



Significance of Periodontal Accelerated Osteogenic Orthodontics in Adjunctive Orthodontic Treatment

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ABSTRACT

Coordination and team work between periodontists and orthodontists plays vital role to boost clinical outcomes of mutual therapies concerning interdisciplinary. Furthermore, imprints on orthodontic therapy by reduction in usual treatment time and resisting anchorage loss. Teamwork of orthodontia and periodontia specialties can create imprints to improve periodontal health as a result of orthodontic treatment. However, equal and reciprocal important that maintenance of periodontal health boosts orthodontic treatment success. Hence, it clears that, interdisciplinary approaches of periodontology and orthodontia plays major role in existing treatment alternatives like periodontal accelerated osteogenic orthodontics (PAOO). PAOO technique may defined as modified decortication with bone grafting augmentations to facilitate faster orthodontic treatment outcome than conventional approaches with least trauma to root and underlying and associate structures. This technique utilizes natural bone remodeling process i.e. (transient nature of demineralization-remineralisation process in healthy tissues). Implications of PAOO technique in healthy hard and soft (bone and periodontium) tissue leads to supplementary advantages like reduced orthodontic treatment time, increased bone volume and post-orthodontic stability. Pedestal of existing literature, our aim is to present a comprehensive knowledge and idea of PAOO technique for clinician and readers.

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Introduction

Among the composition of periodontium, bone is highly mineralized tissue, has capacity to remodels according to situation; this phenomenon imparts orthodontic tooth movement. However, rate of bone remodeling forms a base for orthodontic treatment merely not affects age and time of the patient (Nguyen K et al 2005).

Few studies have been reported that time lapse for treating adult patient is much greater than young patients. However, studies have concluded that due to ageing in periodontium, force dissipation and response to orthodontic forces are less as compare to young patient's periodontium. Hence, to maintain balance between periodontium and fasten orthodontic treatment a healthy periodontal status is important. Many of the studies have been reported that adjunctive treatment approaches plays vital role in improving physiologic status of each (i.e. periodontium and tooth movement)¹.

The most challenging task in adult treatment is to achieve treatment goals, as the development of dentoalveolar process is completed and ageing process initiate². Furthermore, bone shows, aplastic, narrow, less vascular periodontal membrane and alveolar bone morphology, prone to develop root resorption during orthodontic treatment. In 1990's Dr. Wilco thought concept of in cortical bone modification to facilitate speed teeth movement with least bone resorption; increase

volume of alveolar bone. Furthermore, long term stability of orthodontic treatment¹⁻².

Corticotomy was fascinated to orthodontist, as it reduces total time duration of orthodontic treatment in to one-third of normal time, initiates osteogenesis, and reduces chance of root resorption. The hidden advantages of corticotomy was attracted by numerous orthodontist, hence this procedure fills the gaps between orthognathic surgery and camouflage treatment resulting into stable and fast orthodontic outcome with less damage to roots³.

Through this review article we would like to present a comprehensive knowledge, procedures, to help adult patients to get proper orthodontic treatment without orthognathic surgery and root damage during treatment.

Material and Method

Inclusion and exclusion criteria

We have selected articles used to explore the meaning and characteristics of PAOO. We defined "PAOO" superficial decortication followed by autogenous / bone grafting, facilitates in faster tooth movement without root resorption and improving bone / alveolar bone volume. Case reports and studies dealing with compromised periodontium, obtained good results with PAOO technique have been excluded.

Search and retrieval of reports

We searched the following databases: ERIC (1975-june - 2013); Ovid MEDLINE(R) (1995-oct- 2011), Scopus, an Elsevier abstract and citation database (2000-November, 2001) and Ovid Current Contents/All Editions (1993–2013).

We used a combination of key words describing PAOO (periodontic accelerated osteogenic orthodontics). Titles and abstracts of all obtained articles were independently screened by two reviewers to determine if they met inclusion criteria. Full texts of the articles were reviewed by two reviewers

Analysis and presentation of findings

Extraction and presentation of Primary data is from research articles; presentation done only by taking similar features of the articles. Secondary, data obtained from the case reports. Third few review articles.

Results

A total of 387 citations were retrieved from the bibliographic database search, 178 full-text articles were reviewed, and 3 met inclusion criteria, potentially appropriate articles. Four full text articles were retrieved, and one of these met the inclusion criteria.

We identified five major themes in relation to PAOO relationships:

- (1) Evolution of paoo technique.
- (2) Biological principle.
- (3) Clinical implication of paoo.
- (4) Case selection.
- (5) Clinical procedure.

Discussion

Evolution of paoo technique

PAOO has a unique base of distraction osteogenesis, once a bone is stressed can increase metabolic, and cellular activity. Pertaining to dentistry/ orthodontics, a text book written by gilfourd , states that bryaon was first to perform corticotomy. The text also clarify the major and minor surgeries, in minor surgery corticotomy was included. Furthermore corticotomy was indicated to reduce midline diastema¹⁻³.

In 60's kole , modified the corticotomy technique in to surgical blocks, described that vertical and horizontal cuts are met 1-2mm above the apices of teeth. This technique was aimed to reduce resistance to move the bone in desire direction; however this technique was primarily used for correction of deep overbite. This mechanism was applied to expand maxilla and align teeth. To understand the mechanism experiments were carried out on beagle dogs, reported that the vascularity of periodontium was maintained also the vascularity of pulp was also maintained⁴.

Surgical intervention creates a special type movement call as block bone movement. Kole explains that the advantages of modified corticotomy over conventional, in his modified technique, the teeth vitality will be maintained ,reduced treatment time , nutrition supply to bone and pulp is maintained¹⁻⁴.

Gante et al, Chung et al and Hwang et al, modified the technique and reported that extraction of first premolar will add in treatment planning of maxillary teeth. Furthermore, it state that once teeth is removed buccal and lingual cortical bone¹⁻⁴.

In 90's, with the help of computed tomography, has been revealed that rapid tooth movement followed by corticotomy. Thus to overcome Dr.Wilco , modified and added alveolar grafting , auto or xeno graft to avoid dehiscence and patented this process as (PAOO) periodontally accelerated osteogenic orthodontic⁵.

Dr.Wilco, concluded that, Rapid tooth movements should be activated two weeks later after corticotomy the rationale behind was for tooth movement was, rather than tooth-bone

block repositioning, the cascade of transient localized reactions in alveolar bone leading to bone healing⁶.

In 95's, complete procedure was modified in to combination of specific decortications and bone grafting helps rapid tooth movement and avoid dehiscence, however , this process facilitate bone formation and rapid tooth movements. Furthermore, Gerson et al has shown with in 11 month complete tooth movements⁷.

Biological principle

Composition of periodontium, facilitates the remodeling of mineralizes and soft tissue, to orthodontic force; this orthodontic force initiate a micro-environmental remodeling. The basic property of bone is catabolism and anabolism constantly to stress stimuli, process is called as bone remodeling. Orthodontic treatment results in increase bone metabolism and decrease density leads to increase turnover rate of bone⁸.

Many histological studies have been supported rationale behind orthodontic tooth movement and changes associated with periodontium. Most accepted theory was fluid dynamic theory of tooth movement. Depends on type of surgery associated with rapid tooth movement, osteotomy or corticotomy, rate of tooth movement and histological response differs. Micro -ct demonstrated on beagle dogs that selected corticotomy initiates local bone (bone around neck of teeth) remodeling within 60 days. The corticotomy associated with regional acceleratory phenomena called RAP. However, the process of osteotomy acts like distraction osteogenesis which don't have role in local bone alteration phase⁹.

Froster et al , demonstrated the phenomenon of RAP, reported that RAP, increases the bone healing 10-50 time times faster than normal bone healing after orthodontic tooth movement. However, RAP duration is almost 4 months¹⁰.

Clinical implication of paoo¹⁻¹⁰

Based on its principle of results Dr.Wilco suggested few of its indication and contra indications.

Indications

1. To increase speed of orthodontic treatment.
2. To reduce orthodontic treatment duration.
3. Enhance the skeletal malocclusions.

Contraindications

1. Patients with periodontal compromised state
2. Partial or incomplete restored endodontic material.
3. Prone to endodontic failure cases
4. history of prolonged corticosteroid usage,
5. Current medication interfering bone metabolism such as bisphosphonates.
6. Class III malocclusion with long mandible and hypo plastic maxilla.

Case selection¹¹

The reports of dr. wilco concludes that PAOO can be carried out in any age groups; has performed on 11 year young child and also on 70 year old person. However, the patient undergoing procedure should posses' healthy periodontium. PAOO technique can be implicated to treat class I malocclusions with moderate to severe crowding, class II malocclusions requiring expansion or extraction along with active fixed orthodontic mechanics.

It is always better not to perform PAOO technique on horizontal and vertical bone loss, periodontal compromised, root damage or poor roots. Also in patients with rheumatoid arthritis which requires regular doses of NSAIDs. In class III as patient's posses the physical constrains PAOO cannot be performed.

Clinical procedure

The clinical procedure has been divided into two phase,

1. Orthodontic treatment phase.
2. Surgical phase.

Orthodontics treatment phase

Once the case selection has been done, orthodontists play a vital role in determining the need of arch, either to expend or extraction, teeth movement and anchorage plan. Most of the class II case requires anchorage preparation before PAOO for retraction¹⁻⁸.

Once the treatment plan is finalized, case has to precede either of system with 0.22 slots bracket system. Basic advantage of 022 slots is that maintains the arch form; however 018 slot and begg system, during retraction phase has tendency to collapse the arch form⁹⁻¹⁰.

Bracket placement has to be followed based on clinical crown height with standard charts provided by the systems. Initially treatment has to proceed with 14/16 niti based on severity of crowding and pain bearing capacity of case. To level and alignments it takes approximately 2-3 months. 018/020 stainless steel wire should be placed a week before surgery⁹⁻¹².

Once the surgery is performed a two week rest period has to be given. Immediate after two week orthodontic treatment should be performed without delay to gain maximum advantage of surgery. However orthodontist have limited time period of 4-6 months to carry out rapid tooth movement.⁹⁻¹⁵

Surgical technique

Considering ideal criteria of flap, a full thickness should be considered in coronal portion and split thickness at apical portion of the teeth. To overcome, tension, stress and additional releasing incision it is always preferred mesial and distal extension of flap. It is always significant to preserve the collar tissue of lingual or palatal gingiva for esthetic purpose, hence distal tunnel approach should be considered in maxillary anterior region⁹⁻¹⁷.

Decortication

The other name of decortication is wilckodontics, procedure used to reduce orthodontic treatment time by gradual removal of superficial layer of bone along with fibrous and periosteum; facilitates for bone block movements, resistant to root resorption. Many clinician have been explained their own way to perform this procedures with either 0.5mm diameter bur or with piezosurgical knife¹⁻¹⁹. The procedure comprises of two cuts joining each in circularly with in spongiosa. One of the two cuts is vertical cut should starts from distal end of canine of right side and ends with distal of left side canine. The approximate depths of both vertical and horizontal cuts are 1.5-2mm. Note that the horizontal cut 2-3mm above the apices of anterior teeth⁹⁻²³.

Bone grafting

Bone graft is mandatory to be used as a part or step of this procedure. However, quantities of requirement of bone material depend on time, amount and direction of teeth movement; is said to be a 2.5 to 5mL. There are many bone graft material are available, most commonly used materials are deproteinized bovine bone, decalcified free-dried bone allograft. The standard procedure of bone grafting has to be followed, once the bleeding gets controlled than bone graft has to be placed¹⁰⁻²⁷.

Sutures and suture material²⁸

Black beaded suture with interrupted suture technique has to be followed. However availability and technique sensitivity assists for observable suture should be used.

Post surgical instruction/ patient management¹⁵⁻³²

Antibiotics 1gm before half an hour should be injected intravenously, followed by 500 mg of antibiotics for 5 days BD dose should be advised. Surgery may lapse more time; hence, patients should be kept on sedation. Later after surgery NSAIDS, steroids must be giving.

Conclusion

It is a modified step, common corticotomy associate with bone grafting. However this procedure has its following advantages like quick tooth movements, orthognathic surgery can be by possessed; increases bone volume prevents root resorption.

It always depends up on clinical exposure and experience to make best utilization of technique. Hence PAOO technique is sensitive to use without knowing about it. This article gives comprehensive about PAOO.

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