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## Case Series

# The tongue thrust -open bite analogy: A case series

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### ABSTRACT

Treatment of a malocclusion characterized by open bite can be a difficult task for the orthodontist because such a malocclusion develops as a result of the interplay of many different etiologic factors. This article presents a case series of patients showing varying degrees of anterior open bite having a tongue thrusting habit. All patients were given a tongue crib appliance along with 0.022MBT preadjusted edgewise brackets treated with different modalities. Extraction of all 1st premolars was initiated in one case and retraction of anterior teeth was done using skeletal anchorage to improve the overjet and overbite. In other cases, non-extraction therapy was advocated with a modification of MEAW technique by incorporating reverse arch wire mechanics and correcting the anterior open bite.

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## 1. Introduction

Open bite is a distinctive and easily recognizable characteristic of some malocclusions; it has significant functional and esthetic consequences. It is defined as a condition of malocclusion “in which some teeth cannot be brought into contact”. When the jaws are closed, open bite can apply to individual teeth or groups of teeth, and can be restricted to either or both anterior and posterior dentitions. Interestingly, the etiology of anterior open bite is often quite different from that of posterior open bite, and so it is important to identify the fundamental cause of the condition in the diagnostic process.<sup>1</sup>

Malocclusions characterized by anterior open bite are often difficult to treat successfully.<sup>2</sup> The prevalence of open bite is less common than deep bites and the demand for treatment is around 17% (Proffit). Prevalence of open bite around the globe is 4.93% and it greatly varies

with ethnicity and age.<sup>3</sup> Factors like macroglossia, tongue thrusting, abnormal tongue posture, muscular dystrophy causes mandible to drop down from the facial skeleton with progressive distortion of facial proportions and excessive eruption of posteriors, narrowing of maxillary arch segment, invariably resulting in anterior open bite.<sup>4</sup> Consequently, for a number of years abnormal tongue function has frequently been reported as the primary cause of anterior dental open-bite.<sup>5</sup> Understanding the etiology, effects and it management at early stages may be helpful to prevent future severe skeletal malocclusion.<sup>6</sup>

Tongue-thrust, retained infantile swallowing, and reverse swallowing are defined as abnormal patterns of tongue function. Such abnormal functional patterns are commonly noted in conjunction with anterior dental open-bite. This circumstantial finding has resulted in a presumed cause-and-effect relationship.<sup>5</sup> Endogenous tongue thrust is often associated with excessive circumoral contraction on swallowing. Treatment for anterior open bite in a patient with an endogenous tongue thrust should not be carried out,

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as relapse will almost certainly occur.<sup>7</sup>

It is important to determine whether the open bite is skeletal in origin and its extent, or whether it is limited to the dentoalveolar complex. The difference is often in degree or amount, but it certainly will guide treatment decisions, as will the patient's age and growth potential.<sup>1</sup>

Many treatment modalities to control open bite have been proposed. However, they are not always satisfactory because of the strong relapse tendency, which calls for orthognathic surgery, especially in adults.<sup>8</sup> Dental compensation, intermaxillary elastics, use of skeletal anchorage and camouflage treatment are the different modalities advised for the correction of anterior open bite. One of the methods available for the treatment of open bite is the multiloop edgewise arch wire technique developed by Kim.<sup>9</sup>

This technique involves the use of multiloop gable bend arch wires with vertical elastics in the canine regions. Enacar et al<sup>10</sup> modified Kim's<sup>9</sup> technique by using 0.016 ˆ0.022 inch upper accentuated-curve and lower reverse-curve nickel titanium arch wires instead of multiloop gable bend arch wires, with the intermaxillary elastics applied in the canine regions. They suggested that upper accentuated-curve and lower reverse curve nickel titanium arch wires were simpler and more hygienic compared to multiloop arch wires, they reduced chairtime, and did not irritate the soft tissues. Enacar et al<sup>10</sup> reported that their results were similar to those obtained by the multiloop edgewise arch wire system.

Camouflage treatment, usually involves extraction of the first premolars and retraction of the anterior segments to mask or cover up mild, underlying Class II or Class III skeletal problems. The patients must be well chosen so that the treatment is not detrimental to facial esthetics. It is attempted and more successful in Class II patients than Class III patients, and might be indicated in patients with mild to moderate skeletal discrepancies with little growth modification potential. Age and skeletal maturation are important factors to consider, as are the crowding in the arch in which teeth are to be extracted and the patient's vertical facial proportions.<sup>11</sup>

Skeletal anchorage, with dental implants,<sup>12</sup> miniplates, miniscrews, and microscrews,<sup>13</sup> has been used to provide absolute anchorage. Microscrew implants are small enough to place in any area of the alveolar bone, easy to place and remove, and inexpensive. In addition, orthodontic force application can begin almost immediately after placement.<sup>13,14</sup>

Microscrew implants, placed between the second premolars and the first molars in the maxillary arch, can provide anchorage for anterior retraction and posterior intrusion of the teeth. In addition, the use of microscrew implants can eliminate the need for intermaxillary elastics, which have been known to induce extrusion of the molars,<sup>5</sup>

and clinicians might have more chance to close the mandibular plane.<sup>8</sup>

This article presents three case reports of anterior open bite with a tongue thrusting habit treated with two treatment modalities (extraction & non-extraction).

## 2. Case Report 1

A 19-year-old female patient presented with a chief complaint of an anterior open bite and forwardly placed front teeth having a class I skeletal base showing an average growth pattern. On clinical evaluation, the patient had a talon cusp present palatally over the maxillary right central incisor. There was an anterior open bite of 4 mm with a habit of tongue thrusting since childhood. The patient had a convex soft tissue profile with potentially incompetent and positive lip strain. Angle's class I molar and canine relationship was present bilaterally (Figures 1 and 2).

Radiographically, clinical FMA was high (30°) with an increased lower anterior facial height (67mm) and a tendency towards vertical growth pattern. The maxillary and mandibular incisors were proclined and forwardly placed (35°/11mm) & (38°/9mm). IMPA value of 104° (Table 1).

Limited by the patient's non growing status, the moderate open bite, and the severe anterior overjet. Dental protrusion and lack of spacing in the maxillary arch dictated the need for extractions in this case. After discussing all the alternatives of treatment, extraction of all 1<sup>st</sup> premolars was decided and carried out as there was increased proclination of maxillary and mandibular incisors. The right maxillary incisor with the Talon cusp was endodontically treated and the cusp was trimmed palatally.

After obtaining informed consent and a period of separation, .022-in slot appliance bands were fit on the first molars and a tongue crib habit breaking appliance was placed in the lingual sheaths of the molar bands (Figure 3). Bracket positioning was modified based on the MBT philosophy to also aid in the correction of anterior open bite. Following levelling and aligning, space closure was initiated using skeletal anchorage devices placed between 2<sup>nd</sup> premolar and 1<sup>st</sup> molar for complete retraction of anterior teeth (Figure 4) and the final repositioning and settling was done with debonding (Figures 5 and 6).

## 3. Case Report 2

A 21-year-old male patient presented with a chief complaint of gap between upper and lower front teeth with a class I skeletal base with orthognathic maxilla and mandible in an average growing pattern. On examination, patient presented a complex tongue thrust habit. On clinical evaluation, the patient had Angle's class I molar relationship bilaterally with spacing in the upper and lower anterior region (Figures 7 and 8).

**Table 1:** Pre- and post- treatment cephalometric values

Parameters	Normal value	Pre-treatment	Post-treatment
SNA	82±2 <sup>0</sup>	79 <sup>0</sup>	81 <sup>0</sup>
SNB	80±2 <sup>0</sup>	75 <sup>0</sup>	78 <sup>0</sup>
ANB	2±4 <sup>0</sup>	4 <sup>0</sup>	3 <sup>0</sup>
WITS appraisal	-1mm	0mm	0mm
Effective Maxillary Length	96±4mm	77mm	82mm
Effective Mandibular Length	127±6mmmm	95mm	101mm
Angle of convexity	-8.5±10 <sup>0</sup>	5 <sup>0</sup>	10 <sup>0</sup>
Beta Angle	27 -35 <sup>0</sup>	29 <sup>0</sup>	31 <sup>0</sup>
FMA	22-25 <sup>0</sup>	24 <sup>0</sup>	25 <sup>0</sup>
Y axis	53 <sup>0</sup>	65 <sup>0</sup>	66 <sup>0</sup>
LAFH	67-69mm	60mm	60mm
Sn-Go-Gn	32 <sup>0</sup>	30 <sup>0</sup>	30 <sup>0</sup>
Upper Incisor to NA	22 <sup>0</sup> /4mm	30 <sup>0</sup> /5mm	25 <sup>0</sup> /4mm
Upper Incisor to FH plane	107 <sup>0</sup>	114 <sup>0</sup>	113 <sup>0</sup>
Lower Incisor to NB	25 <sup>0</sup> /4mm	31 <sup>0</sup> /5mm	26 <sup>0</sup> /5mm
Lower Incisor to Mand Plane	90 <sup>0</sup>	105 <sup>0</sup>	98 <sup>0</sup>
Interincisal angle	135.4 <sup>0</sup>	117 <sup>0</sup>	128 <sup>0</sup>
Overjet	2 mm	0mm	2mm
Overbite	2 mm	0mm	2mm
Nasolabial angle	102+8 <sup>0</sup>	110 <sup>0</sup>	112 <sup>0</sup>
Lip strain	1 mm	0mm	1mm
Lower Lip to E line	-2 mm	0mm	0mm
Upper Lip to S line	0 mm	0mm	1mm

Patient had an average nasolabial angle, straight facial profile with shallow mentolabial sulcus and competent lips. Radiographically, the patient had a skeletal class I base with an SNA & SNB value of 83° & 80° respectively. The FMA, SN-GO-GN and Y axis values indicated that the patient is a horizontal grower. The maxillary (28°/5mm) and mandibular incisors (43°/8mm) were proclined and forwardly placed with an IMPA of 113° and interincisal angle of 103°. Other cephalometric changes are reported (Table 2).

Since the patient had a straight profile with average cephalometric values, a non-extraction therapy was decided to treat the patient. The treatment included placing 0.022-inch MBT with bracket positioning modified as per MBT to place the anterior brackets 0.5mm more gingivally and posterior brackets 0.5mm more incisally. After sufficient levelling and aligning, 0.019 x 0.025inch stainless steel with a reverse curve of spee was placed in both upper and lower wires which caused extrusion of upper and lower anterior teeth which was followed by anterior box elastics (3.5 Oz) to further correct the open bite (Figure 9). The patient was debonded after 15 months of treatment and all the objectives were met as mentioned above (Figures 10 and 11).

#### 4. Case Report 3

A 14-year-old female patient presented with a chief complaint of gap in front teeth with a class I skeletal base with retrognathic maxilla and mandible in an average

growing pattern. Patient had a complex tongue thrust habit which might have caused the anterior open bite of 5mm. On clinical evaluation, the patient had Angle's class I molar relationship bilaterally with mild crowding in the lower anterior region (Figures 12 and 13).

Average nasolabial angle, straight facial profile with shallow mentolabial sulcus and competent lips. Radiographically, the patient had a skeletal class I base with an SNA & SNB value of 79° & 75° respectively. The FMA, SN-GO-GN and Y axis values indicated that the patient is a horizontal grower. The maxillary (30°/5mm) and mandibular incisors (30°/5mm) were proclined and forwardly placed with an IMPA of 105° and interincisal angle of 117°. Other cephalometric changes are reported (Table 2).

As the patient's soft tissue profile was straight with no major deviations from the norm, a non-extraction therapy was decided to treat the patient. The treatment included placing 0.022 inch MBT appliance along with banding of 1<sup>st</sup> molars to incorporate the tongue crib during the start of the treatment (Figure 14). After sufficient levelling and aligning, 0.019 x 0.025-inch stainless steel were given a reverse curve of spee and they were inverted and placed in the brackets. This would cause extrusion of anterior teeth and intrusion of posterior teeth along with 5/18 inch (2.5 oz) anterior box elastics which would help in the correction of anterior open bite. The patient was debonded after 14 months of treatment and all the objectives were met as

**Table 2:** Pre- and post- treatment cephalometric values

Parameters	Normal value	Pre-treatment	Post-treatment
SNA	82±2 <sup>0</sup>	83 <sup>0</sup>	83 <sup>0</sup>
SNB	80±2 <sup>0</sup>	80 <sup>0</sup>	80 <sup>0</sup>
ANB	2±4 <sup>0</sup>	3 <sup>0</sup>	3 <sup>0</sup>
WITS appraisal	-1mm	3mm	0mm
Effective Maxillary Length	96±4mm	84mm	83mm
Effective Mandibular Length	127±6mmmmmm	105mm	103mm
Angle of convexity	-8.5±10 <sup>0</sup>	5 <sup>0</sup>	5 <sup>0</sup>
Beta Angle	27 -35 <sup>0</sup>	29 <sup>0</sup>	30 <sup>0</sup>
FMA	22-25 <sup>0</sup>	27 <sup>0</sup>	24 <sup>0</sup>
Y axis	53 <sup>0</sup>	65 <sup>0</sup>	60 <sup>0</sup>
LAFH	67-69mm	69mm	64mm
Sn-Go-Gn	32 <sup>0</sup>	30 <sup>0</sup>	27 <sup>0</sup>
Upper Incisor to NA	22 <sup>0</sup> /4mm	28 <sup>0</sup> /5mm	23 <sup>0</sup> /4mm
Upper Incisor to FH plane	107 <sup>0</sup>	118 <sup>0</sup>	110 <sup>0</sup>
Lower Incisor to NB	25 <sup>0</sup> /4mm	43 <sup>0</sup> /8mm	30 <sup>0</sup> /6mm
Lower Incisor to Mand Plane	90 <sup>0</sup>	113 <sup>0</sup>	92 <sup>0</sup>
Interincisal angle	135.4 <sup>0</sup>	103 <sup>0</sup>	128 <sup>0</sup>
Overjet	2 mm	0mm	2mm
Overbite	2 mm	0mm	2mm
Nasolabial angle	102+8 <sup>0</sup>	85 <sup>0</sup>	103 <sup>0</sup>
Lip strain	1 mm	3mm	1mm
Lower Lip to E line	-2 mm	2mm	2mm
Upper Lip to S line	0 mm	6mm	4mm

**Table 3:** Pre- and Post- Treatment Cephalometric Values

Parameters	Normal value	Pre-treatment	Post-treatment
SNA	82±2 <sup>0</sup>	85 <sup>0</sup>	83 <sup>0</sup>
SNB	80±2 <sup>0</sup>	82 <sup>0</sup>	80 <sup>0</sup>
ANB	2±4 <sup>0</sup>	3 <sup>0</sup>	3 <sup>0</sup>
WITS appraisal	-1mm	0mm	0mm
Effective Maxillary Length	96±4mm	80mm	81mm
Effective Mandibular Length	127±6mmmmmm	107mm	110mm
Angle of convexity	-8.5±10 <sup>0</sup>	4 <sup>0</sup>	5 <sup>0</sup>
Beta Angle	27 -35 <sup>0</sup>	42 <sup>0</sup>	39 <sup>0</sup>
FMA	22-25 <sup>0</sup>	30 <sup>0</sup>	32 <sup>0</sup>
Y axis	53 <sup>0</sup>	62 <sup>0</sup>	68 <sup>0</sup>
LAFH	67-69mm	67mm	61mm
Sn-Go-Gn	32 <sup>0</sup>	30 <sup>0</sup>	34 <sup>0</sup>
Upper Incisor to NA	22 <sup>0</sup> /4mm	35 <sup>0</sup> /11mm	25 <sup>0</sup> /5mm
Upper Incisor to FH plane	107 <sup>0</sup>	120 <sup>0</sup>	110 <sup>0</sup>
Lower Incisor to NB	25 <sup>0</sup> /4mm	38 <sup>0</sup> /9mm	28 <sup>0</sup> /7mm
Lower Incisor to Mand Plane	90 <sup>0</sup>	104 <sup>0</sup>	90 <sup>0</sup>
Interincisal angle	135.4 <sup>0</sup>	104 <sup>0</sup>	126 <sup>0</sup>
Overjet	2 mm	0mm	2mm
Overbite	2 mm	0mm	2mm
Nasolabial angle	102+8 <sup>0</sup>	84 <sup>0</sup>	101 <sup>0</sup>
Lip strain	1 mm	5mm	3mm
Lower Lip to E line	-2 mm	4mm	2mm
Upper Lip to S line	0 mm	6mm	4mm

mentioned above (Figures 15 and 16 ).



**Fig. 1:** Pre- treatment extraoral photos (Case 1)



**Fig. 2:** Pre-treatment intraoral photos (Case 1)



**Fig. 3:** Tongue crib habit breaking appliance (Case 1)



**Fig. 4:** Anterior retraction using skeletal anchorage device (Case 1)

### 5. Discussion

Etiology of open bite is complex and multifactorial. Open bite has skeletal and dental components and often the two



**Fig. 5:** Post- treatment extraoral photos (Case 1)



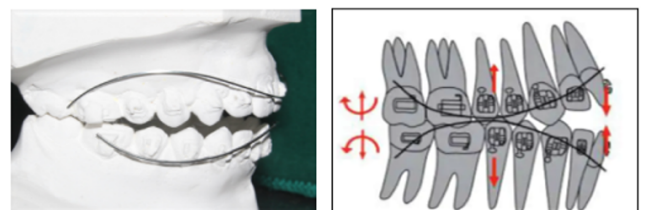
**Fig. 6:** Post-treatment intraoral photos (Case 1)



**Fig. 7:** Pre-treatment extraoral photos (Case 2)



**Fig. 8:** Pre- treatment intraoral photos (Case 2)



**Fig. 9:** Anterior retraction using reverse curve of spee (Case 3)



**Fig. 10:** Post-treatment extraoral photos (Case 2)



**Fig. 15:** Post-treatment extraoral photos (Case 3)



**Fig. 11:** Post-Treatment Intraoral Photos (Case 2)



**Fig. 16:** Post-treatment intraoral photos (Case 3)



**Fig. 12:** Pre-treatment extraoral photos (Case 3)



**Fig. 13:** Pre-treatment intraoral photos (Case 3)



**Fig. 14:** Tongue crib habit breaking appliance (Case 3)

occur together in the same individual. Its etiology must be well investigated to ensure the successful treatment of these patients.<sup>2</sup>

Few etiological factors include:<sup>15</sup>

1. Habits,
2. Hereditary factors
3. Aberrant skeletal development
4. Airway obstruction
5. Stage of development
6. Iatrogenic factors
7. Neurological disturbances,
8. Muscular dystrophy
9. Disproportionately large tongue
10. Temporal mandibular joint derangements and pathological factors.

According to Gershater,<sup>16</sup> (1972), the site of the open bite deformity depends on which forces predominate, and the ability of the teeth and supporting structures to resist change. Also, the severity of the anterior open bite is greatly influenced by the presence of pernicious thumb, finger or lip sucking, mouth breathing habits, and poor labial musculature.

Another etiologic factor leading to open bite might be digit sucking habits. Persistent habit continuing up to the mixed and permanent dentition age groups may well result in anterior open bite. This can cause an upward and forward force onto the anterior aspect of the maxillary complex. (Thompson and Popovich, 1970).<sup>17</sup>

Many studies had shown that, the direction of facial growth also plays an important role as an etiologic factor

for open bite. Direction of the growing mandibular condyle which could be vertical, sagittal (posterior and superior), or any direction in between. (Bjork, 1963).<sup>18</sup> Extreme variation in mandibular rotation can be seen as a factor in solving or compounding an existing problem. Recent work has suggested that the tongue grows at different rate to the surrounding dento-alveolar and muscular tissues, although it is relatively large in the young child, the tongue exerts relatively less influence as the child enters puberty and adulthood. This altered balance of “influence” may explain why some “tongue thrust open-bite” cases become self-correcting, and even in endogenous tongue thrust cases, the open-bite after reduces with age.<sup>19</sup>

Treatment strategies should report the cause of malocclusion. During the clinical examination, environmental factors that contribute to a patient’s malocclusion, such as thumb sucking or tongue thrusting, should be identified and then eradicated. According to the patient’s age, approaches for proper treatment of anterior open bite can be separated. Treatment of open bite can be done in two ways, early-term and late term.

Early term treatment options include orthopedic treatment with a preventive approach such as the following: (1) myofunctional therapy, (2) habit breaking appliances, (3) molar intrusion using high pull headgear, (4) vertical pull chin cup, (5) functional appliances and posterior bite-blocks, and (6) molar intrusion with rapid molar intruder appliance. Late-term treatment options include the following: (1) molar intrusion with fixed appliances, (2) extraction orthodontic treatments, (3) molar intrusion with miniplate and miniscrews or rapid molar intruder, (4) corticotomy-assisted molar intrusion, and (5) orthognathic surgery.<sup>20</sup>

Here, all three cases had an anterior open bite which were treated with non-extraction and extraction modality. All patients had a tongue thrusting habit and they were treated initially during the treatment along with fixed orthodontic appliance. The treatment using reverse archwires with anterior box elastics is a modification of the MEAW technique and is a very convenient way of treating such malocclusions. The case 2 had a severe open bite while the amount of open bite in case 3 was comparatively lesser, but both were treated with non- extraction therapy with great results.

The MEAW mechanism is both versatile and effective in correcting malocclusions such as open bite, deep overbite, Class II, Class III, and malocclusion with a midline deviation. The treatment duration with the MEAW is usually short, particularly in cases of open bite malocclusions. It is, however, important to remember that mere insertion of the MEAW does not guarantee treatment success. MEAW therapy requires a keen sense of judgment in diagnosis and treatment planning. Since the MEAW mechanism moves the teeth rapidly, every minute detail of the wire bending must be precise to obtain the optimal result.<sup>9</sup>

In general, stability is the most important criterion for choosing the open bite treatment method, since this type of malocclusion is difficult to retain. Authors like Goto et al.<sup>21</sup> believe that treatments involving extractions cannot provide stability because the retraction of anterior teeth violates the tongue space. On the other hand, several authors have stated that treatment with extraction allows greater stability, since the retraction associated with anchorage loss promotes bite closure, thus decreasing the need of vertical elastics and correction by extrusion of anterior teeth. In addition, tooth extractions can sometimes help obtaining good lip posture as they allow uprighting the mandibular incisors and retracting the maxillary and mandibular incisors.<sup>22</sup>

## 6. Conclusion

The etiology of anterior open bite is multifactorial and is equally important to distinguish between a dentoalveolar and skeletal open bite. Different method to correct various types of open bites rely most importantly on the vertical control and/or extrusion of the anterior segments in the growing patient. Since the time Skeletal Anchorage devices have been introduced, skeletal changes can also be achieved by intrusion of posterior teeth non-growing patients. For patients with Long Face Syndrome, esthetics may be their main concern, therefore, surgical approach should be considered as an alternative. Although, all the types of treatments provide maximum desirable results, long term stability has to be considered while treating open bite cases.

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