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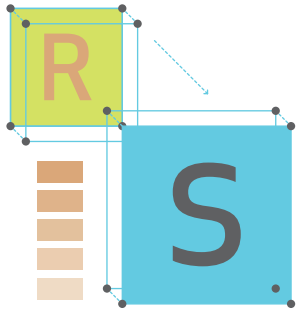

Provisional Restorations: A Key Determinant for Implant Site Development

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ABSTRACT Provisional restoration and interim prosthesis have a significant role in reconstructive dentistry. Esthetics and function of the appliance or restoration are usually the key elements considered in the design and fabrication. While esthetics and function certainly need to be addressed, it is also essential to understand the impact of an interim prosthesis on early hard and soft tissue healing following bone grafting and alveolar ridge augmentation procedures.

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The healing events following tooth extraction have been well documented in the literature.[1-3] Recent studies have demonstrated that horizontal ridge resorption often exceeds 3 to 4 mm within the first six months, and that buccal-lingual ridge collapse and significant ridge atrophy may continue up to 12 months postextraction.[4-6] This becomes especially problematic when implant restoration is planned within the esthetic zone. Nevins et al. showed that 71 percent of anterior extraction sites demonstrated a loss of more than 20 percent of the buccal plate up to three months following extraction.[7] This loss of buccal bone is significant because optimal esthetics can only be achieved if sufficient bone and soft tissue are present at the time of implant placement.

Several procedures have been developed in recent years to help either to preserve the alveolus at the time of tooth extraction, or to augment the edentulous alveolar ridge prior to implant placement, or restoration with a fixed partial denture.[8-10] Socket preservation can be defined as a procedure using bone graft substitutes or guided-bone regeneration in an effort to help prevent buccal-lingual ridge collapse of a preserved tooth socket following extraction. This procedure requires minimally traumatic tooth removal and complete preservation of the labial/buccal plate of bone, but becomes a socket augmentation if the labial/buccal plate has been damaged upon tooth removal or due to pathology. This can be a larger, more difficult procedure that usually requires flap elevation. Alveolar ridge augmentation can be defined as hard or soft tissue augmentation of an atrophied alveolar ridge.

Soft tissue augmentation can be done utilizing autogenous-free or connective

tissue grafts, rotated pedicle grafts, or soft tissue allograft material. Hard tissue augmentation can be achieved by a variety of different techniques and graft materials. These can include both autogenous and allogenic bone blocks, the use of particulate bone grafting substitutes, and guided-bone regeneration. It is important to distinguish between these procedures because different grafting techniques are often used. The course of healing is not the same and early pressure from an interim prosthesis will cause significant resorption of the graft material.

Socket Preservation Procedure

FIGURES 1-3 outline an example of a socket preservation procedure. In this case, the upper left lateral incisor was treatment planned for extraction due to severe root resorption at the apex. The tooth was removed with minimal trauma using periotomes and root pressure forceps. The area was thoroughly debrided, and a very thin but complete labial plate was detected with a bone curette. A collagen membrane (BioMend Extend, Zimmer Dental Carlsbad, Calif.) was cut and adapted to cover the labial bone from inside the socket.[11] The membrane was trimmed to a configuration that when flipped over would cover the socket and extend 2 mm into the undermined soft tissue. Bone graft material (Puros — cancellous mineralized bone allograft-Zimmer Dental) was loosely packed into the socket and the membrane was positioned to cover the graft material and fixated with 6-0 chromic gut suture. A temporary removable partial denture with a ridge lap pontic was placed and the pontic area was relieved so that there was no contact with the membrane covering the socket (**FIGURE 4**).

It is very important to keep the pontic at least 1 to 2 mm away from the

FIGURE 1A. Preoperative view. Upper left lateral incisor planned for extraction due to severe root resorption.

FIGURE 1B. Extracted upper left lateral incisor. Note the severe root resorption at apex.

FIGURE 2A. A collagen barrier membrane is cut to a shape that can fit into extraction socket and cover the defect.

FIGURE 2B. The membrane is positioned into the socket with the long, narrow portion up against the buccal wall of the socket. Particulate bone graft material is packed into the socket up against the membrane.

FIGURE 3A. The membrane is flipped to cover the socket and tucked into the undermined palatal tissue. It is sutured on the palatal aspect with 6-0 resorbable suture.

FIGURE 3B. Buccal view shows completed socket preservation with minimal trauma.

FIGURE 4A. Acrylic removable partial denture has been adjusted to create a ridge lap pontic.

FIGURE 4B. The pontic on partial denture is reduced slightly to allow for a minimum of 1 mm clearance over the membrane covering the socket.

FIGURE 5A. Ten-day postop showing membrane degradation and migrating soft tissue.

FIGURE 5B. Note the excellent tissue response.

FIGURE 6A. Three months' postextraction and socket preservation procedure.

FIGURE 6B. Conversion to ovate pontic in temporary partial denture for gingival shaping.

FIGURE 7A. Three-dimensional NewTom volumetric tomography of socket preservation shows excellent ridge width for proper implant placement.

FIGURE 7B. Implant placement with a flapless approach.

FIGURE 8A. Completed clinical and radiographic views.

FIGURE 8B. Note the excellent tissue health and contour around the implant supported crown.

membrane during the healing phase. The exposed membrane will break down as the epithelium migrates to close the wound. Also, there is healing within the socket that will cause expansion and extrusion of some of the graft material. Pressure from an interim prosthesis at this stage can lead to incomplete bone formation. It generally takes about two weeks for the soft tissue to close over the socket. Transition to an ovate pontic for soft tissue development can begin at three months with implant placement at four months postextraction (**FIGURES 5-8**).

Another well-documented socket preservation technique utilizes bovine particulate graft material and a collagen barrier placed within the extraction socket.[12] An ovate pontic design in a removable or fixed temporary partial denture is used to put pressure on the collagen barrier to seal the socket (**FIGURES 9-11**). This technique is most effective in cases where thick alveolar bone and soft tissue are present following tooth extraction. Care must be taken if this technique is to be used in cases where the soft tissue and underlying alveolar bone are thin. Too much pressure from the pontic can cause excessive hard and soft tissue loss resulting in a compromised esthetic outcome (**FIGURES 12-13**).

Socket Augmentation and Ridge Augmentation Procedures

Socket augmentation and ridge augmentation is much more difficult than the socket preservation. Socket augmentation requires regeneration of damaged or missing labial/buccal alveolar bone upon tooth extraction (**FIGURE 14**), while ridge augmentation is done to regenerate and restore atrophic alveolar ridges. Full thickness mucoperiosteal flaps with vertical and periosteal releasing incisions are needed to secure primary wound closure.

FIGURE 9A. The maxillary central incisors presented with advanced attachment loss due to severe localized periodontitis.

FIGURE 9B. Occlusal view of extraction sockets following tooth removal with minimal trauma.

FIGURE 10A. Bio-Col technique used to fill the extraction sockets. The sockets are grafted with particulate bovine bone graft material and sealed with a collagen sponge.

FIGURE 10B. A temporary removable partial denture with ovate pontic design is utilized as an interim prosthesis. This design rationale is used to support the labial tissue and preserve soft tissue contour.

FIGURE 11A. Ten-day postop. Early healing looks favorable. Good preservation of soft tissue architecture.

FIGURE 12A. Healing at six weeks. Note the change in pontic height from the previous picture.

FIGURE 12B. Extensive loss of hard and soft tissue. A secondary alveolar ridge augmentation procedure had to be completed prior to final restoration.

FIGURE 13A. Clinical and radiographic appearance of completed restoration.

FIGURE 13B.

Advanced surgical principles and guided-bone regeneration techniques are needed to completely restore lost hard and soft tissue. A socket augmentation technique utilizing small bone screws for space maintenance is described in **FIGURES 15-22**. The maxillary incisors were extracted due to advanced periodontal disease. Significant osseous destruction and loss of labial bone was evident. Following degranulation, two bone screws (Osteomed, Shirley, N.Y.) were placed in the interseptal area and positioned vertically so that approximately 3 to 4 mm of the screws were present above the existing alveolar bone (**FIGURE 16**). The area was grafted with demineralized bone allograft (Regenaform RTI, Gainesville, Fla.) and covered with two layers of a resorbable collagen barrier (Bioguide Osteohealth, Uniondale, N.Y.). The area was closed primarily and allowed to heal for five months prior to implant placement.

The bone screws function to keep the membrane and soft tissue from collapsing into the space. Space maintenance is one

FIGURE 14A. Vertical root fracture of upper left central incisor leads to extensive bone loss.

FIGURE 14B. The tooth is removed and a socket augmentation procedure is performed. Note the flap design with mesial and distal vertical incisions for access to the defect.

FIGURE 14C. Re-entry at six months demonstrates complete osseous regeneration

essential requirement for guided-bone regeneration and vertical bone growth. Passive primary closure over the graft site is another. This often requires large flaps and periosteal releasing incisions that can induce significant postoperative swelling. The interim prosthesis must be designed to accommodate the edema, which often can last for several days.

Too often, a temporary removable partial denture is fabricated by the restorative dentist in advance of the augmentation procedure and delivered to the surgeon's office. Significant time is spent by the surgeon reducing the appliance to allow enough space to keep pressure off the surgical site. This results in severe destruction of the prosthesis and a new one usually has to be fabricated, adding cost to the procedure.

The surgeon needs to play an active role in the decision-making for the

FIGURE 15A. Clinical and radiographic appearance of a case demonstrating localized aggressive periodontitis.

FIGURE 15B. The maxillary anterior teeth have severe attachment loss and poor prognosis.

FIGURE 16A. The maxillary anterior teeth are removed and two 12 mm bone screws are placed in the interseptal areas.

FIGURE 16B.

FIGURE 17A. The socket defects are filled and bone graft material is added to the level of the bone screws. The graft material is covered by collagen barrier membranes.

FIGURE 17B. Passive primary closure with interrupted and mattress sutures.

FIGURE 18. An Essix appliance is placed immediately following the surgical procedure.

FIGURES 19A. A resin-bonded fixed provisional restoration is fabricated in the laboratory and is placed after initial swelling from procedure has subsided.

FIGURE 19B

FIGURE 19C.

interim prosthesis in these types of advanced augmentation cases. Communication should take place at the treatment planning phase with the surgeon describing the procedure and the healing events that will follow. Often, two types of interim prosthesis are needed and should be planned for. An Essix appliance can be placed immediately and used for two to four weeks following an augmentation procedure (**FIGURE 18**). It is a cost-effective appliance that most patients will tolerate for a short time. It is somewhat rigid, easy to fabricate and to adjust. Since it is tooth borne, no pressure is applied to the surgical site under function and pontic height can be adjusted easily. The second interim prosthesis can be placed two to four weeks following the augmentation, depending on the size of the graft and needs of the patient. A removable partial denture can be used for smaller graft sites (single tooth) but a fixed prosthesis should be used for the larger augmentations, especially in the esthetic zone (**FIGURES 19A-C**). Movement from a removable prosthesis will result in resorption of the graft leading to reduced bone volume and a compromised restorative and esthetic outcome.

FIGURES 20A. Clinical presentation at five months following extraction and socket augmentation procedure.

FIGURE 20B.

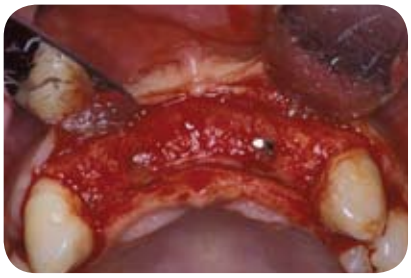

FIGURE 21A. Surgical re-entry at five months. Note the extensive vertical augmentation to the top of the bone screws.

FIGURE 21B. Surgical implant placement.

Conclusion

Socket preservation and augmentation procedures are increasing as dental implant restorations have become the treatment of choice, especially in the esthetic zone. Provisional restoration from an interim prosthesis can adversely

FIGURE 22A. Completed restoration with individual implant-supported crowns.

FIGURE 22B.

affect the result achieved from a grafting procedure. The purpose of this paper was to illustrate different grafting techniques and to provide a rationale for the use of different types of interim prosthesis. Communication between the restorative dentist and the surgeon is essential so that the restorative dentist is aware of the type of graft procedure to be performed. This will allow fabrication of the proper interim prosthesis and give the case the best prognosis for long-termed functional and esthetic success. ■■■■

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