**Vestibular Incision Subperiosteal Tunnel Access (VISTA) for Surgically Facilitated Orthodontic Therapy (SFOT)**

**Abstract**
Surgically Facilitated Orthodontic Therapy (SFOT) in combination with bone augmentation and the placement of anchorage devices installed into bone have been used to accelerate and facilitate orthodontic treatment. This is usually performed after flap surgery, which is associated with moderate morbidity, as well as possible negative sequelae such as gingival recession. The present case report illustrates the clinical benefits of vestibular incision subperiosteal tunnel access (VISTA) for SFOT, and tissue augmentation to facilitate orthodontic therapy. VISTA entails making vertical incision(s) in the vestibule followed by subperiosteal elevation of tunnels to provide direct access to the facial alveolar bone. Unlike previously reported vestibular access surgical procedures, VISTA allows for wider elevation of an access tunnel for clear visual and surgical access to perform careful inter-radicular corticotomy. The present report describes VISTA for corticotomy surgery (anterior mandible and maxillary teeth) in combination with the placement of titanium fixation devices and bone augmentation to facilitate orthodontic treatment of an adult female with borderline Class II Division 1 malocclusion, with excessive overjet and deepbite. In view of the fact that VISTA does not require surface incisions in the gingival margins or papillae, it potentially minimizes gingival recession that sometimes accompanies flap surgery.

**Keywords:** Corticotomy, orthodontics, regional acceleratory phenomenon, tooth intrusion, vestibular incision subperiosteal tunnel access

**Introduction**
Reducing the orthodontic treatment time is attractive for patients and may eliminate the risk of external apical root resorption, demineralization, and loosening patient compliance. Various systemic and localized methods have been used to accelerate the orthodontic tooth movement. The use of prostaglandin E₂, Vitamin D₃, and parathyroid hormone as well as using pulsed electromagnetic fields, electrical currents, distraction osteogenesis, mechanical vibration, low-level laser irradiation, and corticotomy, have been reported to accelerate orthodontic tooth movement.

Animal studies demonstrated that alveolar corticotomies with bur/piezosurgery lead to a regional acceleratory phenomenon (RAP). The RAP, described by Frost, is proportional to the extent of the surgical insult and associated with a localized surge in osteoclastic and osteoblastic activities that collectively lead to a decrease in bone density and an increased bone turnover, facilitating orthodontic tooth movement.

Accelerated orthodontics using alveolar corticotomies with/without augmentation bone grafting has been described by Wilcko et al. and has the potential to resolve malocclusions 3–4 times faster. Various terminologies such as “periodontally accelerated osteogenic orthodontics” and modifications have been introduced, but techniques are generally involve full-thickness periosteal flap reflection followed by the alveolar bone corticotomies (with surgical burs or piezotome), at labial/lingual sides, in the area of desired tooth movement. It has been recommended to see the patient every 2 weeks after the surgery for orthodontic adjustments. Generally, fixed appliances are placed a week before surgery and the appliance is activated at the time of surgery.

The present case report describes a novel approach of using the vestibular incision subperiosteal tunnel access (VISTA) for corticotomy surgery in combination with placement of mini implants and orthodontic miniplate with tube (C-tube) to facilitate orthodontic treatment of an adult case with Class II division 1 malocclusion and deep bite.

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Case Report

Summary of the clinical findings

The patient was a 42-year-old female, presenting with Class II division I malocclusion on Class II skeletal base, slight facial asymmetry at the lower third of the face, deep overbite, increased overjet, and proclined maxillary incisors [Figures 1 and 2]. She presented with a convex profile with a retrognathic mandible, pronounced labiomental fold, and a dominant chin. The molar relationship was asymmetric, full Class II on the right side and Class I on the left side. There was some spacing in the maxillary arch and mild crowding in the mandibular arch.

Medically, there was no relevant medical condition.

Intraoral and radiographic examination revealed restorations on teeth 2, 3, 14, 15, 18, 19, 21, 22, 31, 32, with teeth 22 and 25 had root canal treatment [Figure 3]. Bone loss around teeth 7 and 8, and mobility of teeth 7, 8, 9, and 10 were noted. There was a missing mandibular incisor. The patient received previous orthodontic treatment in 1995 and 1999 in another practice, but this was not successful in correcting the increased overjet and deep overbite.

Treatment plan

She was diagnosed as a borderline orthognathic case and the combined orthodontics and bilateral sagittal split osteotomy to advance the mandible was initially suggested to her, but after comprehensive risk/benefit assessment with the maxillofacial surgeon, orthodontists and periodontist, she decided to have orthodontic treatment only with intrusion of the anterior teeth to correct her deep overbite and reduce the increased overjet. It was decided to use the VISTA[15] to provide access for corticotomy in combination with simultaneous placement of mini implants,[16] initially, and miniplates at a later stage (C‑tube),[17] to facilitate orthodontic treatment.

Sequence of treatment

Following scaling and root planning, the patient was bonded with ceramic self-ligating brackets in the maxillary arch and stainless steel self-ligating brackets in the mandibular arch.

Following initial alignment with NiTi wires and approximately, after 9 months of active orthodontic treatment, a VISTA approach was used simultaneously with vestibular incisions (anterior of 22 and 27) followed by elevation of the full-thickness subperiosteal tunnel flap over teeth 21–28. Corticotomies with piezotome was carried out in the mandible (teeth 22–27) and simultaneously 2 mini implants were placed (anterior mandibular area, between teeth 22/23 and 26/27, Ace Ortho screw, 8 and 10 mm, respectively) [Figure 4]. A mucograft membrane infused with PGDF was also placed under the tunnel and the VISTA approach was sutured back using a 6.0 polypropylene suture. A similar approach was used in the maxilla, 3 weeks later, and 2 C-tubes (posterior maxilla above teeth 3 and 14) were placed and fixed with 5-mm bone screws. Corticotomies were also simultaneously done for maxillary teeth.

Class II elastics and intrusive mechanics using elastic power chains, in the mandibular anterior area, were subsequently used to correct the Class II
malocclusion, reduce the overjet, and intrude the lower incisors [Figure 5], to correct the deep bite. Glass ionomer cement was also used to disarticulate the bite and remove occlusal interferences. To achieve more intrusion of mandibular incisors, approximately 15 months into active orthodontic treatment, 2 mini implants in the anterior mandible were removed and replaced with a C-tube, using the VISTA approach. The C-tube was secured in place with 4-mm and 5-mm bone screws [Figures 6 and 7].

In the end, achieving the Class I molar relationship on both sides was found to be challenging, which was due to the tooth size discrepancy caused by relatively small maxillary lateral incisors, malformed mandibular second premolars, and the presence of three mandibular incisors [Figures 8-10]. The whole treatment took 21 months.

**Overview of Vestibular Incision Subperiosteal Tunnel Access for Surgical Corticotomy**

The VISTA[15] technique for corticotomy and adjunctive augmentation of the recipient site entails a vestibular access incision. The location of the access incision depends on the sites being treated. In the maxillary anterior region, the midline frenum is an optimal location that provides access to two teeth in either direction posteriorly. Additional vestibular incisions are generally required anterior of each canine. The incision is made through the peristeme to elevate a subperiosteal tunnel, gaining access to the facial alveolar bone. The tunnel elevation was extended and retracted in an effort clearly visualize the alveolar bone and perform careful inter-radicular corticotomy. A series of piezosurgery inserts (OT7, OT8R, OT8L) were used to make the corticotomy cuts. Two orthodontic titanium screws were placed between lateral incisor and canine (Ace Surgical Ortho screws, 8 and 10 mm) to provide effective anchorage. The VISTA technique is differentiated from previous techniques for vestibular access and corticotomy, since the VISTA technique enabled much wider tunnel elevation and direct visual access to the surgical field.
provide adequate access to the alveolar bone. The VISTA elevator is introduced through the vestibular access incision and inserted between periosteum and bone to elevate the periosteum away from the bone, creating the subperiosteal tunnel. A series of periosteal elevators are used for the elevation of subperiosteal tunnel. Specially designed elevators (Regenimmune, Inc. Woodland Hills, CA) are used for creating the tunnel from the initial access in a lateral and coronal direction. A contiguous tunnel is created from the vestibular region through the gingival sulci of the teeth and under each of the papillae.

It is important to extend the tunnel elevation to an extent necessary to allow for access to the facial plate to perform the required osteotomy cuts. To accomplish tension-free gingival mobilization, the subperiosteal tunnel is extended beyond the mucogingival margin, as well as through the gingival sulci of the teeth being augmented. Furthermore, the subperiosteal tunnel is extended interproximally under each papilla as far as the embrasure space permits, without making any surface incisions through the papillae. As in the maxilla, the VISTA approach to mandibular corticotomy entails creating a subperiosteal tunnel under the buccal gingiva of the teeth requiring treatment. Choosing an appropriate access incision site is particularly critical in the mandible, especially when addressing posterior corticotomy.

An acute awareness of the location of the mental foramen, mental neurovascular bundle, and its associated branches is necessary to avoid damage following the initial incision and subsequent full-thickness mucoperiosteal dissection. Therefore, given the position of the mental foramen, the optimal location of the access incision is in the vestibule between the mandibular lateral incisor and canine teeth. If necessary, the incision may be positioned between canine and first premolar. Vestibular incisions should not be placed between mesial of the first premolar to distal of the second premolar to avoid severing branches of this vital sensory structure. The availability of three-dimensional imaging such as cone-beam computed tomography would assist in identifying the exact location of the mental foramen.

Once the creation of the subperiosteal tunnel is completed, piezosurgery saws are used to make the corticotomy cuts of approximately 5-mm long and 3-mm deep. Straight or angled piezosurgery saws are used to access the vertical and horizontal corticotomy cuts.

**Discussion**

The present case report described the treatment of a borderline female adult with Class II malocclusion. Corticotomy-assisted orthodontics has offered a new perspective for borderline orthognathic cases and presented with an expanded envelope of tooth movement[21] as well as accelerating orthodontic tooth movement[22-24]. This means with corticotomy-assisted orthodontics or its combination with alveolar bone grafting (Periodontally Accelerated Osteogenic Orthodontics [PAOO][23]) greater retraction, protraction, intrusion, and extrusion for central incisor tooth movements in the maxilla and mandible may be

![Figure 8: Post-therapy intra-oral clinical images showing significant intrusion of mandibular teeth and establishment of a more harmonious occlusal plane. It is notable that the periodontal status was maintained in a healthy manner following comprehensive therapy which did not lead to significant gingival recession](image)

![Figure 9: Post-therapy panoramic radiograph taken at 22 months following initiation of orthodontic therapy, showing significant intrusion of mandibular teeth and establishment of a more harmonious occlusal plane. The comprehensive surgical and orthodontic therapy was uneventfully completed with no adverse consequences to the teeth and periodontal structures](image)

![Figure 10: Post-therapy clinical images, showing extra-oral and intra-oral improvements](image)
possible.\textsuperscript{[21]} Using mini implants and miniplates, as skeletal anchorage, in combination with PAOO or corticotomy facilitated orthodontics can offer treatment for some severe malocclusions, where orthognathic surgery is the most common approach,\textsuperscript{[19,26]} or at least, reduce the complexity of the orthognathic surgery,\textsuperscript{[27]} as well as reducing the treatment time for orthognathic cases.\textsuperscript{[28]}

Recently, by assessing the recession scores (sum of the recession depths), it was reported that, overall, using localized piezoelectric alveolar decortication was not associated with an increase in a gingival recession.\textsuperscript{[29]} However, similar to all periodontal flap surgery procedures, potential negative sequelae of surgical corticotomy with flap surgery is the soft tissue recession in mid-facial, as well as the loss of interdental papilla.\textsuperscript{[30,31]} The potential loss of periodontal attachment in participants with preexisting bone dehiscences may lead to negative esthetic outcomes that can adversely affect the outcome of therapy, necessitating simultaneous hard-tissue augmentation via a flap surgery\textsuperscript{[28]} or tunneling technique.\textsuperscript{[29,32]} This is particularly important as the beneficial effect of corticotomy is mainly in the first 4 months,\textsuperscript{[29]} and the addition of second-stage surgery may become relevant. Therefore, attempts to reduce the gingival margin discrepancies or residual scars,\textsuperscript{[29]} and reducing unnecessary flap reflection are of great importance to the profession. In order to reduce the invasiveness of corticotomy techniques,\textsuperscript{[31]} flapless alternatives to the RAP technique that employ piezolectric devices,\textsuperscript{[12,32]} reinforced scalpels and mallets,\textsuperscript{[34]} piezopuncture,\textsuperscript{[35]} or micro-osteoperforations\textsuperscript{[36]} have been proposed.

In an effort to avoid some of the inherent limitations and potential negative sequelae of surgical corticotomy, VISTA was employed in the case series reported herein. Compared to flap surgery, VISTA is a minimally invasive approach, which has been utilized for the treatment of multiple contiguous recession defects, alveolar ridge augmentation, as well as traction of impacted teeth in the aesthetic zone.\textsuperscript{[15,37-44]} The rationale of VISTA is to access the alveolar bone through one or more vertical incisions made in the vestibule without any surface incisions in the gingival margins or papillae. This approach has been demonstrated to be effective in achieving bone and soft tissue augmentation.

**Conclusions**

The present case demonstrates the application of VISTA for corticotomy and augmentation as adjunct to orthodontic therapy. The prospective randomized controlled clinical trial is warranted to compare the efficacy of the approach outlined herein to the conventional approach of elevating mucoperiosteal surgical flaps for corticotomy as well as bone- and soft-tissue augmentation.

**Clinical Relevance:** Application of VISTA allowed for clear direct visual and surgical access to the alveolar bone without incision or flap in the gingival margins to performa careful inter-radicular corticotomy. Surgically facilitated orthodontic therapy (SFOT) has been shown to be useful in accelerating the therapy and avoiding some adverse effects such as root resorption. However SFOT is sometimes accompanied with gingival recession secondary to flap reflection. The avoidance of gingival margin incision lead to surgical and orthodontic therapy with stable periodontal tissues. The combination of surgical and orthodontic therapy in conjunction with anchorage devices allowed for complex orthodontic tooth movements that was completed in shortened period without adverse dental and periodontal consequences.

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Nil.

**Conflicts of interest**

First author (HHZ) declares patents on instruments used for VISTA, as well as commercial interest in Regenimmune, Inc. which is involved in distribution of VISTA instruments.

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