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Corticotomy, a surgical technique to accelerate orthodontic dental movement

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Abstract

Corticotomy is a surgical method employed to accelerate orthodontic dental movement in adult patients. It refers to osteotomy of cortical bone and leads to a faster bone turnover and to a state of local transient osteopenia, with a lower resistance to dental displacement. A review of literature on electronic database PubMed was performed in order to highlight the main results achieved with this technique.

Background

Corticotomy is a surgical technique used to accelerate orthodontic treatment in the adult patient. In fact, long-term orthodontic therapy can lead to periodontal complications or to the risk of root damage especially in adult patients, who want to end treatment for aesthetic and social needs as soon as possible (1).

Different methods have been proposed to accelerate orthodontic movement of teeth and thus reduce the overall duration of therapy and they can be distinguished in non-surgical, including low intensity laser therapy (2) and pharmacological approaches(3,) and surgical, most employed, including corticotomy.

Corticotomy refers to osteotomy of cortical bone. The acceleration of dental movement following corticotomy is due to increased bone turnover after the surgical procedure; this results in a transient reduction of the density of the trabecular bone and so a lower resistance to dental displacement (4).

RAP (Regional Acceleratory Phenomena) indicates a condition resulting from bone trauma, characterized by faster bone formation than normal remodeling processes. This process (RAP) begins a few days after the trauma, lasts about 4 months and is reduced after 6 months or sometimes more than 24 months (5, 6, 7, 8). RAP leads to an increased osteoblastic activity, creating a window period of 4/6 months in which dental movement can be performed more rapidly (9).

The use of corticotomy in the orthodontic field was introduced by Kole in 1959, which considered the cortical bone as the main resistance to orthodontic displacement (10). The surgical intervention he proposed consisted in the lifting of a full thickness flap on both buccal and oral sides, then making interdental corticotomies and finally horizontal connection osteotomies. However, this technique was very invasive and posed the risk of periodontal and radicular injuries and bone necrosis, so it has never been very successful (11).

In 1991 Suya modified Kole technique, replacing horizontal osteotomies with corticotomies, affecting only the cortical bone (12).

More recently, Wilcko et al. have introduced a new technique, associating corticotomy with the use of bone graft materials, in order to increase bone volume and reduce the risk of fenestration or dehiscence. This technique was termed "Accelerated Osteogenic Orthodontics (AOO)" (5, 6, 7) and subsequently "Periodontally Accelerated Osteogenic Orthodontics (PAOO)" (8).

Due to the invasiveness of corticotomy intervention, flapless and less invasive methods were introduced, including corticision (13), piezocision (14) and micro-osteoperforations (MOPs) (15).

Materials and Methods

A review of literature on the electronic database PubMed (Medline) was performed using the keywords: [Corticotomy] [Orthodontics] [Tooth movement] [Corticotomy-assisted orthodontics].

Seven studies were selected, published between 2007 and 2016, to highlight the main results achieved with this method.

Review

Fischer in 2007 treated 6 patiens with bilaterally impacted canines. Randomly, one canine was surgically exposed with a conventional surgical technique, while the other one was subjected to a corticotomy-assisted surgical technique. When the treatment was completed, it was calculated a statistically significant reduction of treatment time of 28-33% for canines belonging to group exposed through a corticotomy-assisted technique (16).

Akay et al in 2009 selected 10 patients with anterior open bite, who received subapical corticotomy, scheletal anchorage and intrusion forces on maxillary posterior teeth, recording a significant intrusion of these teeth, counterclockwise rotation of mandible and correction of anterior open bite (17).

Aboul-Ela et al in 2011 treated 13 patients who needed extraction of maxillary 1st premolars and retraction of canines. Corticotomy was randomly performed only in one side of the maxillary arch and the other side served as control. Miniscrews were used as anchorage and close nichel-titanium spring coils were used for retraction. The rate of canine movement was found to be 2 times higher in sites subjected to surgical intervention than the control ones during the 1st and 2nd months after corticotomy; during the 3rd month it was 1.6 times higher and during the 4th month 1.04 higher (18).

Shoreibah et al in 2012 evaluated 20 patients with moderate crowding of the lower anterior teeth divided in 2 groups (10 individuals in each group) . One group was subjected to conventional orthodontic treatment, the other one to corticotomy-facilitated orthodontic teeth movement. Treatment duration showed a statistically significant difference between the 2 groups: 17.5 +/- 2.8 weeks in the corticotomy group and 49 +/- 12.3 weeks in the conventional orthodontic therapy group (19).

In 2014 Bhattacharya et al selected 20 patients requiring retraction of upper anterior teeth in the extraction space of 1st premolar. Patients were divided in 2 groups: Corticotomy Group (10 individuals subjected to orthodontic treatment after corticotomy) and Control Group (10 individuals subjected to orthodontic treatment without corticotomy). Corticotomy was performed from mesial surface of upper 1st premolar of one side to the other side and 1st premolars were extracted at the same time. For both groups a NiTi closed coil spring was used for retraction of anterior teeth. The results showed a retraction time significantly higher in control group compared to corticotomy group: the average time for retraction was found to be 131+/-7.5 d for corticotomy group and 234+/-9 d for control group (20).

Al-Naoum et al in 2014 analyzed the efficacy of corticotomy procedure to accelerate dental movement in canine retraction after extraction of upper 1st premolars in 30 patients.The rate of canine retraction in corticotomy sites was 4 times higher during the 1st and 2nd week after surgical intervention than the control group, and 3 times higher between the 2-4th and 8-12th (21).

Jahanbakhsi et al in 2016 treated 15 adult women requiring extraction of 1st maxillary premolars and randomly one maxillary quadrant was subjected to corticotomy procedure, while the other side was treated without surgical intervention. Corticotomy procedure was performed from distal surface of the canine to mesial surface of 2nd premolar. Two weeks after surgery fixed sectional canine retractors were installed on both sides. Average velocity of upper canine retraction was significantly higher in experimental sites than control sites during the first (2.2 mm/month vs 1 mm/month), second (2 mm/month vs 1.1 mm/month), third (1.8 mm/month vs 1.2 mm/month) and fourth (1.4 mm/month vs 1.1 mm/month) months (22).

Conclusions

From the analysis of the reported studies, corticotomy appears to be an effective method in reducing the overall duration of orthodontic treatment and can be used in different clinical situations, including correction of anterior crowding, distalization of canines after the extraction of first premolars, molar intrusion and open bite correction.

Nonetheless this technique requires further studies in orther to state its definite efficacy.

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