ISSN: 2581-5989
PubMed - National Library of Medicine - ID: 101738774

International Journal of Dental Science and Innovative Research (IJDSIR)

IJDSIR : Dental Publication Service

Available Online at: www.ijdsir.com

Volume – 2, Issue – 4, July – August - 2019, Page No. : 254 - 259

Corticotomy Facilitated Orthodontics- An interdisciplinary approach for Faster orthodontic therapy

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Type of Publication: Case Report

Conflicts of Interest: Nil

Abstract

Corticotomy Facilitated orthodontics (CFO) is a clinical procedure that combines procedures such as alveolar corticotomy, bone grafting followed by application of orthodontic forces. This procedure is theoretically based on the bone healing pattern known as the regional acceleratory phenomenon (RAP). Periodontal accelerated osteogenic orthodontics results in an increase in alveolar bone width, shorter treatment time, increased post-treatment stability, and decreased amount of apical root resorption. The purpose of this article is to discuss a case report that comprises the CFO procedure and also a short review on it.

Introduction

Orthodontic tooth movement is influenced by alveolar bone metabolism and bone turnover rate, which determines the quantity and quality of orthodontic tooth movement [1]. High bone turn over signifies increase in the rate of tooth movement whereas slower tooth movement was found in animals with less turn over [2,3].

Reduction of orthodontic treatment time is considered an important goal in the management of malocclusions in adult patients. Corticotomy facilitated orthodontic treatment has been found useful in reducing treatment time and allowing for conventional orthodontic measures treating adult patients with severe malocclusion. [4] Four types of surgical procedures include:

Osteotomy (complete cut through cortical and medullary bone), Corticotomy (partial cut of cortical plate without penetrating medullary bone), Osteotomy (removal of an amount of cortical and medullary bone) and Corticotectomy (removal of an amount of cortex without medullary bone) [5,6]. All these surgical procedures potentiate tissue reorganization and healing by a way of transient burst of localized hard and soft tissue remodeling.

Case Report

A 23 year old male patient was referred to department of Periodontics for corticotomy for retraction of space closure. There was no relevant medical history and no signs and symptoms of temporomandibular dysfunction were observed. His intra oral examination revealed Angle's

Class 1 malocclusion with maxillary, mandibular prognathism and spacing. The patient underwent orthodontic treatment. Even though the alignment was almost complete, retraction space was not closed between 12-13; 13-14; 22-23; 23-24.9 (FIG 1-3)

Prior to surgical treatment, phase I periodontal therapy was performed which included plaque control measures, scaling and root planing. Since this was not a critical anchorage case, mini implants and temporary skeletal anchorage devices (TADs) were not preferred. Both retraction and protraction was needed hence, CFO was planned. Patient was recalled after one week and corticotomy was performed.

After profound anesthesia, Crevicular incision and vertical releasing incision was given and a full thickness mucoperiosteal flap was then elevated extending 3–4 mm beyond the mucogingival junction. Cortication was done with a straight fissure and round bur in both 1st and 2nd quadrant followed by placement of bone graft (G-bone which consists of Synthetic Hydroxyapetite granules). The area was sutured with a surgical silk suture. (FIG 5-8) Post operative instructions were given. Analgesics and antibiotics were prescribed. The patients were instructed not to brush the operated area for 1 week. Sutures were removed after 10 days postoperatively. The patient was recalled after 2 months and space closure was seen in both the quadrants. (FIG 9-11)

Discussion

History

Russian orthopedic surgeon Dr. Gabriel Ilizarov introduced the technique of Distraction Osteogenesis (DO). This technique facilitated new bone formation by surgically distracting the bone. Corticotomy-facilitated tooth movement was first described by L.C. Bryan in 1893. However it was first introduced in 1959 by Henrich Kole[7] as a mean for rapid tooth movement. Kole's procedure involves the reflection of full thickness flaps to expose buccal and lingual alveolar bone, followed by interdental cuts through the cortical bone and barely penetrating the medullary bone. The subapical horizontal cuts connecting the interdental cuts were in osteotomy pattern, penetrating the full thickness of the alveolus. Because of the invasive nature of Kole's technique, it was never widely accepted. 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). 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). Murphy referred PAOO as "in vivo tissue engineering."

Terminologies

1. Corticotomy-Assisted Orthodontic Treatment(CAOT)
2. Accelerated Osteogenic Orthodontics (AOO)
3. PAOO
4. Selective Alveolar Decortication (SAD)
5. Surgically Facilitated Orthodontic Therapy (SFOT)
6. Corticotomy-Facilitated Orthodontics (CFO)

Principle Of Wilckodontics Or Paoo Surgery

The external surface of the bone is removed which is known as decortications or corticotomy, after which the bone goes through a phase of osteopenia, where its mineral content is decreased temporarily. Following decortications, teeth can be moved faster than the traditional orthodontic treatment This phase of corticotomy will initiate a local response known as Regional Acceleratory Phenomenon (RAP) as given by Harold Frost in 1989 [8]. The regional acceleratory phenomenon (RAP) is a tissue reaction to a noxious stimulus that increases the healing capacities of the affected tissues. The RAP is characterized by acceleration

of the normal cellular activities. In about 1-2 months, the tissues of the alveolar bone release rich calcium deposits which lead to the mineralization of new bone [9]. This intensified bone response and increased levels of local and systemic inflammatory markers in the areas of cuts, extend into the marrow spaces. During this transient demineralization-remineralization phase, teeth will move very quickly as the bone is soft and there is less resistance to the force of the braces through the trabecular bone. 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 [9,10]

Indications

1. Resolve moderate to severe crowding within a short period of time
2. Class II malocclusions requiring extractions or expansions
3. Accelerate retraction of the canine following the premolar extraction
4. Mild Class III malocclusions
5. Facilitate eruption of the impacted teeth
6. Facilitate slow orthodontic expansion
7. Enhance post orthodontic stability
8. Correction of open bite and molar intrusion
9. Manipulation of anchorage

Contraindications

1. Patients with periodontitis in its active form
2. Damaged Roots
3. Should not be considered as an alternative for surgically assisted palatal expansion in the treatment of severe posterior cross-bite.
4. Patients with Rheumatoid Arthritis
5. Patients who are taking NSAIDs
6. Patients with bi-maxillary protrusion with a gummy smile
7. Severe Class III malocclusions

Advantages

1. Accelerated treatment time
2. Greater post orthodontic stability and retention
3. Less risk of an unfavorable crown to root ratio
4. Less chances of relapse.

Disadvantages

1. An expensive procedure
2. It is a mildly invasive surgical procedure
3. Mild to moderate pain and swelling, and the possibility of infection is seen. Patient should be given proper post operative instructions regarding post-operative swelling.

Complications Following Corticotomy:

The side effects of PAOO are controversial. Although interdental bone loss, periodontal defects, and reduced attached gingiva were reported, Aboul-Ela[11] et al. suggested that a flap design

leaving two 2 mm of attached gingiva and relieving incisions reduced the periodontal issue by providing vertical orientation without blocking blood flow. In the case of pain or discomfort,

Al-Naoum et al[12].stated that the ingestion of food was painful for the first 2 days, but gradually decreased. Root resorption occurrence is known to be similar for both corticotomy and noncorticotomy cases. However, Chan et al.[13] performed micro-perforations on the mesial and distal aspects, provided a tipping force to the patient and extracted premolars after four weeks. 42 % more root resorption was observed compared to conventional orthodontic tooth movement. Murphy et al. reported that there was no difference in the volume of root resorption when light (10 g) or heavy forces (100 g) were applied after corticision. Corticotomy was not selected by patients because of their fear of surgery due to its invasiveness. Subcutaneous hematomas of the face and the neck have

been reported after intensive corticotomies. Ren et al. [14]reported rapid tooth movement after corticotomy in beagles without any associated root resorption or irreversible pulp injury. Moon et al.[15] reported safe and sufficient maxillary molar intrusion (3.0 mm intrusion in two months) using corticotomy combined with a skeletal anchorage system with no root resorption. Long-term effect of PAOO on root resorption requires further study.

Conclusion

From an esthetic perspective the PAOO technique not only addresses tooth alignment, but also facial features as Hence it is truly in vivo tissue engineering. With a combination of both in-office periodontal surgery and orthodontic treatment, one can now more routinely address the esthetics of the entire lower face. The PAOO technique requires the utilization of numerous modified diagnostic and treatment parameters, but once these are mastered the orthodontist has a powerful new treatment option to offer his or her patients. With the increasing number of adults considering orthodontic treatment, the propensity for adults and even some non growing adolescents for periodontal problems, the PAOO technique can be an especially attractive treatment option

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Figures: Pre-Op (Fig 1-3)

Fig-1.

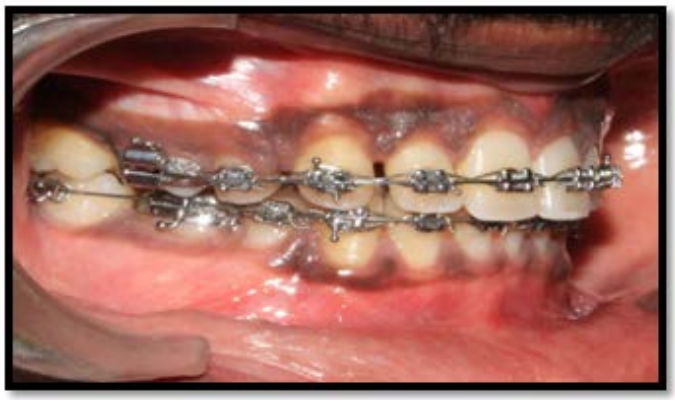

Fig- 2.

Fig -3.

Operative Pics: (Fig 4-8)

Fig -4

Fig – 5

Fig – 6

Fig – 7

Fig – 8

Post-Op Pics: (Fig 9-11)

Fig - 9

Fig - 10

Fig – 11