



Review Article

## Open Bite: A Review

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### ABSTRACT

The term anterior open bite, which means no contact between anterior teeth, stands out due to complexity of treatment, associated with high levels of instability and recurrence. Patients with open bite malocclusion can be diagnosed clinically and cephalometrically, however, diagnosis should be viewed in the context of the skeletal and dental structure.

**Key words:** open bite, malocclusion, mouth breathing.

### INTRODUCTION

Traditionally open bite means opposing teeth do not meet. Vander Linder, however has indicated that the overlap criterion is arbitrary and is associated with the sagittal relation between teeth involved. The absence of an occlusal stop between the teeth with their antagonists or opposing gingival is of greater significance. The same view was held by Moyers, who stated that it is important to use the term open bite for all conditions characterized by absence of an occlusal stop.

Open bite must be considered as a deviation in the vertical relationship of maxillary and mandibular dental arches. In an open bite there should be a definite lack of contact, in vertical direction, between opposing segments of teeth. The loss of contact in vertical direction of segments of teeth can occur between anterior or buccal segments.

**Synonyms:** Apertognathia.

**Definitions:** The term “open bite” was coined by Caravelli in 1842 as a distinct classification of malocclusion <sup>[1]</sup> and can be defined in different manners. <sup>[2]</sup>

Glossary of Orthodontic terms defines open bite as a developmental or acquired malocclusion whereby no vertical overlap exists between maxillary and mandibular anterior or posterior teeth.

An abnormal dental condition in which anterior teeth in maxilla do not occlude those in mandible in any mandibular position. (Mosby’s Medical Dictionary, 8th Edition).

Open bite was defined by Subtelney and Sakuda <sup>[3]</sup> as open vertical dimension between the incisal edges of the maxillary and mandibular anterior teeth, although loss of vertical dental contact can occur between the anterior or the buccal segment.

Open bite is defined as the lack of vertical overlap of the anterior teeth in centric occlusion. [4,5]

**Etiology:** According to Dawson, [6] the major causes of an anterior open bite are forces that result from thumb or finger sucking, pacifier use; lip and tongue habits; airway obstruction; inadequate nasal airway creating the need for an oral airway; allergies; septum problems and blockage from turbinates; enlarged tonsils and adenoids; and skeletal growth abnormalities.

**Prevalance:** An open bite of greater than 2 mm occurs in less than 1% of the population and has five times greater prevalence in the black population than in the white or Hispanic populations. [7] The incidence of anterior open bite ranges from 1.5% to 11% [8] and varies between races and with dental age. [9] In the mixed dentition the prevalence of the anterior open bite can reach up to 18.5%, decreasing with age.

**Classification:**

A) According to Rakosi, four varieties of open bite due to tongue posture may be differentiated as:

a) Anterior open bite-Open bite in a deciduous dentition, caused by tongue dysfunction as a residuum of a sucking habit.

b) Lateral open bite-Occlusion, in this type of open bite on both sides is supported only anteriorly and by first permanent molars.

c) Complex open bite-Severe vertical malocclusion. The teeth occlude only on second molars.

d) Tongue dysfunction and malocclusion-in mandibular prognathism, the downward forward displacement of tongue often causes an anterior tongue thrust habit.

B) A proper cephalometric analysis enables classification of open bite malocclusions:

a) Dentoalveolar open bite

b) Skeletal open bite

1) Positional deviation

2) Dimensional deviation

c) Skeletal Class II open bite

d) Skeletal Class III open bite

C) According to Proffit,

Open bite (mm)

>-4 extreme

-3 to -4 severe

0 to -2 moderate

D) Open bite can be classified as

a) Incomplete overbite

b) Simple open bite

c) Complex open bite

d) Compound open bite

e) Iatrogenic open bite

E) Open bite is classified as

a) Anterior open bite-Anterior open bite is defined as no contact and vertical overlap between the maxillary and mandibular incisors. [10,11]

b) Posterior open bite-When teeth are in occlusion there is a space between posterior teeth.

F) Open bite is classified by Sassouni [12] as (Criterion-Angle of mandibular plane)

a) Skeletal open bite

b) Dentoalveolar open bite

G) Open bite is classified as-

a) Class I open bite

b) Class II open bite

c) Class III open bite

H) The open bite can be the simple type, without abnormal measures to the vertical cephalometric analysis, and complex, when cephalometry shows disharmony in the skeletal components of the anterior facial height. [13]

I) Open bites of following types are also known:

*Soft tissue open bite:* Open bite caused by the action of tongue is extremely rare. More commonly the tongue may maintain an open bite caused by a digit habit. This is more likely when the habit is discontinued only after growth has ceased. A primary atypical swallowing behavior is usually associated

with a marked anterior stigmatism and a degree of bimaxillary proclination.

*True open bite of skeletal origin:* Although the teeth and alveolar processes are adaptable within limits and manage to compensate for moderate variation in vertical height of lower part of face, examples are seen in which an anterior open bite is seen to be associated with increase of infranasal height (vertical distance between nose and chin).

Diagnosis (Methods of evaluation):

- 1) Visual evaluation.
- 2) Cephalometric evaluation.
- 3) Thin plate spine analysis (Morphometric analysis)

Using visual examination, anterior open bite cases in postpubertal growth phase can be grouped as morphometric, functional or combination. The cephalograms and pretreatment records (i.e. extraoral and intraoral photographs and patient history) are to be evaluated. Lateral cephalograms are most commonly used. Using cephalometric evaluation, anterior open bite cases can be classified according to mandibular plane angle, as belonging to 3 groups: hyperdivergent, normovergent and hypodivergent.

#### ***Dentoalveolar Open Bite***

Open bite caused due to thumb or finger sucking habit would be correctly defined as dentoalveolar open bite.

Open bite of dentoalveolar origin occur as a result of underdevelopment anteriorly of maxillary and mandibular alveolar processes. The extent of open bite depends on the eruption of teeth. Supraeruption of molars and infraocclusion of incisors can be primary etiologic factors. Dentoalveolar open bite can further be classified as:

- a) Anterior open bite
- b) Posterior open bite

*Relationship of open bite to head position/airway and gait:*

Open bite results in oral breathing, which in turn has been reported to cause changes in human head posture. The head position relative to cervical spine is the result of integration at CNS level of different external and internal inputs, including visual, cutaneous, musculotendinous and vestibular receptors.

Oral respiration alters the muscle forces exerted by tongue, cheeks and lips on maxillary arch. Oral breathing causes an increase in head elevation and a greater extension of head relative to cervical spine and influences hyoid bone position and intermaxillary divergence.

Sonnesan et al have recently described morphological deviations of cervical vertebral column, in patients with severe skeletal malocclusion traits such as skeletal open bite, such as fusion occurred more often. Fusion was always seen in 2<sup>nd</sup> and 3<sup>rd</sup> cervical vertebrae.

The malpositioning of C1 and C2, through dental malocclusion, torques the duramater because of frontal and dorsal attachments to C1, C2 and C3. Torquing of duramater causes scoliosis, cervical hypolordosis, rotation of pelvis causing uneven leg length, resulting in an abnormal gait.

*Syndromal conditions associated with Open bite:* A few syndromes associated with the presence of open bite, as one of the oral manifestations are listed below.

- Crouzon syndrome
- Beckwith Wiedman Syndrome
- Treacher Collin Syndrome
- Down Syndrome
- Turner Syndrome
- Gorlins Syndrome
- Noonan Syndrome
- Maroteaux Lamy Syndrome
- Lennox Gastant Syndrome
- Moebus Syndrome

### **Treatment**

“Treatment of open bite is difficult but relapse is easy”

Why should open bite be treated?

An open bite should be corrected because it usually affects-

**Aesthetics**-The dentoalveolar open bite malocclusion is essentially unattractive particularly during speech when the tongue is interposed between teeth and lips.

**Functioning of the mouth:** Tongue posture and function should be primary considerations in open bite problems. According to Proffit, “If a patient has a forward thrusting posture of tongue the duration of this pressure even if very light could affect tooth position vertically or horizontally.

Another important reason to fix an open bite is to prevent or alleviate TMJ disorders, the malaligned jaw exerts excessive pressure on jaw joint.

Early Management of Open bites-as given by Melanghlin.

A number of treatment modalities have been suggested for this early management. Some modalities in order of ease of application and treatment are finger and thumb appliances, palatal expansion in case of narrow maxilla, palatal bars and lingual arches, posterior bite planes, high pull facebows and vertical chin cups and removal of deciduous canines and sometimes premolars in cases with crowding and/or protrusion. If adenoids and tonsils are contributing factors to anterior open bite, their removal may aid in bite closure.

**Treatment of Dental Anterior open Bite:**

**In deciduous dentition:** Control of abnormal habits and elimination of dysfunction should be given top priority in deciduous dentition when open bites in children are related to habits, these malocclusions can spontaneously correct once habit ceases. Tongue spikes, either removable or fixed, is

used to prevent tongue thrusting or digit sucking.

Autonomous improvement can be expected only if the deforming muscle activity is terminated and open bite is not complicated by crowding of upper arch. Treatment by screening appliance is indicated.

**Treatment for preadolescents (early mixed dentition):** Habit breaking should be primary objective of treatment in mixed dentition. For this purpose, behavior modification techniques are appropriate. The simplest approach to habit therapy is a straightforward discussion between the child and dentist that expresses concern and includes an explanation by dentist. Another level of intervention is reminder therapy. One of the simplest approach is to secure an adhesive bandage with waterproof tape on the finger. If an intraoral appliance is needed, the preferred method is a maxillary lingual arch with an anterior crib device.

**Treatment for Adolescents (late mixed and early permanent dentition):** By the time adolescence is reached, however, environmental causes of anterior open bite are less important than skeletal factors. It is rare for anterior open bite to be due solely to some habit, or for an open bite to correct spontaneously at this age after habit has been corrected.

In mixed dentition stage, functional appliances like activator, bionator and frankel are indicated. The activator used in the treatment of open bite include Open Bite Activator with tongue crib and Elastic Activator.

**Retention after Anterior Open bite correction:** Relapse into anterior open bite can occur by any combination of depression of the incisors or elongation of molars. Active habits can produce intrusive forces on incisors, while at the same time leading to an altered posture of jaw that allows posterior teeth to erupt. If thumb sucking

continues after orthodontic treatment, relapse is all but guaranteed. Controlling eruption of upper molars is the key to retention in open bite cases.

High pull headgear to upper molars, in conjunction with standard removable retainer to maintain tooth position, is one effective way to control open bite relapse. A better tolerated alternative is an appliance with bite blocks between posterior teeth which stretches patients' soft tissues to provide a force opposing eruption.

A patient with severe open bite is likely to benefit from having conventional maxillary and mandibular retainers for daytime wear and an open bite bionator as a night time retainer, from beginning of retention period.

*Treatment of Posterior Open Bite:* Early treatment includes activator or bionator with flanges to prevent lateral tongue thrust. Fixed appliance can be used to close lateral open bite by employing intermaxillary elastic traction. Posterior open bite is difficult to treat if tongue reflex gets fixed. A permanent type of retention is required after correction.

### ***Skeletal Open Bite***

Skeletal open bite is a symptom of serious skeletal dysplasia. Early diagnosis is crucial since it helps to minimize the problem.

Skeletal open bite occurs as a result of increased downward and backward inclination of mandible. The mandibular angle is increased. On cephalometric analysis, the major indicators of a skeletal relationship that predispose an individual to open bite are a short ramus and downward rotation of posterior maxilla. Both tend to increase anterior facial height and separate anterior teeth. Proffit characterized patients with skeletal open bite and a large total face height manifested entirely in the elongation of the lower third of the face as having long face syndrome. <sup>[14]</sup>

Skeletal open bites are generally considered to be amongst the most difficult orthodontic cases to treat.

*Treatment of Skeletal Open Bites:* SOB is seldom observed in deciduous dentition. Habit control is of secondary consideration in these cases, retarding the increasing severity of dysplasia. Extraoral orthopaedic appliance such as chin caps can be used effectively to redirect growth.

*Treatment in Primary Dentition:* Open bite can be due to skeletal discrepancy of long face type, characterized by increased lower anterior facial height. If the problem is corrected in primary dentition, it is likely to recur relatively quickly when active treatment is discontinued.

*Treatment for Preadolescents:* The key to growth modification is treatment while adequate growth remains. Of the various strategies available, high pull headgear to maxillary first molar is effective.

SOB is difficult to treat orthodontically. It is best treated by orthognathic surgery. The type of orthognathic surgery that can be used to correct a SOB depends on the occlusal plane and magnitude of overbite, the relative antero-posterior position of the jaws and any transverse discrepancy of the maxilla.

*Implants:* When the objective is to increase the overbite, as in skeletal open bite correction, it would be ideal to close the bite by intruding posterior teeth. An intrusive force on the molars can only occur when an extrusive force is placed elsewhere. <sup>[15]</sup>

Undesirable movements of anchorage units, such as extrusion, can cause downward and backward rotation of the mandible, resulting in poor treatment outcomes. Implants offer a possibility of achieving a source of stationary anchorage in skeletal open bite cases. Osseointegrated implants have been successfully used with intrusion mechanics in open bite malocclusions to prevent extrusion of posterior teeth. <sup>[16]</sup> In addition to

single-tooth implants, a skeletal anchorage system using a titanium miniplate temporarily implanted in the maxilla or mandible has been reported to provide a source of immobile anchorage. Titanium miniplates implanted in the buccal cortical bone in the apical regions of the first and second molars have been shown to produce as much as 3 to 5 mm of molar intrusion. Counterclockwise rotation of the occlusal plane is achieved. There is evidence that the skeletal anchorage system may be an effective adjunctive biomechanical procedure for correction of skeletal open bite malocclusion without many of the unfavourable side effects. [17]

*Surgical Treatment:* Surgical treatments for AOB began in the 70s and were indicated for extremely severe cases with mandibular plane above 50 degrees. Thereafter, these treatments have become more common and usually include LeFort I osteotomy for superior repositioning of the maxilla. This allows a counterclockwise rotation of the mandible, thus correcting AOB. [18]

The surgical approaches include maxilla [19,20] or mandible surgeries, [21,22] surgery on both maxilla and mandible, [23,24] anterior maxillary and mandibular surgeries, [25,26] and mandibular surgeries combined with temporary anchorage devices (TADs). [27] Superior repositioning of the maxilla, through total or segmental maxillary osteotomies, is indicated in skeletal open bite patients with excess vertical maxillary growth. Maxillary impaction allows auto-rotation of the mandible, therefore decreasing the lower face height and eliminating anterior open bite. Closing rotation of the mandible using rigid fixation is a viable surgical option for the correction of anterior open bite in instances in which maxillary osteotomies are not indicated to improve facial esthetics. However, closing rotation of the mandible with only mandibular surgery has been shown to be

highly unstable because it lengthens the ramus and stretches the muscles of the pterygomandibular sling. [28] Therefore, a two-jaw surgery involving superior repositioning of the maxilla with a Le Fort I osteotomy is recommended to obtain more stable and predictable results for the surgical correction of skeletal open bite. Mandibular surgeries combined with TADs resolves the high level of surgical invasion and the possibility of alar flaring caused by superior repositioning of the maxilla.

If chin retrusion remains a problem, it may be corrected by a combination advancement and reduction genioplasty.

With regard to the surgical procedures, greater over bite stability can be achieved with maxillary surgical repositioning only, or with bimaxillary surgery, whereas mandibular surgery only produces less stable results. [29] Failure of tongue posture adaptation subsequent to orthodontic and/or surgical treatment might be the primary reason for relapse of anterior open bite. The relative increase in tongue volume in the oral cavity would also cause a relapse of the mandibular position after the mandibular setback, resulting in a decrease in overjet and over bite. Myofunctional therapy and placement of a tongue crib may improve stability in patients, especially with an anterior tongue rest posture. [30]

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