Case Report

Periodontally accelerated osteogenic orthodontics: Novel perio-ortho interrelationship

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Abstract:
Periodontally accelerated osteogenic orthodontics (PAOO) is a clinical procedure that incorporates selective corticotomy, particulate grafting, and application of optimal orthodontic forces. It reduces treatment time, increases stability of teeth, and prevents relapse of orthodontic tooth movement (OTM). The present case report highlights the technique and principles of PAOO for rapid OTM.

Key words:
Corticotomy, orthodontic tooth movements, periodontal accelerated osteogenic orthodontics, piezoelectric surgery

INTRODUCTION

Malpositioned teeth are responsible for esthetic and occlusal aberrations in many adults. Patients frequently avoid orthodontic treatment because of its long duration. Orthodontic movements lead to compression of periodontal ligament which leads to remodeling of alveolar bone. Moreover, orthodontic tooth movement (OTM) is a periodontal phenomenon as all periodontal tissues are involved. It is difficult to maintain periodontal integrity on long-term orthodontic movement.1 Since orthodontic treatment takes a longer duration, there are chances of gingival inflammation, root resorption, decalcification, and dental caries.2 Hence, reducing the treatment time by increasing the rate of tooth movement is considered as an appropriate goal for successful orthodontic treatment.3

A novel treatment procedure to maintain periodontal integrity and to shorten the treatment time had been introduced by Dr. William Wilcko (orthodontist) and Dr. Thomas Wilcko (periodontist) known as periodontally accelerated osteogenic orthodontics (PAOO) popularized as Wilckodontics.1,3

Piezoelectric bone surgery is a new technique developed by Vercellotti.4 The principle behind piezosurgery is, when an electric energy is applied, ceramic discs contract and expand, which causes ultrasonic transduction, and ultimately these vibrations are transferred to the insert of the drill that is applied on mineralized tissues such as bone.5 These vibrations are in the range of 25–29 kHz that cut only the hard tissues and frequency of above 50 Hz will cause damage to soft tissues.6 Piezosurgery provides precise, clean, and smooth cutting with excellent visibility.

G-Graft is the combination of crystalline hydroxyapatite and bovine collagen.7 Osteoconductive materials such as hydroxyapatite or tricalcium phosphate will act as osteoinductive material when used in combination with collagen; with this adjunct effect, G-Graft results in earlier bone regeneration and high dense mature bone. Studies also have shown that combination of type I collagen and hydroxyapatite has synergistic effect which accelerates the osteogenesis.

This case report is an attempt to highlight the technique and principles of PAOO for rapid OTM along with the use of piezo surgery for precise incisions.

CASE REPORT

A 28-year-old female patient was referred to the Department of Periodontics, for corticotomy...
procedure for retraction space closure. Although the alignment was almost completed in anterior region, retraction space was not closed. The reason was that the tooth movement was beyond the envelope of motion which led to failure of retraction space closure. This is the perfect indication for PAOO procedure.

Intraoral examination revealed Angle’s Class I molar relation. The patient was on arch expansion in maxilla [Figure 1a]. After profound anesthesia, a full-thickness mucoperiosteal flap was then elevated extending 3–4 mm beyond the mucogingival junction. With the help of piezosurgical inserts under cold saline irrigation, vertical grooves were placed in the inter-radicular space, midway between the root prominences in the alveolar bone from the distal surface of extraction space on one side to the distal surface of extraction space on the other side. The vertical cuts extend 2–3 mm from the alveolar crest to approximately 2 mm beyond the apices of the roots. At the apical aspects of the roots, semilunar corticotomy cuts were made to join these vertical cuts [Figure 1b]. Perforations were made in the alveolar bone over the radicular surfaces with a round bur.

After the placement of the corticotomy cuts, required amount of G-Graft (particle size 0.9 mm–1.9 mm) was placed in the vertical corticotomy sites [Figure 1c]. The decorticated bone helped to retain the graft material. The flap was adapted to normal position without tension and suturing was done by nonresorbable silk suture. The sutures were left in place for 10 days [Figure 1d].

Capsule Novamox 500 mg was given thrice daily for 5 days as an antibiotic. Tablet Ultracet was prescribed twice daily for 5 days as analgesic. The patients were instructed not to brush the operated area for 1 week and to rinse the oral cavity twice a day with chlorhexidine (0.2%) mouthwash daily. Sutures were removed after 10 days postoperatively. Orthodontic treatment was started within 2 weeks after surgery. 250 g of force was applied on both sides and appliance activation was done every 2 weeks.

The retraction space was closed within 4 months after surgery which is possible only with PAOO [Figure 1e]. Bone density changes were evaluated before and after surgery through computed tomography (CT). CT scan was used for evaluating the changes in the alveolar bone thickness as well as bone density before and after the surgical intervention and retraction of anterior teeth. For the assessment of alveolar bone thickness, contiguous 0.6-mm slice-thickness CT scans were obtained for the maxillary incisors at 120 kV and 175 mA, with the window width set at 2000, 1500 Hounsfield Units. For each tooth, the density of the labiolingual alveolar plates was measured to the nearest 0.2 mm. The same measurements were repeated between 6–7 months after incisor retraction was completed (depending on the case). The evaluation of radiographic density (HU) was done by Siemens Healthcare GmbH, Henkestr. 127 91052 Erlangen, Germany. Postsurgery CT demonstrated an increase in the bone density after 6 months of surgery. The CT image has shown the change in the bone density after the procedure, that is, from 405 to 456 HU [Figure 2a and b].

DISCUSSION

According to the American Association of Orthodontists, the comprehensive orthodontic period ranges between 18 and 30 months. It depends on the severity of malocclusion, any associated bony deformities, and treatment options. The treatment period for nonextraction and extraction case varies between 21–27 and 25–35 months, respectively. Major drawbacks of longer treatment time are increased risk for caries, periodontal diseases, and root resorption. Hence, the prime goal for orthodontists is to reduce the treatment span so that it alleviates the drawbacks of longer treatment time and also improves the patient satisfaction.

Various approaches are there to reduce the treatment span. One among them is administration of parathyroid hormone, thyroxin, Vitamin D3, and prostaglandins. Local/systemic administration of these biologic factors resulted in local pain, severe root resorption, and drug-induced side effects. In order to overcome these effects caused by the drugs, trend turned toward mechanical approach to accelerate the tooth movement. Mechanical approaches include electric current, magnets, laser beams, mechanical vibration, and ultrasound. Apart from this, the technique which has received maximum

![Figure 1: Preoperative image (a); Mucoperiosteal flap elevation and corticotomy (b); Particulate grafting with G-Graft (c); Suturing was done with 3-0 Silk (d); Postoperative image after 6 months (e)](image1)

![Figure 2: Preoperative image of bone density (a); Postoperative image of bone density after 6 months (b)](image2)
attention is the surgical manipulation of bone using dental
distraction, alveolar surgery to underline interseptal bone,
and corticotomies. These approaches focus mainly on the
micro movements of the alveolar bone, thereby reducing the
tissue resistance.

Orthodontic relapse is the most common posttreatment
complication regardless of the method used. To overcome this,
surgically facilitated orthodontic treatment (SFOT) procedures
have become popular. Though the conventional OTM and
SFOT have got advantages and disadvantages in their own
way, patients must be aware of all treatment alternatives.

PAOO is one of the SFOT procedures. PAOO is a clinical
procedure that combines selective decortication, alveolar
augmentation, and application of orthodontic forces. It is based
on regional acceleratory phenomena (RAP), the concept first
described by Herald Frost in the year 1983. RAP was described as
a local response of the tissue to a noxious stimuli resulting
in accelerated regional regeneration process. The principle of
RAP is to accelerate the repair process and to attain functional
recovery during bone remodeling. The bone injury caused by
piezo incision triggers bone remodeling which is the part of
RAP. Demineralization of bone leads to faster movement of
tooth adjacent to the decortication site. Particulate grafting
leads to increase in the bone thickness which decreases
relapse of OTM and increases postorthodontic stability. In
this case, retraction was started 2 weeks after surgery and the
retraction space was closed within 4 months as recommended
by Wilcko et al.[1]

CT was preferred in this study for evaluating the bone density
before and after the surgical intervention. This was supported by
a similar study done by Vercellotti and Podesta.[6] In this
case, piezo electric surgical insert was used to stretch the
incision for examination of dental and osseous topography,
similar to a study which was done by Dibart et al.[9] The use of
CT and a piezo inserts for placing vertical incisions was in
contrary to a study by Iofre et al., in which they have used metal
markers for the placement of vertical incisions.[10]

There have been several reports regarding adverse effects on
the periodontium after corticotomies, ranging from no problems
to slight interdental bone loss and loss of attached gingiva
to periodontal defects observed in some cases with short
interdental distance, but no such changes were observed in the
present case report. Subcutaneous hematomas of the face and
the neck have been reported after intensive corticotomies.
However, no such complications were reported in this case.
In this case report, activation of appliance was started within
2 weeks after surgery to take the advantages of RAP, which
is limited duration effect. In the present case report, G-Graft
was used for particulate grafting which showed increase in
radiographic bone density after 7 months of surgical
procedure. According to Murphy et al., no objective data
exist comparing one grafting material with another in terms of
superiority.[9]

The present case report confirms the dental CT scanning utility
in diagnostic imaging of the buccal, palatal, and interdental
bones. Bone density measurements by CT scanning offer more
precise results compared to radiologic evaluation. Therefore,
bone density measurement by this method can offer more
valuable data than other methods. Studies have shown that
alveolar corticotomies not only accelerate the orthodontic
treatment but also provide the advantage of increased alveolar
width to support the teeth and the overlying structures.

A large sample size with long-term follow-up is required
to assess the full effect of PAOO in accelerated orthodontic
movement.

CONCLUSION

PAOO reduces the treatment time when compared to
conventional orthodontic treatment. PAOO increases the
bone volume posttreatment and covers the vital surfaces of
the root, which contribute to the postorthodontic stability as
well as repair of alveolar dehiscence. The periodontist should
consider an appropriate technique according to the alveolar
topography to avoid complications and to assist accelerated
OTM. With the increasing esthetic demands and a desire for
rapid treatment outcome, PAOO technique can be an attractive
treatment alternative.

Declaration of patient consent

The authors certify that they have obtained all appropriate
patient consent forms. In the form, the patient has given her
current for her images and other clinical information to be
reported in the journal. The patient understand that her name
and initial will not be published and due efforts will be made
to conceal identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

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