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Orthodontic Forced Eruption

A Team Approach in Aesthetic Treatment

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Extraction of maxillary anterior teeth with severe attachment loss leaves an obvious defect that is difficult to reconstruct. The lost soft and hard tissues must be regenerated prior to implant therapy or fixed partial denture placement to replace the missing tooth for the most aesthetically conscious patients. Orthodontic forced eruption (OFE) has been practiced as one method of restoring the soft and hard tissues lost due to periodontal disease.[1-3]

This article illustrates a team approach to treating a difficult periodontal-restorative challenge in the anterior maxilla for a patient with extreme aesthetic concerns. Her gummy smile, midline diastema, and severe periodontal disease were successfully treated with periodontal therapy, forced extrusion, and crown lengthening surgery prior to the restorative phase. This method can be used in similar patients as a more conservative, predictable alternative to achieve aesthetic harmony versus more invasive and time-consuming techniques such as ridge augmentation.

Periodontal disease causes loss of both hard and soft tissues. The loss may be uniform throughout the dentition, but more often it is asymmetric.[4,5] Especially in the aesthetic zone (ie, the anterior jaws), asymmetry coupled with periodontal disease presents a challenge for dentists. In addition, in patients with severe periodontal disease, a tooth or teeth may be deemed unrestorable if attachment loss is significant.

When planning restoration of a tooth, dentists can choose from many different techniques to regain the lost hard and soft tissues. Guided tissue regeneration, bone grafting with either blocks or particulated material, ridge augmentation, gingival grafting, distraction osteogenesis, and sinus elevation are some of the most frequently used and documented methods of restoring tissue architecture. However, these methods are invasive, time-consuming, and expensive. They are also associated with morbidity (for example, at graft donor sites)[6] and, occasionally, unpredictable resorption.[7] Thus, noninvasive and more predictable techniques have been sought.

In the mid-1970s, Ingber[1,8] advocated forced eruption of diseased teeth to treat one- and 2-wall defects. Salama and Salama[9] introduced forced eruption as a method of developing/restoring tissues prior to implant treatment. Subsequent studies reported success with this technique prior to both conventional and implant therapies.[2,10-13]

Figure 1. Initial appearance of the patient (June 7, 2010). Excessive gingival display, a midline diastema, gingival and dental asymmetry, rotated maxillary left canine (No. 11), and short clinical crowns on most teeth are apparent.

Figure 2. Initial periapical view of the maxillary central incisors (June 7, 2010).

Figure 3. Palatal view showing significant attachment loss, dehiscence, and heavy subgingival calculus (October 9, 2010).

The method is predictable and can be done more quickly than many other techniques....

The method is predictable and can be done more quickly than many other techniques, saving time and expense.

The current report details the treatment of a patient with excessive gingival display, a midline diastema, asymmetry at the maxillary central incisors, and significant attachment loss caused by periodontal disease. Her disease activity was controlled, attachment levels were improved and stabilized, and a poor aesthetic appearance was corrected through periodontal therapy, OFE, and crown lengthening surgery.

CASE REPORT

A 55-year-old female smoker was not happy with her smile and rejected a proposed treatment plan from another office that involved extraction of "2 upper front teeth" and placement of 2 adjacent implants. Clinical and radiographic evaluation disclosed excessive gingival display, incomplete passive eruption, asymmetry of the maxillary central incisors, a midline diastema, and significant attachment loss in the anterior maxilla (Figures 1 to 4). The only tooth in her anterior maxilla that showed aesthetic proportions was the left central incisor (No. 9); the other teeth had rather short crowns.

A treatment plan was recommended to harmonize the remaining teeth in the aesthetic zone with the maxillary left central incisor. The proposal included OFE following nonsurgical periodontal therapy (scaling and root planing) and surgical treatment, which included flap surgery to treat teeth No. 8 (maxillary right central incisor) and No. 9, and crown lengthening surgery for the remaining maxillary anterior teeth. The patient agreed to periodontic-orthodontic-restorative therapy. The OFE was needed to minimize the ridge deformity; these are hard to hide and difficult to manage following the removal of maxillary anterior teeth. The key to the success of this

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treatment plan was careful implementation of OFE to support the restorative effort.

The periodontal surgery disclosed severe bone loss on the palatal aspect of teeth Nos. 8 and 9 with heavy calculus deposits. The bone loss was more severe on No. 9 than on No. 8 (Figure 2). Following removal of infected tissue and calculus, periodontal regenerative therapy (PRT) was performed; this included bone grafting, application of demineralized freeze-dried bone allograft (LifeNet Health), and placement of a resorbable bilayer collagen membrane (Geistlich Bio-Gide [Geistlich Pharma North America]).

The patient was referred to an orthodontist, and examination and treatment were as follows: The orthodontic exam revealed a good Class I occlusion with generalized periodontitis; in particular, severe horizontal and vertical bone loss around teeth Nos. 8 and 9. Teeth Nos. 8 and 9 had a hopeless prognosis due to severe periodontal defects, mobility, poor crown-to-root ratios, and unaesthetic crowns. The treatment plan was to remove Nos. 8 and 9 and replace them with implant restorations. However, the periodontal defects and the likelihood of further alveolar resorption following the extraction of teeth Nos. 8 and 9 meant that the prognosis for placement of implants was poor. Therefore, OFE would be accomplished in order to create new alveolar bone so that implants could be placed.

Orthodontic treatment in the presence of severe periodontal disease is not recommended. Therefore, periodontal treatment was performed to control disease activity. Due to the significant attachment loss and heavy subgingival calculus on the palatal aspect of teeth Nos. 8 and 9 (Figure 2), periodontal surgery was performed to gain access to the roots of the teeth and the bony defects to resolve the inflammation, stop bleeding on probing, reduce the pocket depth, and remove the calculus. After a flap was raised and the necrotic tissue and calculus were removed, PRT was performed to prepare teeth Nos. 8 and 9 for OFE. The proposed orthodontic therapy would slowly erupt teeth Nos. 8 and 9 to improve alveolar height and minimize bony defects in the alveolus that would result from the extraction of these teeth.

On November 24, 2010, partial fixed orthodontic appliances (0.018-inch Innovation-R [GAC International] self-ligating brackets) were placed on the anterior teeth (Nos. 6 to 11), and anchor tubes were placed on teeth Nos. 3 and 14 (0.022-inch) (Figures 5 to 7). A 0.016-inch Ni-Ti wire was placed to align teeth Nos. 6 to 11; No. 11 in particular required derotation. Derotation of No. 11 took somewhat longer than expected but was accomplished by May 4, 2011 (Figure 5). At this time a 0.016- x 0.022-inch braided wire (Quad Cat) was placed with 1.5-mm step-down bends to slowly super-erupt teeth Nos. 8 and 9.

Figure 4. Facial view of teeth Nos. 8 and 9 showing the buccal plate, which was missing on the palatal aspect (October 9, 2010).

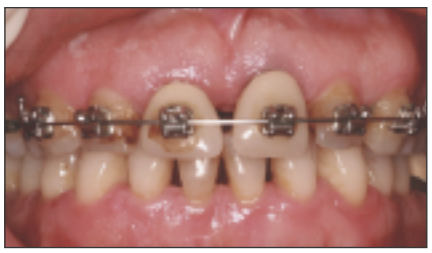

Figure 5. Intraoral view (April 25, 2011) after 8 weeks of orthodontic treatment to rotate the maxillary left canine (No. 11).

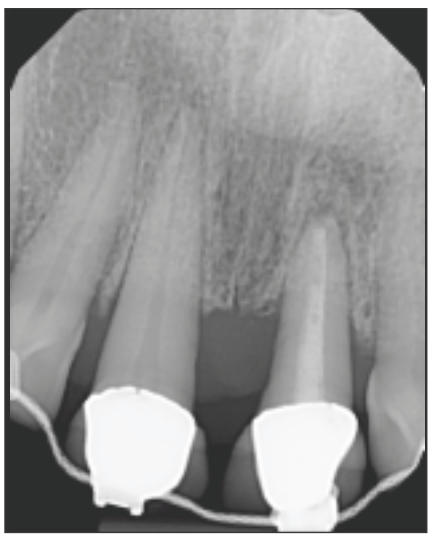

Figure 6. Periapical radiograph taken during orthodontic forced eruption (OFE) (July 6, 2011).

Figure 7. Clinical appearance on July 6, 2011, during orthodontic therapy, after 8 weeks of forced eruption of the incisors and canines and reduction of the central incisor crowns from fremitus.

During the next several months, the patient was seen about every 3 to 4 weeks; at each appointment, the wire was activated 0.5 to 1.0 mm to erupt teeth Nos. 8 and 9. In addition, at each appointment, the teeth were evaluated to eliminate any fremitus (traumatic occlusion) and the clinical crowns of teeth Nos. 8 and 9 were adjusted accordingly (Figures 6 and 7). The objective during this time was to slowly erupt the teeth so that the tension on the periodontal ligament would stimulate osteoblastic activity and the erupting tooth would bring bone with it. Close monitoring and elimination of fremitus were important so that untoward occlusal forces would not result in the destruction of bone. During this time, teeth Nos. 8 and 9 each erupted 4 to 5 mm, and the interproximal spaces were distributed for ideal restoration. On September 29, 2011, the fixed appliances were removed. The patient was instructed to wear a clear (Essix-type) retainer for 12 hours per day and to return to the periodontist and general dentist to plan for the replacement of teeth Nos. 8 and 9.

However, tooth No. 8 had responded positively to periodontal-regenerative therapy; therefore the decision was made to retain it and utilize it as an abutment for the definitive prosthesis. Tooth No. 9 remained hopeless. The original treatment plan included placement of an implant following the extraction of tooth No. 9, but the patient now refused the implant, since the remaining teeth in the aesthetic zone would still require prosthetic restoration to achieve an acceptable appearance. The OFE improved alveolar height for both Nos. 8 and 9. This approach resulted in the creation of new alveolar bone. The multidisciplinary treatment in this case significantly improved the aesthetic appearance of a patient who was not happy with her diastema, excessive gingival display, midline asymmetry, tooth mobility, and significant bone loss.

The definitive prosthesis was placed a year later. Excellent aesthetics and strong function were established for this patient, who originally suffered from generalized moderate and localized severe periodontitis. The patient was pleased with the final appearance of her smile (Figures 8 to 11) and stopped smoking. The aesthetics of the definitive restoration may have been improved by moving the gingival margin of crown No. 8 apically to make it symmetrical with pontic No. 9. This highlights the need for meticulous detailed communication between the treating professionals and the patient during all phases of this type of treatment.

Many authors have investigated the use of extrusion for teeth that would otherwise be considered nonrestorable.

DISCUSSION

Dentists have been exploring the possibility of forced eruption of diseased teeth as a means of augmenting soft and hard tissue and eliminating infrabony defects since the 1970s.[1,8] Since then, many reports of successful forced eruption/extrusion followed by retention and conservative restoration of what would have been hopeless teeth have been published.[2,10-12] In addition to its predictability, forced eruption can usually be completed fairly quickly; Biggerstaff et al[2] completed treatment in 3 patients within about 4 weeks.

Van Venrooy and Yukna[3] provided proof of principle for OFE in an animal study. The attachment apparatus was damaged and periodontal disease was induced in beagle dogs. Teeth extruded with orthodontic elastics were less mobile and displayed shallower pockets, less bleeding, and radiographic bone gain, whereas control (untreated) teeth showed no improvement after 21 days.

In clinical studies, many authors have investigated the use of extrusion for teeth that would otherwise be considered nonrestorable. Biggerstaff et al[2] "reclaimed" nonrestorable teeth with OFE in 3 patients with teeth with compromised gingival margins caused by tooth fractures or perforation of the gingiva. The authors[2] found that the technique was relatively simple and quick, and bone support was regained because the process resembled normal tooth eruption. Camargo et al[10] declared OFE the "technique of choice" prior to crown lengthening in the aesthetic zone. Fakhry[11] also advocated OFE as a more conservative method of restoring teeth, even in sites with minimal coronal tooth structure in the aesthetic zone, but cautioned against overaggressive use of the technique to pre-

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vent periodontal damage and harm to coronal tooth structure.

Many authors have reported on the use of OFE to restore fractured teeth or roots as a means of avoiding more aggressive treatment, including extraction. Goenka et al[14] discussed the use of OFE for teeth that had fractured at or coronal to the gingival level. They[14] reported on the successful treatment of such a case with OFE followed by prosthetic treatment. Addy et al[15] reviewed the literature on treatment of root fractures, noting that sufficient root length was needed to ensure success and avoid extraction of the injured tooth. Valerio et al[16] stated that, in addition, the ferrule should be adequate and the biologic width of the injured tooth/root must be intact to perform OFE and avoid surgical treatment.

As the use of implants has increased, clinicians have used OFE more frequently prior to implant placement to prepare sites to receive implants. Makhmalbaf and Chee[17] cited forced eruption as a viable alternative to preimplantation bone augmentation in their treatment of a woman with bone and gingiva loss. Mankoo and Frost[12] used OFE in 2 patients with advanced periodontal loss. The procedure provided sufficient vertical augmentation for implant placement. Mirmarashi et al[18] showed that OFE could assist in the transition to definitive implant prosthetic treatment. While the teeth to be extracted remained in situ, they were used not only to assist in developing an appropriate soft- and hard-tissue profile, but they also supported a fixed provisional restoration so that a removable provisional was not needed. Amato et al[19] found that OFE prior to implant treatment was successful for bone regeneration about 70% of the time and for gingival augmentation in about 60% of cases. The implant survival rate in their series[19] of 11 patients (27 implants) was 96%. Kan et al[20] used an interdisciplinary approach (periodontics, orthodontics, and prosthodontics) to modify the tissue architecture in the aesthetic zone for multiple adjacent teeth.

Tarnow et al[21] noted that there is about a one- or 2-mm difference between the thickness of the peri-implant soft tissue and that of the soft tissue around the natural dentition, with implants being associated with thinner tissue. The crest of bone at the implant neck should be 2 mm coronal to the bone around the adjacent natural tooth to ensure optimal control of soft-tissue aesthetics and avoid the "black triangle" caused by inadequate papillae.[21]

Rokn et al[13] noted that most attempts at vertical augmentation were unpredictable, whether done via sinus elevation, guided bone regeneration, or distraction osteogenesis; resorption might be minimal or very dramatic and uneven. In addition, these techniques are very invasive, time consuming, and expensive.

Figure 8. Clinical appearance on September 29, 2011, following removal of orthodontic appliances.

Figure 9. Final appearance (March 24, 2012) after one year of periodontic-orthodontic-restorative therapy.

Figure 10. Final appearance in the aesthetic zone. The prosthesis is supported by healthy, pink, and firm keratinized gingiva.

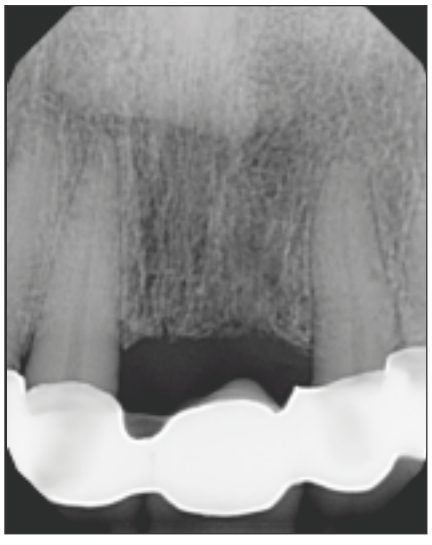

Figure 11. Radiographic appearance after OFE, extraction, crown lengthening, and prosthesis placement.

Periodontal treatment and OFE followed by implant therapy in a woman with generalized aggressive periodontitis was successful, resulting in shallower probing pocket depths, improved hard- and soft-tissue margins, and restoration with an implant-supported prosthesis.

CONCLUSION

OFE may allow for retention and restoration of otherwise hopeless teeth, and it may also provide an alternative to ridge augmentation surgery to regenerate lost hard and soft tissues prior to implant placement or delivery of a fixed partial denture. Extrusion will decrease periodontal pocket depths, and in the case presented, it saved tooth No. 8. In conjunction with conventional periodontal treatment of maxillary anterior teeth, OFE is a viable and noninvasive solution to a patient's aesthetic concerns when dealing with management of a nontreatable tooth in the aesthetic zone. Most patients, if given a choice, will prefer quicker, less aggressive, and more cost-effective treatment, and OFE should be considered in appropriate cases.✦

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