

Modified Approach to the Bio-Col Ridge Preservation Technique: A Case Report

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Abstract

With today's esthetic conscious population, the day of simply extracting a tooth and replacing it at a later date is unacceptable to many patients. It is vital to preserve and maintain the edentulous ridge and normal gingival architecture, which often collapses after tooth extraction. As clinicians, we must have multiple techniques available to preserve or restore the function and esthetics when teeth are unrestorable. This case report describes a modified approach to the "Bio-Col Technique." This modification simplifies the procedure without compromising the esthetic result.

Keywords: Atraumatic extraction, Bio-Col technique, ridge preservation, esthetics, Bio-Oss, fixed partial denture, transitional removable partial denture

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Introduction

Preservation and maintenance of the edentulous ridge form and normal gingival architecture after tooth extraction is rapidly becoming the standard of care in modern dental practice. Extractions should only be performed after careful consideration of and treatment planning for the functional and esthetic replacement of the teeth being removed and their supporting tissues. It is more practical and more predictable to preserve the edentulous ridge and surrounding tissue than it is to reconstruct this tissue once it has been lost.¹ With greater use of implants, a full bony ridge is paramount.

The patterns of resorption and collapse of the alveolar ridge are well documented in the literature.^{2,3} Historically this loss of alveolar tissue and gingival architecture has not been of great concern because a fixed bridge with a modified ridge lap pontic was the solution. Increased concern for more esthetic restorations and more widespread use of dental implants has made the preservation of both alveolar bone and gingival contours essential for reconstruction. Today's dental patients are more demanding about their treatment results. Clinicians must have multiple techniques available to preserve soft tissue and bone when teeth require extraction.

As bone slowly grows into a healing extraction site, there is a simultaneous, predictable resorption process. This usually results in a shorter or narrower, or both, alveolar ridge. Recent studies have demonstrated this resorption often exceeds three to four millimeters horizontally and vertically in the first six months.^{2,3} This loss of alveolar bone may produce an esthetic and functional void in the patient's mouth, especially in the anterior region. When the final treatment plan calls for a removable prosthesis, this void can be filled with gingival colored acrylic. But when a fixed prosthesis with a modified ridge lap pontic or endosseous implant is planned, replacing this lost bony tissue can become more complicated.

Several procedures have been developed over the past few years to repair the defects resulting from tooth loss and subsequent bone resorption. Soft tissue only techniques include free gingival onlay grafts⁴⁻⁵ and subepithelial connective tissue grafts.⁶ Hard tissue techniques use osseous

grafting⁷⁻⁸, guided bone regeneration, and bone swagging.⁹⁻¹³ These procedures, when performed correctly, can produce excellent results, though are potentially unnecessary if preservation techniques are utilized. Additionally, ridge augmentation procedures can be more invasive and have a higher risk of being less successful than the results obtained by preserving the patient's original ridge and gingival contours. Additionally, ridge augmentation procedures must be tailored to the prosthetic treatment planned procedures in order to obtain an acceptable result.

The concept of placing a barrier to prevent the migration of epithelial cells into the wound and allow time for bone formation has been utilized for many years in periodontal surgery.¹⁴⁻¹⁷ Techniques including the placement of membranes, autografts, allografts, xenografts, and alloplasts have successfully repaired periodontal defects. The same principles are now being utilized to grow bone into tooth sockets after the extraction of hopeless teeth.¹⁸⁻²³

The concept of atraumatic extraction followed by socket grafting and placement of an ovate pontic to preserve gingival architecture was presented by Schlar.²⁴ In his original technique he recommended: (1) atraumatic extraction, (2) perforation of the socket wall to create a bleeding surface, (3) condensation of deproteinized bovine bone xenograft (Bio-Oss%) filled to the osseous crest, (4) placement of a collagen matrix material (CollaPlug&) over the graft, (5) horizontal mattress suture over the extraction site, in order to retain the graft and collagen matrix, (6) cyanoacrylate (Iso-Dent*) placed over the suture and collagen to harden the material and decrease permeability of this barrier, and (7) placement of an ovate pontic into the surgery site. The purpose of this article is to present a modified approach to what Schlar termed "The Bio-Col Technique."²⁴

Case Presentation #1

A 28-year old male soldier was referred to the periodontal service by the Prosthodontic Department for atraumatic extraction of the maxillary right central incisor (tooth #8) plus ridge preservation (Figure 1). His medical history was non-contributory. The dental history was significant for childhood trauma to #8. This patient was poorly compliant with comprehensive dental



Figure 1. Pretreatment view #8.



Figure 2. Pretreatment radiograph #8.

care, presenting for annual examinations, periodic prophylaxis, and occasional restorations. He was not fully compliant with recommended evaluations by endodontic and prosthodontic services.

On November 24, 1998, #8 was evaluated and diagnosed with apical resorption and significant apical radiolucency. Additionally, discoloration of esthetic concern was reported. Endodontic therapy was provided utilizing the Thermafil® system. A significant amount of sealer extruded through the apex, during an examination (July 11, 2001), it was noted that #8 had an 8 mm periodontal probing depth and large radiolucency at the apex. It was recommended the patient follow-up with endodontic service, but the patient did not seek evaluation until one year later. Endodontic evaluation was provided on July 11, 2002. At this time, the patient voiced the following chief complaint “I was sent to see if I need a root canal redone.” Significant signs and symptoms noted during the endodontic examination included a buccal sinus tract at the junction of the middle and apical third of the root, mobility, sensitivity to palpation and biting pressure, and probing depths to 6-9 mm. Additionally, the tooth was not tender to percussion and did not respond to cold. Radiographic assessment revealed a wide periodontal ligament space, loss of lamina dura, and previous endodontic therapy. The endodontic diagnosis was previously treated #8 with chronic apical periodontitis. The endodontist was suspicious for root fractures and felt the prognosis was poor (see Figure 2).

The patient was referred to prosthodontic service for evaluation and treatment. The prosthodontist felt that #8 was non-restorable. Restoration

options included endosseous implant #8, fixed partial denture (FPD) #7-9, and removable partial denture (RPD). Complicating the restorative decision between the patient and dental treatment team was the fact this soldier was to deploy from the area in 6 weeks and would be gone for a period of at least 6 months.

This patient was next evaluated by the periodontal service. A diagnosis of generalized mild chronic periodontitis with isolated moderate chronic periodontitis and failed endodontic therapy (#8) was made. An immediate treatment plan of initial therapy, atraumatic extraction of #8 with ridge preservation (modified Bio-Col Technique) with insertion of an acrylic RPD was presented. Since the patient would be deployed from the area, it was felt that a provisional FPD was not prudent. Additionally, due to the pathology in the area, immediate implant placement was not recommended. In an attempt to preserve soft and hard tissue esthetics, an ovate pontic would be fabricated chair side during surgery. After consenting to the treatment plan, the patient was scheduled for treatment. It was stressed to the patient that when he returned from his deployment, he needed to follow-up with prosthodontics and periodontics for definitive restoration of #8 and re-assessment of his periodontal status.

Prior to surgery, the patient rinsed for 60 seconds with a 0.12% chlorhexidine mouth rinse. After local anesthesia was achieved, a sulcular incision with a 15C surgical blade to the osseous crest was made at #8. Next the tooth was extracted atraumatically utilizing periostomes (Figure 3). The extracted tooth was evaluated and gross calculus with over-extended gutta-percha was noted. Additionally on the facial aspect, a horizontal root fracture was noted at the apical third. After

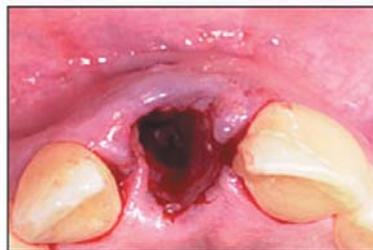


Figure 3. Atraumatic extraction (no buccal cortical plate is present).



Figure 4. Buccal cortical plate fragments.



Figure 5. Acrylic removable partial denture.



Figure 6. Modification to create an ovate receptor site.



Figure 7. Bio-Oss condensed into extraction site, then the CollaPlug placed followed by Iso-Dent cyanoacrylate.



Figure 8. RPD in place.



Figure 9. One week post-surgery (anterior view).



Figure 10. One week post-surgery (palatal view).



Figure 11. Four weeks post-surgery (anterior view).



Figure 12. Four weeks post-surgery (palatal view).

removal of granulation tissue, the socket was inspected. Though there were solid bony walls on the mesial-to-palatal-to-distal aspect, there was no facial plate. (Figure 4) Due to the extensive loss of facial cortical plate, it was anticipated that an Allen type C ridge defect¹² would result with healing (a combination of both loss of ridge height and ridge width).

After copious irrigation with saline, Bio-Oss was condensed into the socket. The clinician utilized finger pressure over the facial gingiva to provide a “solid stop” to condense the graft against. In this situation, the goal of the Xenograft was to minimize ridge collapse which would normally occur without supporting the facial tissues. In addition, because the papillae in this area were friable due to the chronic inflammation, two interrupted 5-0 Vicryl Sutures[^] were utilized to approximate the facial and lingual papillae at the mesial and distal of the extraction site. Next the acrylic RPD was inserted and adjusted (Figure 5). A chair side modification utilizing clear (orthodontic) acrylic resin was added to create the ovate form (Figure 6). Prior to insertion of the partial, a CollaPlug wound dressing material was cut to remove the terminal 1/5 with rounded end. The CollaPlug was placed over the Bio-Oss graft gently condensed to completely cover the bone graft. Iso-Dent cyanoacrylate was placed over the collagen then hardened (Figure 7). Finally, the acrylic RPD with ovate pontic was inserted (Figure 8).

Post-surgery instructions and removable partial denture instructions were provided. The patient was provided analgesics and chlorhexidine mouth rinse and instructed not to perform brushing and flossing in the surgery area for 2 weeks.

At the one-week follow-up, the patient stated he had some “throbbing” when he wore his partial for a long period of time, but was not having problems when he removed the appliance periodically. Clinical examination revealed no significant edema or infection. There was slight marginal erythema in the surgery area, which was determined to be within normal limits (Figures 9 and 10).

At 2 weeks post-surgery, the patient voiced no complaints. The area appeared to be healing well, though some graft was exposed. It was recommended the patient begin brushing (extra-soft toothbrush) and flossing at this site. The prosthodontist felt the ovate shape was acceptable and no modification was needed at this time. Prior to the patient’s deployment, he was evaluated again (one month post-surgery). He voiced no complaints. Clinical examination revealed some exposed graft material that was

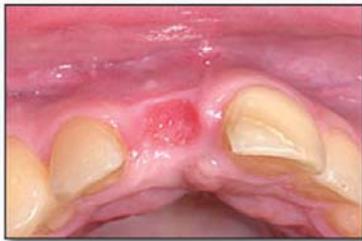


Figure 13. Seven months post-surgery (anterior view).



Figure 14. Seven months post-surgery (palatal view).



Figure 15. Seven months post-surgery. (Gingival margin receded from the pontic of the RPD during healing.)



Figure 16. Radiograph 7 months post-surgery.



Figure 17. Fixed partial denture with ovate pontic in place (intraoral view).



Figure 18. Final prosthesis (extraoral view).

loosely adherent to the soft tissues within the socket. This material was removed, though several particles of Bio-Oss were still adherent within the soft tissues (Figures 11 and 12). The soldier was to follow-up with both the prosthodontic and periodontic services when his deployment was over.

Approximately seven months post-surgery, the soldier returned and was seen by the Prosthodontic Department. Next he was seen by the Periodontal Department, where poor hygiene was noted. The extraction site had healed well and tissue contours were considered very good, especially considering the fact that after

extraction, it was noted there was no facial cortical plate (see Figures 13, 14, 15, and 16).

A definite treatment plan of FPD #7-9 was agreed upon. Teeth #'s 7 and 9 were prepared for FPD, final impression taken, and provisional restoration fabricated. The final prosthesis with an ovate pontic was delivered approximately 3 weeks later (see Figure 17 and 18). The patient still needs to have 3rd molar extractions and periodontal therapy, but #8 site was judged to be successfully restored.

Case Presentation #2

A 34-year old male soldier was referred to the periodontal service by the Emergency Department for evaluation and treatment of a traumatized maxillary right central incisor (tooth #8). Medical history was non-contributory. Dental history was significant for recent trauma to #8 in a basketball game, but the tooth had not been avulsed. The patient had been seen on an emergency basis and the traumatized tooth had been splinted to the adjacent teeth utilizing composite resin and wire available in the Emergency Room Department (see Figure 19).

The patient had a history of good dental compliance, presenting regularly for annual examinations, periodic prophylaxis, and occasional restorative work.

Upon evaluation and diagnosis of the traumatized tooth, it was determined the root had been fractured horizontally at the junction of the middle and coronal thirds. The tooth, therefore, was deemed hopeless and planned for extraction. Restoration options included endosseous implant #8, fixed partial denture (FPD #7-#9), or removable partial denture (RPD). The patient expressed a strong desire to have the tooth replaced as quickly as possible and in a way



Figure 19. History of trauma to maxillary anterior dentition (temporary splint in place).



Figure 20. Abutment teeth prepare prior to extracting tooth #8.

that he would not have to take it in and out of his mouth. It was, therefore, decided to replace the hopeless tooth with a fixed partial denture (FPD #7-#9). After consenting to the treatment plan, the patient was scheduled for extraction, Bio-Oss graft, and collagen plug membrane placement.



Figure 21. Provisional restoration with an ovate pontic (labial view).



Figure 22. Provisional restoration with an ovate pontic (superior view).

Prior to surgery, the patient rinsed for 60 seconds with a 0.12% chlorhexidine mouth rinse. After obtaining profound local anesthesia, teeth #7 and #9 were prepared as fixed partial denture abutments (Figure 20). The restorative dentist then fabricated a provisional FPD with an ovate pontic.



Figure 23. Atraumatic extraction of #8 (buccal cortical plate is intact).



Figure 24. Extracted maxillary right central incisor.

Department for surgery. A sulcular incision was made circumferentially around #8 with a 15C surgical blade. This incision extended apically to the osseous crest. The tooth was then extracted atraumatically using periostomes and a forcep (see Figures 23 and 24).

After irrigation with saline, Bio-Oss was condensed into the socket to the level of the osseous crest (Figure 25).

At this point, the restorative dentist confirmed the shape of the ovate pontic on the prefabricated provisional fixed partial denture would support the soft tissue contours.

A CollaPlug wound dressing material was then cut to remove the terminal 1/5 with a rounded end (see Figure 26).

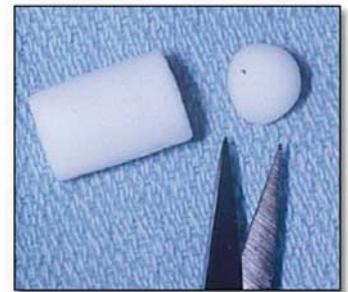
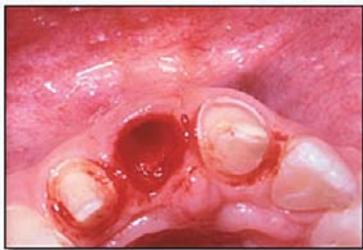


Figure 26. CollaPlug cut and section to the right is utilized.

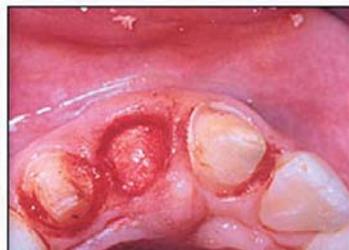
The CollaPlug was placed over the Bio-Oss graft and gently condensed to completely cover the bone graft (Figure 27). The provisional FPD was cemented in place with temporary cement (Figure 28).

Finally, the interface between the ovate pontic and gingival margin was sealed with Iso-Dent cyanoacrylate (Figure 29). The patient was then provided with post surgery instructions, analgesic medication, and chlorhexidine mouth rinse (to be used at the surgical site in-lieu of traditional oral hygiene for two weeks).

At the one-week follow-up (Figure 29), the patient reported discomfort for the first two days post



A. Empty extraction site.



B. Bio-Oss condensed to osseous crest.

Figure 25.

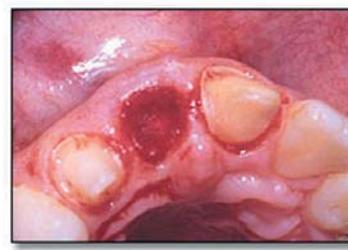


Figure 27. CollaPlug condensed over Bio-Oss.



Figure 28. Provisional fixed partial denture cemented, then Iso-Dent cyanoacrylate placed to seal the pontic-gingival interface.

The patient was then escorted to the Periodontal 6



Figure 29. One week post-surgery.



Figure 30. Five months post-surgery.

surgery, but it was controlled with analgesic medication. He complained of no significant tenderness at the surgical site when the area was palpated. Clinical examination revealed no significant edema or infection. At the 3-week follow-up, the patient voiced no complaints. The area appeared to be healing well, and it was recommended to the patient he begin brushing (extra-soft toothbrush) and flossing. Special instructions with demonstrations were provided to teach the patient on how to floss under the ovate pontic. The restorative dentist made a slight modification to the acrylic at the ovate site. At the 8-week follow-up visit, the patient had no complaints and the surgical site appeared to be healing normally. The patient was encouraged to continue performing excellent oral hygiene. It was elected to allow healing for 12 more weeks so the tissues could complete the healing process and stabilize their position prior to final impression. The patient was next seen 5 months post surgery, and the surgical site appeared well healed (Figure 30).

The restorative dentist was pleased with the gingival contours. A polyvinylsiloxane impression was taken and delivered to the lab for final prosthesis fabrication. The final restoration with an ovate pontic was cemented (Figures 31 and 32).

The patient was instructed on proper homecare, with specific instructions on flossing under the ovate pontic. Overall the patient expressed pleasure in the contours of his restoration. The restoring dentist was pleased with the tooth contours, ridge shape, appearance of pontic “emerging” from the soft tissues, and cleansability of the ovate pontic.

Discussion

The era of simply extracting teeth is rapidly coming to an end. State of the art dentistry requires careful treatment planning and modern techniques to preserve as much as possible of the patient’s existing alveolar bone and gingival contours during extraction. The technique presented in this article is a modification of the Bio-Col Technique first published by Schlar.²⁴ There are four modifications to Schlar’s description. First, the CollaPlug wound dressing is used in a significantly smaller quantity simply to cover the Bio-Oss graft, not layered to the level of the free gingival margin. On average only the terminal 1/5 of the entire plug is utilized. Second, the horizontal mattress suture is eliminated, with this modification, suturing is only used if soft tissue trauma occurred during the extraction procedure (e.g., the interdental papilla is torn). Third, when a fixed provisional is utilized the Cyanoacrylate is not applied to the CollaPlug and horizontal mattress suture as advocated by Schlar. Instead, the provisional is first temporarily cemented and then the cyanoacrylate is placed at the gingival margin-pontic interface to “seal” this area. Finally, it is recommended the provisional be removed and modified between 3-6 weeks post-surgery. The final impression should not be taken until after a minimum of 4 months healing time.

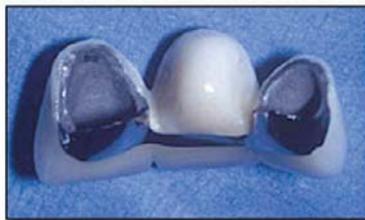


Figure 31. View of pontic’s ovate shape.



Figure 32. Final restoration.

This technique is useful not only in preserving alveolar bone, but in maintaining soft tissue architecture at the extraction site. By immediately supporting the soft tissues surrounding the socket, the restorative dentist is able to create a pontic that retains the appearance of gingival margin and sulcus resulting in a much more believable prosthesis. The FPD pontic will have a very natural emergence profile from the gingival tissue. As a result, it should be difficult to impossible for the patient's family and friends to realize a tooth or teeth have been extracted. The

modified Bio-Col Technique provides the clinician another option for esthetic areas.

Product List

- % Bio-Oss, Osteohealth Co. Shirley, NY 11967
- & CollaPlug, SulzerMedica, Carlsbad, CA
- * Iso-Dent, Ellman International Inc. Hewlett, NY 11557
- ^ Vicryl, Ethicon, Johnson and Johnson, Somerville, NJ
- @ Thermafil, Dentsply, York, PA 17405

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