Treatment of Bimaxillary Protrusion by Corticotomy-Assisted Orthodontics

ABSTRACT

The two most important aspects of orthodontic treatment are esthetics and treatment duration. Acceleration in orthodontic tooth movement has been frequently reported by corticotomy-facilitated orthodontic treatment. This case report presents a patient of Class I bimaxillary protrusion treated with all first premolar extraction. Selective alveolar decortication with fixed mechanotherapy was carried out. Light forces were applied after the surgical procedure with frequent activation for retraction. The total treatment time was 15 months with anterior retraction completed in just 3½ months. Successful space closure was achieved in a shorter duration with no adverse effects on the periodontium.

Keywords: Bimaxillary protrusion, Corticotomy, Regional accelerator phenomenon.

INTRODUCTION

Over the past decade, alveolar decortications, or “corticotomies,” have become a popular way of increasing the rate of tooth movement where the cortical layer of bone is cut or perforated to the depth of the medullary bone without creating a mobile segment. Wilcko et al., who brought alveolar decortication into mainstream orthodontics, were the first to emphasize that the treatment effect was because of the regional acceleratory phenomenon (RAP) that facilitates the orthodontic tooth movement.

Corticotomies initiate the RAP; they increase the rate of bone remodeling, reduce mineral density, and create a transient osteopenia. The RAP is a normal localized reaction of soft and hard tissues to noxious stimuli. It is associated with increased perfusion and bone turnover and decreased bone density. Importantly, the RAP is simply an acceleration of existing biological processes; it does not elicit new processes. Bimaxillary protrusion, a frequently encountered malocclusion in clinical practice, is characterized by protrusive and proclined upper and lower incisors and an increased procumbency of the lips. Adult patients with bimaxillary protrusion requiring maximum anchorage usually require at least 2 years of active treatment. However, there is a constant demand to shorten the treatment time. To meet their expectation without compromising the treatment outcome, orthodontic treatment combined with corticotomy has been brought into practice.

In adult patients, this technique significantly shortens the treatment time by reducing the resistance of the dense cortical bone to tooth movement. Also, a better bone support is seen due to addition of bone graft, with decreased chances of relapse.

This article describes the management of an adult patient with Class I bimaxillary protrusion malocclusion with proclined incisors, incompetent lips, and a convex facial profile. The orthodontic treatment included extraction of all first premolars followed by fixed orthodontic treatment aided with corticotomy of the upper arch.

CASE REPORT

An 18-year-old postpubertal female patient reported with the chief complaint of forwardly placed and spaced upper front teeth since childhood. She had no significant medical history. No signs or symptoms of temporomandibular dysfunction were noted. She had no previous experience of dental treatment.

EXTRAORAL EXAMINATION

Patient had a mesoprosopos face and incompetent lips. Profile examination revealed a convex, posteriorly divergent facial form and an acute nasolabial angle. Excessive incisor display was seen at rest and at smiling (Fig. 1).
INTRAORAL EXAMINATION

Intraoral examination revealed a bilateral Angle’s Class I molar relationship, overjet of 8 mm, and overbite of 2 mm (20%) with a moderate curve of Spee. The arches were U shaped and asymmetrical. Spacing of 8 mm was seen in maxilla and crowding of 4 mm was seen in mandible with no transverse discrepancy. The upper and lower midline was centered. Soft tissue examination revealed a satisfactory periodontal health (Fig. 2).

RADIOGRAPHIC EXAMINATION

The panoramic radiograph showed no caries, no bony deficits, and a normal bone level. All the teeth including the third molars were present (Fig. 3). Cephalometric examination revealed a Class I skeletal base (ANB angle 3°), vertical growth pattern (GoGn-Sn 35°, FMA 31.5°), proclined maxillary incisors (U1 to NA 47°), proclined mandibular incisors (L1 to NB 34°; Incisor mandibular plane angle (IMPA) 105°), an acute nasolabial angle of 85° with protrusive upper and lower lips (U lip–S line +2.5 mm; L lip–S line +4.5 mm) (Fig. 4 and Table 1).

TREATMENT OBJECTIVES

The treatment objectives included (1) consolidation of spacing in maxilla, (2) correction of crowding in mandible, (3) correction of proclined incisors, (4) obtaining an ideal overjet and overbite, and (5) improving the facial and dental esthetics with an esthetic smile.

Keeping in mind the age and growth status of the patient, the demand of a faster treatment time was met with corticotomy-assisted orthodontic tooth movement. The treatment plan involved extraction of all first
TREATMENT PROGRESS

In the first stage, the lower first premolars were extracted (to relieve crowding) and both the upper and lower arches were bonded with preadjusted appliances of 0.022” × 0.28” slot dimension (MBT prescription; 3M Unitek). A transpalatal arch was given in the upper arch for anchorage (Fig. 5).

Monthly visits and necessary adjustments were made until alignment and leveling were completed with correction of crowding in lower arch and closure of spaces in the upper arch. The arches were leveled with continuous archwires, starting with 0.016” nickel–titanium (NiTi) wire in both arches till 0.017 × 0.025 SS fitted passively into the bracket slot in both the arches.

In the next stage, the surgical procedure was carried out. A full-thickness mucoperiosteal flap was reflected mesial to the second premolar on the labial and palatal side of the maxillary arch keeping the interdental papilla intact. Decortication of the alveolar bone was carried out using a round bur in a high-speed air rotor handpiece. Vertical decortication cuts were made in the interradicular space extending from a point 2 to 3 mm below the crest of the bone to a point 2 mm beyond the apices of the roots. Horizontal corticotomy cuts were placed to connect the vertical cuts along with alveolar perforations. Simultaneous extraction of first premolars was carried out in the upper arch. A demineralized freeze-dried bone allograft was placed over the surgical site to aid in alveolar augmentation. The flaps were repositioned and sutured (Fig. 6). The patient was kept under antibiotic coverage and a periodontal pack was placed for 2 weeks following which the sutures were removed and active forces were applied for en masse retraction of the upper anterior teeth using sliding mechanics (Fig. 7).

Retraction was completed in 3½ months. Settling was done on 0.016” NiTi wire in a Class II pattern for a period of 2 months. Total treatment time was 1 year and 3 months (15 months). Hawley retainers were delivered to secure the stability of both the arches (Fig. 8).
TREATMENT RESULTS
Posttreatment records showed that the treatment objectives were achieved. The facial photographs showed improved esthetics. A straight facial profile, competent lips, and an esthetic smile were appreciated (Fig. 9). Class I canine and molar relation was maintained with well-aligned arches,
acceptable overjet and overbite, and good interdigitation. The interdental papilla was preserved and no gingival recession was seen (Fig. 10).

The posttreatment panoramic radiograph showed parallel root positions with no significant signs of bone or root resorption (Fig. 11). Posttreatment lateral cephalometric analysis showed no skeletal changes, normally inclined upper and lower incisors (U1 to NA 20°, L1 to NB 27°, IMPA 99°), an obtuse nasolabial angle of 110° with reduced protrusion of upper and lower lips (U lip–S line 0 mm; L lip–S line +2.5 mm) (Fig. 12, Table 1).
DISCUSSION

Surgically facilitated orthodontic treatment modalities have been in the literature since the 1950s with more case reports surfacing in the late 1980s and early 1990s. Wilcko et al reintroduced a surgical treatment modality consisting of an in-office periodontal procedure (corticotomy) combined with orthodontic tooth movement. Following the surgical procedure, the teeth were moved rapidly into the grafted bone.

A recent study has shown that the greater the surgical insult, the greater the osteopenia, alveolar decalcification, and more rapid the tooth movement. Systematic reviews conclude that surgically facilitated orthodontics is safe for the oral tissues and results in a phase of temporarily accelerated tooth movement.

Reducing the orthodontic treatment time is one of the major concerns of both the orthodontist and the patient. Longer duration of treatment predisposes to caries, external root resorption as well as decreases patient cooperation. Fixed mechanotherapy coupled with alveolar corticotomy has been proposed as an alternative to conventional orthodontic treatment for rapid tooth movement.

Studies report that teeth can be moved 2 to 3 times further in 1/3 to 1/4 the time required for traditional orthodontic therapy. Chung et al reported that the complete retraction of anterior teeth combined with corticotomy in a case with severe bimaxillary protrusion took less than 3½ months. According to the clinical observations of Duker, the required position of the teeth after corticotomy could be achieved even earlier than 1½ to 3 months. Germeç et al observed the total dramatical reduction in the orthodontic treatment time (16 months) when compared with the average treatment time for extraction therapy (31 months).

In the above treated case of bimaxillary protrusion, faster results were achieved with no detrimental effects on the hard and soft tissues. Although numerous case reports of corticotomy-combined orthodontics have been published, controlled clinical and histological studies are needed for better understanding of the biology of tooth movement with this procedure and its effect on the periodontium and postretention stability. Long-term studies are needed to evaluate the advantages and disadvantages of this technique.

CONCLUSION

Corticotomy-facilitated orthodontics is an effective treatment alternative in adults with severe malocclusion to decrease the treatment time and increase the quality of treatment. The periodontist plays a crucial role in assisting orthodontists to achieve the desirable results in a shorter period of time. It is an effective method for maximum anchorage cases in adult patients as it helps to overcome many of the current limitations of this treatment, including lengthy duration, potential for periodontal complications, lack of growth, and the limited envelope of tooth movement. The mechanism behind corticotomy-assisted orthodontic treatment can be summarized as the induction of bone metabolism via decortication lines and points around the teeth to be moved to enhance bone and periodontal turnover, resulting in a transient stage of osteopenia during treatment.

REFERENCES