Implant-Supported Bite Blocks for Open Bite Correction in Adults

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ABSTRACT

Altering the vertical dimension of the face remains one of the greatest clinical challenges with a multitude of orthodontic, orthopedic and surgical interventions recommended for the correction of associated skeletal, dental and neuromuscular abnormalities. Along with treatment, long-term stability of open bite corrections remains questionable, mainly because of weak musculature. Use of posterior bite blocks has been advocated to stretch the muscles and in turn increases the muscle strength. Muscle stretching also assists in posterior teeth intrusion. In adult patients, implants have been shown to be quite effective for active intrusion. This article highlights an innovative approach which essentially incorporates posterior bite block with active intruding component, i.e. implants. A specific protocol of treatment and retention with this approach is described.

INTRODUCTION

Open bite malocclusion has long held great fascination in orthodontics. Even though the prevalence of open bite is low (3.5% in patients between the age of 8 to 17 years1), its treatment has proven to be extremely challenging for the orthodontists. The cause of anterior open bite is multifactorial and can be attributed to a combination of skeletal, dental and soft tissue effects.2 It is mainly caused by overeruption of the posterior teeth or vertical overgrowth of the posterior dentoalveolar structures and sutures.3 Either of these implies a posterior rotation of the mandible, superior repositioning of the glenoid fossa due to underdevelopment of the middle cranial fossa and anterior portion of the maxilla or a combination of these effects. This growth pattern could be associated with tongue and orofacial muscular imbalance.3

Various treatment modalities have been proposed for the correction of skeletal anterior open bite.4-20 These include the use of high pull headgear, vertical-pull chin cup, extractions, functional appliances, posterior bite blocks and its modifications and recently skeletal anchorage supported intrusion. Every system has its own problems and none has provided the final answer to basic enigma of open bite, i.e. relapse.

Out of above-mentioned modalities, bite blocks are effective in holding vertical overdevelopment as well as shown to enhance muscular strength. They are also effective in producing condylar growth and a forward rotation of mandible.20 This is quite effective in growing patients. But in adult patients for active posterior teeth intrusion, temporary anchorage devices (TAD) have been shown to be effective.3 But implant-supported intrusion is also prone to relapse. According to Kurodo et al,4 there is almost 30% relapse after implant-supported intrusion and the main reason quoted is continued posterior eruption because of weak musculature.

This technical note aims to present the fabrication and application of an implant-supported bite block therapy which ensures en-mass posterior intrusion without any side effects and increased stability because of increase in muscle strength. A specific treatment protocol with two phases, i.e. active treatment with implant supported bite blocks and retention with bite blocks is presented.

CASE REPORT

A female patient, 21-year-old, came with a compliant of spacing between upper and lower anterior teeth, i.e. anterior open bite (Figs 1A to C). Clinical examination revealed a skeletal open bite malocclusion. There was no history of sucking habit or respiratory problems. Clinically, the open bite was of 6 mm (Figs 1A to C).

Cephalometrically (Figs 2A and B) patient had all the features of skeletal open bite, including steep mandibular plane angle, obtuse gonial angle, increased lower anterior face height and excessive posterior dental heights. As evaluated by CVMI method (Figs 2A and B), patient’s growth was complete.
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Figs 1A to C: Pretreatment intraoral photographs

Table 1: Cephalometric data

<table>
<thead>
<tr>
<th>Measurement</th>
<th>Pretreatment</th>
<th>Posttreatment</th>
<th>After 8 months of retention</th>
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<tr>
<td><strong>Sagittal</strong></td>
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<tr>
<td>• SNA*</td>
<td>80</td>
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<td>81</td>
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<tr>
<td>• SNB*</td>
<td>75</td>
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<td>78</td>
</tr>
<tr>
<td>• ANB*</td>
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<td>3</td>
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<tr>
<td><strong>Vertical</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• SN-GoGn</td>
<td>39</td>
<td>35.5</td>
<td>35</td>
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<tr>
<td>• Ar-Go-Me</td>
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<td>130</td>
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<tr>
<td>• N-Me (mm)</td>
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<tr>
<td>• S-Go/N-Me × 100%</td>
<td>58</td>
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<td><strong>Dental</strong></td>
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<td>• Upper incisor-NA (mm)</td>
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<td>3</td>
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<tr>
<td>• Lower incisor-NB (mm)</td>
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<td>3</td>
</tr>
<tr>
<td>• Upper incisor ANS-PNS** (mm)</td>
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<td>27</td>
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</tr>
<tr>
<td>• Lower incisor Go-Gn** (mm)</td>
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<td>• Upper molar ANS-PNS** (mm)</td>
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<td>• Lower molar Go-Gn** (mm)</td>
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<td>• Overbite (mm)</td>
<td>–6</td>
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*Angular measurement; **perpendicular linear measurement

Treatment Objectives

The patient’s main complaint was the anterior open bite that was of skeletal origin as confirmed by cephalometric analysis, it impaired his esthetics. Therefore, the objectives were to establish normal overbite and redefine perioral muscular function and balance.

Treatment Alternatives

On cephalometric analysis (Figs 2A and B) (Table 1), it was evident that incisor inclinations were normal, hence nonextraction options were thought off. The treatment objective

Figs 2A and B: Pretreatment: (A) Cephalogram, (B) Panorex
for the maxilla included altering the vertical position through posterior impaction. For this, surgical option was possible since growth was complete. But patient was reluctant for any major surgical procedure. The only other effective option was of implant supported posterior intrusion.

Posterior intrusion only with removable blocks was not possible mainly because of lack of patient compliance and lack of growth.

Finally, option of implant supported intrusion was selected by patient. Even if effective, this modality also shows relapse up to 30%\(^4\) and can cause buccal flaring, if force is applied only from buccal implants. To minimize this relapse and to prevent buccal flaring, posterior bite blocks were added to the design. This would help to increase muscle strength as well as could have favorable effect on condylar growth in terms of its vertical growth.

**Treatment Progress**

The initial segmental alignment and leveling was carried out on 0.022 slot MBT prescription brackets (Figs 3A and B). After this alignment, posterior intrusion was started.

**Implant Placement (Figs 4A and B)**

Zygomatic implant surgery was conducted using local infiltration anesthesia delivered bilaterally to the zygomatic sites of the maxilla. The zygomatic buttress was palpated in the labial sulcus, and a 1 to 2 cm high vertical incision was made starting at the mucogingival junction, while maintaining contact with the bone. An I-shaped multipurpose implant (Tasarim Med, Istanbul, Turkey) was adjusted to fit the contour of the lower face of each zygomatic process and fixed by three bone screws.

The straight arm of the implant, which was previously bent in the opposite direction, was exposed in the oral cavity through the attached gingiva at the mucogingival junction. Similar procedure was followed for placement of mini-implant in mandibular molar area. This was used for control of lower posterior teeth extrusion during the treatment. The patient was advised to use antiseptic mouthwash for 1 week and to maintain proper oral hygiene during this healing period.

**Appliance Construction (Figs 5A and B)**

The appliance consists of two 3.5 mm acrylic bite blocks connected with two heavy palatal arches (1.4 mm round stainless steel) and wire attachments on each buccal side, which are used for force application. Palatal arches are bent over two layers of wax to avoid impingement on the palatal mucosa during intrusion. Bite blocks cover all of the teeth that need to be intruded, i.e. generally all teeth distal to the upper canines. The outer wire attachments are made from 0.9 mm stainless steel wire.

**Placement and Force Application (Figs 6A to D)**

After allowing 7 to 10 days for wound healing and after removal of the sutures, the appliance is first tried in the mouth to check
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Figs 5A and B: Appliance construction

Figs 6A to D: (A) Before intrusion, (B) mode of intrusion, (C and D) after completion of intrusion

Figs 7A and B: (A) Before treatment, (B) after 8 months of retention with passive blocks
for even occlusal contact. Glass ionomer cement is used to bond the appliance. Two 9 mm NiTi coil springs (Masel, Bristol, Pa) were placed bilaterally between the tip of the implant and the outer wire creating an intrusive force of 400 gm. Mandibular implants were used for preventing extrusion of the mandibular molars.

The patient was observed at 4-week intervals, and progress was observed. Intrusion was achieved in 4.5 months. The anterior open bite was corrected in 4.5 months (Figs 6A to D). Intrusion of the posterior segment is retained with wire ligation between the molar tube and the implant throughout the subsequent orthodontic treatment. The implants were removed about 1 month before debonding.

**Results Achieved (Figs 7A and B)**

At the end of treatment, a Class I canine and molar relationship and correction of the anterior open bite were achieved through the impaction of maxillary posterior dentoalveolar segment and eruption and up righting of the upper incisors (Figs 7 and 8) (Table 1). The incisors were erupted, when the accentuated curve of Spee in the upper arch was aligned with straight wires. No other particular extrusion mechanics were involved in the treatment. The molars were impacted 3.5 mm, and this impaction was maintained throughout the treatment. Mandibular molar intrusion was minimal since no active intrusive force was applied for intrusion of mandibular molars. The mandibular plane showed 3.5° of counterclockwise autorotation (Figs 8A and B) (Table 1).

**Figs 8A and B:** (A) Before debonding cephalogram, (B) superimposition

**Fig. 8:** Temporalis electromyographic activity: (A) Before treatment, (B) after 8 months of retention
Posterior bite blocks with tongue cribs were used for 8 months as a retention protocol. At the end of retention, overbite of 2 mm was achieved. Electromyographic examination at the end of retention revealed increase in masseter and temporalis activity (Fig. 9).

**DISCUSSION**

It has been emphasized that increasing the vertical dimension of the face artificially results in skeletal adaptations which are not limited to the dentoalveolar region but occurs throughout the craniofacial complex, including muscular attachments. Posterior bite blocks that are used in the treatment of skeletal open bite, produce a forward and upward mandibular rotation by transmitting the masticatory muscle forces to the buccal dentoalveolar regions and preventing their vertical growth. These also help in essential vertical condylar growth. Both these factors are most essential for open bite correction stability. Over the years, no other orthodontic modality has shown such favorable changes. The purpose of this article is to present a two-phase therapy that ensures predictable treatment and improved stability.

The protocol which was followed consisted of two-phase treatment as follows:

1. **Phase I**: Active intrusion of posterior teeth with implant-supported bite blocks.
2. **Phase II**: Retention with posterior bite blocks with tongue cribs for 6 to 8 months.

Intrusion obtained with this modification appears to be because of muscular stretch secondary to increased vertical dimension as well as active component, i.e. implants. This view is supported by Woods and Nanda, who hypothesized that the depression of posterior segment seen could be attributed to increased muscular force occurring in response to increased vertical posterior dimension as well as to the presence of active intruding components.

In the orthodontic literature, stability of intrusion obtained with implants has not been explored. But according to various case reports, about 30% relapse is expected after intrusion with implants. The reasons for this higher percentage of relapse could be as follows:

1. No change in tongue position, muscle length and masticatory force. Therefore, the posterior teeth will erupt up to a point where the original balance between the eruptive and masticatory forces is reestablished.
2. With conventional implant supported maxillary posterior teeth intrusion, there is compensatory eruption of mandibular posterior teeth, hence minimal change in vertical dimension.

The advantages of adding posterior bite block with implant are as follows:

1. Increase in muscle strength and bite force. This seems to be important factor in retention of corrections achieved.
2. No buccal flaring of posterior teeth, as often seen with conventional posterior intrusion using only buccal implants.
3. Compensatory eruption lower posterior dentition is prevented.

4. Need of only two buccal implants/zygomatic plates. With conventional designs to prevent buccal flaring, palatal implants are needed. Additionally to prevent lower compensatory eruption, mandibular buccal implants are required. Thus effectively with conventional mechanics at least six implants are needed.
5. In place of zygomatic plates, microscrew implants been maxillary 2nd premolar and 1st molar can also be used.

Certain precautions are needed to be taken with this design:

1. Ideal cases are adolescent/adult skeletal open bite patients. In growing individuals spring loaded or magnetic bite blocks could be preferred.
2. Force applied should be parallel to long axis of maxillary 1st molar.
3. Retention with posterior bite blocks is essential. If needed, tongue cribs can be added to the design.

**CONCLUSION**

With implant-supported bite blocks significant intrusion, maxillary posterior teeth can be achieved. This approach is ideal for adult skeletal open bite cases who refuse surgical treatment. Addition of bite block results in increase in muscle strength which is most critical for retention.

Posterior blocks with or without tongue cribs as a retention plate, for at least 6 to 8 months, is equally critical for success of the therapy.

In extreme skeletal open bite cases, where greater amounts of treatment changes are required or desired, it may be necessary to extend treatment or delay it until orthognathic surgery is appropriate. Although surgery may be the only way to alter the large vertical skeletal discrepancies, orthodontists will inevitably be faced with the situation of attempting nonsurgical approaches in borderline patients with vertical skeletal dysplasia. The modified modality presented is promising for such patients.

**REFERENCES**


