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Open Bite- A Review

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Abstract

A review of open bite which is considered a malocclusion that still defies correction, especially in terms of stability. The literature reports numerous studies on the subject but with controversial and conflicting information. Disagreement revolves around the definition of open bite, its etiological factors and available treatments. It is probably due to a lack of consensus over the etiology of open bite that a wide range of treatments has emerged, which may explain the high rate of instability following the treatment of this malocclusion.

Keywords: Open Bite, vertical malocclusion.

Introduction

The term **"OPEN BITE"** was coined by *Caravelli* in 1842 as a distinct classification of malocclusion1 & can be defined in different manners.2

Definitions

"When there is less than an average over bite."

"Edge-to-edge relationship".

"Definite degree of openness".

Some authors have determined that open bite, or tendency towards open bite occurs when overbite is smaller than what is considered normal. Others argue that open bite is characterized by end-on incisal relationship. For semantic reasons, and because it is in agreement with most definitions in the literature2,3,4 anterior open bite (AOB) is herein defined as the lack of incisal contact between anterior teeth in centric relation.

Open bite was defined by Subtelney and Sakuda as an 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 5

"A deviation in the vertical relationship of the maxillary and mandibular dental arches characterized by a definite

lack of contact between opposing segments of teeth." (Daniel Subtelny, 1964).

"Failure of tooth or teeth to meet antagonists in the opposite arch".

"Localized absence of occlusion while the remaining teeth are in occlusion" (Moyer's).

Open bite can also be defined as a malocclusion without contact in the anterior region of the dental arches, being the posterior teeth in occlusion. When it extends to the posterior segment, it is called combined open bite. A reduction in depth of the bite can be associated with skeletal hyper divergence, otherwise referred to as long face syndrome or high angle disharmony6.

Among all malocclusion. Open bite is one of the most prevalent malocclusion and has the most difficult treatment. In early stages open bite can undergo self correction by the growth and elimination of the harmful habits. However those patients after the growth may have unfavourable prognosis, if it is associated with the abnormal facial pattern or an atypical behaviour of the tongue in swallowing and phonation, the early diagnosis and treatment are crucial, especially n deciduous and mixed dentitions, due to relationship with the period of growth and development. The use of preventive therapeutics measures allows to normalize the development of dental-facial structures.

Prevalence of open bite

Given these different definitions for AOB, its prevalence varies considerably among studies depending on how authors define it. Prevalence in the population ranges from 1.5% to 11%.2 The age factor, however, affects prevalence, since sucking habits decrease and oral function matures with age. At six years old 4.2% present with AOB whereas at age 14 the prevalence decreases to 2%.7

Figure 1

In the US population, differences in prevalence were detected between the different ethnicities, with 4% occurring in Caucasian children and 16.% in Afro-descendant children. Despite its low prevalence, the demand for treatment of this malocclusion is very common as approximately 17% of orthodontic patients have AOB8, which means that professionals should treat it in an effective and stable manner.

- Proffit:1%,5 times more prevalent in blacks than whites.
- Tulley:1% (English children).
- Korkhaus:4.2% in 6-year-old groups. 2.5% in 14-year-old age groups.

Malocclusion can occur in 3 planes of space -

1. Sagittal
2. Transverse
3. Vertical

Open bite is a types of vertical malocclusion

-Problems in the vertical dimension includes open bite and deep bite malocclusion and also facial disfiguration. Some problems can be divided into those that are limited to the dentoalveolar area and those that predominantly are of skeletal nature.

a. Dentoalveolar = Open / Deep Bite

b. Skeletal = Hypo / Hyper divergent

If only dentoalveolar structures are involved, the terms open bite and deep bite is used.

-If skeletal structures are involved, the types of vertical facial patterns can be described as hyperdivergent and hypodivergent.

-These vertical dysplasias clinically have been termed long face syndrome and short face syndrome. Generally, facial patterns with a mandibular plane angle greater than 300 are considered hyperdivergent, and less than 200 hypo divergent.

Differentiation Between Skeletal & Dentoalveolar Malocclusion

-Skeletal open bite as a result of increased downward and backward inclination of the mandible. The mandibular angle is increased.

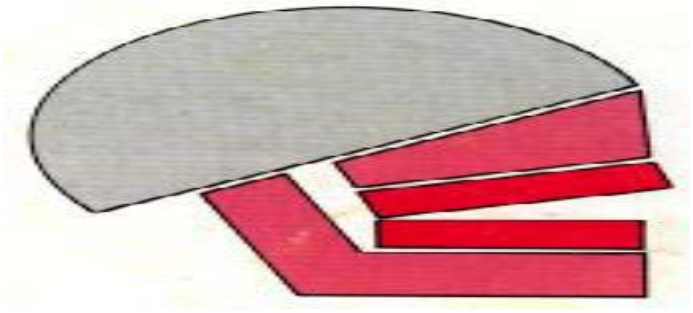

Figure 2

Open bite of dentoalveolar origin as a result of underdevelopment anteriorly of the maxillary and mandibular alveolar processes.

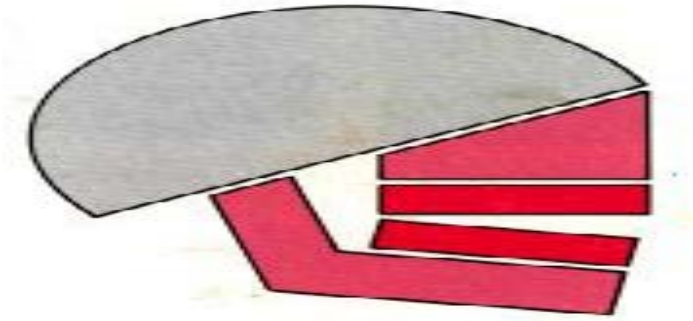

Figure 3

Etiology

Open bite can also be divided into two broad groups:

- Hereditary.
- Non- hereditary.

a) Transitional OB.

b) Habits e.g. Thumb sucking.

c) Abnormal Tongue Function + Posture.

d) Naso-respiratory.

e) Trauma or pathology in condyle.

f) Neurological disturbances.

g) Iatrogenic factors.

h) Failure of eruption

Esthetic Considerations[9]

Balance between the nose, lips, and chin profile is essential for optimal esthetics.

The nasolabial angle also is important.

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

The lower facial third is elongated in patients with skeletal open bite.

Functional Consideration[10]

Tongue posture and function should be primary considerations in Open-bite problems.

According To Proffit “if a patient has a forward thrusting posture of the tongue the **duration** of this pressure even if very light could affect tooth position vertically or horizontally”.

Differentiation between primary causal and secondary adaptive or compensatory tongue dysfunction is essential. Acc. to Proffit “A tongue thrust swallow is a useful physiologic adaptation if you have an open bite, which is why an individual with an open bite also has a tongue thrust swallow” (i.e. Secondary adaptive tongue dysfunction)

According to Bahr and Holt, four varieties of tongue thrust may be differentiated

a) Tongue thrust without deformation:- Despite the abnormal function, no deformations ensues.

b) Tongue thrust causing anterior deformation:- i.e anterior open bite, sometimes coupled with bilateral narrowing of the arch and a posterior crossbite. Moyers (1964) terms this a simple open bite.

c) Tongue thrust causing buccal segment deformation

with a posterior open bite is often seen clinically. Lateral tongue thrust activity also can be responsible for a functional deep bite, a variation of the posterior open bite. Some Class II, division 2 malocclusion fit this category. Invagination of the cheek into the interocclusal space also may be a factor in this dysfunction.

d) Combined tongue thrust:- causing both an anterior and a posterior open bite, is another common dysfunction. This is called a complex open bite by Moyers and is more difficult to treat.

According to Rakosi, four varieties of open bite due to tongue posture may be differentiated:[10]

Anterior Open Bite

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

Figure 5

Lateral Open bite: Occlusion, In this type of open bite the occlusion on both sides is supported only anteriorly and by the first permanent molars.

Figure 6

Habitual Position

The tongue thrusts between the teeth laterally.

The tongue dysfunction occurs in conjunction with a disturbance in the physiologic growth processed around the first and second deciduous molars.

Figure 7

Complex open bite: Severe vertical malocclusion. The teeth occlude only on the second molars.

Figure 8

Habitual Position

Tongue-thrusting occurs during function.

Tongue dysfunction and malocclusion:

In mandibular prognathism, the downward forward displacement of the tongue often cause an anterior tongue-thrust habit.

Figure 9

Clinical Considerations[10]

Depending on the severity of the malocclusion, various forms of anterior open bites may be observed:

- **Pseudo-open bite:** Cases with an open bite of less than 1 mm
- **Simple open bite:** more than 1 mm between incisors, but the posterior teeth are in occlusion
- **Complex open bite:** Open bite extends from premolars or deciduous molars on one side to the corresponding tooth on the other side.
- **Compound or infantile open bite:** Open bite is completely open including the molars.
- **Iatrogenic open bite:** consequence of orthodontic therapy, which produces atypical configurations due to appliance manipulation or adaptive neuromuscular response.

Cephalometric Criteria[10]

A proper cephalometric analysis enables a classification of open bite malocclusions

1. Dento Alveolar Open Bite.
2. Skeletal Open Bite.
   - Positional Deviations.
   - Dimensional Deviations
3. Skeletal Class II Open Bite
4. Skeletal Class III Open Bite

Dento Alveolar Open Bite

- The extent of the dentoalveolar open bite depends on the extent of the eruption of the teeth.
- Supra-occlusion of the molars and infra-occlusion of the incisors can be primary etiologic factors.

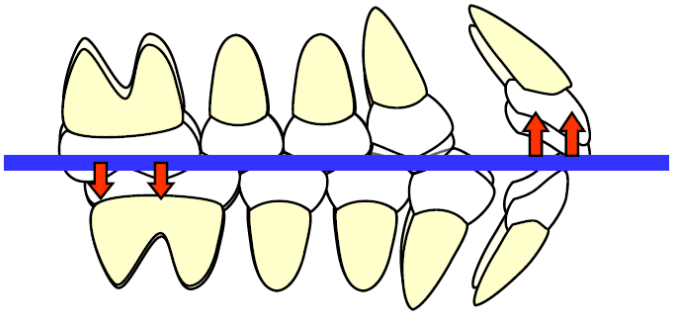

Figure 10

- In vertical growth patterns the dentoalveolar symptoms include a protrusion in the upper anterior teeth with lingual inclination of the lower incisors.
- In horizontal growth patterns, tongue posture and thrust may cause proclination of both upper and lower incisors.
- A lateral open bite may be considered dentoalveolar in combination with infra-occlusion of molar teeth.

Vertical growth pattern associated with anterior tongue dysfunction

In Vertical growth pattern, tongue thrust tends to tip the upper incisors to the labial and the lower incisors to the lingual.

Figure 11

- Protrusion in the upper anterior teeth with lingual inclination of the lower incisors.
- Over eruption of posterior teeth and steeper than normal mandibular plane

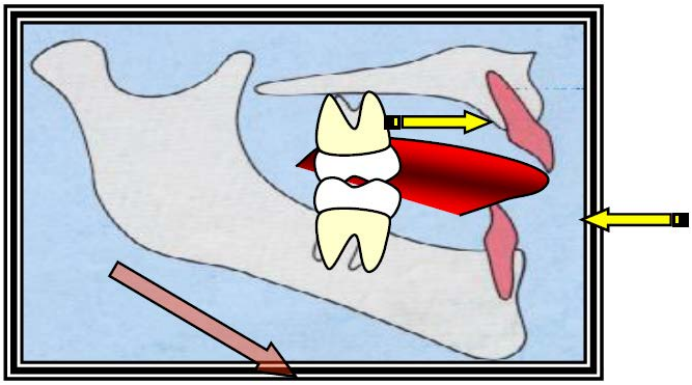

Figure 12: Steep mandibular plane

Horizontal growth pattern associated with anterior tongue dysfunction

Horizontal growth pattern, tongue thrust causes bimaxillary dental protrusion, i.e. labial tipping of upper and lower anterior teeth.

Figure 13

The incisor relationships in a case with an anterior open bite, tongue-thrust, and horizontal growth pattern

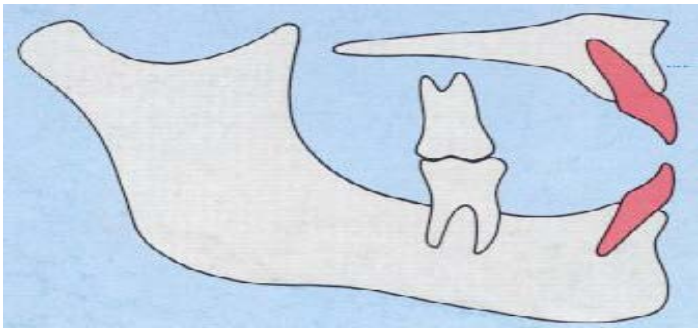

Figure 14

Skeletal Open Bite

a) Dysgnathia with a vertical growth pattern

b) The downward and backward rotation of the mandible is the cause of the anterior open bite. The gonial angle and its lower segment are markedly enlarged.

c) The clinical picture of the open bite is partly compensated by the linguo-version of the upper anterior teeth.

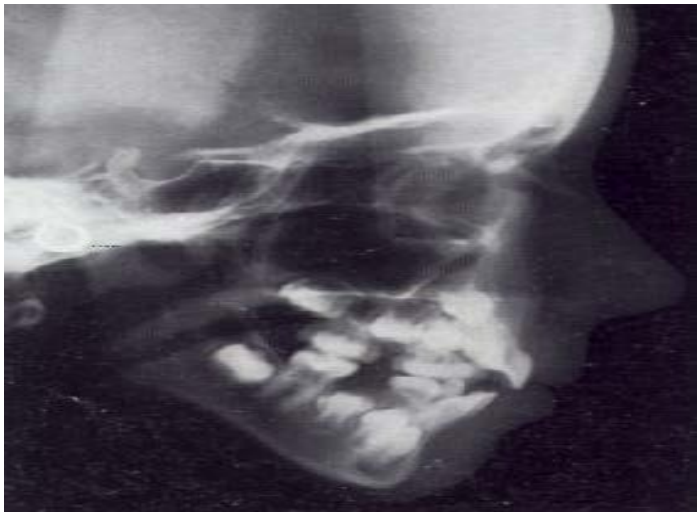

Figure 15

Skeletal factors in the development of an open bite type

1. The posterior half of the palate is tipped downward, carrying the molars further downward. This gives rise to a large palato-mandibular plane angle.

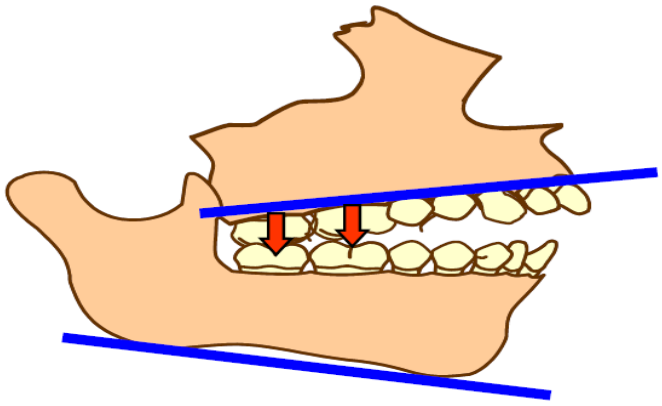

Figure 16

2. The combination of an excessive development of the upper mid-face heights (cranial base to molars) and a lack of development of posterior facial heights (S-Go) results in the downward and backward rotation of the mandible.

3. Because of the short ramus and the lower palate, the pharyngeal space is constricted. In order to breathe, these persons keep their tongues forward. Further enhanced by the dental open-bite, there is a tongue-thrusting tendencies.

4. When enlarged tonsils are present, the tongue is further confined anteriorly. As the narrow palatal vault reduces the necessary space, there is a tendency toward tongue protrusion. This, in turn, may be a factor in the creation of bi-dental protrusion.

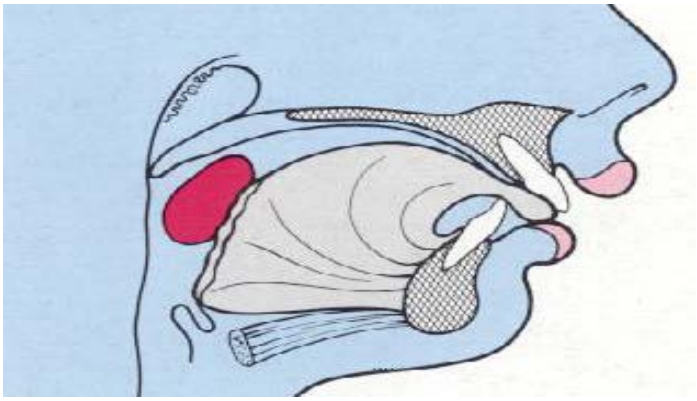

Figure 17

Treatment of Open Bite In

1) Deciduous dentition

2) Mixed dentition

3) Permanent dentition

Treatment in the Deciduous Dentition

1. Control of abnormal habits and elimination of dysfunction should be given top priority in the deciduous dentition.

2. The anterior open bite improves as soon as the habit is stopped.

3. Treatment with screening appliances is indicated in such open- bite cases.

Screening Appliance

1. Screening appliances intercept and eliminate all abnormal perioral muscle function in acquired malocclusions resulting from abnormal habits, mouth breathing, and nasal blockage.

2. Open bite created by finger sucking and retained visceral deglutition-pattern, tongue function can be helped with vestibular screens.

The deciduous dentition is the stage in which treatment of the open bite is easier because there is basically dentoalveolar involvement (about 95%), with little skeletal involvement in the malocclusion (Figure 18).

Predominance of open-bite skeletal components in the deciduous dentition rarely occurs, because when the open bite is initially established there is greater dentoalveolar involvement, and with growth and development, if the open bite is not corrected, the skeletal component progressively increases.11

Thus, treatment of open bite in the early stages of development is easier than correction in the permanent dentition12.

Figure 18 Open bites in the deciduous dentition has predominantly a dentoalveolar characteristic

As explained earlier, the primary causes of open bite at this stage are deleterious habits and anterior tongue posture. However, no orthodontic treatment should begin before 5 years of age because of child immaturity.

It is always more favorable and desirable that the child spontaneously abandons the habit, which may, in many situations, culminate with spontaneous correction of the open bite13; minimizing the chances for relapse14.

Figure 19: Spontaneous correction of the open bite in the deciduous dentition after abandonment of the habit

Before 5 years of age, the parents should be oriented only to suggest to the child to gradually abandon the pacifier/thumb-sucking habit, to prevent behavioral consequences. A clear language should be used, the habit should not be refrained and the child should be at ease, with positive motivation by compliments and smiles.15

The psychoanalytic theory suggests that if there is persistence of the habit in this period, even after the strategies mentioned earlier, it may be a sign of psychological disorders. In this case, no punitive action should be applied to the child, and the effective treatment should be performed in the mixed dentition.

Approach to open bite treatment before 5 years of age.

a. An attempt should be made to exchange the habit for a desired toy.

b. If the child does not abandon the habit, he/she will have to be orthodontically treated after 5 years of age.

c. If the child abandons the habit, the bite may or not close depending on the persistent unusual tongue posture or thrust.

d. If it does not close, orthodontic treatment has to be performed after 5 years of age.

e. If the bite has closed, the child may still present persistent functional tongue problems or not.

f. If there are persistent functional tongue problems, the child should undergo speech therapy.

g. If there are no functional tongue problems, no orthodontic or speech therapy are necessary.

In few occasions, even help of a psychologist may be necessary in cases when the habit is strikingly strong16.

If the child did not abandon the habit or even if he/she did, but the open bite did not close because of persistent unusual tongue thrust and posture, generally after 5 years of age, treatment of anterior open bite in the deciduous dentition can be performed with either a removable or fixed palatal crib, which are also used in the mixed dentition and are described ahead2 (Figure 20).

Although treatment of the open bite with a removable or fixed palatal crib may be instituted in the deciduous dentition, it is preferable, because of child immaturity, to postpone it to the mixed dentition period. Therefore, in this interim period, between 5 years of age and the mixed dentition period, more time is allowed for the child to abandon the habit, if it has not occurred, or for the bite to close. If the clinician feels that the child is mature enough after 5 years of age, treatment can be instituted, similarly as in the mixed dentition.

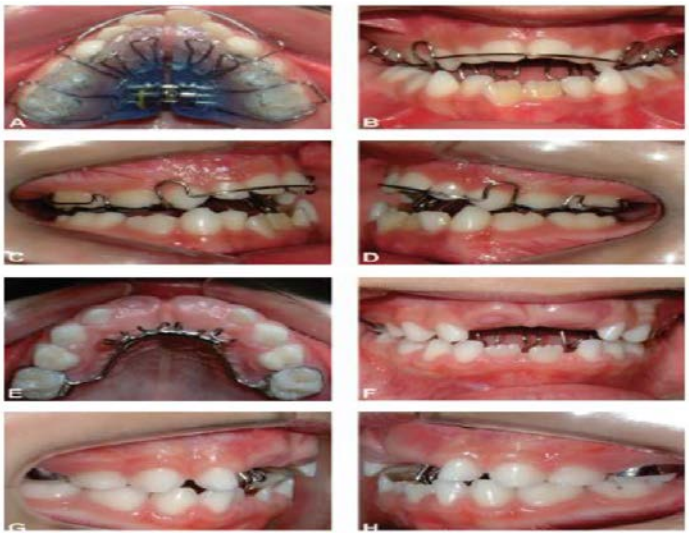

Figure 20: (A–D): Removable palatal tongue crib. (E–H): Fixed palatal tongue crib.

Mixed Dentition-Treatment

A) Tongue Crib

A removal or fixed appliance can inhibit tongue thrust. The crib used with a removable appliance for an anterior open bite consists of a palatal plate with a horseshoe-shaped wire crib. The crib is placed in the area of local tongue dysfunction and resultant malocclusion. The acrylic also can be interposed between the teeth, covering the occlusal surfaces of the upper molars, to prevent eruption of these teeth and enhance anchorage of the plate, which is especially beneficial in open-bite problems.

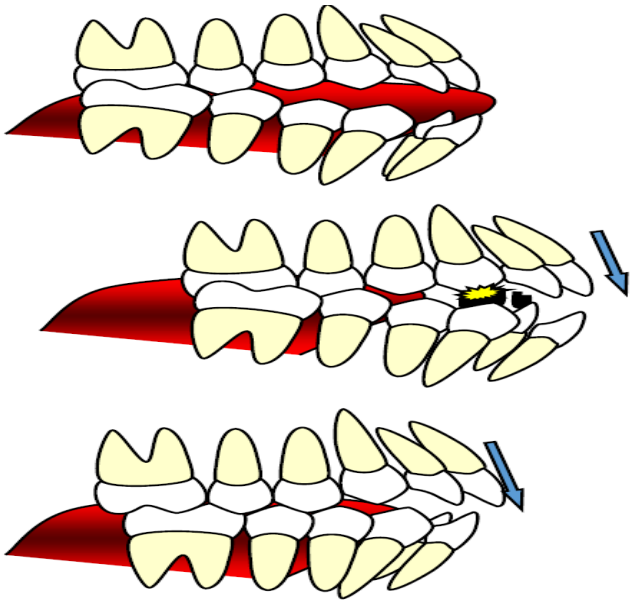

Figure 21

The bite-block here can be 3 to 4 mm, which is usually beyond the postural vertical dimension in open-bite patients. In such cases a stretch reflex is elicited from the closing muscles that enhances the depressing action on the buccal segments and helps close the anterior open bite.

Functional appliance in open bite correction

A) Activator[17]

The bite is opened 4 to 5 mm to develop a sufficient elastic depressing force and load the molar that are in premature contact. Properly constructed activators that follow this principle can influence the vertical growth pattern in these cases.

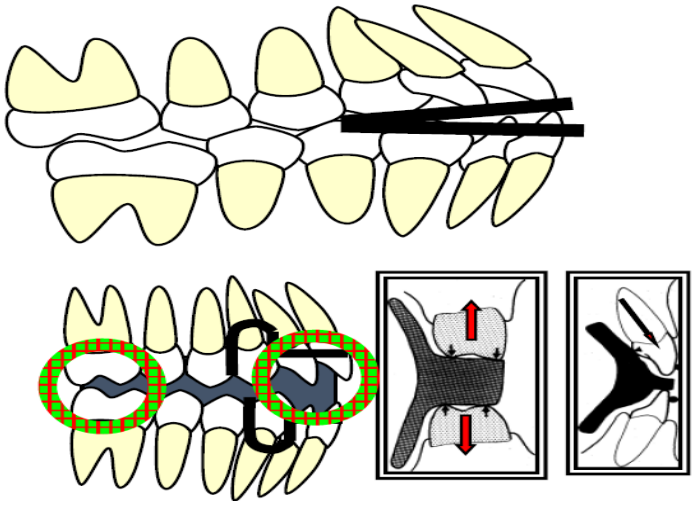

Figure 22

To “close the V” between upper and lower dental arches by depressing the posterior maxillary segments with the activator in a manner analogous to that of orthognathic surgery

B) Bionator18

Used to inhibit abnormal posture and function of the tongue. The construction bite is as low as possible, but a slight opening allows the interposition of posterior acrylic bite blocks for the posterior teeth, to prevent their extrusion. To inhibit tongue movements, the acrylic portion of the lower lingual part extends into the upper incisor region as a lingual shield. Closing the anterior space without touching the upper teeth. The palatal bar has the same configuration as the standard bionator, with the goal of moving the tongue into a more posterior or caudal position.

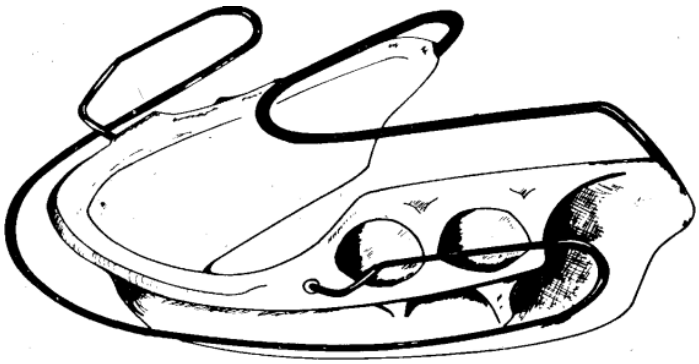

Figure 23

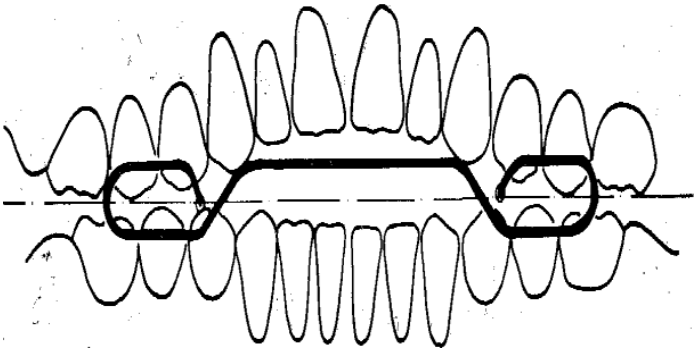

Figure 24

The labial bow differs from the standard appliance, that the wire runs approximately between the incisal edges of the upper and lower incisors.The labial part of the bow is placed at the height of correct lip closure thus stimulating, the lips to achieve a competent seal and relationship.The vertical strain on the lips tends to encourage the extrusive movement of the incisors, after eliminating the adverse tongue pressures.

C) Frankle IV

The working principle of the FR in establishing the mandibular forward rotation with the posterior edges of the buccal shields as a rotational center. Anteriorly, the mandible is raised by the force of the anterior vertical muscle chain being strengthened by lip seal exercises.

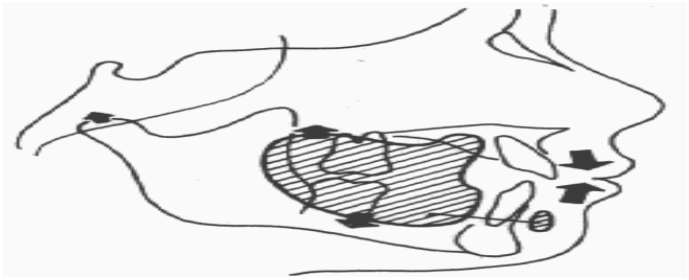

Figure 25

Normally, anterior open bite problems show protracted tongue posture with incompetence of lips. The tongue tooth contact replaces the lip seal during deglutition to create negative atmospheric pressure.FR IV along with lip exercises cause lip contact, reducing tongue protrusion and cause the tongue to move back into its normally raised position in proximity with palate, during deglutition.

D) Twin Block

Maintain occlusal contact to intrude the posterior teeth. Do not allow the second molars to over erupt. Extend occlusal cover or occlusal rests distally to second molars. Do not trim the upper block in open bite cases.This will allow the lower molars to erupt and again popping the bite open.

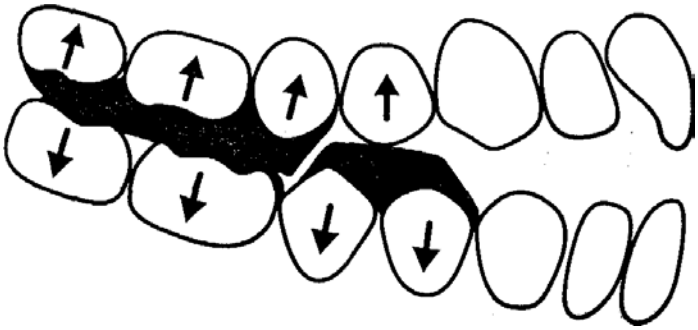

Figure 26

3. Permanent Dentition

Open-Bite Nonextraction Treatment

In the permanent dentition, the skeletal component is greater than in the deciduous and mixed dentitions and can be restricted to the alveolar bone or compromise the whole skeletal growth pattern2. Due to the greater involvement of the skeletal structures in the open bite in the permanent dentition, treatment is more difficult, especially regarding stability, which is not as satisfactory as in early. Because the amount of vertical growth is reduced at this stage, closure of the open bite is generally obtained by orthodontic force application. It is usually performed through the use of fixed orthodontic appliances, during leveling and alignment, aided by the use of vertical intermaxillary elastics in the anterior teeth, with the objective of extruding these teeth19. The patients have to use the elastics constantly, around 18–20 hours a day, removing them only during meals, to obtain satisfactory results.

A tongue crib or spur can also be used isolated or associated with anterior vertical elastics, to correct tongue posture and consequently close the bite20.

Concomitant use of the tongue crib or spur is important because it contributes in correcting tongue posture and increases the orthodontic mechanical efficiency. Further explanation on tongue crib and spur will be provided ahead

Usual clinical procedures

Closing an open bite in nonextraction treatment requires planning, beginning with bracket bonding. The anterior teeth should be bonded more cervically because this procedure will allow additional vertical movement of these teeth to extrude and consequently will help in closing the bite.

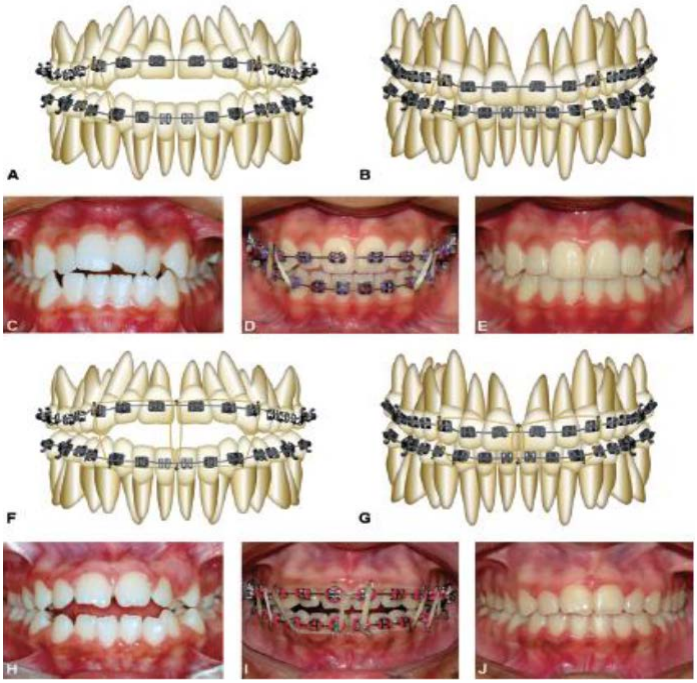

Figure 27: Vertical intermaxillary elastics used in the anterior teeth to correct anterior open bite..

In particular, the mandibular anterior teeth have to be bonded more cervically because this will allow a greater overbite of the anterior maxillary teeth, working as an overcorrection (Figure 29).

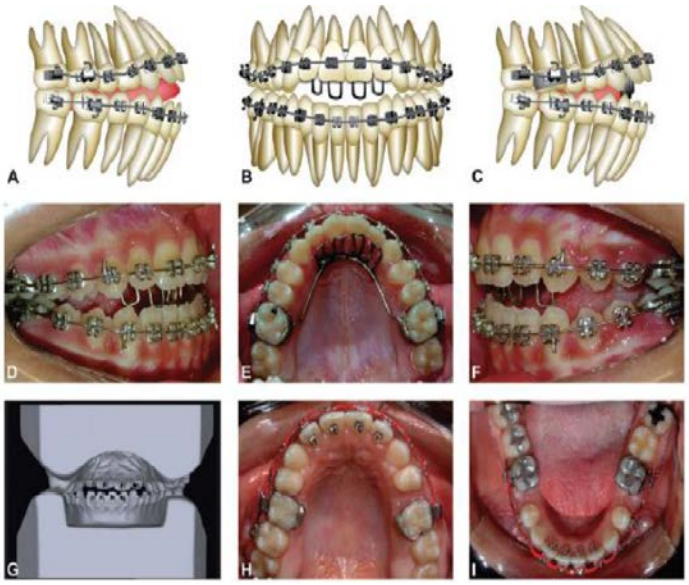

Figure 28: Tongue crib and tongue spurs to correct tongue posture.

Leveling and alignment can be obtained with different archwire sequences, following the usual principle of proceeding from the lightest to the heaviest archwire. It may begin with round nitinol wires, from the lightest to the heaviest, until a 0.016-in stainless steel archwire can be inserted.

Vertical elastics are usually used when 0.018-in stainless steel archwires are placed. Otherwise, one can also conduct leveling and alignment with progressively increasing rectangular thermo-activated NiTi archwires until a 0.019 × 0.025-in archwire is inserted. Vertical elastics are then used with these archwires.

All archwires should be flat, with no reversed or accentuated curve of Spee. If there are transverse discrepancies, these should be corrected before placing the vertical elastics to close the bite.

Vertical elastics can be used when there are still some anteroposterior discrepancies that are concurrently being corrected.

The objectives of using the elastics, besides extruding the incisors, are also to correct the occlusal plane inclination, to align the maxillary incisors in relation to lip line and

upright the posterior teeth that are usually mesially tipped21 The elastics are recommended to be used as much as possible, except during meals, which corresponds to approximately 18–20 hours of usage explained to patients so they can overcome the initial discomfort.

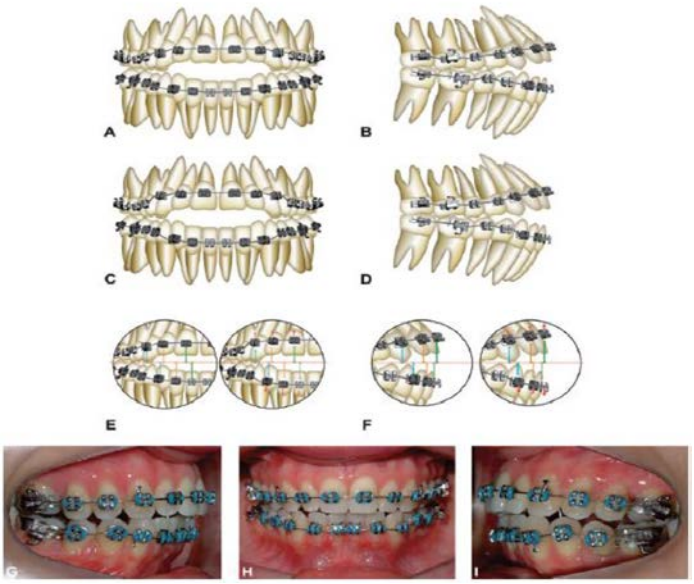

Figure 29: Anterior teeth bonded more cervically to aid in closing the anterior open bite

Orthodontic-Surgical Preparation to Correct Skeletal Anterior Open Bite

Stages of combined orthodontic-surgical treatment (Arnett and McLaughlin 2004)[22]

i. Treatment planning

ii. Orthodontic treatment

iii. Presurgical impression and revaluation of teeth positioning

iv. Presurgical records and definite treatment planning

v. Plaster model surgery and construction of an intermediary splint

vi. Orthognathic surgery

vii. Bracket rebonding, finishing procedures and appliance removal

viii. Retention and final records

Conclusion

There are various treatment options at different ages and the treatment of open bite remains a challenge to the clinician. Thus a careful diagnosis and timely intervention will improve the success of treating this malocclusion.

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