

## Periodontally Accelerated Osteogenic Orthodontics: Case Series, Review and Update

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### How to cite the article:

Chandy S, Paul RK, Sunil PC, Babu G, Vallabhan CG. Periodontally accelerated osteogenic orthodontics: Case series, review and update. J Int Oral Health 2015;7(11):118-121.

### Abstract:

The use of orthodontic treatment in adult patients is becoming more common and these patients have different requirements specially regarding duration of treatment and facial and dental aesthetics. Alveolar corticotomy is an effective means of accelerating orthodontic treatment. Orthodontic treatment time is reduced with this technique to one-third of that in conventional orthodontics. The most important factors in the success of this technique is proper case selection, surgical and orthodontic treatment. The aim of this article is to present a comprehensive review of the literature, including contemporary clinical techniques, case reports, indications, contraindications, complications, and side effects.

**Key Words:** Corticotomy facilitated orthodontics, periodontally accelerated osteogenic orthodontics, regional acceleratory phenomena

### Introduction

Conventional orthodontics depends solely on periodontal ligament mediated tooth movement and for good treatment results to be possible; the patient must have a sound periodontium. Periodontal therapy done adjuvantly with orthodontic therapy can prove beneficial to patient by either preventing relapse or by helping to maintain good oral hygiene. On the other hand, malalignment of teeth is often associated with plaque accumulation and periodontal breakdown which can be corrected by orthodontic treatment thereby positively influencing the periodontal health. Thus, periodontic-orthodontic interrelationships can impart a remarkable dimension to the whole treatment outcome.<sup>1</sup>

Recent years have witnessed a significant increase in the number of patients' especially older patients, seeking

orthodontic treatment for malocclusion. Time limitation is a common problem of many orthodontic patients. This constant demand for a shortened orthodontic treatment time paved the way for the development of many novel techniques intended to speed up the process. Application of device-assisted therapy such as pulsed electromagnetic fields and direct electric current to selected teeth,<sup>2</sup> prostaglandins, osteocalcin,<sup>3</sup> photobiomodulation with low-level laser therapy<sup>4</sup> are some of the techniques demonstrated by several studies to be effective in accelerating the tooth movement. However down the years, clinical experiences proved that these methods are not without undesirable side effects. In 1998, Wilcko brothers reintroduced corticotomy facilitated orthodontics, already described by Kole in 1959, with some modifications, which was based on the fact that mechanical force alone was insufficient for rapid tooth movement and that a surgical stimuli by virtue of inducing transient osteopenia would result in acceleration of tooth movement.<sup>3</sup>

### Review and Update of Periodontally Accelerated Osteogenic Orthodontics (PAOO)

#### History of corticotomy facilitated orthodontics

1893 witnessed the introduction of corticotomy facilitated orthodontics by Bryan. Kole in 1959 described the Kole's bony block technique which was later put down by many orthodontists' due to its aggressive nature. In 1972, the first experimental animal study of alveolar corticotomy was done by Bell and Levy.<sup>5</sup> In 1975 Duker conducted a study on beagle dogs to determine the effect of corticotomy on teeth vitality and marginal periodontium.<sup>6</sup>

In 2000, the Wilckos reported on a novel technique in which they amalgamated corticotomy facilitated orthodontic technique with alveolar augmentation and titled it as accelerated osteogenic orthodontics, which was recently renamed as PAOO. This technique includes reflection of full thickness flaps prior to selective alveolar decortication in the intended area performed just 2 mm short of the alveolar bone extending beyond the apices of the teeth. These corticotomy cuts must perforate the cortical bone only and barely extend into the medullary bone. Bone graft consisting of demineralized freeze-dried bone and bovine bone can then be applied directly over the bone cuts and the flap sutured in place. Following the surgery, orthodontic adjustments were made approximately every 2 weeks.<sup>7,8</sup>

The fundamental aim of accelerated osteogenic orthodontics surgery is to decrease the resistance offered by cortical bone

to tooth movement by creation of relatively thin layer of bone over root prominences. Alveolar augmentation of labial and lingual cortical plates using bone grafts are used in an effort to enhance and strengthen the periodontium.<sup>7</sup>

The biologic rationale behind tooth movement following corticotomy facilitated orthodontics was explained by the Wilckos as a result of demineralization/remineralization process occurring in and around the corticotomied sites. This was found to be consistent with the “regional acceleratory phenomenon” described by Frost. According to regional acceleratory phenomena (RAP), injury to bone/decortication triggers normal bone healing.<sup>7</sup> Thus, it should be assumed that decortication can set off increased medullary bone turn over adjacent to corticotomy sites resulting in low bone density which promotes rapid tooth movement with less root resorption.<sup>8</sup> This concept of RAP revolutionized PAOO and overthrew the “Bony Block Concept” by Kole that prevailed till that time.

The need for flap reflection remained the major limitation of PAOO which led to the introduction of a minimally invasive technique called corticision – A flapless transmucosal procedure by Kim *et al.* and Kim *et al.* This technique results in rapid resorption of bundle bone leading to rapid tooth movement.<sup>3,9</sup> Current developments in the field of orthodontics have focused on the use of human mesenchymal stromal cells allograft due to rapid healing and regeneration potentials with reduced immunological issues with the host tissue.<sup>10</sup> The purpose of this article is to describe the clinical surgical procedure that comprise PAOO procedure.

**Case Reports**

**Case 1 - PAOO using micromotor and bur**

A 24-year-old male patient undergoing conventional fixed appliance therapy for crowding of upper and lower anteriors for past 1 year in the Department of Orthodontics, was referred to Department of Periodontics with complaint of rotated 33. With the conventional orthodontic technique the derotation requires much time and so to scale down the treatment time patient was advised PAOO.

An informed consent was obtained from the patient prior to surgery. After administration of adequate anesthesia (inferior alveolar nerve block), cervicular and interdental incisions were placed from distal papilla of 31 to mesial papilla of 36 (Figure 1). Vertical releasing incisions were given on distofacial line angle of 31 and mesiofacial line angle of 36 and full thickness flap elevated beyond the apical region of 31, 32, 33, 34, 35 both buccally and lingually (Figure 1). Linear vertical groove were placed circumscribing the apical region of 33 of depth 0.5 mm both buccally and lingually in interradicular area using round bur and micromotor handpiece. Decortication holes were made on radicular surface both buccal and lingually (Figure 2). Bone graft (osseomold) mixed with saline was placed in the groove both buccally and lingually. Flap was

approximated using simple interrupted sutures and Coe pack was placed (Figure 3). Analgesics (Tablet Zerodol P tid for 3 days), antibiotics (Capsule Amox 500 mg tid for 5 days), serratiopeptidase (Lyser 20 mg bid for 3 days) and mouthwash (Chlorhexidine 0.2%) was prescribed to the patient. After 2 weeks, patient was recalled for suture removal and reviewing the case (Figure 4).

**Case 2 - PAOO using piezotome**

Patient aged 21 years, female was referred from the Department of Orthodontics, for the management of lower anterior crowding using PAOO. On clinical examination, labially flared 31 and 41 with lingually placed 32 and 42 was observed.



**Figure 1:** Placement of crevicular incision facially using No.: 15 BP blade.



**Figure 2:** Vertical corticotomy grooves placed facially using No.2: round bur.



**Figure 3:** Osseograft placed facially with simple interrupted sutures given and co-pack placed.

Orthodontic brackets were placed 1 week prior to surgery. Clinical preparation should follow the same protocol used for any oral surgical procedures. After administration of bilateral mandibular nerve block, crevicular incisions were given from 33 to 43 joined by vertical releasing incisions facially and crevicular incisions from 33 to 43 on lingual aspect. Full thickness mucoperiosteal flaps were reflected both on the facial and lingual aspects beyond the apices of the teeth (Figure 5). After flap reflection, vertical corticotomy cuts were made between roots in relation to 31, 32, 41, and 42, both facially and lingually using piezotome stopping just short of alveolar crest (approximately 3 mm) (Figure 5). These cuts were connected beyond the apices of teeth with scalloping horizontal cuts. Cortical perforations were made using a diamond round bur (no-2) on selected areas of the radicular surface, facially and lingually. The mucoperiosteal flap was then sutured in position using 4-0 simple interrupted sutures and periodontal pack was placed over the surgical site. Antibiotics, analgesics, antibiotic mouthwash and post-operative instructions were given. After 2 weeks, the patient was recalled for suture removal and healing was found to be uneventful (Figure 6).

**Discussion**

In this case series, two cases were subjected to PAOO which included cases of correction of derotation and crowding by orthodontic treatment. In all these cases, proper asepsis was followed during surgical procedures and care was taken to minimize trauma to the soft tissues. Application of ice packs to the affected area was found to be useful in reducing the degree of post-operative swelling and edema.<sup>5</sup> All the cases were reviewed after a week and satisfactory healing was observed. Cases were reviewed during 3 months, 6 months and 1 year and it was noted that tooth movements occurred much faster when compared with conventional orthodontic treatment. One of the above cases were carried out by piezoincision which has been found to produce good clinical results with minimal invasion when compared with the conventional surgical technique.<sup>2</sup>

In the first case, the treatment result that is derotation of 33 was achieved in just 3 months following PAOO, whereas correction of crowding in the respective case was achieved within 6-8 months, thus slenderizing the treatment time to one-third that of conventional treatment time. This reduction in treatment time is by means of RAP initiated by corticotomy in which tissue formation occurs at a rate which is 2-10 times faster as a response to the stimulus applied. RAP usually begins a few days after application of stimulus, reaches a peak by 1-2 months and lasts for 6-24 months during which the orthodontic treatment has to be done for maximum results to be obtained.<sup>11</sup>

Alveolar corticotomies are intended to remove only the cortical portion of the alveolar bone whereas osteotomies tend to remove both cortical and medullary bone in sufficient



**Figure 4:** Healing after 3 months post-operatively facially and lingually.



**Figure 5:** Vertical corticotomy grooves places facially and lingually using piezotome.



**Figure 6:** Co-pack places and healing after 1 month post-operatively

quantities.<sup>12</sup> Although corticotomy procedure resulted in more bone removal than conventional procedure, no clinical difference in bone support or changes in preferred drug list health was found. This is due to the fact that unlike in true osteotomy where a block of bone gets removed, only perforation of the cortical plate was done leaving the medullary bone intact. This resulted in cell deposition within the existing

area of bone.<sup>13</sup> In both the cases, no history of root resorption was evident even when the teeth were moved rapidly to the desired location and this is a remarkable advantage of PAOO. The possible explanation is that following PAOO the cortical resistance is eliminated and the tooth is orthodontically moved through the much softer medullary bone.<sup>14</sup>

The other advantages include more bone support due to addition of bone graft, low relapse rate and it can be used to accelerate the movement of individual teeth or dental segments and incisor retraction.<sup>11</sup>

Though with many advantages to its credit, PAOO being a surgical procedure is not free from disadvantages such as post-operative pain and swelling, crestal bone loss and possibility of recession. This might be the reason for most of the orthodontic patients turning down the PAOO procedure and opting for conventional orthodontic treatment.<sup>8</sup> In the three above mentioned cases pain and swelling were effectively managed with anti-inflammatory drugs together with serratiopeptidase. The patients were given prior information regarding the procedure and that it was associated with pain and swelling and this helped to ameliorate the post-operative apprehension of the patient. As corticotomy-facilitated tooth movement is a periodontal ligament mediated sterile inflammatory process, non-steroidal anti-inflammatory drugs has been found to be very effective in suppressing the inflammatory response and is recommended.<sup>14</sup> Bone grafting procedures as well as inclusion of connective tissue graft in corticotomies has been found to improve post-treatment alveolar width, as well as enhance aesthetics and gingival health.<sup>15</sup>

### Conclusion

The results from this case series showed that PAOO done under similar conditions produced faster tooth movement in both the cases. PAOO definitely assures a means of reducing the lengthy treatment time in orthodontic patients. This technique does not cause any periodontal damage or bone/root resorption. Further clinical studies with inclusion of many more patients and follow-up are needed to confirm the long-term effects of this technique. With proper case selection and treatment planning, PAOO can definitely be a stepping stone in the future of orthodontic treatment.

### References

1. Vercellotti T, Podesta A. Orthodontic microsurgery: A new surgically guided technique for dental movement. *Int J Periodontics Restorative Dent* 2007;27(4):325-31.
2. Nimeri G, Kau CH, Abou-Kheir NS, Corona R. Acceleration of tooth movement during orthodontic treatment – A frontier in orthodontics. *Prog Orthod* 2013;14:42.
3. Kim SJ, Park YG, Kang SG. Effects of corticision on paradental remodelling in orthodontic tooth movement. *Angle Orthod* 2009;79(2):284-91.
4. Kau CH, Kantarci A, Shaughnessy T, Vachiramon A, Santiwong P, de la Fuente A, et al. Photobiomodulation accelerates orthodontic alignment in the nearly phase of treatment. *Prog Orthod* 2013;14:30.
5. Bell WH, Levy BM. Revascularization and bone healing after maxillary corticotomies. *J Oral Surg*. 1972;30:640-8.
6. Jorge C, Julian C, Elena B, Cesar C. Corticotomy assisted orthodontics. *J Clin Exp Dent* 2012;4:54-9.
7. Hessam N, Frank KY, Hsuang CC. Periodontally accelerated osteogenic orthodontics with autogenous bone grafting. *Compendium* 2008;29:2-8.
8. Hassan AH, Al-Fraidi AA, Al-Saeed SH. Corticotomy-assisted orthodontic treatment: Review. *Open Dent J* 2010;4:159-64.
9. Kim SJ, Moon SU, Kang SG, Park YG. Effects of low-level laser therapy after Corticision on tooth movement and paradental remodelling. *Lasers Surg Med* 2009;41(7):524-33.
10. Vinod K. *Integrated Clinical Orthodontics*, Vol. 4. London: Wiley-Blackwell; 2012. p. 392-419.
11. Alghamdi AS. Corticotomy facilitated orthodontics: Review of a technique. *Saudi Dent J* 2010;22(1):1-5.
12. Dano DO, Bruno Franco de O, Rodrigo VS. Alveolar corticotomies in orthodontics: Indications and effects on tooth movement. *Dent Press J Orthod* 2010;15:144-57.
13. Fischer TJ. Orthodontic treatment acceleration with corticotomy-assisted exposure of palatally impacted canines. *Angle Orthod* 2007;77(3):417-20.
14. Wilcko W, Wilcko MT. Accelerating tooth movement: The case for corticotomy-induced orthodontics. *Am J Orthod Dentofacial Orthop* 2013;144(1):4-12.
15. Patel N. Corticotomy assisted orthodontics: A review of surgical technique and literature. *OA Dent* 2014;2:1-8.