Buccal Plate Augmentation: A New Alternative to Socket Preservation

Alfonso Caiazzo, DMD, Federico Brugnami, DMD,† and Pushkar Mehra, BDS, DMD‡*

Alveolar ridge resorption occurs after tooth extraction and has the potential to either complicate implant placement or impair the final esthetic result. Techniques to preserve natural bone and soft tissue contours are of great interest to clinicians and patients because even subtle postextraction buccal plate resorption may have significant clinical effects, particularly in the esthetic zone.

Buccal plate augmentation (BPA) is a novel approach for ridge preservation aiming to avoid recession of the facial wall of the socket without interfering with the natural healing mechanism of the extraction socket. It consists of placement of bone graft material over an intact buccal plate, underneath the soft tissues in a surgically created pouch with an aim to maintain or augment the soft tissue esthetics of the region.

J Oral Maxillofac Surg 68:2503-2506, 2010

Alveolar ridge resorption after tooth extraction is a frequently observed phenomenon that may either decrease the predictability of dental implant placement or impair the final esthetic results.[1,2] The biologic process behind the healing of an extraction socket has recently been reviewed.[3] This has led to re-evaluation of techniques widely used to preserve the natural architecture of the alveolus after extraction, such as immediate implant placement in fresh sockets and the use of osseous graft materials.[3]

It is now known that resorption will especially target the buccal plate if the socket is not grafted immediately after dental extraction,[3,4] thereby increasing the risk for facial soft tissue recession.[4] Even when minimal, such resorption can usually lead to significant adverse clinical effects, particularly in the esthetic zone. It is well known that despite successful osseointegration of a dental implant, an anterior implant restoration may be judged to be a failure based on poor soft tissue appearance.[5-8] Thus surgical techniques meant to preserve natural bone and soft tissue contours after tooth extraction are of great interest to contemporary clinicians.

Several clinical techniques and a variety of biomaterials have been introduced over the years in an effort to overcome this possible bone remodeling and resorption after extraction.[9-14] Grafting of sockets provides stable results clinically,[9-14] but at the histologic level, unless a membrane is used, fibro-encapsulation of the graft particles occurs, especially in the cervical area.[14,15] It has also recently been proposed that placement of bone graft material in the fresh extraction wound causes delayed healing.[16] Guided bone regeneration may enhance regeneration of the socket but requires a more technique-sensitive procedure and longer healing interval for graft maturation of the implant placement, when compared with cases whereby natural healing of the socket occurs.[17,18]

Buccal plate augmentation is a new approach for ridge preservation and for maintaining soft tissue contour. This technique prevents recession of the facial wall of the socket without interfering with the self-healing process of the extraction socket. The surgical technique involves placement of particulate bone graft overlying the buccal plate, underneath the soft tissues, in a surgically created pouch. In our experience, this simple technique helps maintain optimal soft tissue contour and very predictably provides for a solid ground base for optimal esthetic and functional replacement of a missing tooth when delayed implant placement is indicated.

Surgical Technique and Case Example

A 46-year-old woman was referred by her dentist for extraction of a nonrestorable, upper right first

*Private Practice in Oral and Maxillofacial Surgery, Salerno, Italy.

†Private Practice in Periodontics, Rome, Italy.

‡Associate Professor and Chairman, Department of Oral Maxillofacial Surgery, Boston University Goldman School of Dental Medicine and Boston Medical Center, Boston, MA.

Address correspondence and reprint requests to Dr Mehra: Department of Oral Maxillofacial Surgery, Boston University, 100 E Newton St, Ste G-407, Boston, MA 02118; e-mail: pushkar.mehra@bmc.org

0278-2391/10/6810-0019$36.00/0
doi:10.1016/j.joms.2010.05.044

FIGURE 1. Surgical extraction of the vertically fractured upper right first premolar was planned followed by delayed implant placement.

Caiazzo, Brugnami, and Mehra. Buccal Plate Augmentation. J Oral Maxillofac Surg 2010.

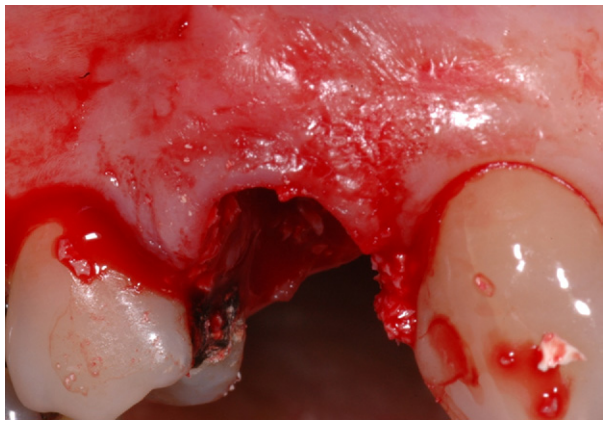

FIGURE 3. Manual compression of the graft is performed to evenly spread the particulate graft to mimic the shape of the root structure of the extracted tooth.

Caiazzo, Brugnami, and Mehra. Buccal Plate Augmentation. J Oral Maxillofac Surg 2010.

premolar tooth (Fig 1). The treatment plan included rehabilitation with an implant-supported restoration. Her medical history and social history were noncontributory, and she had good oral hygiene. A delayed approach relative to surgical implant placement was warranted. The tooth was extracted atraumatically and the vertical fracture confirmed clinically. The socket was thoroughly debrided to remove residual granulation tissue. A surgical caliper was used to measure the buccolingual dimension at the midpoint of the extraction socket. A periosteal elevator was used to carefully perform limited soft tissue dissection in a full-thickness manner to create a "pouch" on the facial aspect at midpoint areas of the socket (Fig 2A). Saline solution–rehydrated bovine bone xenograft was next placed in the pouch overlying the buccal plate with a syringe (Fig 2B). The amount of graft material is dictated by what the soft tissue elevation/pouch allows. The bone graft material was then manually compressed several times with an instrument and the process repeated to achieve adequate filling of the pouch. The final appearance of the grafted material should mimic the root eminence of the extracted tooth (Fig 3). No sutures were required, and no attempt was made to coronally reposition the flap. The socket was left to heal with natural secondary intention. Chlorhexidine gluconate oral rinse was prescribed for 2 weeks to enhance plaque control. Implant placement was then performed in routine fashion at 6 weeks postoperatively. The area was restored with an implanted-supported prosthesis (Fig 4). Clinical and radiographic examination at 1 year postoperatively (Figs 5, 6) and measurements and comparison of preoperative and postoperative diagnostic cast analyses (Fig 7) showed adequate healing of the bone graft and socket with maintenance of optimal soft and hard tissue contours.

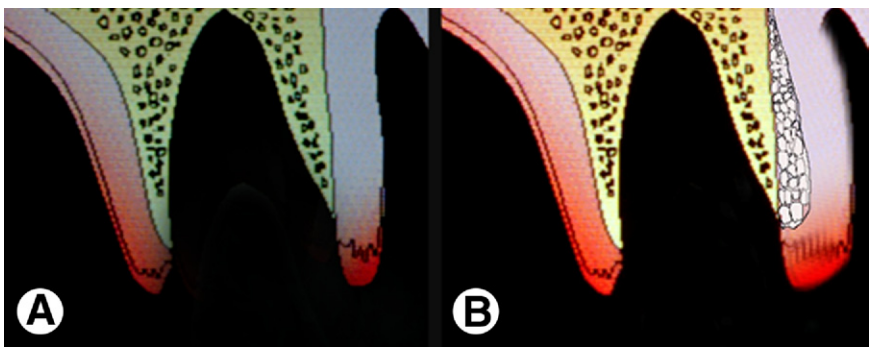

FIGURE 2. *A*, The tooth was extracted and a conservative, minimal dissection was performed on the buccal plate to reflect soft tissues, thereby creating a "surgical pouch." *B*, Bone graft material is placed into the surgical pouch on the facial aspect of the buccal bone plate, thereby augmenting it.

Caiazzo, Brugnami, and Mehra. Buccal Plate Augmentation. J Oral Maxillofac Surg 2010.

FIGURE 4. Final restoration with an implant-supported restoration showing excellent soft tissue esthetics.

Caiazzo, Brugnami, and Mehra. Buccal Plate Augmentation. J Oral Maxillofac Surg 2010.

FIGURE 5. Photograph at 1 year postoperatively showing preservation of optimal soft tissue contour on buccal surface.

Caiazzo, Brugnami, and Mehra. Buccal Plate Augmentation. J Oral Maxillofac Surg 2010.

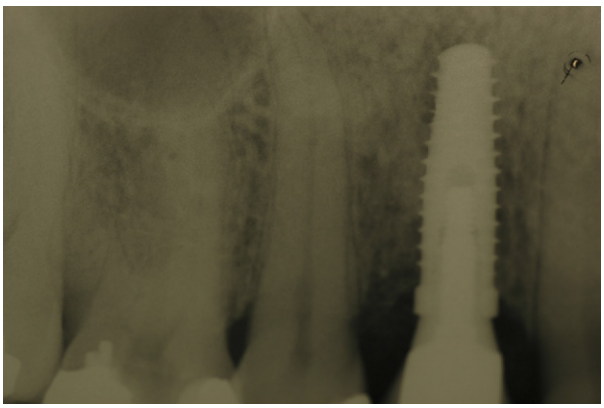

FIGURE 6. Periapical radiograph showing implant placement and final restoration.

Caiazzo, Brugnami, and Mehra. Buccal Plate Augmentation. J Oral Maxillofac Surg 2010.

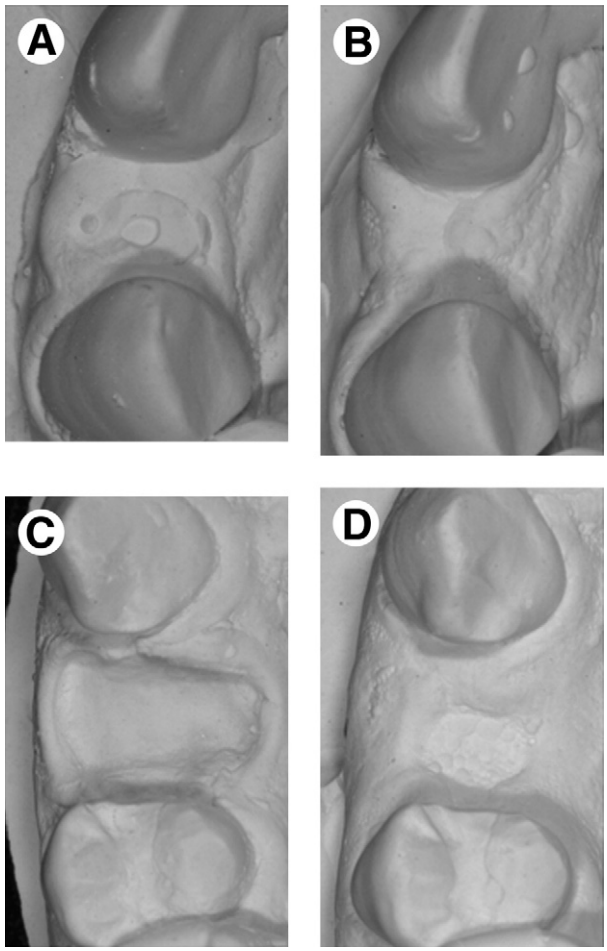

FIGURE 7. Preoperative and postoperative dental model analysis showing effectiveness of extraction with buccal plate augmentation in maintaining buccolingual dimension of alveolar ridge (*C, D*) when compared with extraction without buccal plate augmentation (*A, B*).

Caiazzo, Brugnami, and Mehra. Buccal Plate Augmentation. J Oral Maxillofac Surg 2010.

Discussion

Extraction sockets are self-healing defects, and in a relatively short amount of time, the void left by the root of the tooth extracted is filled by new bone.[1] This bio-physiologic phenomenon, however, may result in some adverse changes in the architecture of the edentulous ridge due to resorption of buccal bone, which could jeopardize implant placement or lead to an unfavorable esthetic result.[2] Although the degree of bone loss is neither certain nor constant and it is quite variable in different individuals and anatomic situations, most alveolar width and height changes usually occur in the first 6 months after extraction.[2]

Clinicians may be faced with situations whereby an immediate implant placement is not indicated. In such circumstances 2 options exist: *1*) allow the socket to naturally heal without grafting or *2*) place a

socket graft. The former risks loss of hard and/or soft tissue, especially on the buccal plate, because of immediate or delayed resorption, whereas the latter forces a longer healing time before implant placement.

The described technique (termed "buccal plate augmentation") is aimed at optimizing the bone graft's ability to improve regeneration and maintain or improve labial/buccal contours without interfering with the natural, self-healing capability of the alveolus after extraction. The rationale of the procedure is that slowly resorbing or nonresorbing particles of bovine xenograft become incorporated in the soft tissues, thereby preventing possible recession and also enhancing soft tissue appearance of the edentulous ridge. Although other types of graft can perhaps be used, we recommend bovine xenograft because it has a very low resorption rate. The slowly resorbing nature of the augmentation graft particles may help prevent resorption of the newly regenerated area in the socket long term.[19,20] In addition, regenerating the facial aspect of the buccal plate with nonresorbable membrane and bovine xenograft may possibly also prevent bone remodeling at the head of the implant, thereby preventing future soft tissue recession and esthetic complications.[21,22] This technique actually works like a "modified" full-guided bone regeneration procedure by aiming to overbuild the bone around the neck of the implant and attempting to avoid bone resorption that may take place subsequently.

Our new technique thus may help to maintain or improve the appearance and contour of the edentulous ridge after tooth extraction in intact 4-wall extraction socket defects by establishing the base for a good functional and esthetic replacement of the missing tooth with an implant-supported prosthesis (Figs 5-7). It also yields cost savings because the volume of graft required to augment the labial plate is much lower than what would be required in a traditional socket-preservation procedure. At the time of submission of this report, we have successfully used this technique in 25 patients with excellent results. Although the preliminary results are very promising, further investigation is warranted to understand the biology of the efficacy (if any) behind this technique, as well as some factors that may influence its success or failure (eg, thickness of buccal plate after extraction, presence of adjacent teeth, type of bone graft, and use of membranes).

References

1. Chen ST, Wilson TG Jr, Hämmerle CH: Immediate or early placement of implants following tooth extraction: Review of biologic basis, clinical procedures, and outcomes. Int J Oral Maxillofac Implants 19:12, 2004 (suppl)
2. Lekovic V, Camargo PM, Klokkevold PR, et al: Preservation of alveolar bone in extraction sockets using bioabsorbable membranes. J Periodontol 69:1044, 1998
3. Araújo MG, Wennström JL, Lindhe J: Modeling of the buccal and lingual bone walls of fresh extraction sites following implant installation. Clin Oral Implants Res 17:606, 2006
4. Pietrokovski J, Massler M: Alveolar ridge resorption following tooth extraction. J Prosthet Dent 17:21, 1967
5. Choquet V, Hermans M, Adriaenssens P, et al: Clinical and radiographic evaluation of the papilla level adjacent to single-tooth dental implants. A retrospective study in the maxillary anterior region. J Periodontol 72:1364, 2001
6. Mecall RA, Rosenfeld AL: Influence of residual ridge resorption patterns on implant fixture placement and tooth position. 1. Int J Periodontics Restorative Dent 11:8, 1991
7. Razavi R, Zena RB, Khan Z, et al: Anatomic site evaluation of edentulous maxillae for dental implant placement. J Prosthodont 4:90, 1995
8. Buser D, Martin W, Belser UC: Optimizing esthetics for implant restorations in the anterior maxilla: Anatomic and surgical considerations. Int J Oral Maxillofac Implants 19:43, 2004 (suppl)
9. Nemcovsky CE, Serfaty V: Alveolar ridge preservation following tooth extraction of maxillary anterior teeth. Report on 23 consecutive cases. J Periodontol 67:390, 1996
10. Stanley HR, Hall MB, Clark AE, et al: Using 45S5 bioglass cones as endosseous ridge maintenance implants to prevent alveolar ridge resorption: A 5-year evaluation. Int J Oral Maxillofac Implants 12:95, 1997
11. Brugnami F, Then PR, Moroi H, et al: Histologic evaluation of human extraction sockets treated with demineralized freeze-dried bone allograft (DFDBA) and cell occlusive membranes. J Periodontol 67:821, 1996
12. Sclar AG: Strategies for management of single-tooth extraction sites in aesthetic implant therapy. J Oral Maxillofac Surg 62:90, 2004 (suppl 2)
13. Bartee BK: Extraction site grafting for alveolar ridge preservation. Part 2: Membrane-assisted surgical technique. J Oral Implantol 27:194, 2001
14. Carmagnola D, Adriaens P, Berglundh T: Healing of human extraction sockets filled with Bio-Oss. Clin Oral Implants Res 14:137, 2003
15. Artzi Z, Tal H, Dayan D: Porous bovine bone mineral in healing of human extraction sockets. Part 1: Histomorphometric evaluations at 9 months. J Periodontol 71:1015, 2000
16. Araújo M, Linder E, Lindhe J: Effect of a xenograft on early bone formation in extraction sockets: An experimental study in dog. Clin Oral Implants Res 20:1, 2009
17. Brugnami F, Then P, Moroi H, et al: Guided bone regeneration with DFDBA prior to implant placement. Clinical evaluation and histologic evidence of osteoblastic and osteoclastic activities in demineralized freeze-dried bone allograft. Int J Periodontics Restorative Dent 19:259, 1999
18. Mellonig JT, Towle HJ: Letter to the editor. J Periodontol 66:1013, 1995
19. Hatano N, Shimizu Y, Ooya K: A clinical long-term radiographic evaluation of graft height changes after maxillary sinus floor augmentation with 2:1 autogenous bone/xenograft mixture and simultaneous placement of dental implants. Clin Oral Implants Res 15:339, 2004
20. Chiapasco M, Zaniboni M, Bosco M: Augmentation procedures for the rehabilitation of deficient edentulous ridges with oral implants. Clin Oral Implants Res 17:136, 2006 (suppl 2)
21. Grunder U: Soft tissue augmentation techniques to enhance esthetics around implants. Quintessence 23:35, 2004
22. Grunder U, Gracis S, Capelli M: Influence of the three dimensional bone-to-implant relationship on esthetics. Int J Periodontics Restorative Dent 25:113, 2005