Orthodontically Assisted Vertical Augmentation in the Esthetic Zone

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Abstract

Severe periodontal disease leading to tooth loss causes multiple challenges when treatment planning replacement of these teeth with implant-supported restorations. Provisionalization and transitioning the patient from natural dentition to implant-supported restorations without use of removable prostheses can be difficult to achieve. A detailed evaluation and comprehensive treatment plan should precede extraction of the affected teeth. Forced eruption as a method of modifying the osseous and gingival topography has been established. This clinical report illustrates the use of nonmaintainable teeth to simultaneously develop the site for future implant placement, as well as support a fixed interim restoration during treatment. Patient was classified as an American College of Prosthodontists Prosthodontic Diagnostic Index (ACP PDI) class IV patient.

Bone resorption of residual ridges is a sequel to extraction of teeth. In cephalometric studies on the vertical resorption of the anterior residual ridges following extractions, both the volume and the rate of bone loss varied among different patients.[1] In another cephalometric study using a rat model,[2] postextraction resorption and remodeling was shown to continue for a period of up to 12 weeks. This would translate to an even longer period in humans.

The maxilla resorbs palatally and apically following extraction of a tooth with most of this remodeling occurring within the first 3 to 4 months.[3] Cephalometric studies have also shown that ridge resorption is most rapid during the first 3 months of denture wear and particularly during the 3-week postextraction period. These changes showed great individual variation.[4] In a comparative study of dental casts with ridge defects in the anterior maxilla, it was noted that the most common ridge defect was of the Siebert class III variety.[5] In other words, the most common ridge defect in an anterior edentulous area has both horizontal and vertical defects.[6]

Because of this variable pattern of resorption, a detailed evaluation and comprehensive treatment plan should always precede an extraction in the esthetic zone. Ingber[7] and Pontoriero et al[8] and others proposed forced eruption as a method of modifying the osseous and gingival topography.[7] These authors proposed that stretching the periodontal ligament fibers during tooth movement imparts tension to the alveolar bone. The tension stimulates bone deposition at the alveolar crest.[8] Extrusive tooth movements can also enhance the volume of the soft tissue by increasing the zone of attached gingiva.[9] Salama and Salama[10] applied the concept of forced eruption developed by Oppenheim in 1942 to site development for dental implant placement.

Using orthodontic movement may create a greater volume of available bone and soft tissue prior to dental implant placement. In addition, augmentation in the vertical plane is the most difficult procedure to accomplish. This clinical report illustrates the use of nonmaintainable teeth to simultaneously develop the site for future implant placement in the vertical plane, as well as maintain the patient in a fixed temporary restoration during the length of active treatment.

Clinical report

A 25-year-old Hispanic woman presented to the Department of Advanced Prosthodontics at the University of Southern California School of Dentistry. Her chief complaint was increasing mobility of her maxillary lateral and central incisors. The patient was also dissatisfied with the ever-increasing open contacts

Figure 1 Preoperative photograph, anterior view.

between her maxillary anterior teeth. She was classified as ACP PDI class IV for the completely dentate patient.[11]

The patient's medical history was unremarkable, and an intraoral examination revealed grade III mobility on maxillary central and lateral incisor teeth (Fig 1). There were no occlusal contacts between the maxillary and mandibular anterior teeth in the intercuspal position. The maxillary anterior teeth were severely proclined and supererupted; however, the lips were competent, and there was no speech impediment. All fricative and sibilant sounds were normal. Radiographic examination revealed severe horizontal bone loss in the anterior maxilla associated with the maxillary incisors. Vertical bone loss was also observed and only about 3 to 5 mm of attachment remained (Fig 2). The remainder of the dentition was intact.

The patient was referred to the Department of Advanced Periodontology at the USC School of Dentistry to develop a multidisciplinary treatment plan. Following periodontal, radiographic, and microbiological investigations, the patient was diagnosed with generalized aggressive periodontitis. The microbiological findings revealed a predominance of *Actinobacillus actinomycetemcomitans, Porphyromonas gingivalis*, *Tannerella forsythia*, and *Campylobacter* species. Based on these findings, the patient was diagnosed with generalized aggressive periodontitis associated with putative periodontal pathogens. The prognosis was classified as guarded for the first molars and nonmaintainable for the maxillary incisors.

The following is a treatment plan for this patient based on the diagnoses:

1. Periodontal: initial therapy
2. Orthodontic: extrusion of the maxillary incisors
3. Preparation of teeth #8 and #9 as fixed partial denture (FPD) abutments
4. Extraction of #7 and #10
5. Immediate implant placement into #7 and #10 sites
6. Delivering interim FPD, #7 to #10
7. Confirming integration of implants
8. Delivering implant-supported provisional after extraction of #8 and #9
9. Pontic site development for #8 and #9
10. Definitive restoration

Initial therapy for this patient consisted of scaling and root planing with concurrent systemic (250 mg Amoxicillin and Metronidazole three times per day for 8 days) and localized antimicrobials (iodine 10% for 5 minutes). A subgingival irrigation syringe was used for the delivery of the local antimicrobials.[12]

Three months following initial therapy, clinical signs of active generalized aggressive periodontital disease were absent. There was no bleeding on probing, and culture demonstrated a dominance of gram-positive aerobic cocci.

Orthodontic extrusion of the maxillary incisor teeth was initiated after confirming periodontal health in August 2005 (Fig 3). Because of the extent of forced eruption, endodontic therapy was required as the incisors had to be shortened as eruption progressed (Fig 4A). Tooth movement was

Figure 2 Preoperative full mouth periapical series.

Figure 3 Initiation of orthodontic treatment.

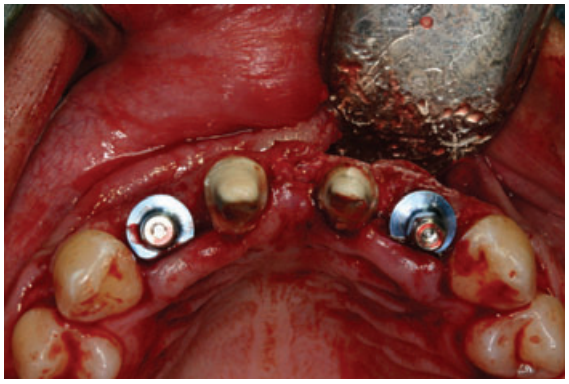

Figure 5 Immediate placement of dental implant at time of extraction.

exaggerated to compensate for soft and hard tissue remodeling after extractions (Fig 4B). Orthodontic extrusion of the maxillary incisor teeth was finished after 15 months.

Maxillary central incisors were prepared to receive the tooth-supported interim FPD from #7 to #10. The lateral incisors were extracted as atraumatically as possible, and implants were placed at the time of extraction[13,14] (Fig 5). Soft tissues were closed over the implants, and the interim restoration was delivered over the implant sites.

After 5 months, integration of the implants was confirmed, impressions were made of the implants, an FPD was fabricated with the implants as abutments, and ovate pontics were formed at the sites of #8 and #9. Following the extraction of #8 and #9, this interim restoration was delivered (Fig 6).[15] A further 5 months elapsed before impressions were made to allow time for bone and soft tissue remodeling.

In addition, prior to impression making, esthetic, phonetic, and functional aspects of the interim restoration were approved

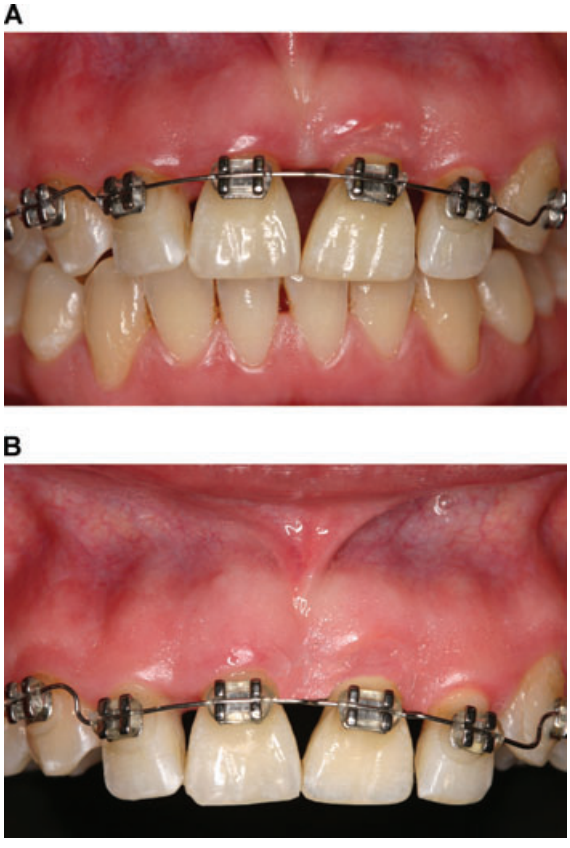

Figure 4 (A) Orthodontic treatment in progress. (B) Completion of orthodontic treatment (note position of brackets and bends in wire).

Figure 6 (A) Implant-supported provisional with ovate pontics for central incisors. (B) Implant-supported provisional seated, intraoral view.

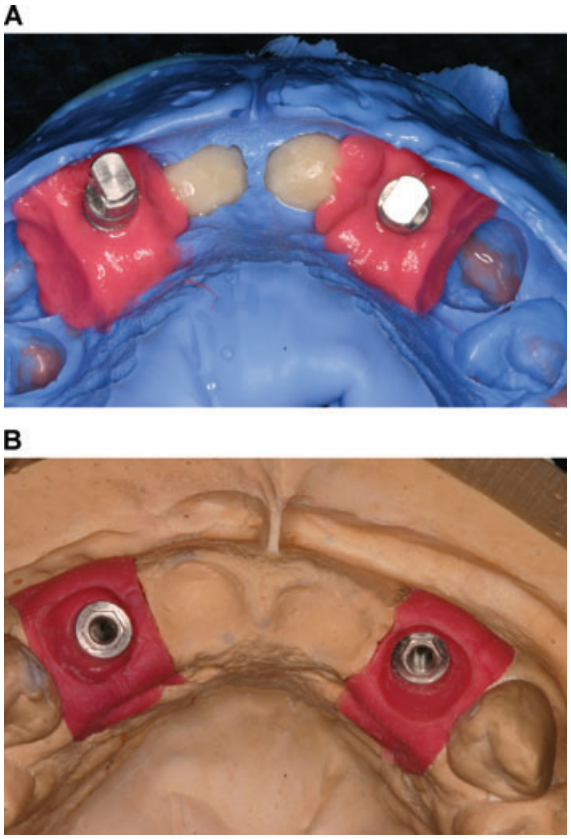

Figure 7 (A) Pick-up impression incorporating interim restoration (note ovate pontics). (B) Master cast from pick-up impression.

by the patient. Following this approval, diagnostic casts and clinical photographs were taken of the interim restoration together with the master cast developed from a pick-up impression technique of the interim restoration[16] (Fig 7). This information was provided to the laboratory technician to duplicate the shape and form of the interim restoration in the definitive restoration. A definitive metal–ceramic screw-retained FPD prosthesis was delivered (Figs 8 to 10).

Figure 8 Intraoral view of definitive restoration.

Figure 9 Patient smiling, definitive restoration.

Discussion

This clinical report describes treatment planning and execution of a solution for a young, esthetically conscious patient who was about to have her maxillary anterior teeth extracted. The course of treatment allowed the patient to be maintained with fixed restorations and used orthodontics to improve the recipient sites for implants and ovate pontics.

Block autografts have been used to reconstruct deficient alveolar ridges. These grafts are primarily cortical and tend to incorporate exceptionally well with recipient bone in a relatively short time. They also maintain postimplant-placement bone volume and retain their density relative to the augmented site. Despite the many advantages that block grafts offer for alveolar ridge augmentation, there are complications with autografts when used for horizontal and vertical augmentation. Morbidity with this grafting protocol is associated with both donor and recipient sites. Donor site morbidity includes complications such as bleeding, nerve injury, soft tissue injury, block fracture, and mandibular fracture. Recipient site morbidity includes trismus, bleeding, pain, swelling, bruising, infection, neurosensory deficits, bone resorption, dehiscence, and graft failure.[17]

Moreover, when using block grafts, teeth in the graft site need to be extracted. This alone would preclude this patient from receiving a fixed interim restoration. The most prevalent complications of block grafts are associated with removable prostheses causing loading and movement of the graft.

When using orthodontics for site development, the length of treatment time is not significantly different from methods where surgery is used for site development, because there is minimal healing time. This case was particularly suitable for site development by orthodontic means, as the horizontal dimension of the intended implant sites was adequate.

If the teeth were extracted in their original position, alveolar resorption and remodeling would have resulted in the ridge being positioned in a more apical and palatal position. This loss of tissue would have been exacerbated with the presence of periodontal pathogens. Horizontal and vertical surgical ridge augmentation would have been required to mitigate this decision.

In summary, for this particular patient presentation, forced eruption of the maxillary anterior teeth allowed an increased volume of bone without any additional surgical procedures. It

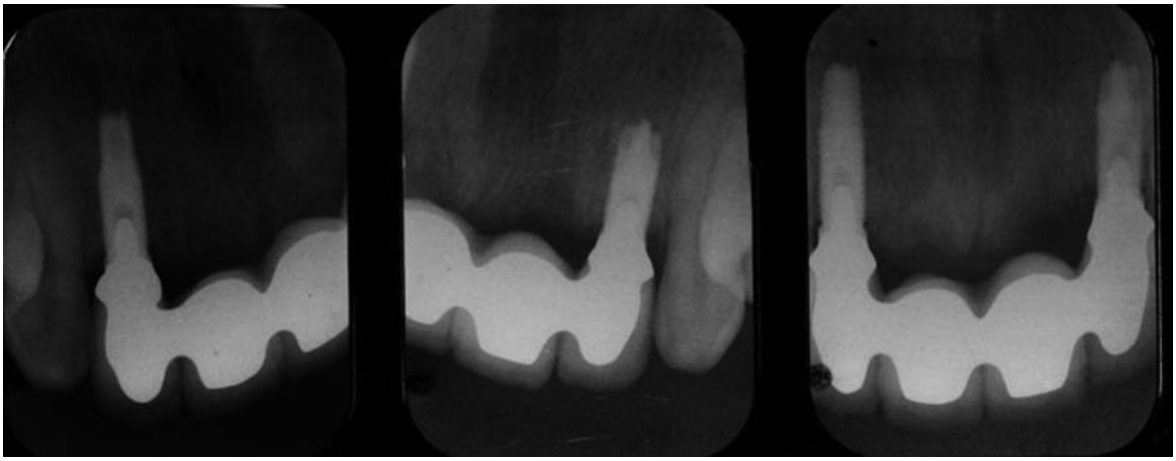

Figure 10 Radiograph of definitive restoration.

also made the implant sites conducive to immediate implant placement postextraction,[13,18] because forced eruption of the teeth reduced the extraction defects and allowed better engagement of bone during implant placement. In addition, an ample volume of soft tissue was developed with the tooth movement reducing the need for additional soft tissue procedures.[10,19]

Summary

A case was presented illustrating the importance of treatment planning prior to any irreversible therapy. This course of treatment allowed the patient to undergo transition from teeth to implant-supported restorations without the use of a removable prostheses and allowed development of implant sites without additional surgical procedures.

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