

MANAGEMENT OF OPEN BITE, ETIOLOGY, TREATMENT, AND STABILITY

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ABSTRACT

Open bite malocclusion is defined as a lack of vertical overlap between the maxillary and mandibular incisors. The complexity of an anterior open bite is attributed to a combination of skeletal, dental, soft tissue, and habitual factors. Numerous treatment strategies have been proposed to manage the diverse aetiologies of anterior open bite. Yet, due to a high rate of relapse after both traditional and surgical orthodontic treatment, it is considered one of the most challenging dentofacial deformities to correct. The diagnosis and treatment modalities are variable according to the etiology. Failure of tongue posture adaptation subsequent to orthodontic and/or surgical treatment might be the primary reason for relapse of anterior open bite. While an anterior open bite is a tough clinical challenge, careful diagnosis and the timely application of appropriate treatment and appliances are key to improving results and achieving long-term stability. The aim of the article is to arrive at a precise diagnosis and classify with early intervention using the most appropriate treatment and retention modalities to achieve long term functional and esthetic goals.

KEYWORDS: Open bite, Orthodontic management, Skeletal discrepancies, Behavioral habits

INTRODUCTION:

The term “open bite” was coined by Caravelli in 1842 as a distinct classification of malocclusion ^[1]. Anterior open bite is defined as no contact and vertical overlap between the maxillary and mandibular incisors ^[2,3]. The complexity of an anterior open bite is attributed to

a combination of skeletal, dental, soft tissue, and habitual factors ^[4]. It is defined as a malocclusion with no contact in the anterior region of the dental arches, while the posterior teeth remain in occlusion. When the malocclusion extends to the posterior segment, it is called a combined open bite ^[5]. 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 ^[6]. Multiple treatment strategies aimed at different etiologies of anterior open bite have been proposed. However, there is a tendency toward relapse after conventional or surgical orthodontic treatment^[7]. A dental open bite can often be treated with fixed orthodontic therapy. However, a more comprehensive approach is required for treating skeletal open bite, which may involve orthognathic surgery. Dental open bite in growing patients can be treated with myofunctional appliances, followed by a retention period with removable orthodontic devices. Nasal obstruction should be addressed during the pubertal growth phase, and tongue hyperactivity, during swallowing or even at rest, can alter the axial inclinations of the incisors, potentially leading to open bite^[8].

CLASSIFICATION OF OPEN BITE:

Worms, Meskin, and Isaacson in 1971 ^[9]:

- Simple OB: from canine to canine with a 4mm or greater gap in centric relation
- Compound OB: from premolar to premolar
- Infantile OB: from molar to molar

According to Proffit, an Open bite is classified in (mm)^[6]:

- >-4 extreme
- -3 to -4 severe
- 0 to -2 moderate

Rakosi classified open bite based on tongue posture as ^[10];

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

Sassouni classified open bite by considering the mandibular plane angle ^[11]:

- (a) Skeletal open bite
- (b) Dentoalveolar open bite

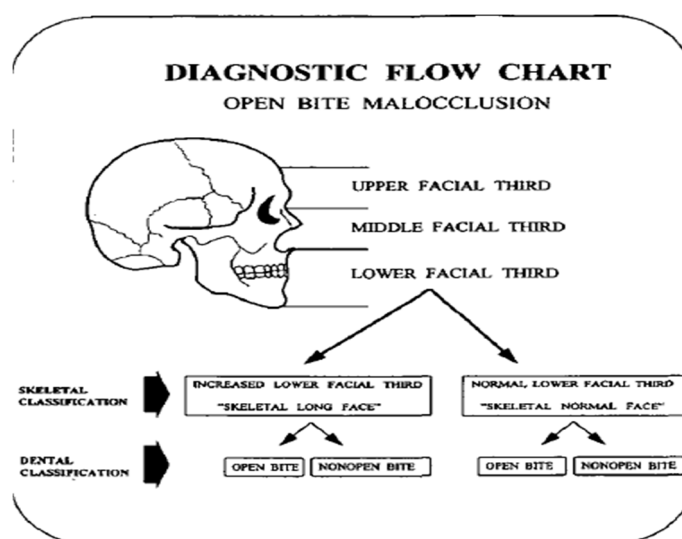


Figure 1: flow chart for open bite malocclusion

ETIOLOGY:

The etiology of anterior open bite malocclusions is multifactorial, and numerous theories, including genetic, anatomic, and environmental factors have been proposed.

GENETIC AND ANATOMIC FACTORS:

An anterior open bite is related primarily to the patient's unfavorable growth potential and heredity ^[12]. Based on cephalometric analyses, the steepness of the mandibular plane is considered the key skeletal finding associated with a skeletal anterior open bite. An increased gonial angle, a downward and backward position of the mandibular ramus, and shortened posterior facial height are additive in the production of the high mandibular plane angle in an open bite population ^[13]. Another useful method to help predict vertical growth patterns is based on Nahoum's diagnosis, is the ratio of upper anterior facial height to lower anterior facial height (AUFH: ALFH). If a patient has an open bite and an AUFH: ALFH ratio of less than 0.65, then the open bite is considered skeletal, which cannot be corrected by orthodontic treatment alone^[14]. Macroglossia has been suggested as a possible cause of an open bite ^[15]. Some anatomic conditions, such as enlarged adenoids and/ or tonsils, swollen nasal turbinates, and deviated nasal septa, may impair normal upper respiratory nasal function ^[16]. Mouth-breathing as a result of upper airway obstruction may cause an anterior open bite, but its direct relationship has not been proven ^[17]. Local factors include osteoarthritis, reactive arthritis, avascular necrosis, infection, and traumatic injuries. Systemic connective tissue or autoimmune diseases that can cause condylar resorption include rheumatoid arthritis, psoriatic arthritis, scleroderma, systemic lupus erythematosus, Sjögren syndrome, ankylosing spondylitis, etc^[18].

ENVIRONMENTAL FACTORS:

Studies have emphasized the contribution of abnormal tongue function, deleterious oral habits, abnormal swallowing patterns, and speech problems to the open bite phenomenon. Tongue dysfunction may either cause or result from abnormal swallowing behavior ^[19]. The severity of the condition is also influenced by persistent thumb sucking, finger/lip sucking, mouth breathing habits, and weak lip musculature ^[19].

DIAGNOSIS:

It can be done either clinically or by Cephalometric analysis

CLINICAL FEATURES ^[20]:

1. Overjet combined with an open bite less than 1 mm - Pseudo open bite
2. Open bite more than 1mm between the incisors, and posterior teeth are in occlusion - simple open bite.
3. Open bite extending from premolars (or) deciduous molars on one side to the corresponding teeth on the other side - complex open bite.
4. Compound (or infantile open bite is completely open, including molars
5. Iatrogenic open bite is the consequence of orthodontic therapy. In mixed dentition, various therapeutic measures may cause an open bite.
 - (a) An open activator with a high construction bite causes a tongue thrust habit and results in an anterior open bite. Intrusion of posterior teeth creates a posterior open bite, especially in the deciduous molar area.
 - (b) Expansion treatment - buccal segments tip buccally with elongation of lingual cusps. This creates prematurity and opens the bite.

(c) In distalization of maxillary first molar with extra-oral force, the molars are often tipped down and back, elongating the mesial cusps. This creates an open bite in a downward, backward growing face with already having excessive anterior face heights.

CEPHALOMETRIC FEATURES:

Sassouni ^[21] pointed out that the horizontal anatomic planes (Figure 2) -

1. The inclination of the anterior cranial base,
2. Frankfort plane,
3. Palatal plane,
4. Occlusal plane,
5. Mandibular plane tends to converge toward a single point in well-proportioned faces.

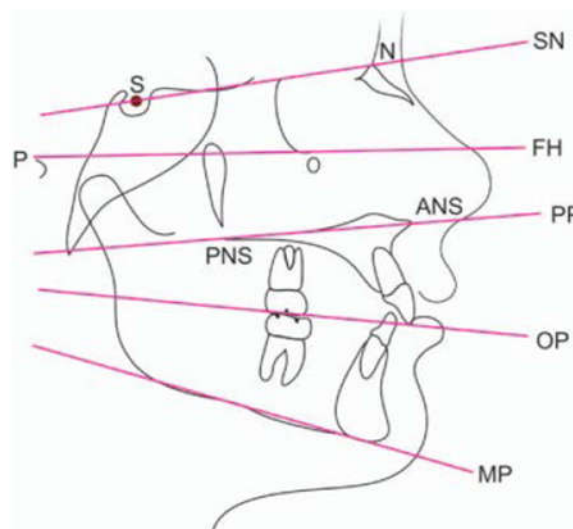


Figure 2: Planes referred for Sassouni Analysis

The inclination of these planes to each other reflects the vertical proportionality of the face. If the planes intersect relatively close to the face and diverge quickly as they pass anteriorly, the facial proportions are long anteriorly and short posteriorly, which predisposes the individual to an open bite malocclusion (skeletal open bite).

If the planes are nearly parallel, so that they converge far behind the face and diverge only slowly as they pass anteriorly, there is a skeletal predisposition to anterior deep bite (skeletal deep bite).

TREATMENT PLAN:

Anterior open bite is a tough orthodontic challenge, but the many approaches available can lead to improved chewing, incising, esthetics, and speech for the patient. The critical rule is that treatment strategies must always be tailored to the specific underlying cause of the bite problem.

Open bites that have been diagnosed as a result of habits such as thumb sucking or tongue thrusting, require their interception using passive habit-breaking appliances. The habit breaker can be either a removable or a fixed type of crib. Persistence of the cause will offer a severe limitation in the corrective procedures. Thus, to allow normal development of the anterior dentoalveolar region, the palatal crib may be an excellent treatment option, since it prevents thumb or dummy sucking and avoids tongue thrusting^[22,23].

The presence of abnormal nasopharyngeal pathology should be ruled out after referring the patient to an otolaryngologist. The control of those factors should be given due importance before rushing to correct the existing open bite ^[22,23].

MYOFUNCTIONAL AND ORTHOPEDIC THERAPY:

The treatment approach is directed at vertical control of facial growth and/or 'real' or relative intrusion of the posterior teeth. The maxillary posterior segment can be intruded by an occipital headgear, which rotates the maxilla in clock clockwise direction, thereby closing the open bite^[22,23]. In adult patients, anterior open bites are typically linked to extruded posterior teeth. Consequently, intruding or controlling the vertical movement of these teeth is the ideal treatment approach. Due to surgical risks, as well as the patient's existing facial balance and profile, a nonsurgical approach was selected. This involved skeletal anchorage combined with the modified MEAW (Multiloop Edgewise Archwire) technique—a proven method for open bite correction. Specifically, this modified technique applies a NiTi maxillary wire with an accentuated curve of Spee and a mandibular wire with a reverse curve of Spee to close the open bite^[28].

Skeletal anterior open bites can be treated during growth using functional appliances such as F.R.-IV or a modified activator. These appliances incorporate bite blocks interposed between the posterior teeth, which have an intrusive action on the upper and lower posterior teeth. Patients exhibiting a downward and backward rotation of the mandible with increased vertical growth benefit from therapy using a vertical pull headgear with a chin cup if treated during the mixed dentition period. Vertical chin cup inhibits the vertical growth in the mandibular posterior dentoalveolar region. It decreases the mandibular plane angle and helps in closure of gonial angle, indicating anterior rotation of the mandible^[24].

ORTHODONTIC CORRECTIVE THERAPY :

Mild to moderate dental open bites can be successfully managed using fixed mechanical appliances in conjunction with box elastics. This form of elastic application consists of an elastic that is stretched to extend between the upper and lower anteriors. This brings about extrusion of the upper and lower anteriors. This form of therapy may not give favourable results

in severe skeletal open bites. The correction of the anterior open-bite resulted mostly from a counterclockwise rotation of the mandible (caused by the intrusion of the maxillary posterior teeth). Excessive extrusion of the incisors to close an anterior open bite is not recommended since the condition will have a high risk of relapse once the appliances are removed^[29]. Temporary anchoring devices (TADs), which have a significant clinical value, offer skeletal anchorage for effective orthodontic treatment and are widely employed in the orthodontic field. Miniscrews have several benefits, including minimal cost, easy placement and removal, and sufficient anchorage to support tooth movement. Concerning stability and patient safety, complications can occur during miniscrews placement and following orthodontic loading. Although complicated malocclusions are more frequently treated with miniscrews^[30].

SURGICAL CORRECTION:

The extrusion of incisors to close an open bite is usually considered undesirable and unstable for the treatment outcome^[31]. The CCW rotation of the mandible is especially favorable in skeletal Class II patients, which produces anterior movement of the chin and improves the patient's profile. In skeletal Class III patients, the CCW rotation of the mandible without surgical setback will worsen the patient's profile. Skeletal open bites in adults are best treated by surgical procedures involving the maxilla and the mandible. This includes step-down of the maxilla and setup of the mandible. The surgical treatment depends upon other factors, like the anterior-posterior relationship of the maxilla and mandible. The one-jaw surgery including either maxillary LeFort I impaction or mandibular BSSO with CCW rotation. Two-jaw surgery normally combines maxillary LeFort I osteotomy and BSSO. Isolated mandibular surgery with CCW rotation of the mandible was considered to be less stable in long-term stability^[32]

RETENTION AND STABILITY:

The importance of retention is to enhance stability, especially by eliminating the cause of the open bite. Studies of long-term results of open bite orthodontic treatment by Lopez-Gavito et al^[7] and surgically treated cases by Denison et al^[25] indicate that the relapse rate can range from 35% to 42.9%. Relapse after anterior open bite treatment has been attributed to tongue posture, growth patterns, treatment parameters, and surgical fragment instability, possibly due to increased facial height and extrusion of maxillary molars. About the surgical procedures, greater overbite stability can be achieved with maxillary surgical repositioning only, or with bimaxillary surgery, whereas mandibular surgery only produces less stable results^[26]. Myofunctional therapy and placement of a tongue crib may improve stability in patients, especially with an anterior tongue rest posture^[27]. Clinicians attempt to maintain the corrected open bite for growing patients by applying a vertical chin cup or high-pull headgear to the upper molars in conjunction with a standard removable retainer. Retainers with occlusal coverage to prevent further molar extrusions, and wearing conventional retainers in the daytime, combined with wearing a functional appliance with bite blocks (an open bite activator or a bionator) at night time can also be used. Some clinicians even suggested that prolonged retention with fixed or removable retainers is advisable and necessary in most cases of open bite treatment^[26].

CONCLUSION:

Effective management of bite malocclusions is a complex, individualized process built on three pillars: diagnosis, causes, and treatment. Diagnosis must accurately assess skeletal and soft tissue factors. Treatment strategies, which include procedures, surgical choices, and behavioral changes, are now greatly enhanced by technology like TADs and advanced imaging. Despite these tools, long-term success fundamentally requires dedicated patient cooperation and

consistent follow-up. Therefore, to ensure optimal results as the field evolves, clinicians must prioritize collaboration and a patient-centered approach.

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