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Review Article

Dentoalveolar Surgery and Orthodontics- A Review

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Abstract

Dentoalveolar surgical procedures in orthodontic treatment may prove to be an alternative method to reduce treatment time and improve outcome in adolescent and adult patients. This article reviews the clinical surgical practice in orthodontic treatment, indications and biological principles, as well as the limitations and risks of surgical techniques.

Keywords: Corticotomy; Dentoalveolar Surgery; Orthodontics

Introduction

In Chile, the demand for orthodontic treatments in the public and private dental system grows every year. The duration of these treatments has always been one of the biggest concerns of both patients and orthodontists, resulting in an average duration of 33.9 months [1].

Some authors describe that the duration of orthodontic treatment, which is affected by numerous factors, such as the severity of the case, the treatment plan, the clinical capacity of the professional, the need to perform extractions and the patient's compliance, usually ranges from 24 to 36 months in current clinical situations [2,3].

This leads to the need to seek complementary procedures to conventional treatment to reduce the duration of treatment and at the same time improve results, in terms of aesthetics and function, which subsequently impacts on the patient's quality of life.

In modern Public Health, cost efficiency in an important objective, so a treatment that extends too far in time violates the afore mentioned objective, so clinical efforts must be oriented to be effective. Likewise, the longer the treatment, the higher the costs associated with the patient and the higher the percentage of treatment rejections due to this reason. In turn, shorter treatments decrease the likelihood of undesirable side effects such as root resorptions and problems induced by plaque accumulation bacterial such as white spots, cavities or periodontal diseases [1].

Thus, given this constant demand for shorter treatments, new studies have been conducted with different approaches to increase the effectiveness of orthodontic treatment by shortening its duration.

Dental displacement during orthodontics occurs as a result of a biological process, characterized by a remodeling of the alveolar bone and the periodontal ligament in response to a force, which promotes extensive cellular and molecular changes in the periodontal [4]. Bone remodeling processes begin when an orthodontic force is applied to the periodontal which, in turn, generates an aseptic inflammatory response. This inflammation alters the homeostasis and microcirculation of the periodontal ligament, creating areas of

ischemia and vasodilation, resulting in the release of several biological mediators, such as cytokines, chemokines, growth factors, neurotransmitters, metabolites of arachidonic acid and hormones. These molecules trigger a series of cellular responses that promote bone reabsorption by osteoclasts at pressure sites and bone formation by osteoblasts at stress sites [5].

In orthodontics, surgical procedures can be extremely useful in movements that will not normally occur without this assistance or will be extremely slow and avoid unnecessary or difficult movements of the teeth, to reduce risk [6].

In this regard, there is a growing number of publications that emphasize surgery dentoalveolar combined with orthodontic treatment comor alternative method for adolescents and adults [7].

However, surgery can be associated with discomfort, morbidity and discomfort for the patient, a fact that favors that this technique is not the first option for some patients. And its effect on the overall duration of treatment is limited by the indication of the procedure, the time of surgery and the skill of the professional. In addition, the number of appointments and chair time needed to complete treatment may not decrease due to the shorter recommended intervals between controls. Therefore, it is difficult to determine whether any reduction in the duration of treatment would exceed the additional cost of the surgical procedure [8].

The evaluation of the updated bibliographic data reveals the main techniques used in orthodontic surgery. Most described include dentoalveolar osteotomy (interdental or subapical), dentoalveolar ostectomy (interdental ostectomy, wegde-shaped), dentoalveolar microfracture, dentoalveolar corticotomy, dentoalveolar corticectomy and dental distraction [7].

Dentoalveolar osteotomy complementary to orthodontic treatment

Dentoalveolar osteotomy is related to a complete resection of bone a (cortex and medulla) surrounding a tooth, respecting muscle insertions, mucosa and periosteum to maintain an adequate blood supply in the bone fragment and dental pulp [7].

In this technique, the teeth are mobilized with their supporting structures and repositioned to the desired position either immediately during surgery or after it through the application of orthodontic forces for a short time [7].

The approach in a first stage includes dissection of the vestibular flap with vertical interdental cuts, which extend from the vestibular region to the piriformis opening, where they can be unified by an anatomical space or by a horizontal cut in the lower region of the nasal floor [9].

After completing the vertical or horizontal cuts, the newly formed tooth-bone segment is repositioned by finger pressure or mobilized for a certain period by applying orthodontic forces. The protection of the integrity of the tissue with palatina mucosa on at least one side, is paramount in this first stage.

The second stage includes dissection of the initial palatine flap and osteotomy of the palatine bone. It is recommended to wait four to five weeks to maintain a proper blood supply even though the palatine mucosa appears healthy in seven to ten days.

This second stage is followed by a labial osteotomy after three or four weeks in the second phase with mobilization and repositioning of the newly formed tooth-bone segment [9].

As a disadvantage of this procedure, is the concern for the side effects that could be generated, such as the loss of dental vitality, vascular necrosis of the bone segment, gingival recession, loss of the bone crest with the consequent formation of sac periodontal, delayed segment movement due to bone interference and traumatic occlusion.

To prevent these complications, a thorough evaluation and proper surgical planning should be carried out, considering the proximity of the roots and using small strawberries in the osteotomy to obtain the greatest possible connection of the bone segments, especially at the vertex of the alveolar crest.

Since bone healing is completed within four to six weeks, immediate postsurgical mobilization of the segment by orthodontic forces should be performed within two to four weeks, to avoid the loss of the advantages obtained with surgery.

Consequently, bone manipulation through surgical intervention, whether orthognathic or dentoalveolar, becomes intriguing to orthodontists based on the alteration associated with bone biology of tooth movement [7].

Dentoalveolar microfracture technique

In this technique, after applying interdental and horizontal cuts, the final movement of the bone segment is performed by fractures using osteotomes. Medeiros and Bezerra report that the fixation is performed by means of a wire arch, obtaining a healthy and healed periodontal in a period of eight months [10].

A microfracture technique combined with corticotomy may reduce treatment time.

Dentoalveolar corticotomy assisted by orthodontic ratting (CAOT)

This surgical procedure of assistance to conventional orthodontics is considered as one of the modern methods that aims to reduce the time of treatment and the overcoming of some limitations, especially in adult patients [11]. In this way, it is postulated as the safest and most effective therapeutic option to enhance the dentary movement during orthodontic treatment [12].

A corticotomy is defined as a surgical procedure whereby only the cortical bone is cut, perforated or mechanically altered [13].

Other authors define it as the surgical-co procedure of controlled osteotomy and limited to the cortical bone table, usually the buccal, little invasive, which as an additional advantage allows a pattern of bone remodeling with little risk of damage to periodontal tissues [14].

For many years it has debated in the literature and different CAOTt's technical have been described. In 1956 it was introduced the so-called bony-block theory to accelerate dental movements in orthodontic treatments.

A new surgical technique was introduced in 2001 by the Wilcko brothers: first called AOO (Accelerated Osteogenic Orthodontics) and later PAOO (Periodontal Accelerated Osteogenic Orthodontics) and recording the technique as a whole under the name of Wilckodontics (Wilcko, Wilcko, Pulver, Bissada and Bou- quot, 2009; Wilcko and Wilcko, 2013) [15].

The PAOO is developed in three phases:

- Selective alveolar corticotomy: By flap to total thickness preserving the aesthetics of the papilla. After this, interproximal cuts of 0.5 mm depth limited to the vestibular and lingual corticals [16].
- Bone grafting: The second phase consists of performing alveolar augmentation procedures by placing xenogenous or autogenous regeneration material in the decortication areas, being optional the placement of resorbable collagen membranes. The flap is sutured with simple points not resorbable and removed 1-2 weeks after the intervention [16].
- Application of orthodontic forces: Recommending the placement of appliances 1 week before corticotomy. The start of treatment should be done after surgery, postponing it to a maximum of 2 weeks. Force activations should be carried out every 2 weeks for 4 months [16].

In 2006, sand introduced a new method to preserve the integrity of the periodontal: lift a flap of full thickness and perform interproximal corticotomies with piezoelectric devices. Although the aim was to achieve a safer procedure, the elevation of the flap increased the risk of postoperative complications and discomfort [17].

To solve this problem, a new surgical technique, Piezocision™ was introduced. A transmucosal approach is performed by vestibular, interradicular, which allows the insertion of the piezoelectric instrument to perform a corticotomy 3 mm deep. This technique is especially indicated in patients with fine biotypes since it respects the white tissues and favors their healing. Hard and/or soft tissue grafts can be added through a tunneling procedure [18,19].

On the other hand, the most recent explanation of the biological mechanism behind CAOT concluded that localized selective decortication surgery in combination with dentary movement by conventional orthodontics results in rapid alveolar bone remodeling in the bone marrow cavities, leading to less hyalinization of the periodontal ligament and absence of the delay phase during the later stages of orthodontic treatment [20]. This was used to explain the apparent decrease in root resorption on the side of corticotomy, an apparently additional advantage of CAOT.

Other authors propose that the decorticated bone is demineralized and presents a phase of removal deletion (3- 4 months) as a response of the tissue to induced surgical trauma which reduces resistance to orthodontic forces, time that is used for rapid teeth movement [21].

As for the results obtained by this technique, the movement rate achieved is 1 - 2 mm/week, compared to 1 mm per month obtained through normal orthodontics [22].

Other authors found an acceleration of tooth movement by 2 - 2.5 times compared to tooth movement by conventional or non-surgically assisted orthodontics. In addition, it was classified as safe in terms of the periodontal health and presented low or no risk of root reabsorption [23].

Direct benefits were also described in canine traction, slow expansion, open bite correction, treatment of dentoalveolar bimaxillary protrusion and molar intrusion [24].

However, there is no evidence to support that dentoalveolar corticotomy as well as orthodontic treatment improves the movement of ankylosed teeth, post-tensile alveoli closure, post-orthodontic stability or transverse expansion [23].

In addition, there are authors who claim that corticotomy facilitates an acceleration of tooth movement for only 4 months, after that the rate of movement returns to normal [25].

However, clinical experience has led to the assertion that recurrence after treatment facilitated by corticotomy is minimal due to increased root support after healing and loss of tissue memory by bone turnover and remodeling processes [8].

One of the limitations of corticotomy is the volume of the oral bone table. Since the procedure requires the lifting of the flap to the total thickness beyond the dental apexes, it would be contraindicated in areas with absence of oral bone tables which would result in recession of marginal tissue.

Additionally, the periodontal clinical parameters and the volume of the oral bone table of the teeth undergoing corticotomy remain stable after the procedure.

Dental distraction

Distraction osteogenesis is a biological process of new bone formation between the surfaces of bone segments that gradually separate by incremental traction.

In the distraction of the periodontal ligament and in the distraction dentoalveolar, bone strength is surgically reduced, allowing new bone to be generated in the area of osteotomy or corticotomy [26].

This technique responds to a recent and innovative use of distraction osteogenesis applied to orthodontic tooth movement, moving individual dental segments quickly and reducing orthodontic treatment time [26].

As for the results, the generation of new bone has been disced at a speed of approximately 1 mm per day [26].

It has been observed that the best time to start dentary movement with orthodontics is when the edentonous space is fibrous and bone formation has just begun.

Conclusion

Despite the various techniques described in the literature, evidence points to surgical methods as the most effective means of accelerating tooth movement in orthodontic treatment [12].

More clinical and histological studies are needed to understand the biology of dental movement using these techniques.

More research is required, with well-designed studies, in the field of acceleration of tooth movement during orthodontics, with additional attention to optimal application protocols, overall duration of treatment, adverse effects and cost-benefit analysis based on the specific characteristics of each method.

Bibliography

1. Carlos Felipe Zepeda-Diaz. "Factors that Affect the Duration of Orthodontic Treatments in a Health Serviceor Public". *The International Journal of Odontostomatology* 13.3 (2019): 386-395.

2. Yi J., *et al*. "Effectiveness of adjunctive interventions for accelerating orthodontic tooth movement: a systematic review of systematic reviews". *Journal of Oral Rehabilitation* 44 (2017): 636-654.

3. Mavreas D and Athanasiou AE. "Factors affecting the duration of orthodontic treatment: a systematicreview". *European Journal of Orthodontics* 30 (2008): 386-395.

4. Huang H., *et al*. "Accelerated orthodontic tooth movement: molecular mechanisms". *American Journal of Orthodontics and Dentofacial Orthopedics* 146 (2014): 620-632.

5. Krishnan V and Davidovitch Z. "On a path to unfolding the biological mechanisms of orthodontic tooth movement". *Journal of Dental Research* 88 (2009): 597-608.

6. Chung KR., *et al*. "Speedy surgical-orthodontic treatment with temporary anchorage devices as an alternative to orthognathic surgery". *American Journal of Orthodontics and Dentofacial Orthopedics* 135 (2009): 787-798.

7. Uzuner and Darendeliler. "Dentoalveolar surgery combined orthodontics". *European Journal of Dentistry* 7.2 (2013).

8. Hoogeveen EJ., *et al*. "Surgically facilitated orthodontic treatment: a systematic review". *American Journal of Orthodontics and Dentofacial Orthopedics* 145 (2014): 51-64.

9. Epker BN and Paulus PJ. "Surgical-orthodontic correction of adult malocclusion single tooth dento-osseous osteotomies". *American Journal of Orthodontics* 74 (1978): 551-563.

10. Medeiros PJ and Bezerra AR. "Treatment of an ankylosed central incisor by single-tooth dento-osseous osteotomy". *American Journal of Orthodontics and Dentofacial Orthopedics* 112 (1997): 496-501.

11. Wilcko WM., *et al*. "Rapid orthodontics with alveolar reshaping: two case report of decrowding". *International Journal of Periodontics and Restorative Dentistry* 21 (2001): 9-19.

12. Long HU., *et al*. "Interventions for accelerating orthodontic tooth movement - A systematic review". *The Angle Orthodontist* 83.1 (2013): 164-171.

13. Murphy KG., *et al*. "Periodontal accelerated osteogenic orthodontics: a description of the surgical technique". *Journal of Oral and Maxillofacial Surgery* 67 (2009): 2160-2166.

14. Gantes B., *et al*. "Effects on the periodontium following corticotomy- facilitated orthodontics. Case reports". *Journal of Periodontology* 61.4 (1990): 234-238.

15. Carina Verdasco. "Dental Movement Acceleration mediated by Corticotomies in Orthodontic Treatment". *Psychologia Latina* (2018): 458-460.

16. Stober EK., *et al*. "Selective alveolar corticosteroid as adjuvant to orthodontic treatment: literature review". *Revista Española de Ortodoncia* 40 (2010): 215-230.

17. Bertossi D., *et al*. "Orthodontic micro-surgery for rapid dental repositioning in dental malpositions". *Journal of Oral and Maxillofacial Surgery* 69 (2011): 747-753.

18. Vercellotti T and Podesta A. "Orthodontic microsurgery: a new surgically guided technique for dental movement". *International Journal of Periodontics and Restorative Dentistry* 27 (2007): 324-331.

19. Cassetta M., *et al*. "Minimally invasive corticotomy in orthodontics: a new technique using a CAD/CAM surgical template". *The International Journal of Oral and Maxillofacial Surgery* 44 (2015): 830-833.

20. Baloul SS., *et al*. "Mechanism of action and morphologic changes in the alveolar bone in response to selective alveolar decortication-facilitated tooth movement". *American Journal of Orthodontics and Dentofacial Orthopedics* 139 (2011): S83-S101.

21. Wang L., *et al*. "Tisssue responses in corticotomy- and osteotomy- assisted tooth movements in rats: histoloy and immunostaining". *American Journal of Orthodontics and Dentofacial Orthopedics* 136.6 (2009): 770.

22. AlGhamdi AST. "Corticotomy facilitated orthodontics: Review of a technique". *The Saudi Dental Journal* 22 (2010): 15.

23. Hassan A., *et al*. "Corticotomy assisted orthodontic treatment. A systematic review of the biological basis and clinical effectiveness". *The Strategic Management Journal* 36.79 (2015): 794-801.

24. Wilcko WM., *et al*. "Rapid orthodontics decrowding whit alveolar augmentation: case report". *World Journal of Orthodontics* 4 (2003): 197-205.

25. Mathews DP and Kokich VG. "'Accelerating tooth movement: The case against corticotomy-induced orthodontics". *American Journal of Orthodontics and Dentofacial Orthopedics* 144.1 (2013): 5-13.

26. Kharkar VR., *et al*. "Comparative evaluation of dento-alveolar distraction and periodontal distraction assisted rapid retraction of the maxillary canine: A pilot study". *International Journal of Oral and Maxillofacial Surgery* 39 (2010): 1074-1079.

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