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Review Article

Wilckodontics: An Interdisciplinary Treatment Approach in Dentistry – An Overview

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Abstract

Wilckodontics, also known as Periodontally Accelerated Osteogenic Orthodontics (PAOO), is an advancing technology in the field of dentistry. It is a procedure which has made rapid orthodontic movement possible by stimulating and harnessing the innate potential of living bone. It is a multidisciplinary treatment approach utilizing periodontal regenerative surgery to create rapid orthodontic movement. It reduces periodontal complications in patients undergoing orthodontic treatment as their teeth are confined to non-flexible alveolar bone. This clinical procedure has gained popularity as a treatment option in adults, which is otherwise time-consuming as mineralization and maturation of the upper and lower jaws are complete. This overview focuses on the historical background, indications, contraindications, surgical technique and modification in Wilckodontics.

Keywords: Periodontally Accelerated Osteogenic Orthodontics; Rapid Orthodontic Movement; Periodontal Regenerative Surgery; Corticotomy; Wilckodontics; Alveolar Bone

Introduction

Periodontium is comprised of gingiva, periodontal ligament, cementum and alveolar bone. The soft tissue components being gingiva, periodontal ligament and hard tissue components being the cementum and alveolar bone, of which the alveolar bone is most mineralized. With the increase in awareness of orthodontic treatment and a more esthetic demand from the patients, adult orthodontic treatment has come into the limelight [1]. However, the problems associated with adult orthodontics is the long duration of time, dento-facial esthetics and the type of appliances used, as many patients do demand to remove their braces soon and reduce the treatment duration due to esthetic concern [1,2]. Moreover, in adult patients prolonged orthodontic treatment may cause periodontal disease and bone loss further resulting in relapse [1,2,4,7]. Thus in 1995, Dr. Thomas Wilcko (Periodontist) and Dr. William Wilcko (Orthodontist) – the Wilcko Brothers, introduced the concept of "Wilckodontics" also known as Periodontally Accelerated Osteogenic Orthodontics (PAOO) [2].

History

Principle of Wilckodontics dates back to 1950s where a Russian orthopedic surgeon Dr. Gabriel Ilizarov introduced the technique of Distraction Osteogenesis (DO) so as to facilitate new bone formation by surgically distracting the bone [1,2,4-6,8,15]. Using this concept, periodontists perforated the cortical bone so as to facilitate the tooth movement. In 1959, Henrich Kole postulated the concept of "bony block movement" where the thick dense layer of cortical bone that offered most resistance to tooth movement was disrupted. This created moving blocks of bone in which teeth were embedded facilitating tooth movement [2,4,5]. In 1980, Harold Frost observed a direct correlation between degree of injuring a bone and the intensity of its healing response and called it as rapid acceleratory phenomenon (RAP) [1,2,4,7]. Here there is a temporary burst of tissue remodeling which rebuilds the bone back to its normal state. In 1990s, Wilcko brothers combined corticotomy and their observations on RAP and developed PAOO in 1995 [2].

Biological rationale [3]

In Wilckodontics, there is decortications made in the alveolar bone resulting in an increased alveolar volume after orthodontic treatment and the teeth can be moved 2-to-3 times fast than the traditional orthodontic treatment [1-3]. The transient localized demineralization-remineralization phenomenon in the alveolar bone, leaves the collagenous soft tissue matrix of the bone, which further remineralizes following orthodontic tooth movement. This remineralization that takes place, results in greater stability in the orthodontic treatment outcome [3,4,7,9].

Indications [4]

1. Treatment of moderate to severe crowding within a short period of time
2. Class II malocclusions requiring extractions or expansions
3. Mild Class III malocclusions
4. Facilitate eruption of the impacted teeth
5. Facilitate orthodontic expansion
6. Retraction of the canine following the premolar extraction
7. Correction of open bite

Contraindications [5]

1. Patients with periodontitis in its active form
2. Damaged Roots
3. Patients with Rheumatoid Arthritis
4. Patients with NSAIDs as they interfere with the production of prostaglandin hormones which slow down the bone formation, which is but natural in Wilckodontics [2]
5. Patients with bimaxillary protrusion with a gummy smile
6. Class III malocclusions

Principle of wilckodontics or PAOO surgery

PAOO is not just cutting into the bone, but in this surgical procedure, some external surface of the bone is removed which is known as decortications, after which the bone goes through a phase of osteopenia, where its mineral content is decreased temporarily. This process of decortications will initiate a local response known as Regional Acceleratory Phenomenon (RAP) as given by Harold Frost in 1989 [1,4-7] which results in a sort of reorganizing activity adjacent to the surgical wound site. In about 20 to 55 days, the tissues of the alveolar bone predominantly from the spongiosa by osteoclasis and osteocytic osteolysis, release rich calcium deposits which leads to the mineralization of new bone [8]. This intensified bone response and increased levels of local and systemic inflammatory markers in the areas of cuts, extend into the marrow spaces.

In this transient demineralization-remineralization phase, braces can move the teeth very quickly as the bone is soft and there is less resistance to the force of the braces through the trabecular bone [9]. Once the teeth are moved in their desired new positions, an additional new alveolar bone is formed which leads to a stable and a long-lasting treatment as conventional orthodontic treatment [6-9].

Treatment procedure

Surgical technique

This interdisciplinary treatment involves the team work by an orthodontist, periodontist, maxillofacial surgeon and the general dentist, wherein after the treatment plan, the orthodontic brackets with a light wire are engaged for a week before the surgical procedure.

Flap Reflection: The main objective of the flap design and reflection is to provide visibility and accessibility to the alveolar bone so as to perform corticotomies, cover the particulate bone graft, maintain the height and volume of the interdental tissues and provide esthetics by maintaining a proper gingival form. On administration of local anesthesia, a full thickness mucoperiosteal flap is reflected labially and lingually on the coronal aspect so as to visualize the corticotomy sites, and a split thickness flap is reflected at the apices of the teeth so as to enable minimal tension of the flap during suturing [1,4,5,15]. After flap reflection, the area is thoroughly debrided and curettage is done so as to remove any inflamed tissue if present (Figure 1 and Figure 2).

Figure 1: Preoperative photograph with an intrasulcular incision with lower anterior teeth.

Figure 2: Preoperative photograph with an intrasulcular incision in the 43, 44 region.

Decortication: Alveolar decortication is done on the labial and lingual side with a No.1 or 2. round bur so as to initiate the Regional Acceleratory Phenomenon (RAP) response [1,3-5] wherein vertical groove is placed in the interradicular space in-between the root prominences in the alveolar bone. This groove is placed with a piezosurgery which is an effective method of decortications, wherein the groove extends from a point 2 to 3 mm below the crest of the bone to the point 2mm beyond the apices of the roots. These vertical corticotomies are then connected with a circular-shaped horizontal corticotomy in such a way that the cuts extend through the entire thickness of the cortical plate, barely into the cancellous bone (Figure 3-5).

Figure 3: Full thickness mucoperiosteal flap reflected.

Figure 4: Decortication done with placement of vertical grooves.

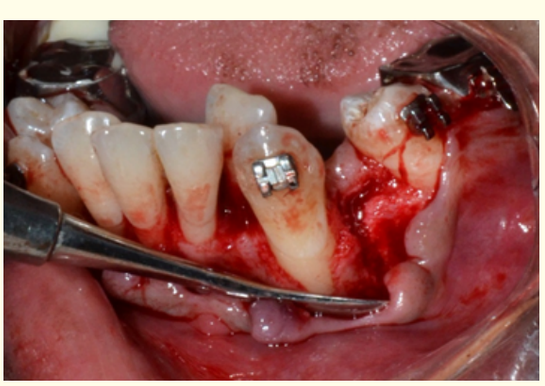

Figure 5: Decortication done and vertical grooves placed with 34.

Bone Grafting: Particulate bone grafting is done either with an autogenous bone graft, decalcified freeze-dried-bone allograft or combination of both in the areas that have undergone corticotomies, after which the flaps are approximated and closed using non-resorbable interrupted sutures so as to achieve a primary flap closure. Placement of bone graft is believed to be responsible for the increased post-treatment alveolar bone width and the teeth can be moved 2 - 3 times more in 1/3rd time required than traditional orthodontic therapy [21,22] (Figure 6-8).

Figure 6: Bone graft placed in the lower anterior region.

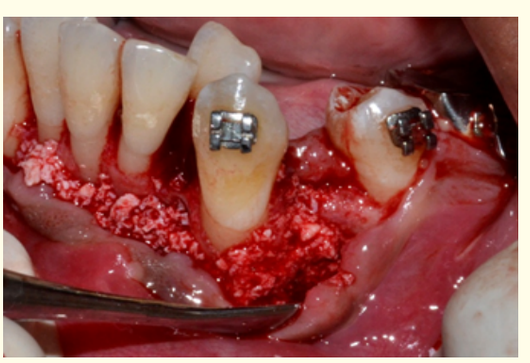

Figure 7: Bone graft placed with 33, 34 region.

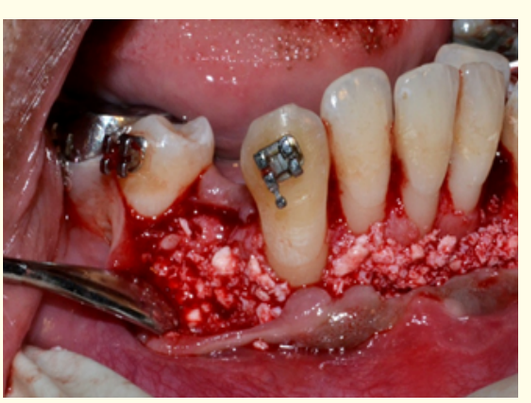

Figure 8: Bone graft placed with 43, 44 region.

Orthodontic Adjustments: After repositioning of the flap, an immediate heavy orthodontic force can be applied to the teeth, wherein the initiation of orthodontic forces should not be delayed for more than 2 weeks after surgery, and within 4 to 6 months period, the accelerated tooth movement has to be accomplished.

Usually the Wilckodontics treatment extends from 3 months to 9 months, followed by compulsory placement of retainers for atleast 6 months [3,4,7] (Figure 9 and Figure 10).

Figure 9: Sutures placed.

Figure 10: Coe-pack placed.

Discussion

The demand for Wilckodontics or PAOO treatment procedure has been increased by leaps and bounds considering its treatment benefits over conventional adult orthodontics. The benefits of Wilckodontics [1-3,7] include rapid tooth movement in short treatment duration and less chances of relapse, not much of a change in the facial profile post treatment due to the additional bone formed after the desired tooth movement is achieved, less need for headgear and orthognathic surgery, less root resorption, gingival recession or furcation involvement and no effects on the pulp vitality in the area of corticotomy [1-3].

Sanjideh., *et al.* (2010) [10] compared PAOO with conventional orthodontic tooth movement and observed that the rate of tooth movement in PAOO facilitated rapid tooth movement twice than the control group. Suya., *et al.* (1991) [11] observed that Wilckodontics procedure was not only less painful, producing less root resorption and relapse but the major active tooth movements were completed within 3 - 4 months of treatment. Dibart., et al. (2009) [12] found that a case of crowded teeth was solved within 17 weeks of active treatment with Wilckodontics. Sirisha (2014) [13] observed that with Wilckodontics, the rate of tooth movement was doubled on the corticotomy treated sites by about 1 mm/month. Oliveira., *et al.* (2010) [20] found the maxillary canine retraction following premolar extraction with PAOO to be as early as four months. Few reports have also observed the treatment of severe malocclusions with PAOO without much change in the facial profile of the patient [14-16]. Ren., *et al.* [17] observed that there was no root resorption or loss in the pulp vitality after corticotomy following rapid tooth movement.

As such there are no major side effects of Wilckodontics, but some reported cases include pain and swelling [3] after the surgical procedure, subcutaneous hematomas [18], loss of interdental bone and periodontal defects observed [2]. However, one of the major drawbacks of this technique is the exposure of the roots that happens in cases of thin gingival biotype and thin cortical plates [3]. Thus encorporating autogenous soft tissue grafts such as the connective tissue graft, platelet-rich-plasma, platelet-rich-fibrin and growth factors under the full thickness flap is considered as a gold standard [3,19].

Current Concept in Wilckodontics

In cases of thin gingival biotype, to prevent the exposure of the roots, the usage of autogenous soft tissue graft such as connective tissue grafting which is still considered to be the gold standard among all other soft tissue grafting techniques can be included under the full thickness flap reflected. The graft can be harvested from the keratinized palatal side. Platelet rich plasma, platelet rich fibrin, and growth factors can also be included under the flap. The usage of platelet rich fibrin increases the stability of the graft [19].

Summary and Conclusion

Wilckodontics is inducing bone metabolism via decortication lines [2,3] 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 [3].

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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