PERIODONTALLY ACCELERATED OSTEOGENIC ORTHODONTICS –AN OVERVIEW

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Abstract

As modern life calls for quick and efficient orthodontic treatments, a novel orthodontic modality was developed utilizing adjunctive periodontal surgery that includes bone corticotomy combined with bone augmentation. This multidisciplinary team approach: Periodontally Accelerated Osteogenic Orthodontics (PAOO) or Wilckodontics seems to be promising not only for reducing orthodontic treatment duration, but also for biological aspects during and after orthodontic treatment. PAOO enhances bone remodeling and augmentation, accelerates tooth movement and significantly reduces the duration of treatment.

This article describes the PAOO technique and explain advantages over traditional orthodontics and how

and why this advanced periodontal surgical technique contributes to orthodontic treatment.

Key words: Periodontal accelerated osteogenic orthodontics , Adult orthodontics, regional acceleratory phenomenon.

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Introduction

Adults have more specific objectives and concerns related to dentofacial aesthetics, the type of orthodontic appliance and the duration of treatment and they are more prone to periodontal complications since their teeth are confined to thick mineralised alveolar bone.

All these factors make adult orthodontic treatment a challenging therapeutic modality in dentistry, which necessitates the need for improvised concepts and procedures for the purpose of creating a functional dentition in a healthy periodontal environment [1].

Periodontally Accelerated Osteogenic Orthodontics (PAOO) has delivered an entirely new dimension to dentofacial orthopedics. It combines selective decortications-facilitated orthodontic technique with alveolar augmentation. Corticotomy surgery initiates and potentiates normal healing process (Regional Acceleratory Phenomena) (Wilcko et al., 2000, 2001, 2003, 2008). Regional Acceleratory Phenomena (RAP) is local response to a noxious stimulus , a process by which tissue forms faster than the normal regeneration process. By enhancing the various healing stages, this phenomenon makes healing occur 2–10 times faster than normal physiologic healing (Frost, 1983). The RAP begins within a few days of injury, typically peaks at 1–2 months, usually lasts 4 months in bone and may take 6 to more than 24 months to subside (Wilcko et al., 2000, 2001, 2003, 2008).[2]

.INDICATIONS

- To increased alveolar volume and enhanced periodontium (i.e., correction of dehiscences and fenestrations).
- Resolve Crowding and Shorten Treatment Time
- Accelerate Canine Retraction after Premolar Extraction
- Enhance Post-Orthodontic Stability
- Facilitate Slow Orthodontic Expansion
- Facilitate Eruption of Impacted Teeth
- Molar Intrusion and Open Bite Correction
- Manipulation of Anchorage

Contraindications and Limitations

- Patients with active periodontal disease or gingival recession[3]
- should not be considered as an alternative for surgically assisted orthodontics
- palatal expansion in the treatment of severe posterior cross-bite.
- bimaxillary protrusion is accompanied with a gummy smile,which might benefit more from segmental osteotomy

Complications

- Subcutaneous hematomas of the face
- adverse effects to the periodontium, ranging from no problems to slight interdental bone loss and loss of attached gingiva [4].

Advantages of PAOO versus Traditional Orthodontics

- Enhanced muco-gingival status, both soft and hard tissues with reduced risk of gingival recession.
- Less risk of root resorption
- Less risk of post-orthodontic relapse
- Treatment time reduced by 60-70%, therefore less time in appliances, happier patients and less risk of iatrogenic disease – caries/gingivitis.
- It can be used to treat moderate to severe malocclusions in both adolescents and adults and can reduce the need for extractions.
- Except for severe Class III skeletal dysplasia, PAOO can replace some orthognathic surgery.

Disadvantages:

- More expensive than conventional braces
- Being a mildly invasive surgery, it has its risks
- some swelling and tenderness immediately after surgery
- Need to recover for a week and must stay away from school or work.

Historical Review;

The application of corticotomy surgery to correct malocclusion was first described in 1892 by L. C. Bryan, but it was Heinrich Köle in 1959 who reintroduced alveolar corticotomy to resolve malocclusion (Köle 1959). He combined interdental alveolar corticotomy surgery with a through-and-through osteotomy apical to the teeth.

Suya's technique (1991) differed from Kole's with the substitution of a subapical horizontal corticotomy cuts in place of the horizontal osteotomy cut beyond the apices of the teeth (corticotomy: thinning of cortical plate without penetrating medullary bone, osteotomy: complete cut through cortical plate to medullary bone)[5].

Frost, an orthopedic surgeon, had described a direct correlation between degree and proximity of bone trauma and intensity of physiological healing response, which he coined Regional Acceleratory Phenomena, or RAP (Frost 1983), and the decalcification-recalcification described by Wilcko et al. (2001, 2003) was consistent with RAP.

BIOLOGICAL RATIONALE

Histological studies done by Sebaoun et al., 2008 showed that selective alveolar decortication induced increased turnover of alveolar spongiosa . Surgery results in a substantial increase in alveolar demineralization, a transient and reversible condition. This will results in osteopenia (temporary decrease in bone mineral density). The osteopenia enables rapid tooth movement because teeth are supported by and moved through trabecular bone. As long as tooth movement continues, the RAP is prolonged. When RAP dissipates, the osteopenia disappears and the radiographic image of normal spongiosa reappears. When orthodontic tooth movement is completed, an environment is created that favors alveolar re-mineralization[6].

Buchanan et al. (1988) documented a similar observation in alveolar bone following tooth extraction, as did by Yaffe et al. (1994) after alveolar periosteal flap elevation and Verna et al. (2000) after tooth movement. Ferguson and coworkers have suggested that the increased stability provided by PAOO may be due to "loss of tissue memory from high tissue turnover of the periodontium, as well as increased thickness of the alveolar cortices from the augmentation grafting.

Technique of periodontally accelerated osteogenic orthodontics (Wilcko et al., 2000, 2001, 2003, 2008)

After proper case selection, orthodontic appliances are better to be placed one week prior to the surgery. Standard brackets, archwires, and normal orthodontic force level can be used.

Surgery can be done in a normal clinical setting with or without sedation. After administration of local anesthesia, crevicular incision is made buccally and lingually extending at least two to three teeth beyond the area to be treated.

Full-thickness flaps are reflected labially and lingually using sulcular releasing incisions. Vertical releasing incisions can be used, but they should be positioned at least one tooth away from the "bone activation". Flaps should be carefully reflected beyond the apices of the teeth to avoid damaging the neurovascular complexes and to allow adequate decortication around the apices . Selective alveolar decortication is performed in the form of decortications cuts and at points up to 0.5 mm in depth, combined with selective medullary penetration to enhance bleeding[7]. Rothe et al. (2006) found that patients with thinner mandibular cortices were at increased risk for having dental relapse—hence the necessity for osseous grafting during the PAOO procedure. Bone graft materials [Autograft (Nowzari et al., 2008)[8], mix of Autograft + Allograft, Allograft + Xenograft, or Xenograft + Alloplast] are then placed over the decorticated areas.

Antibiotics can be mixed with bone graft. Wilcko et al. (2000, 2001, 2003, 2008) recommended the use of mix

of demineralized freeze-dried bone and bovine bone with clindamycin[9]..

If there is any recession in the teeth, it can be treated at the same time with connective tissue graft or acellular dermal matrix allograft (AlloDerm). The mucoperiosteal flap is then sutured with interrupted 4– 0 suture being careful to preserve the interdental papillae. Postsurgical instructions are the same as any standard oral surgical procedures. Antibiotics, analgesics, and antiseptic mouthwash should be given to the patient[8].

Sutures should be left in place for a minimum of two weeks. Tooth movement should start one or two weeks after surgery. Unlike conventional orthodontics, the orthodontic appliance should be activated every two weeks until the end of treatment after PAOO.

Clinical studies:

- In 2001, Fulk and in 2003 Skountrianos compared mandibular arch decrowding in nonextraction orthodontics following PAOO and non-PAOO; active treatment times were 3.1 times more rapid (6.6 versus 20.7 months) following PAOO and post treatment outcomes were statistically the same as judged by cephalometric and study cast variables.
- In 2003 Nazarov and O'Hara (2005) analyzed the Stability of orthodontic clinical outcomes using the Objective Grading System (OGS) during retention, the clinical outcomes of PAOO patients improved and did not demonstrate relapse[9].
- .Wilcko published a report about two adult patients with severe crowding who were treated *via* PAOO in just 6.5 months and also reported a case of an adult female who was treated in only 4.5 months[10].
- Ren *et al.* reported rapid tooth movement after corticotomy in beagles without any associated root

  resorption or irreversible pulp injury.
- Liou *et al.* demonstrated normal pulp vitality after rapid tooth movement at a rate of 1.2 mm per week.

Conclusion;

PAOO is a promising technique that has many applications in the orthodontic treatment of adults because it helps

to overcome many of the current limitations like lengthy duration, potential for periodontal complications, lack of growth and the limited envelope of tooth movement. It can be an attractive treatment option and be a "win-win" situation for both the dentist and the patient.

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