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A Review Paper on the Orthodontic Management of Front Open Bites asks Whether Surgery is Always Required

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ABSTRACT:-

Introduction: Due of their complicated origin and extremely high relapse incidence, anterior open bite cases are highly challenging to treat adequately. Treatment options include deterrent appliances, high-pull headgear, fixed appliances with and without extractions, orthognathic surgery, and skeletal anchorage with miniplates or miniscrews, depending on the cause of the anterior open bite malocclusion and the patient's age.

Methods and Methods: The combining of fixed appliance orthodontic therapy and orthognathic surgery is the gold standard treatment for skeletal anterior open bite situations. Temporary anchoring devices (TADs), which can be used to close anterior open bites, have been created recently. Orthognathic surgery may be avoided in a few cases of anterior open bite thanks to the development of TAD as a successful therapy option.

Conclusion: The anterior open bite closure with TAD is a relatively novel treatment, and there is currently little proof of its long-term stability.

Keywords: Anterior open bite , TAD, Orthognathic , Skeletal anchorage , Relapse

INTRODUCTION: -

Due to the high frequency of relapse, the anterior open bite (AOB) malocclusion is one of the most difficult malocclusions to treat [1-2]. When the teeth in the buccal segment are in occlusion, it is known as the absence of vertical incisor overlap. The goal of this paper is to examine and describe the many orthodontic treatment options that can be utilised to manage AOB as a non-surgical alternative to surgery, as well as the supporting data.[3-6] The "period

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of tongue thrusts" spans from the early 1960s to the mid-1970s because tongue thrust was frequently blamed for malocclusion [6]. Prior to the 1970s, dentoalveolar modifications and/or habit modification were the mainstays of orthodontic treatment [7].

Skeletal, dental, pulmonary, neurologic, and behavioural factors all play a part in the multifactorial aetiology of AOB [1,8]. In general, it can be said to have skeletal or dental origins [9].When the vertical component of growth disproportionally surpasses the horizontal component of growth, a high-angle skeletal pattern with increased Frankfort Mandibular Plane Angle might result in an AOB. When just the posterior molars are in occlusion, as in severe cases, labial tooth eruption is unable to make up for the increase in inter-occlusal distance. Some or all of the following cephalometric characteristics may be present in patients with an AOB: significant ante-gonial notching, receding chin, reduced inter-incisal angle, reduced inter-molar angle, and increased lower anterior facial height. It is thought that soft tissues also contribute to AOB. Ineffective lips may cause the tongue to shove forward in order to create an oral seal during swallowing, which could intrude the anterior segments and change their dentoalveolar position. Digit chewing frequently causes an AOB because it prevents the eruption of the vertical incisors. This, together with posterior cross bites brought on by increased cheek pressure and a lowered tongue position, narrow the arch. Greater tonsillar or adenoidal blockage may contribute to prolonged mouth breathing, which can result in increased vertical growth [8]. The most common indications for treatment are an improvement in appearance and functionality. Patients with a severe AOB frequently struggle with food incision and experience verbal issues, including lisps. Although there is limited evidence that it might help with speech, closing an AOB usually aids in eating [8,9].

Various therapy options for closing AOB are shown in the literature, depending on the relevant diagnosis. Some examples of the treatment modalities include high-pull headgear, chin cups, various biting blocks, functional appliances, fixed appliances with or without extractions, and multi-loop edgewise archwires [10]. In cases of skeletal aetiology, definitive treatment typically entails a combination strategy of orthodontic treatment with fixed appliances and orthognathic surgery. Le Fort I osteotomy with posterior maxillary impaction or bimaxillary osteotomy is typically part of the surgery [8,9].

Orthognathic surgery can be notoriously unstable when treating AOB. Different orthognathic treatments to closure an AOB and their relapse rates have been compared in a number of studies. Maxillary impaction was reported to have a lower relapse rate (7% overbite decrease) than two jaw surgeries (12% overbite decrease) by Proffit et al. in 2000 [11].

Teittinen et al. also compared the relapse rate of patients with previous maxillary impaction and mandibular counterclockwise rotation to closure AOB to patients with only previous maxillary impaction. Only 3.5 years after treatment did each patient with a maxillary impaction still have a positive overbite, but in three cases with bimaxillary surgery, the open bite returned. Both groups (one and two jaw surgeries) experienced a vertical relapse of the maxilla; in the bimaxillary group, the alterations were statistically significant [12].

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By rotating the mandible in the opposite direction from the clock, it might also be able to surgically close an AOB. Due to the possibility of prolonging the pterygomasseteric sling, this has been viewed by many as uncertain. When the jaw was rotated counterclockwise during surgery, Frey et al. observed more relapses [13]. In class II cases with retrusive mandible and chin, Bisase et al. suggested this procedure, reporting that the closure of AOB by mandibular counterclockwise rotation are at least as stable as AOB closed by maxillary impaction [5]. Van Sickels reviewed the research on AOB closure with counterclockwise mandibular rotation, presented three instances with varying levels of stability, and came to the conclusion that counterclockwise mandibular rotation should only be done with extreme caution. However, there is little question that skeletal AOB are prone to relapse regardless of the surgical technique used, as he stated that larger and more rigid plates and screws can help to prevent the early stability [14]. Skeletal anchoring devices have been created recently as an alternative to treating a skeletal AOB through orthognathic surgery. For molar intrusion to rectify an AOB, skeletal anchoring is used [2-4] preventing devices.

When a young patient's AOB is brought on by a digit-sucking habit, the open bite will naturally close after the habit is broken. With passive orthodontic appliances like the Hayrake appliance, which also permits spontaneous improvement, thumb-sucking behaviours can be broken. Headgear with a high pull A popular method for managing AOB therapy involves inserting upper molars that are thought to have extruded and as a result, caused the AOB [6]. By reducing the clockwise rotation of the mandible or even causing it to rotate counterclockwise, some writers also reported some vertical control [12,13]. It frequently goes with fixed, useful appliances bite blocks at the back. Acrylic is typically used to make posterior bite blocks, which fit between the mandibular and maxillary teeth. They are typically utilised in the early treatment of AOB cases and can be spring loaded or connected with magnets. This permits the jaw to rotate upward and forward by preventing the eruption of the back teeth [9, 14Maxillary infiltration In situations when it is intended to intrude the entire maxillary teeth, such as gummy smile cases, which include a degree of vertical maxillary excess, splints that cover the entire maxillary dentition are also employed with high-pull headgear. The efficiency of passive posterior bite blocks of two different heights (5 and 10 mm) was tested in a study by Iscan et al. with an untreated control group of AOB cases. The mandible continued to rotate backward and downward in the control group, dramatically lowering facial height, whereas the mandible rotated upward and forward in the treated groups, creating a positive overbite [15].

When the AOB is connected to a class II malocclusion in growing patients, removable functional appliances and high-pull headgear can be used. This combination aids in reducing the vertical dimension while adjusting the anteroposterior disparity [9].

For the management of AOB with a skeletal II pattern, we typically employ a Clark Twinblock as the functional appliance of preference together with high-pull headgear in our clinic. The top and lower bite blocks of this removable functional appliance cooperate to

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position the lower jaw forward. The upper appliance contains an expansion screw to expand the arch and always has tubes placed occlusally between the premolars and molars to accommodate the high-pull headgear when the Twinblock is used in Class II AOB cases headgear.

The open bite-bionator is a detachable device that has posterior bite blocks to prevent the posterior teeth from protruding. An 11-year-old female patient with an AOB related to finger sucking. b Patient wearing a Hayrake device (deterrent appliance). 3 months after wearing the Hayrake gadget, there were c Occlusal alterations. Patient is sporting a high-pull hat. A patient using flying tubes to insert headgear has a Clark Twinblock. b Patient sporting a high-pull helmet and a Clark Twinblock oral maxillofacial surgery The labial bow is positioned at the height of proper lip closure, and an acrylic section that serves as a lingual shield extends from the lower lingual part into the top region. 20 patients with a high angle skeletal connection were investigated by Defraia et al., who compared the MPA to an untreated control. The treated group displayed a significantly larger overbite (+1.5 mm) and narrower palatal planemandibular plane angle (1.9°).He comes to the conclusion that early use of the open-bite bionator improves intermaxillary divergences [12]. The Fränkel 4 has been recommended in situations where the orofacial musculature's improper postural activity contributes to the open bite. It is a functional detachable appliance that operates by permitting upper and lower incisors to emerge vertically and retraction of the upper incisors. According to certain authors, mandibular rotation can switch from downward and backward to upward and forward as a result of Frankel wear. In a randomised clinical trial, Erbay et al. evaluated the effects of the Fränkel function regulator appliance on the treatment of Angle Class I skeletal AOB malocclusion. The results showed that Fränkel 4 therapy could reverse the naturally occurring downward and backward growth direction of the mandible, which was seen in the control group.

Occasionally, this device is used on growing patients to divert the condylar growth in an effort to minimise excessive vertical growth, but it has lost favour in recent years due to a lack of convincing evidence of its effectiveness. In 1978, Pearson removed four first premolars and had the remaining twenty growing patients with backward rotating inclinations and AOB wait for the remaining teeth to erupt while wearing a vertical pull chin cup for at least 12 hours each day. The mandibular plane angles decreased by an average of 3.9° [18] and the AOB were all closed. In children with an Angle Class I AOB, Torres et al. examined the dentoalveolar and soft tissue alterations brought on by a detachable appliance used in conjunction with high-pull chin cup therapy. No significant differences were seen in the level of molar eruption or in the lower anterior face height when they compared the outcomes of patients treated with a control group, indicating that the vertical control anticipated from the chin cup therapy did not take place [19].

AOB can also be closed by separating the front incisors using upper and lower fixed appliances and vertical intermaxillary elastics. A transpalatal arch and a high pull headpiece

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to invade the upper molars can be employed in addition to the fixed appliance. If the cause of the open bite is dental rather than skeletal, fixed appliances alone should be used. Fixed appliances with anterior box-elastics cause the anterior incisors to protrude, which is frequently unstable and only useful if the incisors have not previously done so due to natural compensatory [8]. Straight-pull Headgear should not be used to distalize the molars in addition since doing so expands the bite by causing molar extrusion. Due to the undesirable side effect of molar extrusion, Class II or III elastics should be used with caution [9]. However, Schudy elastics, which allow for an additional anterior extrusion component of force, have been reported to be useful in these circumstances. The AOB is closed by the retroclination of proclined upper and lower incisors [10]. The ability of the soft tissues to adjust to the altered dental arrangement of the teeth will determine how stable AOB correction with fixed orthodontic appliances will be. Premolar extractions and space closure with fixed appliances in orthodontics are two viable treatments for AOB correctionThe incisors may be retracted, causing uprighting and relative extrusion, and the mesial movement of the molar teeth may result in a reduction in the mandibular plane angle and closure in the AOB [20The stability of open bite cases treated with fixed appliances, headgear, and elastics was the subject of a study by Lopez-Gavito et al. Pretreatment, immediately after treatment, and 10 years after retention were the three time points at which cephalometric radiographs of 41 individuals with at least 3 mm of open bite were assessed. They discovered that whereas 65% of the patients had rather consistent outcomes, 35% of the patients had an open bite of at least 3 mm [21] On the basis of the degree of pretreatment overbite, three groups were distinguished in a different study by Zuroff et al., which raised the sample size to 64 patients. An open bite group (no incisal overlap), an overlap group (incisal overlap and no incisal contact), and a contact group (incisal overlap and incisal contact). 60% of the open bite participants had no incisor contact ten years after retention. However, no one experienced negative incisor overlap, and the biggest vertical relapse in the entire sample was only 2.4 mm [10].

Edgewise Archwire method with many loops the Multi-loop Edgewise Archwire approach was described by Kim et al. as being used for AOB closure treatment [6]. With no requirements for torque, angulation, or tip, they used an edgewise ideal archwire made of 16-by-22-inch stainless steel in an edgewise bracket system.

Bending loops into the archwires enabled vertical and horizontal control, reduced load, and deflection rate. There are five loops in each quadrant and an L-shaped loop between each interbracket distal to the lateral incisors. After changing the occlusal plane, this appliance operates by extruding the anterior teeth and raising the molars. The anterior segments are extruded in order to seal the AOB using strong intermaxillary elastics. The drawback of this method is that the majority of correction was achieved through front tooth extrusion rather than molar invasion.

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Anterior tooth extrusion is prone to relapse [16]. devices for temporary anchoring

In recent years, bone anchors made of titanium have been employed to orthodontically treat AOB . Orthodontists have more treatment choices thanks to the use of skeletal anchoring, which is particularly useful in the treatment of AOB [12]. Some professionals contend that using bone anchors can manage AOB instances without the necessity for orthognathic surgery. By employing titanium miniplates as anchors, Umemori et alexperiments's [13] showed that mandibular molar intrusion is effectively accomplished. Two titanium L-shaped miniplates were bonded to the buccal cortical bone on either side of the lower first and second molars' apical regions in two severe AOB instances. The lower molars were forced into position and the open bite was much enhanced by the use of elastic threads as an orthodontic force. Force application began a month after the plates were fixed. Using a fixed straight wire appliance, the upper and lower teeth were fused together. After five months, the intrusion was finished, and the miniplates and permanent appliance were taken out after eighteen months. The mandibular plane angle dropped from 41° to 39.5° and 41.9° to 37.7°, respectively, and Class I occlusion was accomplished with a typical overbite and overjet, primarily because of a smaller posterior vertical dimension. The occlusal plane was rotated counterclockwise by 4°, 2°, and 3, 1°, respectively, while the lower molars were intruded by 3.5 and 5 mm, respectively. The author comes to the conclusion that in AOB situations, using implants as anchorage can successfully invade the molars and simplify orthodontic therapy. Long-term follow-up controlled randomised studies, however, do not support these theses in any way. The closure of AOB was described by Erverdi et al. [20], who also suggested the zygomatic buttress area as a potential anchorage point for maxillary molar intrusion. In his case report from 2006, an L-shaped implant with the tip exposed was attached with three bone screws in the zygomatic buttress area and used to apply intrusive force. The orthodontic device was made out of two acrylic bite blocks joined together by two palatal arches, with wire connectors on each buccal side for applying force. The force application commenced 7 days after implant insertion. Two 9.0-mm NiTi coil springs were placed bilaterally between the tip of the implant and the outer wire creating an intrusive force of 400 g. The 3.6 mm intrusion persisted after therapy with fixed appliances, however the counterclockwise rotation returned as the treatment progressed. The lower molar teeth's gradual extrusion was the main cause of this. When the intrusion appliance was first removed, a minor posterior open bite caused by the acrylic bite blocks was seen. The lower molars' extrusion closed the open bite since the upper teeth were anchored to the zygomatic implant and could not do so (occlusal plane angle: 14.0° to 21.0°). This study demonstrates the viability of zygomatic anchoring for molar intrusion within the confines of a single case report. It is necessary to do additional research with larger sample sizes and to evaluate long-term stability.

Three case reports are used to describe the intruded maxillary molars with miniplate anchoring described by Sherwood et al. [2]. The patients received orthodontic fixed appliances and T-shaped miniplates, which were surgically positioned between the first and second molars and secured with two 5-mm miniscrews apiece, as part of their treatment.

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Eight weeks after surgery, loading started. Up until the AOB were closed, intrusion mechanics were used for 5.5 months. There is no longer-term follow-up in these case reports.

Miniplates and miniscrews are employed in skeletal AOB situations where the goal is to close an AOB by intruding the posterior teeth, and undesired side effects of extrusion of anterior TAD in place (between LL6 and LL7) to intrude molars teeth are avoided.

Numerous case studies have demonstrated that, at least temporarily, implanted miniplates in the maxilla or the mandible help intrusion of the upper and lower molars up to 3-5 mm while simultaneously accomplishing counterclockwise rotation of the jaw [2, 33, 34]. Because the front teeth are vulnerable to relapse and root resorption, this method allows the orthodontist to close AOB without having to extrude them [16].

Because miniplates can be positioned where support is most needed, they are more adaptable than screws. Because they are secured in place by three or more screws, they have the benefit of being three-dimensionally stable. They should be placed far from the tooth roots to prevent damage to the roots or interference with root movement [2]. One week must pass after tooth placement before vigorous tooth movement can begin. A week prior to debonding, the miniplates are typically removed [8, 16]. In 9 adult open bite patients who had received a successful course of treatment, Sugawara et al. looked at the percentage of relapse after SAS (sketelal anchorage system). They all underwent a fixed appliance used in conjunction with SAS to bilaterally invade the first and second mandibular molars. To determine the extent of intrusion, each patient had three lateral cephalometric radiographs taken: T1, T2, and T3, one year after the fixed appliances were debonded. At the first and second molars, the average depth of intrusion was 1.7 and 2.8 mm, respectively. The average amount of relapse was, respectively, 0.5 mm at the first molar and 0.9 mm at the second.

The changes at T1-T2 and T1-T3 did not differ statistically from one another. According to Sugawara et al., the average relapse rates at the first and second molars were 27.2% and 30.3%, respectively. He therefore proposes an intrusion overcorrection [16]. Baek et al. looked at the long-term stability of AOB treatment using miniscrew implants inserted into the maxillary posterior teeth. Nine patients who had been diagnosed with AOB had fixed appliances in addition to molar intrusion by miniscrew implants. Before and after therapy, as well as one and three years following treatment, lateral cephalometric radiographs were collected.

At the 3-year follow-up, the maxillary first molar had a 23% relapse rate and was typically 2.39 mm intruded. The scientists noted that the first year of retention was when 80% of relapses took place. Between the 1- and 3-year follow-up, there was no discernible return of the incisor overbite, and the relapse rate was 17%. The majority of relapses, according to Baek et al. [35], happen in the first year of retention. Miniplates do, however, have a few drawbacks.

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Their placement is restricted, they cost a lot of money, and both insertion and removal involve two surgical operations [36]. On the other side, miniscrews are frequently employed in orthodontics as skeletal anchoring for tooth movement. They are affordable, simple to use, and frequently implanted while the patient is under local anaesthesia. Recent case studies published in peer-reviewed journals have demonstrated that teeth can successfully be intruded using miniscrews as skeletal anchoring [15, 19]. When closing an AOB, miniscrews placed in the maxillary posterior buccal bone can be helpful for posterior intrusion. Furthermore, using miniscrews for intrusion during active growth encourages the mandible to rotate in a counterclockwise direction, improving the anteroposterior and vertical disparity [19].

CONCLUSIONS:-

For the treatment of mild to moderate AOB instances, the orthodontist has a variety of treatment options accessible. With the development of TAD as a successful therapeutic approach, orthognathic surgery may be avoidable in a few AOB instances. Since this method is still relatively new, there is yet no proof that AOB closure with TAD is stable over the long term. Numerous case studies have shown how TAD can be used successfully in non-growing skeletal open bite patients that may have previously required orthognathic surgery. Skeletal anchorage devices have various advantages over single or bimaxillary jaw surgery for the treatment of AOB, including reduced costs, less invasiveness, and a simpler, lower morbidity procedure. To determine the long-term stability and efficacy of this approach as a treatment in the management of AOB cases, more research on skeletal anchorage devices must be done.

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