> Augmentation of the volume and contour of the available bone may be required to ensure stability of the implant at Stage I surgery and serve as a scaffold for an aesthetically acceptable soft-tissue profile.<sup>44</sup> The soft tissue must be of sufficient quantity and quality to create a gingival margin and an interproximal form that are compatible in shape, color, and texture with the adjacent teeth. To achieve natural soft tissue aesthetics, the contour, height, and width of the gingiva at the implant site must correspond to the soft tissue aspect surrounding the adjacent natural teeth.<sup>45</sup>

Reconstruction prior to implant placement optimizes the ridge and soft tissue architecture; however, the number of surgical procedures and the length of treatment time are increased. Ridge reconstruction at the time of implant placement reduces treatment duration and the procedures required, but the rate of implant failure is increased. Reconstruction subsequent to implant placement may compensate for delayed changes in ridge morphology, but it may lead to reduced implant stability during healing, additional treatment duration, and increased risk of implant failure.<sup>6</sup>

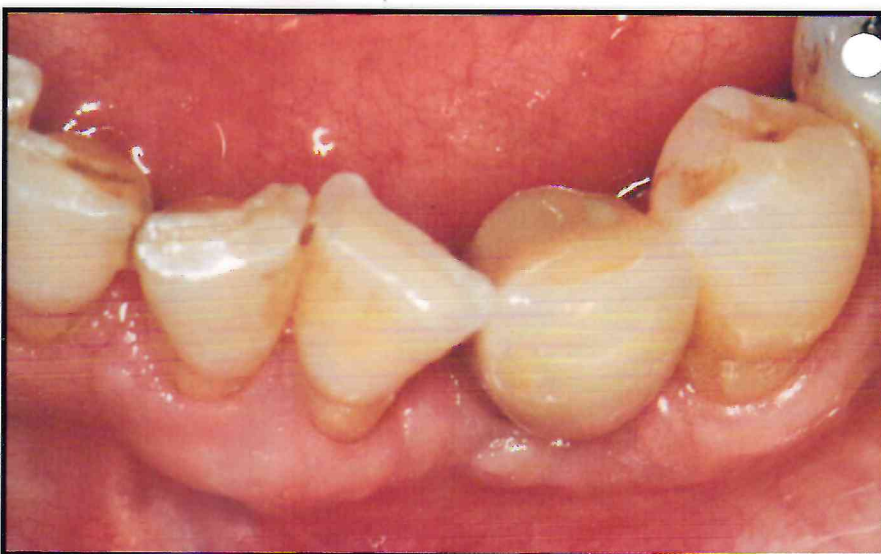
In a Class I site, it is easy to combine the extraction of the tooth, implant placement, and membrane placement into one surgical stage. In a Class II defect, the treatment phases may be similarly combined due to the ability of the site to maintain sufficient space requirements. In Class III and IV defects, a staging of the regeneration process is required. While these stages lengthen treatment duration, they provide a greater predictability of success. The more a clinician combines



**Figure 19.** Six months postplacement, the membrane is removed, and the implant is placed in the site completely surrounded by bone.



**Figure 20.** Postoperative radiograph of the implant-supported mandibular restoration.



**Figure 21.** Postoperative occlusofacial view of the mandibular left first premolar reveals optimal soft tissue contour.



and compresses the various regeneration stages in an effort to expedite treatment duration and limits the number of surgical procedures, the greater the risk and severity of surgical and healing complications.<sup>8</sup> It should be emphasized that the hard and soft tissue aspects of site development are generally achieved separately. The soft tissue components are generally configured at the first stage and at the implant uncovering. The hard tissue reconstruction is performed only prior to or at the first stage, resulting in optimal fixture placement, while the soft tissue reconstruction is required for optimal aesthetics. However, when socket seal surgery is implemented, hard and soft tissue augmentation is performed simultaneously.

Numerous studies have indicated that the immediate placement of an implant in an extraction site is as successful as delayed or staged implant placement in a healed and matured bony site, with the additional advantage of a shorter treatment time.<sup>46,47</sup> Other studies have demonstrated that there are no significant differences in periimplant hard/soft tissue, bone resorption, and in levels of bone integration between the immediate and delayed implant treatment sites.<sup>48</sup> However, bone regeneration takes more time when bone grafting material is used.<sup>49</sup>

## CONCLUSION

During the treatment planning, the duration of each operative phase must be determined. The anticipated strategy for extraction must also be resolved. The immediate placement of implants, in combination with GBR, has several advantages over more traditional approaches. They include preservation of the remaining alveolar bony walls postextraction, prevention and reduction of bone resorption, placement of the implant on the optimal axis of a natural tooth, decrease in treatment time and risk of trauma, minimization of bone heating caused by socket preparation, and maximization of the number of highly predictable treatment modalities clinically available.<sup>50</sup>

Recognizing these advantages and limitations, the immediate implant placement is indicated only in clinical cases where the volume of bone is adequate. In more complex cases with soft and/or hard tissue deficiencies, a delayed or staged implant placement is indicated.

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