

A Surgically-Assisted Technique to Accelerate the Orthodontic Tooth Movement- Wilckodontics – A Literature Review

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Abstract

Review Article

Orthodontics combined with alveolar decortications, ostectomy and bone grafting can accomplish rapid tooth movements, thus accelerating the process. This is known as Accelerated Osteogenic Orthodontics (AOO). Alveolar decortication with augmentation bone grafting technique combined with orthodontics is called periodontally accelerated osteogenic orthodontics or PAOO. The Principle of Wilckodontics is to induce constant internal bone strain by judicious tooth movement and transmucosal perforation to perpetuate the therapeutic osteopenic state thus inducing regional acceleratory phenomenon (RAP). Surgically facilitated osteogenic orthodontics treatment can often be completed in one third to one fourth of the time required for traditional orthodontic treatment. Compared with traditional orthodontic treatment, this treatment has the obvious advantage of dramatically shorter treatment time. The advent of corticotomy-facilitated orthodontics as a predictable, though aggressive, method of dramatically accelerating orthodontic tooth movement and enhancing post-orthodontic treatment stability, has paved the way forward for clinicians to modify this approach and develop less invasive techniques.

Keywords: Wilckodontics, Corticotomy, PAOO, AOO, RAP.

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INTRODUCTION

Orthodontic treatment is difficult in adults compared to adolescents due to the increased chance of hyalinization of bone, the increased risk for periodontal problems and the reduced tissue turnover in adults [1]. Due to these reasons an interdisciplinary orthodontic tooth movement is necessary to provide shorter treatment periods and to reduce side effects of orthodontic tooth movement. Kole *et al.* [2] acknowledged that without the help of surgical interventions, treatment is seldom possible in patients older than 16 years. Wilcko and Ferguson *et al.* introduced a new technique which combines selective decortication facilitated orthodontic technique and alveolar augmentation. This technique is known as periodontally accelerated osteogenic orthodontics (PAOO). This allows teeth to be moved 2-3 times further in 1/3rd to 1/4th the time required for traditional orthodontic treatment [3, 4].

Periodontally accelerated osteogenic orthodontics (PAOO), also known as Wilckodontics, has become a very useful modality in the field of surgical orthodontics to provide faster tooth movement.

Regulation of the remodeling process of the periodontium to bring about rapid tooth movement gives an edge over existing traditional concepts of orthodontic treatment. Ever since its conception and patent by Wilcko and Wilcko[5], the term Wilckodontics has become more popular. This technique involves decortication of the alveolar bone which is done to serve two purposes; first, it reduces the resistance offered by the thick alveolar housing to tooth movement and second, it initiates the regional acceleratory phenomenon (RAP) due to which there is temporary burst of hard and soft tissue remodeling which helps to regenerate the bone to its normal state [6].

The most frequent concern of orthodontic patients is removal of their braces and this constant demand to shorten the treatment time in adult patients often results in protracted treatment time and associated periodontal problems. With all these considerations in mind adult orthodontic treatment differ and is challenging. Hence, periodontally accelerated osteogenic orthodontics has offered solutions to many limitations in the orthodontic treatment of adults [5].

The advantages of corticotomy assisted orthodontics includes reduced treatment time, enhanced expansion, increased traction of impacted teeth and post orthodontic stability.

Corticotomy is defined as the osteotomy of the cortical bone. It is a procedure whereby only the cortical bone is cut, perforated or mechanically altered in a controlled surgical manner. Hence, combining orthodontics with selective alveolar decortication and bone grafting can lead to a wider range of tooth movements while simultaneously reducing risk factors that may lead to periodontal breakdown.

Utilising surgical techniques concomitantly with fixed orthodontic appliance therapy have proven to be clinically predictable and effective methods at accelerating orthodontic tooth movement and reducing the duration of treatment [7, 8]. Current evidence suggests that bone exposed to surgical insults undergo a regional acceleratory phenomenon during healing; the decreased regional bone density and accelerated bone remodelling after injury is thought to be responsible for the acceleration of tooth movement during orthodontic therapy [9, 10].

Regional Acceleratory Phenomenon (RAP)

Orthopaedist Herald Frost in 1983 recognised that surgical wounding of osseous tissue results in striking reorganising activity adjacent to the site of injury (in osseous/ soft tissue surgery). He collectively termed this cascade of physiologic healing events – “The Regional Acceleratory Phenomenon” (RAP) [6, 9]. The RAP is a local response of tissues to noxious stimuli by which tissue regenerates faster than normal in a regional regeneration/remodeling process [9]. This response varies directly in duration, size, and intensity with the magnitude of the stimulus. The duration of RAP depends on the type of tissue, and usually lasts about four months in human bone. This phenomenon causes bone healing to occur 10-50 times faster than normal bone turnover [12].

The healing phases of RAP have been studied in the rat tibia. There is an initial stage of woven bone formation, which begins in the periosteal area and then extends to medullary bone, reaching its maximal thickness on day seven. This cortical bridge of woven bone is a fundamental component of RAP, providing mechanical stability of bone after injury. From day seven, the woven bone in the cortical area begins to undergo remodeling to lamellar bone, but woven bone in the medullary area undergoes resorption, which means transitory local osteopenia. It seems that medullary bone needs to be reorganized and rebuilt after establishment of the new structure of cortical bone, and to adapt to the reestablishment of cortical integrity (three weeks in rats). There is also a systemic acceleratory phenomenon (SAP) of osteogenesis due to systemic release of humoral factors [12].

In human long bones, following surgical injury, RAP begins within a few days, usually peaks at 1-2 months, and may take from 6 to 24 months to subside completely [12]. RAP results in a decrease in regional bone densities (osteopenia) in healthy tissues whereas the volume of bone matrix remains constant. Orthodontic force application alone is a stimulant sufficient to trigger mild RAP activity. But when tooth movement is combined with selective decortication, RAP is maximized [12]. However, in 2001 Wilcko *et al.* revisited the original technique of bony block movement with some modifications. He attempted two cases with severely crowded dental arches, and speculated that the dynamics of physiologic tooth movement in patients who underwent selective decortication which might be due to a demineralization-remineralization process rather than bony block movement. They suggested that this process would manifest as a part of RAP that involves the alveolar bone after being exposed to injury (corticotomy) and during active tooth movement [13].

Wilcko, *et al.* [12] went on to report that the remineralization phase of the RAP was remarkably complete in the adolescent at two years post corticotomy surgery. In the adult however the remineralization was not only incomplete at two years post corticotomy surgery, but it was still incomplete at 12 years post corticotomy surgery with a net loss of alveolar bone. They attributed this net loss of alveolar bone in the adult to the decreased recuperative potential of adult bone in comparison to adolescent bone. Wilcko, *et al.* [12, 14] have additionally reported that the tooth movement can be best surgically facilitated by providing for a thin layer of activated bone over the root surfaces in the direction of the intended tooth movement. The demineralization of this thin layer of bone will leave the soft tissue matrix of the bone and islands of osteoid that can be carried with the root surfaces of the teeth where it will remineralize in the desired position. This remineralization process is almost complete in the adolescent, but only partially complete in the adult.

Indication

- For decrowding of the dental arches.
- For reducing treatment time with sufficient stability.
- For protraction of molars.
- For early space closure in extraction case.
- For single or segmental intrusion and treating open bite.
- For expansion of arches in buccal region.
- To facilitate eruption of impacted tooth.

Contraindication

- Patients with systemic disease like diabetes mellitus, bleeding disorders, congenital heart disease, uncontrolled hypertension etc.
- Patient with poor oral hygiene.

- Patient with active periodontal disease
- Patients on long term medications which will slow down bone metabolism, such as bisphosphonate and NSAIDs. NSAIDs lead to prostaglandin inhibition resulting in reduced osteoclastic activity thus disturbing bone remodeling.
- Patients on long term steroid therapy due to the presence of devitalized areas of bone
- Patients with compromised width of the attached gingiva.

PAOO (Periodontally Accelerated Osteogenic Orthodontics) Technique

Balance between resorption and deposition is very important factor for any kind of tooth movement. By modifying this balance we can bypass the waiting period for resorption and move the teeth farther without causing any irreversible damage to periodontium. This has been the topic of interest for many researchers [2, 18]. In process of resorption the catabolic activity mediated by osteoclasts is the limiting factor in the rate of tooth movement in which periodontal ligament plays a crucial role [19]. This procedure is performed under local anaesthesia.

Flap Design

Full thickness mucoperiosteal flap is reflected with proper releasing incisions. Flap should be reflected beyond root apices of teeth to be move if segmental molar intrusion required. The flaps should be extended beyond the corticotomy sites mesially and distally to prevent vertical releasing incisions. The interdental papilla can be reflected with the flap or left in place [3]. However the interdental papilla between the maxillary central incisors is preserved for aesthetic purposes [10]. After flap reflection, the area is thoroughly debrided and curettage done to remove any inflamed tissue, if present.

Decortication

Vertical cortical scaring incisions are performed over interproximal cortical bone and extend beyond root apices. Then horizontal connecting incision is done. This is done both on buccal and palatal sides. Scaring can be done by piezoelectric knife or small round bur with sufficient irrigation. The purpose of scaring over bone is not to decorticate and separate the

dentoalveolar segment. Only scaring is done in form of either vertical or horizontal incisions or dots over cortical plate to just alter or modify balance between resorption and deposition by means of production of RAP.

Particulate Grafting

Bone graft material is placed over decorticated area. Most commonly used material for grafting is decalcified freeze dried bone allograft (DFDBA). Wilcko *et al.* introduced the use of mix of demineralized freeze-dried bone with bovine bone and clindamycin. The particulate bone graft can also be wet with platelet-rich plasma to facilitate the placement of the graft and to increase the stability of the graft material [11]. The volume of particulate bone graft used is 0.25-0.5ml per tooth. Excess amount of bone graft should be avoided to prevent tension over flap during closure.

Closure

The flaps are approximated with non resorbable interrupted sutures without excessive tension [14, 11]. The specific suture used, is based upon the thickness of the tissues. The sutures are then left in place for a minimum of 2 weeks. For the epithelial attachment to re-establish itself, it is important to allow the sutures to be left for a sufficient period of time. Premature suture removal may lead to flap displacement, dark triangles, and gingival recession [14]. No packing is required.

Orthodontic Treatment

An immediate heavy orthodontic force should be applied on the teeth after flap repositioning. The initiation of orthodontic force should not be delayed more than 2 weeks as there is limited amount of time to accomplish accelerated tooth movement

Postsurgical Management

Analgesics and adjunctive antibiotics are prescribed for 1 week. Long-term administration of nonsteroidal anti-inflammatory agents is discouraged as these may interfere with the regional acceleratory process [11]. Regular follow up has to be scheduled every 2 weeks during application of Orthodontic force after surgery [15].

Table-1: Steps in PAOO

Steps in PAOO
Orthodontic appliances are placed one week prior to the surgery.
Creviceular incision is made buccally and lingually extending at least two to three teeth beyond the area to be treated.
Full thickness flap is reflected on both buccal and lingual aspects beyond the apices of the teeth if possible.
Any interdental papillary tissue remaining interproximally should be left in place.
Selective decortications can be performed on both buccal and lingual sides.
Vertical corticotomy cuts are made between the roots using a diamond round bur.
Bone graft materials are then placed over the decorticated areas.
The mucoperiosteal flap is then sutured with interrupted sutures.
Suture removal after 2 weeks.

CONCLUSION

Wilckodontics is inducing bone metabolism via decortications lines around the teeth to be moved so as to enhance bone and periodontal turnover, thus resulting in transient osteopenia and accelerating tooth movement facilitating a short period of orthodontic treatment. This treatment thus considers the expectations of adult orthodontic patients so as to reduce the timeframe of the treatment and enhance esthetics. Therefore, Wilckodontics will lead to increased number of adult patients to opt for orthodontic treatment. Since it is a multidisciplinary approach, it will also enhance the coordination between orthodontist, periodontist, oral surgeon and the general dentist.

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