PERIODONTAL ACCELERATED OSTEOGENIC ORTHODONTICS - A REVIEW

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ABSTRACT
Increased societal demands have led patients to request shorter orthodontic treatments, yet their expectations for outstanding final results remain high. One option for reducing treatment time is the dual-specialty in-office corticotomy-facilitated bone augmentation approach called the periodontally accelerated osteogenic orthodontics procedure (PAOO). This procedure is theoretically based on the bone healing pattern known as the regional acceleratory phenomenon (RAP). PAOO results in an increase in alveolar bone width, shorter treatment time, increased post treatment stability, and decreased amount of apical root resorption. Tooth movement can be enhanced and cases completed with increased alveolar volume providing for a more intact periodontium, decreased need for extractions, degree of facial remodeling and increased bone support for teeth and overlying soft tissues, thereby augmenting gingival and facial esthetics. This article reviews the historical perspective, technique, indications and contraindications for PAOO.

KEYWORDS: Corticotomy; orthodontic treatment

INTRODUCTION
An increasing number of adult patients are seeking orthodontic treatment.[1] There are several psychological, biological and clinical differences between the orthodontic treatment of adults and adolescents. Adults have more specific objectives and concerns related to facial and dental aesthetics, the type of orthodontic appliance and the duration of treatment. Growth is an almost insignificant factor in adults compared to children, and there is increasing chance that hyalinization will occur during treatment.[2] The development of corticotomy-assisted orthodontic treatment (CAOT) opened doors and offered solutions to many limitations in the orthodontic treatment of adults. This method claims to have several advantages. These include a reduced treatment time, enhanced expansion, differential tooth movement, increased traction of impacted teeth and, finally, more post-orthodontic stability. The evidence of the success of corticotomy as an adjunct to orthodontic treatment has not been well documented, and few published reports are available. The aim of this article is to present a comprehensive review of the literature, including the historical background, the contemporary clinical techniques, indications, contraindications, complications and side effects.[3,4]

HISTORICAL BACKGROUND
Europe is the birthplace of corticotomy-related surgeries. In 1931, Bichlmayr[5] introduced a surgical technique for rapid correction of severe maxillary protrusion with orthodontic appliances. Wedges of bone were first removed to reduce the volume of bone through which the roots of the maxillary anterior teeth would need to be retracted. Corticotomy has roots in orthopedics going back to the early 1900s. In 1892, it was first defined as a linear cutting technique in the cortical plates surrounding the teeth to produce mobilization of the teeth for immediate movement.[6] Köle introduced a surgical procedure involving both osteotomy and corticotomy to accelerate orthodontic tooth movement, based on the concept that teeth move faster when the resistance exerted by the surrounding cortical bone is reduced via a
surgical procedure. Köle further explained that the reduced resistance enhances an en bloc movement of the entire alveolar cortical segment, which is connected by softer medullary bone, including the confined teeth, when exposed to orthodontic forces.\[^7\] Suya specified that most orthodontic treatments should be completed in the first three to four months after corticotomy and before fusion of the tooth-bone units.\[^6\] Frost\[^9\] found a direct correlation between the severity of bone corticotomy and/or osteotomy and the intensity of the healing response, leading to accelerated bone turnover at the surgical site. This was designated “Regional Acceleratory Phenomenon” (RAP). RAP was explained as a temporary stage of localized soft and hard-tissue remodeling that resulted in rebuilding of the injured sites to a normal state through recruitment of osteoclasts and osteoblasts via local intercellular mediator mechanisms involving precursors, supporting cells, blood capillaries and lymph.\[^10\]

**CASE SELECTION**

PAOO can be used to accelerate tooth movement in most of the cases requiring orthodontic treatment. It has been shown to be particularly effective in treating moderate to severe crowding, in Class II malocclusions requiring expansion or extractions, and mild Class III malocclusions.\[^3,11\]

PAOO can be used in both maxillary and mandibular arches.

**SURGICAL TECHNIQUE**

The PAOO technique described by Wilkois as follows: full-thickness flaps are reflected labially and lingually using sulcular releasing incisions. The releasing incision can also be made within the thickness of the gingival attachment or at the base of the gingival attachment (mucogingival junction). Vertical releasing incisions can be used, but they should be positioned at least one tooth away from the “bone activation”. Flaps should be carefully reflected beyond the apices of the teeth to avoid damaging the neurovascular complexes exiting the alveolus and to allow adequate decortication around the apices. Selective alveolar decortication is performed in the form of decortications cuts and at points up to 0.5 mm in depth, combined with selective medullary penetration to enhance bleeding. This poses little threat to tooth vitality and makes PAOO much safer than the osteotomy technique, in which cuts extend into the medullary bone around the teeth that are to be moved. Adequate bio-absorbable grafting material is placed over the injured bone. Flaps are then repositioned and sutured into place. Sutures should be left in place for a minimum of two weeks. Tooth movement should start one or two weeks after surgery. Unlike conventional orthodontics, the orthodontic appliance should be activated every two weeks until the end of treatment after PAOO.\[^4,12\]

**INDICATIONS**

- **Resolve Crowding and Shorten Treatment Time**\[^14\]
  - Corticotomy and osteotomy were used in orthodontics primarily to resolve crowding in a shorter period of time. Several authors have described cases in which moderate and severe crowding was treated without extraction by corticotomy/osteotomy-assisted orthodontics and in shorter periods of time.\[^4,12,14\] It has been shown that corticotomy is efficient in reducing the treatment time to as little as one-fourth the time usually required for conventional orthodontics. Wilcko published a report about two adult patients with severe crowding who were treated via AOO in just 6.5 months.

- **Accelerate Canine Retraction after Premolar Extraction**\[^15-16\]
  - Canine retraction after premolar extraction is a lengthy step during the extraction stage of orthodontic treatment. Canine retraction was accelerated by corticotomy in two animal studies.

- **Enhance Post-Orthodontic Stability**\[^17\]
  - Stability after orthodontic treatment may not always be achievable. Little has shown that 10 years after orthodontic treatment, only 30% of patients had satisfactory alignment of the mandibular incisors.

- **Facilitate Eruption of Impacted Teeth**\[^18\]

- **Facilitate Slow Orthodontic Expansion**\[^19\]

A limited number of successful techniques is available for the treatment of maxillary arch constriction; these include surgically-assisted rapid palatal expansion (SARPE) and slow palatal expansion. These techniques are aggressive in nature and less accepted by patients. The presence of nongrowing alveolar bone that confines the teeth in the predetermined space available in the alveolus limits transverse tooth movement.
Molar Intrusion and Open Bite Correction\cite{20,21}

CAOT has also been used in the treatment of severe anterior open bite in conjunction with skeletal anchorage.

**Manipulation of Anchorage\cite{22}

CAOT was used in the treatment of bimaxillary protrusion as an adjunct to manipulate skeletal anchorage without any adverse side effects in only one-third of the regular treatment time.

**CONTRAINdications**

Patients with active periodontal disease or gingival recession are not good candidates for CAOT. In addition, CAOT should not be considered as an alternative for surgically assisted palatal expansion in the treatment of severe posterior cross-bite. CAOT also should not be used in cases where bimaxillary protrusion is accompanied with a gummy smile, which might benefit more from segmental osteotomy.\cite{23}

**CONCLUSION**

From an esthetic perspective the PAOO technique not only addresses tooth alignment, but also facial features and, as such, is truly in vivo tissue engineering. With a combination of both in-office periodontal surgery and orthodontic treatment, we can now more routinely address the esthetics of the entire lower face. Corticotomy reduces cortical resistance to allow more rapid tooth movement, especially in non-growing patients. When combined with conventional orthodontic mechanics, it can avoid undesirable side effects without the need for orthognathic surgery, thus enhancing the stability of results and shortening treatment time.

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**BIBLIOGRAPHY**


