Case Report

Corticotomy-facilitated Orthodontic Correction of Ectopic Central Incisor – A Case Report

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Abstract

Alternative techniques such as surgically-facilitated orthodontic therapy (SFOT), using corticotomy and single- or multiple-tooth osteotomy to enhance orthodontic tooth movements, are gaining popularity. Presented here is a case report of correction of an ectopically erupted maxillary central incisor using corticotomy-facilitated orthodontic treatment. The results were achieved in comparatively lesser time with good retention and stability.

Introduction

Dental practitioners are searching continually for science-based treatment options to better address the needs and concerns of patients and to achieve better treatment acceptance. This need is particularly true for adult patients whose problems can prove much more difficult to treat when compared with children because of the inherent lack of growth. To further complicate the problem, orthognathic surgical options are being selected less often, even though they are an optimal choice for the treatment of skeletal discrepancies. At the same time, patients of all age groups are demanding shorter treatment times.

These are just some of the reasons for alternative techniques for the development of surgically-facilitated orthodontic therapy (SFOT). SFOT techniques, using corticotomy and single- or multiple-tooth osteotomy to enhance orthodontic movement, are gaining popularity(1).

A corticotomy is a surgical technique in which only the cortical bone is cut, perforated, or mechanically altered to the depth of the medullary bone and the medullary bone remains intact. Some of the techniques suggest buccal and

lingual corticotomy(2), while others recommend corticotomy on the buccal side to promote expansion. Some techniques routinely recommend extensive bone grafting in an attempt to facilitate bone development, while others do not. All of the corticotomy techniques primarily focus on weakening the cortical bone-tooth interface. Frost, an orthopedic surgeon, in his description of bone repair, suggested one of the desired effects of decortication(3). Physiologically, this theory proposes that when bone is injured or decorticated, it initiates a normal healing process with exuberant bone remodeling that is directly related to degree and proximity of bone trauma. Frost named this process regional acceleratory phenomenon (RAP) (3). Since then, this theory has been rigorously studied and proposed as a method of accelerating orthodontic treatment by other researchers(2, 4-6).

Numerous animal studies have shown up to a five-fold increase in medullary bone turnover in areas adjacent to corticotomy sites(7). It is speculated that this high medullary bone turnover in healthy tissues results in new bone formation and low bone density, which are conditions that promote rapid tooth movement with less root resorption(8). In addition, Chung et al. suggested that corticotomy combined with heavy forces lead to histologic

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Fig.1 Extra-oral image.

changes known as compression osteogenesis, in which the medullary bone of the decorticated segment can be bent to expand the traditional boundaries of orthodontic treatment (9).

Recently, Wilcko developed a patented technique called Accelerated Osteogenic Orthodontics (AOO) or Periodontally Accelerated Osteogenic Orthodontics (PAOO). This technique is similar to conventional corticotomy, except that selective decortication in the form of lines and points is performed over all teeth that are to be moved. In addition, a resorbable bone graft is placed over surgical sites to augment confining bone during tooth movement. After a healing period of one or two weeks, orthodontic tooth movement is started and then followed up using a faster rate of activation at two week intervals (10, 11).

Case Report

A 12-year-old male patient reported to us with a chief complaint of presence of one tooth over another and gap between upper front teeth. Clinical examination revealed the following findings:

Extra-oral examination (Fig. 1):

- Dolichocephalic
- Leptoprosopic
- Mild convex Facial Profile
- Competent Lips

Fig.2 Intra-oral image showing ectopically erupted right maxillary central incisor.

Fig.3 Lateral cephalogram showing labially placed maxillary central incisor.

- Acute nasolabial angle
- Deep mentolabial sulcus

Intra-oral examination (Fig. 2):

- End-on molar relationship on right side and class I on left side
- End-on canine relationship on both sides
- Increased overbite
- Ectopically erupted maxillary right central incisor
- Localized upper and lower anterior spacing
- Lower dental midline shifted right by 2 mm and upper dental midline by 1 mm
- 6 mm space between 21 and 22
- Rotation of 24, 25 and 32.

Table 1 Cephalometric measurements

Measurement	Norm/SD	Pre-treatment	Post-treatment
SNA	82 + / - 2	83	83
SNB	80 + / - 2	78	80
ANB	2 + / - 2	5	3
Wits appraisal (mm)	0	2	1
FMA	25 + / - 2	25	27
U1-NA (degree)	22 + / - 2	25	23
U1-NA (mm)	4	5	4
L1-NB (degree)	25 + / - 2	26	25
L1-NB (mm)	4	5	4
IMPA	90 + / - 5	98	93
Nasolabial angle	102 + / - 2	96	100
E-line (upper lip)	-4	2	0
E-line (lower lip)	-2	1	-1

Fig.4 OPG showing maxillary right central incisor overlapping lateral incisor.

All routine diagnostic aids were used, including lateral cephalogram (Fig. 3), with cephalometric analysis (Table 1) and O.P.G. (Fig. 4).

Diagnosis

Mild skeletal class II with average growth pattern and dental class I malocclusion.

Treatment objectives

- To achieve optimum facial esthetics.
- To correct ectopically erupted I1
- To achieve Class I molar and canine relations on both sides
- To correct spacing
- To correct rotations
- To correct midline shift.

Treatment plan: To obtain the above objectives, we decided to treat the case with a non-extraction method using a 0.022" Pre-adjusted Edgewise Appliance. To gain the

Fig.5 Surgical image of corticotomy procedure.

space required in the upper arch, a Quad-helix was used to expand the dental arch. To facilitate the alignment of the ectopic central incisor, we decided to use the corticotomy procedure, which was selected as the patient's father had a job with the possibility of transfer and they insisted on completing the treatment within a year.

Treatment progress

The 0.022" PEA appliance (Roth prescription) appliance was bonded to the upper and lower arches, except in the ectopic maxillary central incisor. A quad-helix was soldered to upper first molar and extended to the canines for mild dental expansion. Leveling and alignment of both arches and creating space for the central incisor were performed with NiTi and stainless steel archwires that were progressively changed. The patient was prepared for corticotomy at the end of 4 months (Fig. 5).

Fig. 6 Post-treatment photograph.

A standard edgewise bracket with power arms was bonded to 11, and 21 was banded with another standard edgewise bracket and power arm. The power arms make the point of force application closer to the center of resistance, thus helping to achieve maximum bodily tooth movement. E-chains were applied from 21 to bring the ectopic incisor to the arch.

Corticotomy procedure

After a periodontal full flap was dissected, by using small round burs, vertical lines (2 mm depth corticotomy) parallel to the root of the central incisor were created 5 mm beyond the apex in the maxillary bones and interconnecting the lines at the apex by horizontal corticotomy. The marginal bone crest was not touched by these surgical procedures. While osteotomy cuts were recommended on both alveolar surfaces (buccal and lingual), two recently published case reports showed the results of selective corticotomy limited to the buccal and labial surfaces to reduce surgery time and postoperative patient discomfort, and to avoid the risk of violating vital lingual anatomy (12, 13).

By the end of 10 months the central incisor was brought to the arch. Finishing and detailing was then carried out with selective grinding, and the treatment was completed at month 15 (Fig. 6). Removable Hawley's retainers were used for both arches.

Corticotomy procedure helped to move the ectopic central incisor to its correct position in the fastest and most effective manner within a period of 5 and half months. Total movement was about 6 mm horizontally (mesial) and 10 mm vertically (extrusion). All the desired treatment objectives viz. correction of molar and canine relations to Class I, correction of midline shift and rotation were achieved on completion of active orthodontic treatment

Fig. 7 Post-treatment OPG.

(Fig. 7).

Discussion

Corticotomy appears to “supercharge” traditional orthodontic therapy and make the associated dentoalveolar complex more plastic and malleable. This is very effective in accelerating orthodontic rotation and tipping movements and in helping moderate-arch development. After healing, results appear to be very stable, probably because of reduced tissue memory as compared with traditional orthodontic tooth movement.

CAOT is a promising technique that has many applications in orthodontic treatment because it helps to overcome many of the current limitations of this treatment, including lengthy duration, potential for periodontal complications, lack of growth (in adult patients) and the limited envelope of tooth movement. The mechanism behind CAOT can be summarized as 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. This enhances and accelerates tooth movement if followed by a short period of orthodontic appliance treatment. As opposed to conventional osteotomy used in alveolar distraction, the preservation of the medullar vasculature during a corticotomy procedure provides an adequate blood supply and nutrition. This accelerates the rate of tissue healing and remodeling and hence orthodontic movement can start immediately after surgery. It has been calculated that the rate of tooth movement is doubled (2.5 mm to 3 mm at day 25) in comparison to standard orthodontics without any detrimental effects on periodontal tissues. This surgically assisted approach for improved tooth movement is beneficial for molar intrusion, space closure, de-crowding and open bite management. Most of the recently published literature

shows no adverse effects of corticotomy on the periodontium (12, 14). In the present case, no reduction in the crest bone height, gingival recession or apical root resorption was seen after orthodontic treatment. The disadvantages of this procedure are the need for more frequent activation when compared to conventional orthodontic treatment, the extra expenses for periodontal surgery, and the mild postoperative discomfort that the patient needs to tolerate for a faster treatment course.

Conclusion

This case presents an exciting new concept to address dentoalveolar discrepancies using corticotomy, and active orthodontics. These techniques have significantly changed the way many providers diagnose and treat patients. SFOT procedures are likely to gain greater acceptance as more clinical evidence emerges and more refined protocols become available.

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