ORIGINAL RESEARCH PAPER

Orthodontics

KEY WORDS: Orthodontics, Corticotomy, Piezocision.

EFFECTS OF CORTICOTOMY AND PIEZOCISION IN ORTHODONTICS, LITERATURE REVIEW.

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ABSTRACT

A corticotomy is a procedure whereby only cortical bone is surgically cut, perforated or mechanically altered and at the same time minimally penetrates the bone marrow.[1] Corticotomy assisted orthodontic treatment is an established and efficient technique that has gradually gained as a complementary treatment option for the treatment of adult orthodontics.[2] Different surgical techniques are found to perform corticotomy; among them: corticotomy, corticostion, accelerated osteogenic orthodontics-AOO, micro-osteoperforations and the piezocision technique.[3] Corticotomy is used to facilitate orthodontic dental movement and to overcome some deficiencies of conventional orthodontic treatment such as: the long duration required, the limitation of dental movement and the difficulty in producing movements in certain directions. Clinical applications for corticotomy include: dental crowding, accelerating canine retraction after premolar extraction, retraction of anterior teeth, facilitating eruption of impacted teeth, molar intrusion and correction of open bite and facilitating slow orthodontic expansion.[2]

INTRODUCTION

The corticotomy consists of a surgical maneuver in which a cut or a perforation is made in the cortical portion of the bone, it can be performed with hand cutting instruments such as low or high speed rotary and piezoelectric instruments; all these with abundant irrigation. Through this procedure, osteoblasts and osteoclasts are activated, facilitating dental movement with a favorable response for bone.[4] The objective of this process is to pass through the cortex and touch the medullary bone to stimulate bone turnover, resulting in an facilitated orthodontic treatment. It is characterized by a three to four-fold decrease in time in an orthodontic treatment, in addition to decreasing root resorption and obtaining greater stability compared to conventional orthodontic treatment.[5]

The rapid movement of the teeth in the corticotomy is due to the increase in bone turnover in response to surgical trauma. This change in bone physiology results in a localized decrease in the density of the trabecular bone, which in turn would offer less resistance to dental movement.[2] This decrease in resistance is explained by the underlying regional accelerating phenomenon, which is a temporary stage of localized soft and hard tissue remodeling that leads to the reconstruction of the injured sites to a normal state by recruiting osteoclasts and osteoblasts through intercellular local mediating mechanisms that include precursors, inflammatory cells, blood capillaries and lymph.[7] This accelerated remodeling is influenced by bone density and hyalinization of the periodontal ligament. There is a direct correlation between the severity of bone corticotomy and / or osteotomy and the intensity of the healing response, which leads to an accelerated bone turnover at the surgical site.[8]

DEVELOPING

Henrich Köle in 1959 was the one who introduced the description of a corticotomy technique associated with orthodontic treatment to accelerate dental movement.[9] Köle believed that the continuity of cortical bone offered the greatest resistance to tooth movement. His surgical intervention was carried out by creating separate bone blocks with vertical lingual and oral corticotomies and a horizontal supra-apical osteotomy that connected mesial and distal cuts, and postulated this theory as "movement of bone blocks." [10]

Although corticotomy procedures are quite effective in helping to accelerate orthodontic tooth movement, they are intrinsically invasive due to the need for significant flap elevations, which can result in post-surgical discomfort and complications that prevent patients from undergoing such procedures. Some studies have also reported that procedures that involve full-thickness flap elevation can cause periodontal problems and increase dental mobility and bone dehiscence.[11,12,13.]

Another procedure, minimally invasive; "The Piezocision TM technique" was introduced in 2009. This flapless technique used an ultrasonic piezo-surgical knife to perform microincisions in the gum and cortical alveolar bone.[14] In the surgical technique, vertical microincisions are made with a microblade of scalpel or a scalpel blade number 15 in the vestibular interradicular spaces from the base of the papilla and finally transmucosal corticotomies are made through the incisions previously made, at a depth of 2 to 3mm. No suturing is necessary, unless tunnels are made for bone graft placement. Orthodontic forces are applied every 14 days. The advantages of this technique is to be minimally traumatic, so pain, inflammation and post-surgical ecchymosis are rare, since no flap of total thickness is lifted and the surgical time is short, this technique reduces damage to osteocytes and allows the survival of bone cells.[16,17] Of the most important advantages is that the use of piezoelectric scalpel, due to its microvibration, allows selective cutting in mineralized structures without damaging soft tissues. It has as disadvantages that it allows poor visibility; The piezoelectric scalpel and the difficulty in controlling bone grafting are necessarily required.[17]

INDICATIONS AND CLINICAL APPLICATIONS:[6,8,18,19,21,22.]

1. Perform molar intrusion and extrusion movements or closing an open bite.
2. Potentialize the correction of severe to moderate grade malocclusions.
3. Perform more extensive movements in a very short time compared to conventional orthodontic treatment.
4. Solve the crowding and shorten the treatment time.
5. Accelerate canine retraction after premolar extraction. Distal canine movement is a time-consuming procedure for patients with premolar extraction. Conventional

techniques result in canine retraction rates of 0.5 to 1 mm per month, depending on the age and sex of the patient. Therefore, complete canine retraction may require 5 to 9 months. Conventional treatments with fixed devices are likely to require 1.5 to 2 years.

6. Improve post-orthodontic stability. Stability after orthodontic treatment may not always be attainable. Little has been shown that 10 years after orthodontic treatment, only 30% of patients had a satisfactory alignment of the mandibular incisors. Stability was reported as one of the advantages of corticotomy-assisted orthodontics. It was discovered that orthodontic treatment facilitated by corticotomy resulted in better retention compared to conventional orthodontic treatment.
7. Facilitate the eruption of impacted teeth. Surgical traction of impacted teeth, especially canines, is a frustrating and prolonged procedure. A study by Fischer showed that under the same periodontal conditions, the corticotomy-assisted approach produced faster movement of the teeth during traction of the palatally impacted canines compared to conventional methods of canine traction at the end of each treatment.
8. Facilitate slow orthodontic expansion.

CONTRAINDICATIONS: [5,8,18,24.]

- The absence of spinal bone that provides adequate vascularization or a thin bone crest.
- Active periodontal disease or gingival recession.
- Teeth with inadequate endodontic treatment or with periapical reaction prior to surgery.
- Ankylosis.
- Uncontrolled systemic diseases or blood dyscrasias or coagulopathies.
- In patients taking medications that modify bone metabolism such as bisphosphonates or NSAIDs, since these inhibit prostaglandins and therefore osteoclastic activity.

ADVANTAGES AND DISADVANTAGES: [17,18,24,25.]

Advantages	Disadvantages
decreased treatment time	causes inflammation and pain
lower orthodontic limits allowing more extensive movements without periodontally compromising the patient	is not applicable for all patients in general, patient selection will depend on their systemic and oral situation to determine whether or not you are a candidate for this procedure
greater post-treatment stability due to the process of demineralization / remineralization of the socket in initial conditions and presence of neoformed bone once the orthodontic movement is finished	A minimum of 10mm bone remnant must be had in the apical-coronal direction, in the vestibule-lingual direction it must be at least 7mm wide, the thickness of the alveolar bone must be at least 3mm , there is a sufficient amount of medullary bone between the bone cortices to avoid fractures.
Correct vestibular anatomical defects in the form of depression that usually accompany the narrow alveolar crest	
Decreases the possibility of extractions and the risk of root resorption	

CONCLUSIONS

Corticotomy and piezocision had no adverse impact on the periodontal state, including plaque index, depth of probing, insertion levels, gingival recession, degrees of mobility and alveolar crest levels.

Piezocision however seems to be a less traumatic technique with greater patient acceptance. More Studies (ECA) are required to confirm your acceleration rate, risk-benefit ratio, long-term follow-up.

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