Treatment Planning Challenges in the Maxillary Anterior Region Consequent to Severe Loss of Buccal Bone

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ABSTRACT

The burgeoning popularity of dental implant usage in the maxillary anterior region is well recognized. On the other hand, challenges involved in achieving optimal esthetics through implants have also been discussed extensively. Presence of labial/buccal bone in the maxillary anterior region is necessary for esthetic success of treatment, with or without the use of dental implants. This case report describes the multidisciplinary management of a rare case with severe loss of buccal bone confined to the maxillary central incisor region. A patient with a recent history of orthodontic treatment presented with a large buccal dehiscence of soft tissue that exposed nearly the entire buccal root surface of both maxillary central incisors. The treatment plan included extraction of both central incisors, hard and soft tissue ridge augmentation, and an all-ceramic fixed partial denture. After 2 years in function, the condition of soft tissues and integrity of the restorations remained stable. A discussion of traditional versus contemporary treatment planning using dental implants in such situations is presented.

CLINICAL SIGNIFICANCE

Although implant therapy has proven to be a highly successful option, traditional treatment without implants may be advantageous in certain clinical situations. Compared to implant therapy, it can provide similar or better esthetic results with reduced treatment procedures, expenses, and time.

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INTRODUCTION

Presence of buccal alveolar bone is well recognized as an important determinant of dento-gingival esthetics in contemporary esthetic dentistry.[1] Various reasons for loss of buccal bone include periodontal disease, traumatic extractions, aberrant bony topography, and physiologic resorption because of missing teeth for an extended period of time.[2] Another less commonly detected reason for loss of alveolar bone is adverse orthodontic teeth movement, which can result in dehiscence of the bone.[3] Depending upon the nature of the intended teeth movement and direction of the applied force, this has the potential to significantly affect the structure of the bone. Oftentimes, soft tissue thickness can mask small fenestrations, but large dehiscence of the bone can result in esthetic and functional compromises and may even result in loss of involved teeth.[3]

Various treatment methods have been described to restore hard and soft tissues when there is a loss of dental and alveolar components in the maxillary anterior region. They can be broadly classified as surgical and prosthetic methods. Prosthetic methods include creation of a long proximal contact area and/or utilization of gingiva-colored prosthetic material to compensate for the lost hard and soft tissues.[4–6] These materials can be incorporated in a prosthesis that is supported by either natural teeth or dental implants.

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The gingiva-colored prosthetic material could either comprise of porcelain or a composite resin type of material.[5,6] Both materials have inherent advantages and disadvantages. Their primary advantage being that they allow the clinician to control prosthetic tooth length, shape, and help obtain a pleasing interdental papilla.[4,5] A commonly recognized disadvantage of these materials is that shade matching of the prosthetic gingiva with the natural gingiva is often challenging.[7] Therefore, it has been recommended to avoid using this option when a patient's smile line displays the prosthesis-tissue junction (PTJ) or the junction between prosthesis and natural gingiva.[8]

Successful use of dental implants in the maxillary anterior region for partial edentulism has been well documented in the literature.[9] On the other hand, challenges involved in achieving optimal esthetics through implants have also been discussed extensively.[10,11] This is mainly because of biological limitations related to lost buccal and interproximal bone and attainment of optimal soft tissue esthetics. The literature also suggests that it is more predictable to obtain an interdental papilla between a natural tooth and an implant or between two pontics, than obtaining it between two adjacent implants.[10,11] Treatment planning implants in the esthetic zone is further challenging, when there is a need for a large bone graft and adjuvant soft tissue graft. This can lead to additional clinical procedures and increase the duration of treatment and expenses for the patient.

The use of connective tissue grafts has been extensively described in the literature to augment partially edentulous alveolar ridges, when there is a loss of horizontal and vertical dimensions.[2,12–16] More commonly, they are used to augment pontic sites when planning a fixed partial denture (FPD) supported by natural teeth and thus eliminate the need for a gingiva-colored prosthetic material.[2] The common source for harvesting a connective tissue graft is from the soft tissues overlying the lateral regions of the palate. The connective tissue graft not only helps to provide an optimal esthetic emergence profile but also favors the patient's oral hygiene performance around the restorations.[2,13,14] The disadvantages of this procedure are primarily related to the maximum amount of soft tissue afforded by the donor site, need for an additional surgical procedure, and need for careful contouring of the soft tissues that is dependent upon the skill of the clinician.

The purpose of this article is to describe treatment planning and management of a patient with extensive loss of buccal bone in the maxillary anterior region using traditional perio-prosthodontics therapy.

CASE REPORT

A 42-year-old woman presented to the prosthodontist requesting improvement of her maxillary anterior esthetics (**Figure 1**). Her dental history included recent orthodontic and periodontal treatment. Clinical examination revealed that the patient had 10 mm of gingival recession localized to both maxillary central incisors due to a large buccal dehiscence that exposed nearly the entire root surface (**Figure 2**). Periapical radiographs confirmed severe bone loss around the central incisors with a class II mobility (**Figure 3**). Occlusal assessment revealed a class II division 2 malocclusion. After analysis of the patient's history, it was predicted that the patient's maxillary anterior teeth were orthodontically intruded after extraction of her first premolars. Perhaps, movement of the maxillary anterior teeth during intrusion resulted in bone dehiscence at the level of the roots and loss of soft tissue on the buccal aspect of both central incisors.[3] The patient's oral hygiene was acceptable, and periodontal maintenance was performed at 3-month intervals. Site-specific diagnoses included localized moderate gingivitis with localized severe clinical attachment loss and external apical root resorption.

After careful consideration of the diagnosis, extent of hard and soft tissue loss, patient expectations and finances, treatment options were formulated by an interdisciplinary team involving a periodontist and a prosthodontist. The treatment plan included extraction of maxillary central incisors, hard and soft tissue ridge augmentation, and an all-ceramic FPD using the lateral incisor teeth as abutments. A diagnostic wax-up was

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FIGURE 1. Close-up view of the patient's smile at the time of initial presentation.

FIGURE 2. Frontal image of the maxillary anterior teeth with significant loss of buccal and interproximal soft tissues. Note the loss of tissues localized to the two central incisors.

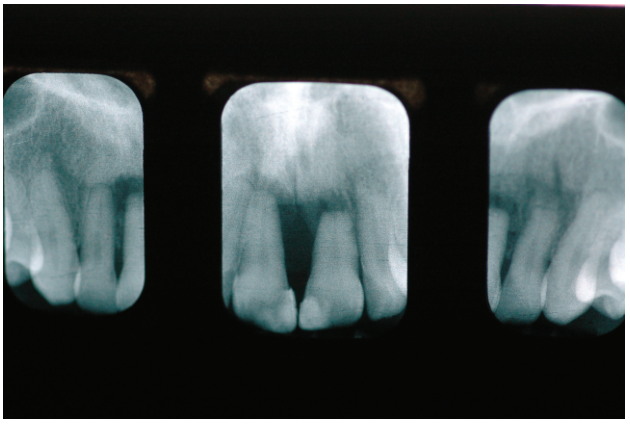

FIGURE 3. Peri-apical radiographs of the maxillary anterior teeth showing severe horizontal bone loss and external apical root resorption of the incisors.

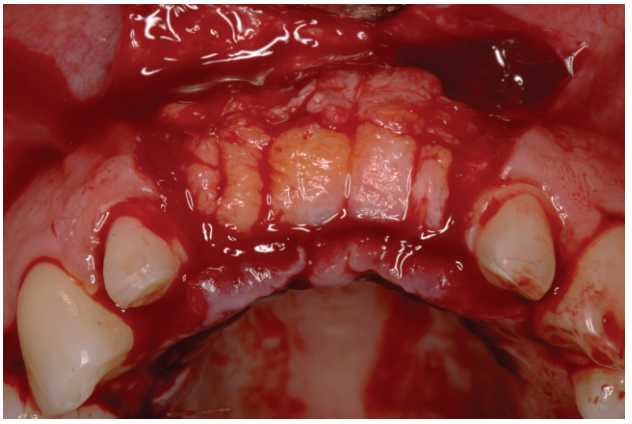

FIGURE 4. Interpositional connective tissue grafts stabilized with resorbable sutures prior to primary wound closure.

accomplished, and an acrylic resin interim FPD was fabricated with ovate pontics.

Thereafter, both lateral incisors were prepared for all-ceramic FPD retainers. Immediately after tooth preparations, the central incisors were extracted and a deproteinized bovine bone graft was placed into the extraction sockets and covered with a resorbable collagen membrane. Lateral sliding pedicle flaps were used to obtain primary closure, and the interim FPD was cemented with minimal contact between the ovate pontics and tissue to accommodate swelling during initial wound healing. Eight weeks later, the patient was scheduled for an interpositional connective tissue graft procedure to further augment the ridge as planned. Approximately 2.5 × 1 cm of connective tissue graft was unilaterally harvested from the right side of the palate. The pontic sites were augmented with the graft according to standard surgical principles[12] (Figure 4). There were no complications during the surgical procedure and healing phases.

Eight weeks later, the soft tissue was contoured to accept ovate-shaped pontics of optimal form using coarse and then fine football-shaped diamond burs (#368, Brasseler USA, Savannah, GA, USA), and the interim restorations with ovate-shaped pontics were cemented[2] (Figure 5). After an interval of 6 more weeks, tissue maturation

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FIGURE 5. Frontal image of the interim fixed partial denture. Note healing of the soft tissues at the surgical site.

FIGURE 6. Occlusal view of the pontic sites and teeth preparations prior to making final impressions. Note adequate restoration of buccal soft tissues.

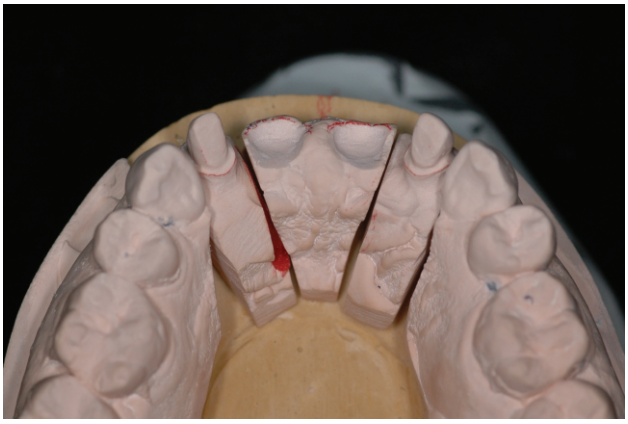

FIGURE 7. Lingual view of the dies showing teeth preparations and pontic sites that were developed.

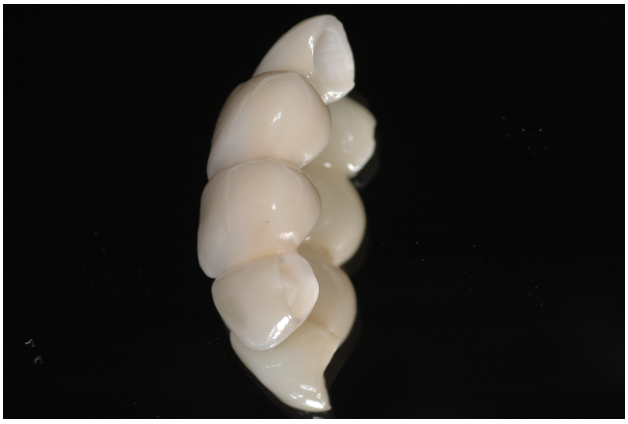

FIGURE 8. All-ceramic zirconia-based fixed partial denture showing ovate-shaped pontics.

around the interim FPD was confirmed (Figure 6). Standard prosthodontic procedures were then followed, and a zirconium-based all-ceramic FPD (Lava, 3M ESPE, St. Paul, MN, USA) was successfully fabricated and cemented using a resin-based cement (RelyX Luting Plus; 3M ESPE) (Figures 7 through 10). The patient was educated about oral hygiene maintenance around the FPD using superfloss (Oral-B, Boston, MA, USA) and proxabrush (Gum-Sunstar America Inc., Chicago, IL, USA). She was placed on a 4-month recall program. After 2 years in function, the condition of the soft tissues and integrity of the restorations remained stable (Figure 11). The patient remained satisfied with her esthetics, treatment choice, and outcome of the interdisciplinary care (Figure 12).

DISCUSSION

With the exception of financial considerations, contemporary treatment planning is relatively straightforward in the maxillary anterior region, if there is adequate bone available for implant placement.[17] Careful consideration should also be given for soft tissue phenotype (thick versus thin), tooth form (square versus triangular), and height of existing interdental papilla of adjacent teeth. However, minimal or lack of any bone for implant placement, as seen in our patient, warrants careful consideration and re-assessment in the approach for treatment planning (Table 1). Not all partially edentulous patients are indicated for implant therapy. For this patient, severe loss of alveolar bone

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FIGURE 9. Frontal image of the all-ceramic fixed partial denture at the time of cementation. Soft tissues at the surgical site are undergoing healing.

FIGURE 10. Occlusal view of the all-ceramic fixed partial denture. Note adequate healing of the palatal soft tissues on the patient's right side from where the graft was harvested.

FIGURE 11. Two-year follow-up of the patient reveals acceptable esthetics and healthy tissue surrounding the surfaces of the fixed partial denture.

FIGURE 12. Close-up view of the patient's smile with final restorations. Compare with Figure 1.

dictated extensive bone grafting and possibly soft tissue grafting to facilitate implant therapy. From our patient's perspective, reduction of enamel and dentin on healthy adjacent teeth to support an FPD was deemed less aggressive and less painful than harvesting a large volume of cortical bone graft from the ramus or symphysis. The soft tissue grafting would have been a requisite for both options to attain optimal esthetics. Furthermore, the authors could not clearly establish whether the block graft and implant-supported restorations could provide esthetic superiority over the traditional treatment alternative for this patient.
The patient was educated about the advantages and disadvantages of both treatment options to aid in her treatment decision.

A pedicle soft tissue graft is a good option to increase the volume of tissue for the pontic area in the maxillary anterior region. However, in our patient, the volume of soft tissue needed was so large that the authors were concerned about adequate blood supply and undisturbed healing to such a large pedicle. Therefore, an interpositional connective tissue graft procedure was the treatment of choice. All-ceramic material was chosen over metal-ceramic for final restoration because of its superior esthetics, as the patient's exaggerated smile displayed the cervical regions of her lateral incisors. Additionally, there were adequate dimensions for the connector, which is a prerequisite for success in all-ceramic FPDs.[18] The span of the FPD was designed to be short by involving only the lateral incisors as the

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TABLE 1. Patient considerations in treatment planning for replacement of missing teeth in the maxillary anterior region when there is a severe loss of buccal bone

Patient considerations	Traditional perio-prosthodontics (connective tissue graft + FPD)	Implant prosthodontics (block graft + implant + FPD)
1. Potential for optimal esthetics	Similar	Similar
2. Expenses	Less	Significantly higher
3. Invasiveness and pain	Lesser—requires removal of enamel and dentin of adjacent teeth and palatal soft tissue	Higher—requires harvesting bone from a remote site and potentially, additional soft tissue
4. Minimum number of surgical procedures after extraction of teeth	One	Two
5. Treatment duration	Shorter	Longer
6. Interim/healing stage	Fixed interim prosthesis always	May require removable interim prosthesis
7. Availability of prosthetic material options	Similar	Similar
8. Risk potential and risk factors	Lesser—decay of abutments, future need for endodontic treatment	Higher—parasthesia, anesthesia, implant loss, infection
9. Management of future prosthetic complications	Expansive to all teeth involved in the prosthesis	Expansive or individualized depending upon the number of implants and prosthetic design (screw versus cement retained)
10. Long-term stability of treatment	Unknown	Unknown

FPD = fixed partial denture.

authors felt that it would be too aggressive to prepare the adjacent healthy natural canines for "additional support." Besides, there is no evidence in the literature that supports the concept of Ante's Law; studies of short-span all-ceramic FPDs in the anterior region have shown promising results.[18,19]

The patient's lip position in maximum smile appeared to be slightly inferior to the cervical margins of her central incisors. Presence of a gummy smile in this patient may have dictated the use of a gingival colored prosthetic material as an adjunct to soft tissue grafting, in order to obtain esthetic teeth proportions and interdental papilla.[4–6] It can be argued that the choice of treatment for this patient could potentially subject her natural abutment teeth to future caries or need for endodontic treatment, as they are the most common complications, associated with FPDs.[20] However, this patient had a low history of caries and the caries risk assessment revealed a very low score. Also, the patient was educated about oral hygiene maintenance underneath the pontics and around the abutments. At a 2-year follow-up, the patient's oral hygiene and gingival health were acceptable.

CONCLUSION

Patients with loss of teeth and buccal bone in the maxillary anterior region present with different degrees of severity. Traditional periodontal and prosthodontic treatment using a connective tissue graft and FPD offers a number of advantages over implant therapy in certain situations; they should be considered as a viable option during treatment planning.

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REFERENCES

1. Teughels W, Merheb J, Quirynen M. Critical horizontal dimensions of interproximal and buccal bone around implants for optimal aesthetic outcomes: a systematic review. Clin Oral Implants Res 2009;20:134–45.
2. Garber DA, Rosenberg ES. The edentulous ridge in fixed prosthodontics. Compend Contin Educ Dent 1981;2:212–23.
3. Handelman CS. The anterior alveolus: its importance in limiting orthodontic treatment and its influence on the occurrence of iatrogenic sequelae. Angle Orthod 1996;66:95–109.
4. Coachman C, Salama M, Garber D, et al. Prosthetic gingival reconstruction in fixed partial restorations. Part 1: introduction to artificial gingiva as an alternative therapy. Int J Periodontics Restorative Dent 2009;29:471–7.
5. Salama M, Coachman C, Garber D, et al. Prosthetic gingival reconstruction in fixed partial restorations. Part 2: diagnosis and treatment planning. Int J Periodontics Restorative Dent 2009;29:573–81.
6. Coachman C, Salama M, Garber D, et al. Prosthetic gingival reconstruction in fixed partial restorations. Part 3: laboratory procedures and maintenance. Int J Periodontics Restorative Dent 2010;30:19–29.
7. Simon H, Raigrodski AJ. Gingival-colored ceramics for enhanced esthetics. Quintessence Dent Technol 2002;25:155–72.
8. Bidra AS, Agar JR. A classification system of patients for esthetic fixed implant-supported prostheses in the edentulous maxilla. Compend Contin Educ Dent 2010;31:366–79.
9. Buser D, Martin W, Belser UC. Optimizing esthetics for implant restorations in the anterior maxilla: anatomic and surgical considerations. Int J Oral Maxillofac Implants 2004;19:43–61.
10. Tarnow D, Elian N, Fletcher P, et al. Vertical distance from the crest of bone to the height of the interproximal papilla between adjacent implants. J Periodontol 2003;74:1785–8.
11. Salama H, Salama MA, Garber D, Adar P. The interproximal height of bone: a guidepost to predictable aesthetic strategies and soft tissue contours in anterior tooth replacement. Pract Periodontics Aesthet Dent 1998;10:1131–41.
12. Seibert JS, Salama H. Alveolar ridge preservation and reconstruction. Periodontol 2000 1996;11:69–84.
13. Abrams L. Augmentation of the deformed residual edentulous ridge for fixed prosthesis. Compend Contin Educ Gen Dent 1980;1:205–13.
14. Seibert JS. Reconstruction of deformed, partially edentulous ridges, using full thickness onlay grafts. Part I. Technique and wound healing. Compend Contin Educ Dent 1983;4:437–53.
15. Cohen ES. Ridge augmentation utilizing the subepithelial connective tissue graft: case reports. Pract Periodontics Aesthet Dent 1994;6:47–53.
16. Seibert JS, Louis JV. Soft tissue ridge augmentation utilizing a combination onlay-interpositional graft procedure: a case report. Int J Periodontics Restorative Dent 1996;16:310–21.
17. Gastaldo JF, Cury PR, Sendyk WR. Effect of the vertical and horizontal distances between adjacent implants and between a tooth and an implant on the incidence of interproximal papilla. J Periodontol 2004;75:1242–6.
18. Raigrodski AJ. Contemporary materials and technologies for all-ceramic fixed partial dentures: a review of the literature. J Prosthet Dent 2004;92:557–62.
19. Raigrodski AJ, Chiche GJ, Swift EJ Jr. All-ceramic fixed partial dentures. Part III: clinical studies. J Esthet Restor Dent 2002;14:313–9.
20. Goodacre CJ, Bernal G, Rungcharassaeng K, Kan JY. Clinical complications in fixed prosthodontics. J Prosthet Dent 2003;90:31–41.

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