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Anterior open bite and its management in orthodontics: A systemic review

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Abstract: *In contemporary orthodontics management of anterior open bite (AOB) is challenging chore for an orthodontist. As anterior open bite can be skeletal and dental a thorough diagnosis of etiologic factors should be done for providing a stable results post treatment. Because AOB is more prevalent in primary dentition than permanent dentition it is possible to make early diagnosis and treatment plan for the patient. There are multiple etiologic factors responsible for AOB but childhood oral habits such as thumb sucking, tongue thrusting are believed to have strong relationship with AOB. Patients with anterior open bite have long face syndrome.AOB effects the esthetics, mastication and articulation of some phonemes which results in dyslalias in some patients. In addition to these steepness of mandibular plane, large interlabial gap, increased posterior dentoalveolar height, increased lower anterior facial height and gonial angle are found on clinical and radiographic examination. Treatment plan for AOB varies in growing individuals and adults, functional appliances and orthodontic intervention can be used in mixed dentition patients where as in adults orthodontic intervention and orthognathic surgery are the choice of treatment in adults. Various treatment modalities has been used for treating AOB in order to achieve the stable results such as, Fränkel regulator-4 (FR-4), open-bite bionator (OBB), quad-helix appliance, posterior bite blocks, maxillary expansion appliances + vertical pull chin cup (VPCC), rapid maxillary intruders (RMI), class II headgears appliances, vertical-pull chin cup (VPCC), temporary anchorage devices (TAD'S).But early treatment of AOB still remains a controversy. The main aim of this review was to address the etiology, treatment options and post-treatment stability in AOB patients.*

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I. Introduction

Besides the global concern of dental caries among the general population, there is also a mounting problem of malocclusion in growing individuals and adults. Malocclusion results in morphological, functional and esthetic problems and is suspected to be allied with many factors such as genetic, environmental and behavioral[1].Skeletal open bite also called as long face syndrome is usually a difficult abnormality to correct. In primary and mixed dentition the most common abnormality recognized are anterior open bite (AOB) and posterior cross bite [2]. When the all the teeth are in occlusion except in the anterior region, it is recognized as anterior open bite(AOB)[3,4].AOB is found to be more prevalent in primary dentition and mixed dentition with a expected prevalence rate ranging between 6.2% to 50% globally, varying accordingly in different types of population used in various studies[5].

It is believed that AOB is most likely to be predominant during the mixed dentition period, because during primary dentition period it is mostly self corrected in majority of the cases[6].In addition to occlusal and aesthetic alterations, AOB also effects the mastication and articulation of specific phonemes, as the unification of teeth,tongue,palate,palatal rugae,lips and oropharynx plays an important role in expression of sounds to build verbal communication[7].Consequently their capability to converse correctly may be compromised[8].The purpose of this review is to enlighten AOB and discuss the possible treatment options available in field of orthodontics.

II. Etiology

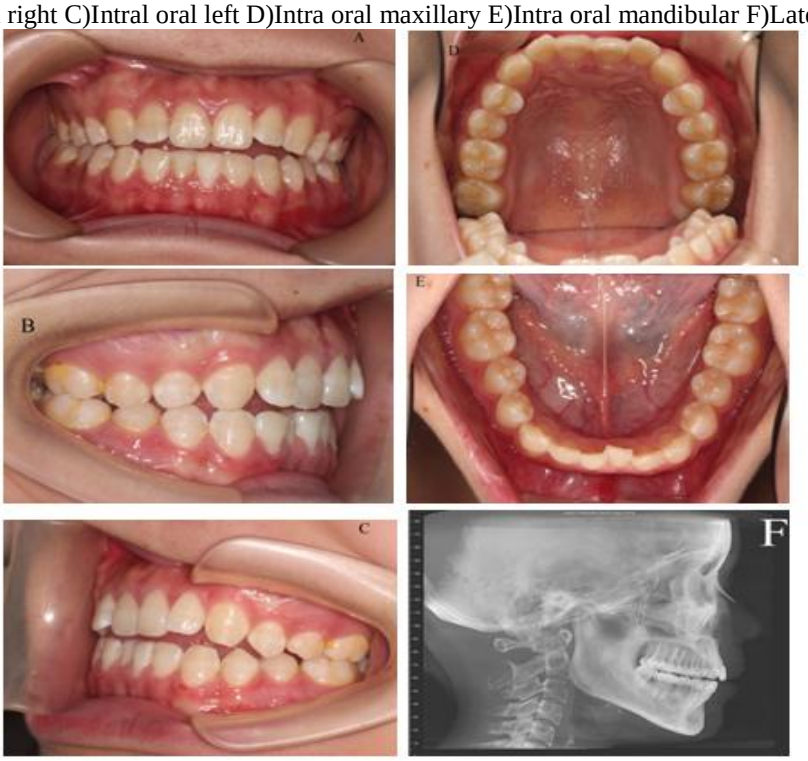
The etiology of open bite is considered to be multifactorial which indicates that it can be produced by single factor. The fundamental leading causes are size and position of the tongue, oral habits, mouth breathing, enlarged lymphatic tissues and unfavorable growth patterns[9].It is observed that during primary and mixed dentition period AOB is comparatively common[10]. This type of malocclusion is generally associated with persistent thumb sucking habit and hyperdivergent facial pattern[11].Among younger children the presence of prolonged oral habits leads to AOB and may influence the quality of life[12].Non-nutritive sucking habits(NNSH) during primary dentition is strongly associated with the occurrence of AOB[13].According to some studies the incidence of AOB is about 60% in children with non-nutritive sucking habits[14].Some authors suggest that genetic factors plays not as much of a role in occurrence of AOB, hence this type of malocclusion is mostly acquired than inherited[15].

III. Clinical manifestations of AOB

The diagnosis of AOB is confirmed upon clinical and radiographic examination of the patient. Among the soft tissue findings a big interlabial gap is considered as one of the important sign of skeletal open bite [16].And the important skeletal finding of anterior open bite is steepness of mandibular plane angle. According to some authors open bite was of classified into two types skeletal and dental. On radiographic examination skeletal open bite shows various changes whereas, dental open bite is confined to anterior teeth and adjacent hard and soft tissues without showing any considerable changes in cephalometric radiographs[17].As a result of mechanical blockage of incisors vertical development and its adjacent alveolar component, dentoalveolar and dental open bite is formed but skeletal relationship is normal .Increased posterior dentoalveolar height, increased lower anterior facial height and gonial angle, short mandibular angle are some of the features observed in skeletal open bite[18]. And some other features found are marked incisor and labial inclination and crowding, lip incompetence, profile convexity. Because of this motive anterior open bite is one of the main causes for masticatory and phonatory operative impairment [19].According to some studies patients with AOB showed speech disorders and some distortion dyslalia's [20].According to Sahad there is a strong correlation between patients with AOB and hissing sound as it is difficult for them to produce sounds like /t/d/s/z/ [21]. Patients with AOB have difficulty with swallowing, mastication, speech and breathing [22]. As there is no lip seal in patients with AOB because of lack of articulation of maxillary and mandibular dentition in front region, AOB is considered to be associated with mouth breathing and sleep-disordered breathing in growing children[23].

Fig 1:- Extra oral images of a patient with AOB:- A 21 year old female patient with anterior open bite measuring about 3mm.Fig from A to F depicts the various aspects of patients profile. A)Facial front B)Facial front smiling C)Facial ¾ right D)Facial ¾ right smiling E)Facial profile F)Facial profile smiling

Fig 2:-Intra oral images. Fig 2 depicts the intra oral aspects from and lateral cephalogram A to F. A)Intra oral front B)Intra oral right C)Intral oral left D)Intra oral maxillary E)Intra oral mandibular F)Lateral cephalogram



IV. Treatment modalities for AOB

It's quite challenging for an orthodontist to treat AOB and maintain its results. Since the occurrence of AOB can be affected by race and age [16].For treatment of growing patients orthopedic and functional appliances can be used but in adults only orthodontic intervention and orthognathic surgery are left for curative intervention [24, 25]. According to various studies both surgical and non surgical treatment of AOB has high success rates which is expected to be greater than 75% (the mean value for patients treated with only orthodontic approach is 75% and 82% for both orthopedic and orthodontic approach)[26]

Since orthodontic approach cost-effective option for patient it is also less invasive and has long-term stability result. Non-surgical approach entail either the intrusion of posterior dentition which is over-extruded but is less common or the extrusion of anterior dentition[27].In few cases orthodontic intervention may result in adverse extrusion of incisors and also more display of gingival[28].Posterior intrusion can be utilized in many cases but it requires adequate anchorage. Use of high-pull head gear is found to be effective for anchorage but patient co-operation is required to acquire good results. For management of open bite mini implants shows good success rate and provides sufficient amount of skeletal anchorage [29]. There are various orthodontic appliances which can be utilized for treating AOB during mixed dentition period such as Fränkel regulator-4 (FR-4),open-bite bionator (OBB),quad-helix appliance, posterior bite blocks, maxillary expansion appliances + vertical pull chin cup(VPCC), rapid maxillary intruders (RMI), class II headgears appliances, vertical-pull chin cup(VPCC)[30].Among growing adults and older patients superior repositioning of maxilla through orthognathic surgery to rotate mandible upward and forward in order to correct anterior open bite and reduce the lower anterior face height was the only option but in contemporary orthodontics temporary anchorage devices (TAD), together with miniscrews and miniplates have been utilized for intrusion of maxillary posterior teeth which allows autorotation of mandible and correction of anterior open bite[31,32].

V. Brief summary of appliances and their effects used in treatment of AOB

1. Functional appliances

A. Fränkel appliances + lip seal exercises:- The effects of the combination therapy regarding these two appliances were noticeable dentoalveolar effects without any significant results in skeletal region. There may be longer stability of achieved results if the lips are sealed without strain

B. Open bite bionator (OBB):- According to one theory OBB was more effective when used in combination with other appliances than when it was used alone [33].Other effects of OBB are improved intermaxillary vertical correlation, facial convexity is decreased and reduces open-bite in class II patients, reduces overjet and ANB angle [34].Extrusion of maxillary molars is controlled.

2. Bite Blocks

A. Spring loaded bite blocks (SLBB):- Iscan [35] verified that SLBB generates more molar intrusion and ramal inclination. The effects of SLBB are incisors extrusion, maxillary molars intrusion, control of posterior dentoalveolar height.

B. Posterior bite blocks(PBB) 5mm and 10mm (PBB5 and PBB10):- The effects of PBB are incisive extrusion and lingual tipping, manages posterior dentoalveolar height, mandibular autoration, PBB5 and PBB10 both are found to be effective in treating AOB. IT is observed that PBB10 produces greater mandibular sagittal growth and autorotation and increase in gonial angle [36].

C. Magnetic Bite Block (MBB):-In 1986 Dellinger [37] was the first one to use magnets to treat anterior open bite. The affects of magnetic bite blocks are incisor extrusion, molar intrusion, decrease anterior facial height, mandibular autorotation, comparatively more effective than spring loaded bite blocks and acrylic bite blocks.

3. Rapid molar intruder (RMI):- It can be utilized in early and mixed dentition period.RMI was introduced and named by Carano [38] a decade ago. It is designed in such manners that it has coil spring along with elastic modules in it is applied to first molars through bands which are in turn attached to molars. The effects of RMI are molar intrusion, mandibular autorotation with advancement of chin which improves appearance of patient.

4. Cribs (or) Spurs

A. Removable palatal crib (RPC):- It is found to be effective in the anterior dentoalveolar region it guides the extrusion and uprightning of maxillary and mandibular incisors. Skeletal changes depend on patient's co-operation.

B. Spurs (BS):- It is effective only in the dentoalveolar region while there was no change in skeletal region.

C .Fixed palatal crib(FPC):- According to some authors cribs are found to be effective in correcting maxillomandibular vertical relationship but others reported that it produces only dentoalveolar changes[39]. It is more efficient than removable crib because it does not require conformity.

5. Quad helix/crib (Q-H/C):- It obstructs the suckling habit, incisor extrusion and lingual tipping, comparatively more effective than removable crib as it does not require conformity. It directs the rotation of palatal plane downwardly and improves intermaxillary vertical relationships [40].

6. Fränkel regulator-4(FR-4):- FR-4 is found to be effective in treating AOB. It also corrects the steep mandibular plane.

7. Vertical chin cup (VCC):- There was noticeable increase in the overbite with VCC either when used alone or with other appliances [41]. Some of its effects are decreased gonial angle, vertical control, molar eruption not guided skeletal changes depends on patient's obedience.

8. Temporary anchorage devices (TAD'S)

A. Miniscrews (or) miniplates: - The effects includes intrusion of maxillary maxillary posterior teeth, decrease in anterior facial height [42].

9. Maxillary intrusion splint: - It obstructs the eruption of mandibular teeth and facilitates the intrusion of maxillary posterior teeth in-turn reduces the open bite. It is designed in such manner that it covers all maxillary premolars and molars but not the canines because of this in few patients there a premature occlusion in canine region and potential posterior open bite is noticed [43].

10. Orthognathic surgery: - The patients who are adults and who acquired comparatively substantial open bite before the treatment were suitable for LeFort I osteotomy. It reduces the open bite, lengthening of maxillary and mandibular incisor occurs. Posterior region of the maxilla will be elevated [44].

VI. Occurrence of relapse in retention phase

It is quite a difficult task for an orthodontist to maintain the retention of anterior open bite after treatment because it is one of the most complex types of malocclusion [45]. Occlusion usually becomes difficult to be maintained because of uncontrolled tongue movements and positions. Various types of retainers are advised for anterior open bite cases such as fixed retainers, removable retainers like occipital head gears, functional appliances in combination with posterior bite plane and TAD'S[45].When relapse occur the common esthetic features to be seen are interpoximal spacing between anterior teeth and repeal smile line. According to Remmors [46] from his study conducted on 52 patients with anterior open bite 27% of successfully treated patients showed relapse of open bite after 5 years of post treatment. There was 35% relapse in post retention period in patients according to study conducted by Lopez-Gavito [47]. Treatment of open bite with TAD's and orofacial myofunctional therapy (OMT) had shown comparatively better results[48,49].Childhood oral habits such tongue thrusting, thumb sucking, mouth breathing etc. contribute to one of the etiological factors in developing anterior open may result in relapse. According few authors this can be prevented by treating the open bite cases through a multidisciplinary approach by involving various specialists such as orthodontist, otorhinolaryngologists, orofacial myofunctional therapist and maxillofacial surgeons are sometimes required in adults [50].

VII. Conclusion

In summary, to do the successful treatment and achieve the stable results of anterior open bite cases, a thorough assessment of etiologic factors involved and proper diagnosis should be done. Utilization of various fixed and removable appliances when prescribed in combination with functional appliances showed promising results in the treatment. Whereas, there are very few reports of relapse when TAD'S are used for treating open bite cases. Early diagnosis and treatment of open bite cases is usually a better option but there are reports of relapse in some cases. By providing a multidisciplinary approach through involving different specialists post treatment relapse in many cases can be avoided. Further studies are required to enlighten the standardization of diagnostics, treatment plan and post treatment plan for anterior open bite cases.

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Conflict of interest

The author have no conflict of interest

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