

Wilckodontics - A Gift of Time

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Abstract

Periodontally accelerated Osteogenic Orthodontics (PAOO) also known as Wilckodontics is a relatively new treatment modality which opens the door for successful adult orthodontics and drastically reduces the time taken to complete orthodontic treatment with fewer complications. This approach highlights the synergistic effects of two dental fields, orthodontics and periodontics, to improve the overall treatment of the patient. The technique dates back to early 1900s, however recent times have shown a change in the principle and technique undertaken to perform this surgery. It is a clinical procedure that combines selective alveolar corticotomy, use of bone grafts and the application of orthodontic tooth movements. It is based on the principle of Rapid acceleratory phenomenon as described by Frost. The present article describes the clinical surgical procedure and emphasizes on the rationale, advantages and disadvantages of PAOO.

Keywords: Periodontally accelerated Osteogenic Orthodontics; PAOO; Wilckodontics; accelerated Osteogenic Orthodontics; Corticotomy-assisted orthodontics

Abbreviations

PAOO: Periodontally accelerated Osteogenic Orthodontics; RAP: Regional Acceleratory Phenomenon; NSAIDs: Non-Steroidal Anti-Inflammatory Drugs; MTDLD: Monocortical Tooth Dislocation and Ligament Distraction Technique

Introduction

In recent times, we have seen a considerable increase in the number of adult patients opting for orthodontic corrections. However, the dento-alveolar development ceases after adolescence. This may cause hinder the treatment outcome and time taken. The average treatment time for adult orthodontic patients is 18.7 to 31 months[1]. The incidence of root resorption is higher due to the presence of an aplastic, narrow, and less vascular periodontal membrane and alveolar bone[2]. This poses a challenge for both the periodontist and orthodontist. To overcome this, a synergistic approach involving orthodontic tooth movement along with periodontal regenerative surgery can help creating rapid orthodontic movements while minimizing its possible side effects.

There are four types of bone remodelling techniques that include: Osteotomy (complete cut through cortical and medullary bone), corticotomy (partial cut of cortical plate without penetrating medullary bone), ostectomy (removal of an amount of cortical and medullary bone) and corticotectomy (removal of an amount of cortex without medullary bone)[3].

History

The concept of surgically assisted orthodontic tooth movement has been studied since the 1800's. In 1893, L.C. Bryan was the first to describe corticotomy facilitated tooth movement. This was published in the textbook by SH Guilford[4].

The major breakthrough in this field was put forth by Henrich Kole in 1959. He emphasized that most resistance to tooth movement was caused by the continuity and thickness of the dense cortical bone. This led to theory of "bony block movement" wherein he theorized

that by disrupting the continuity of the cortical bone, he was actually creating and moving blocks of bone in which teeth were embedded. His technique included a combined radicular corticotomy and supra-apical osteotomy. His technique was limited to the cortical bone and consisted of buccal and lingual interproximal vertical corticotomy cuts. Approximately 1 mm below the apices of the roots, these vertical cuts were then connected by horizontal osteotomy cuts[5].

In 1975, Duker conducted a study to determine the effect of corticotomy on tooth vitality and the marginal periodontium in beagle dogs. He concluded that the marginal bone should be preserved and the interdental cuts should be made at least 2 mm apical to the alveolar crest level [6]. Suya., *et al.* in 1991 modified the supraapical horizontal osteotomy incision and concluded that a horizontal corticotomy would facilitate the luxation of the bone blocks [7]. This technique was further modified by Wilcko., *et al.* They added the concept of alveolar augmentation to corticotomy assisted orthodontic technique and patented the procedure as periodontally accelerated osteogenic orthodontics (PAOO). A combination of demineralized freeze dried bone allograft (DFDBA)/xenograft or a bio absorbable alloplastic graft were used for alveolar augmentation. The pre-existing fenestrations were covered resulting in the increase of bucco-lingual thickness [8].

Principle of PAOO

It is based on the principle of Regional Acceleratory Phenomenon (RAP). RAP was first described by Herald Frost in 1983. Frost recognised that original injury resulted in accelerated normal regional healing process. RAP was described as a local response of the tissue to a noxious stimuli resulting in accelerated regional regeneration process. However, this response was directly related to the size, duration, intensity and magnitude of the stimuli. RAP may last for four months in human bone and increase the bone healing by 10-50 times faster than normal bone turnover[9]. Shih and Norrdin concluded that corticotomy of the intraoral cortical bone resulted in a transient burst of hard and soft tissue remodelling thereby accelerating the normal regional healing process[10]. Accelerated bone turnover and decreased regional bone density are two main features of RAP which play a major role in orthodontic tooth movements.

Goldie and King reported an increase in the orthodontic tooth movement in induced-osteoporotic lactating rats [11]. Wilcko., *et al.* radiographically demonstrated an osteoporotic state in regions treated with corticotomy. Computed Tomography suggested a demineralization-remineralization phenomenon. They further found similar accelerated tooth movement with small cortical perforations instead of corticotomy cuts. All these findings suggested that RAP is responsible for rapid orthodontic tooth movement [12].

Patient selection

This procedure can be carried out for all ages. A few contra-indications include dental bone loss, periodontal disease and damaged roots. Patients on NSAIDs are contra-indicated. This technique is useful in treating almost all cases of mal aligned teeth except Class III cases.

Advantages [13]

1. Drastic reduction in the time taken for tooth movement
2. Root resorption not reported in most cases
3. Incidence of relapse is low
4. After AOO, there is more bone to support your teeth and facial profile
5. Less need for appliances and headgear (depending on the case)
6. The technique has its roots in proven orthopaedic research and treatments

Disadvantages [13]

1. Expensive procedure
2. Mildly invasive surgical procedure with associated risk of pain, swelling and the possibility of infection

3. Patients on NSAIDs cannot be treated with this technique
4. Class III malocclusion cases cannot be treated.

PAOO Procedure

Corticotomy-assisted orthodontics is a therapeutic procedure involving controlled surgical damage resulting in an accelerated tooth movement. The procedure aims at modifying the balance between the resorption and apposition of bone. This helps in reducing the time taken for the alveolar bone to resorb and thereby leading to rapid movement of the teeth without causing any damage to the periodontium. The alveolar bone comprises of lamellar bone which is configured into cortical and trabecular bone. During a healthy state, the balance between apposition and mineralization is maintained. Due to the difference in the surface volumes between the trabecular and cortical bone, it takes less time to remodel the trabecular bone [14]. Selective alveolar destruction leads to regional alveolar osteopenia and increased secretion of calcium from the spongiosa. The latter may be attributed to osteoclasts and osteocytic osteolysis. This results in a catabolic condition followed by new bone deposition. The osteoid begins to mineralize in 20-55 days [7].

Prior to the surgery, a detailed comprehensive medical history is recorded for the patient. A complete clinical and radiographic evaluation is done to evaluate the periodontal status of the patient. Phase I therapy is performed to control the local factors and the patient is recalled for the surgery. Full thickness muco-periosteal flaps are reflected both buccally and lingually. The flaps are reflected beyond the apices of the teeth. Thorough debridement and curettage is carried out. Selective alveolar decortications are made on both buccal and lingual surfaces. Burs or piezosurgery units may be used for the removal of bone. Interdental vertical corticotomy cuts are made extending just apical to the alveolar crest. A scalloping horizontal cut is made apical to the apices connecting the vertical cuts. Numerous corticotomy perforations are made in the cortical plate. Bone substitutes are placed over the activated bone. The flaps are repositioned in order to get complete closure. Use of excessive graft material should be avoided. Interrupted loop sutures are given and a periodontal pack is placed [12]. NSAIDs are usually avoided post surgically since they inhibit the prostaglandin production and interfere with the bone growth process. The patient is usually asymptomatic by the 3rd day and healing period may extend from 7-10 days. After complete recovery from the procedure, orthodontist adjusts the braces about every 2 weeks. Depending on case, braces are put for 3 to 9 months. After the braces are removed, a retainer for at least 6 months is usually recommended.

Recent Advances

Lasers

Laser assisted corticotomy is considered a highly useful non-invasive procedure. It utilizes the Erbium, Chromium doped Yttrium Scandium Gallium Garnet (Er-Cr: YSGG) laser irradiation to reduce the cortical bone without reflecting the flap surgically. This leads to an enhanced orthodontic tooth movement [15].

Monocortical Tooth Dislocation and Ligament Distraction (MTDLD) Technique

Tomaso Vercellotti described the MTDLD technique involving two separate, simultaneous dental movements acting on opposite surfaces of the root. Vertical and horizontal microsurgical corticotomies are performed around tooth root surface that are in the direction of movement. Strong biomechanical forces are immediately applied leading to the rapid dislocation of the bone and the root surface. A rapid distraction of ligament fibres is produced on the root surfaces that are opposite to the direction of movement. These are caused due to the dislocation forces. The final tooth movement is achieved by the application of normal orthodontic biomechanics [16].

Conclusion

PAOO can be defined as an inter-disciplinary treatment modality involving the orthodontist and periodontist aimed at an effective treatment approach for adults, reduced treatment time and reduced risk of root resorption. Usually the orthodontic treatment aims only at tooth movement; however, the introduction of this technique alters the bone levels and facilitates faster movement. It has been successfully used to treat cases for decrowding, molar intrusion etc. However, benefits of the treatment are under scrutiny. Most importantly patient co-operation is a necessity for the success of the treatment. Patients are usually sceptical to an addition of a surgical procedure in

orthodontics and thus patient education and motivation is an important aspect. Many authors have questioned the reduced orthodontic treatment time without assessing the treatment quality. Randomized clinical trials are needed to ascertain the significance of bone grafting along with corticostomy.

Conflict of Interest

No conflict of interest.

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