

Case Report

Orthodontic treatment of a severe combined anterior and posterior open bite case, involving ankylosis and eruption disturbances in late adolescence

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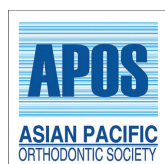


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ABSTRACT

Treatment of a combined anterior and posterior open bite case is a demanding orthodontic procedure that requires, in many cases, a multidisciplinary approach. Disturbances in the time or pattern of permanent teeth eruption can often cause or aggravate these clinical conditions, that once established can affect the occlusion, the mastication, the speech, and the oral health quality of life index of such a patient. This article describes the orthodontic treatment of a teenager with severe anterior and posterior open bite, a unilateral posterior crossbite and serious mastication problems. Proper diagnosis, treatment planning, and mechanotherapy used, resulted in excellent orthodontic outcome, greatly improving all aspects of the patient's initial concerns and the clinician's goals.

Keywords: Anterior open bite, Posterior open bite, Posterior crossbite, Ankylosis, Primary failure of eruption

INTRODUCTION

In general terms, open bite can be defined as the lack of contact of opposing teeth. Because of their multifactorial etiologies, dental and skeletal open bites are among the most difficult malocclusions to treat to a successful and stable result because they develop as a result of the interplay of many etiologic factors.^[1-3] Etiologic factors include heredity, abnormal mandibular growth patterns, and imbalance between jaw postures, abnormalities in dental eruption, airway obstruction, finger-sucking habits, and tongue posture and function.^[4] Anterior open bite is defined as a malocclusion with no contact in the anterior region of the dental arches and the posterior teeth in occlusion and is relatively prevalent among children in the primary dentition. It is called combined open bite when malocclusion extends to the posterior segment as well. Posterior open bite can be defined as failure of contact between the posterior teeth when the teeth occlude in centric occlusion. Posterior open bite is rarely observed, especially in adults.^[5] In some patients, lateral open bite is due to a disturbance of the eruption mechanism itself so that non-ankylosed teeth cease to erupt. Few lateral, open bite cases are reported in the literature and in the majority involved ankylosed teeth or primary failure of eruption.^[6] Other possible causes are, among others, tongue interposition, and skeletal discrepancies. Dental open bite can be treated with orthodontic therapy, but a true skeletal open bite may require surgical intervention along with orthodontic treatment. An open bite can manifest as an aesthetic, functional, and psychological problem to patients. The functional problem comprises defect in speech, mastication, and deglutition resulting in impairment in child development.

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Posterior crossbite is a common malocclusion in the deciduous and mixed dentitions, with prevalence rates of 7.5–22%^[7,8] and in the permanent dentition with rates of 10.2–14.4%.^[9] The etiology of this malocclusion may be dental, skeletal, and/or functional.^[10] The major risk factor is non-nutritive sucking habits, such as pacifier or thumb sucking and breastfeeding habits. Other identified risk factors are mouth breathing, as well as factors that could affect lingual functions leading to inadequate tongue capacity.^[11] Few studies have reported the self-correction of posterior crossbite in the deciduous dentition, related to the discontinuation of sucking habits and chronic respiratory childhood diseases.^[12,13] However, this condition is usually not self-corrected.^[10,14,15] Studies with adolescents and adults have revealed that patients presenting posterior crossbite have an increased risk to develop craniomandibular disorders, showing more signs and symptoms of these conditions.^[8,12] Several authors suggest the early treatment of crossbites to prevent mandibular dysfunction as well as craniofacial asymmetry.^[14-17]

In this case report, we present the treatment of a patient with a combined anterior and posterior open bite, as well as a unilateral posterior crossbite, treated with a hyrax appliance followed by fixed appliances treatment. The treatment results were ideal and perfect occlusal, masticatory, and esthetic results were achieved.

DIAGNOSIS AND ETIOLOGY

A 15 years, 3-month-old male presented into the clinic of K.D.M. with the chief complain the inability to bite and chew. He stated that he had chewing issues for quite some time, but the situation was getting worse with time. He reported to have had an earlier orthodontic consultation and was told to return after the exfoliation of all deciduous teeth.

The patient's medical and dental history were free noncontributable.

Extraoral examination revealed a dolichofacial skeletal pattern with a very mild facial asymmetry and a nose deviation to the patient's left side. The patient had a straight profile, increased lower facial height, and no signs of lip strain at rest. On smiling, only 50% of the maxillary central were exposed and a very small portion of the upper laterals and the canines.

Intraoral examination revealed a Class II molar relationship on the right side with posterior crossbite, over-retained deciduous lower and upper left 2nd molars, as well as, absence of the upper left permanent second molar. Severe anterior and posterior open bite was present on both sides. The only contact point of the whole occlusion was at the central incisors and the first and second right molars. The left posterior segment had no contact points, even on manipulation. Posterior open bite measured 4 mm in the right side and 7 mm in the left side. The

overbite was 1 mm measured on the right central incisor and overjet 0.5 mm. Upper midline deviated 1.5 mm to the right and did not coincide with the lower. Upper arch exhibited 3 mm of spacing and lower arch 2 mm of crowding. On swallowing, a severe lateral tongue thrust was present [Figure 1].

The patient was free of any temporomandibular signs and symptoms.

The panoramic examination confirmed the presence of all 32 permanent teeth. Lower 2nd premolars and upper left second premolar were impacted, as also the upper left 2nd molar. The third molar position seemed unfavorable [Figure 2a].

Periapical films confirmed the panoramic findings for over-retained deciduous molars with unfavorable root resorption pattern and bone recession in the area [Figure 2b].

Initial cephalogram X ray and the respective analysis are presented in Figures 3 and 4.

Treatment objectives

Main objectives of the orthodontic treatment were to correct the anterior and posterior open bite, correct the right posterior crossbite, achieve Class I molar and canine relationships and establish an ideal overjet and overbite. Treatment also aimed to achieve “the six keys to normal occlusion”^[9] and a mutually protected occlusion,^[10] to provide satisfactory facial esthetics and masticatory function, to eliminate the abnormal tongue thrust, and to achieve stable treatment results.

Treatment alternatives

It was apparent from the beginning that this would be a very challenging clinical case to treat. The patient was informed on all the issues present, especially those connected with the anterior and posterior open bite and the lack of vertical alveolar growth in the posterior area. The impaction of the upper left and lower second premolars seemed to be due to the ankylosed deciduous molars, but it was very difficult to establish the reason of the inability of the upper left second molar to erupt.

The patient was also informed on the limitations of orthodontic treatment alone and was presented with all possibilities including:

- Tooth bearing expansion appliances
- Temporary anchorage device (TAD) assisted expansion appliances
- Surgically assisted rapid palatal expansion if the midpalatal suture failed to open
- Fixed appliances
- TAD's to facilitate and enhance tooth movements
- Surgical exposure and luxation of the upper left second molar
- Extraction of the upper left second molar if not erupted



Figure 1: Initial facial and intraoral photos.

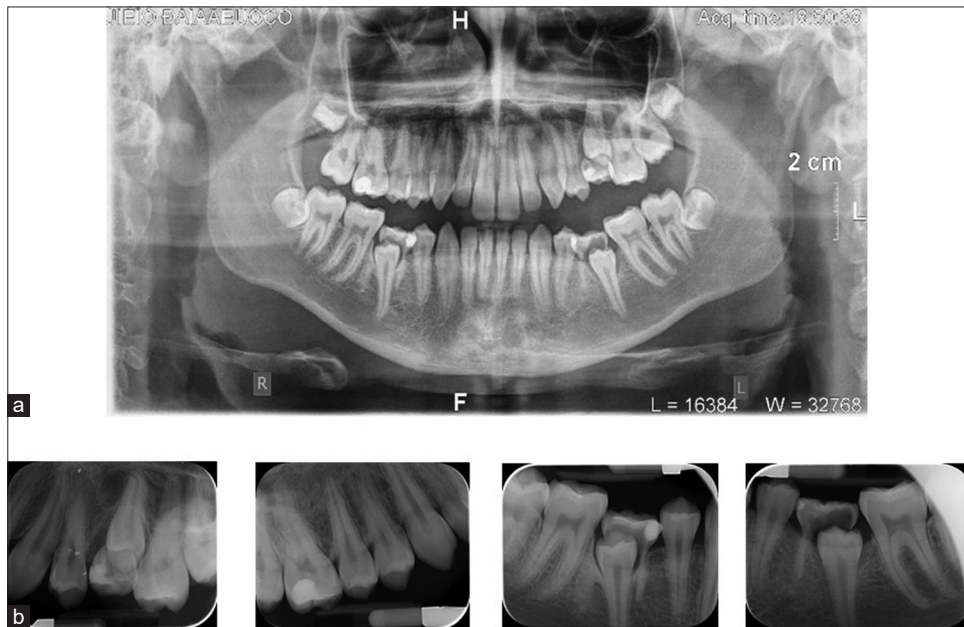


Figure 2: (a and b) Panoramic examination confirmed the presence of all 32 permanent teeth. Lower 2nd premolars and upper left second premolar were impacted, as also the upper left 2nd molar. The third molar position seemed unfavorable. Periapical films confirmed the panoramic findings for over-retained deciduous molars with unfavorable root resorption pattern and bone recession in the area.

- and traction into position of the upper left third molar
- Possibility of implants if the posterior teeth on the upper left quadrant failed to erupt
- Orthognathic surgery.

Due to the age of the patient, both parents and him opted to start out with the best non-invasive treatment plan, to be reevaluated if progress would not be the anticipated one.

Treatment progress

The patient was first referred to his attending dentist for an evaluation check-up and immediate extraction of all retained deciduous molars. To correct the posterior crossbite, a hyrax appliance was delivered, and the patient was instructed to activate the appliance twice a day [Figure 5]. There was excellent cooperation and biological response and the midpalatal suture opened within approximately 2 weeks' time. The appliance was retained into position for 6 months

and time was given to the second premolars to erupt. Indeed, the eruption potential of the premolars was excellent and they gradually erupted once the deciduous molars were extracted. Unfortunately, no signs of eruption of the upper left second molar were present.

During the retention phase of the hyrax appliance and before fixed appliances were placed, the patient was referred to the oral surgeon with instructions to remove the unerupted lower third molars due to the proximity to the second molar roots, and to expose and luxate the upper left second molar. No attachments were placed at this point on the molar, and the whole occlusal surface was exposed. With the hyrax still in position, time was given to the upper left second molar to erupt. Not confirming fears of primary failure of eruption, it soon started to erupt into the oral cavity.

In continuation, all upper and lower teeth were bonded with a 0.22 straight wire appliance. Initial wires were 0.14 nickel-titanium (NiTi), and it was decided that the treatment will proceed with very light forces. The patient was seen approximately every 6 weeks and during the summer every 10 weeks, as he was moving from the city. During the last year of his treatment he moved out of town for studies; thus his appointments were delayed.

Wire sequence was 0.14 NiTi, 0.14 SS, 0.16 SS, 0.18 NiTi, 0.18 SS, 0.16 × 0.022 NiTi, 0.16 × 0.022 SS, and

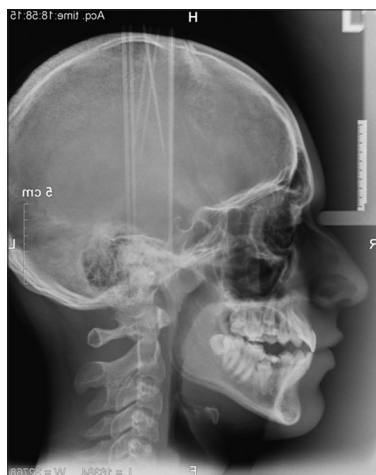


Figure 3: Initial cephalogram age: 15 years, 3 months.

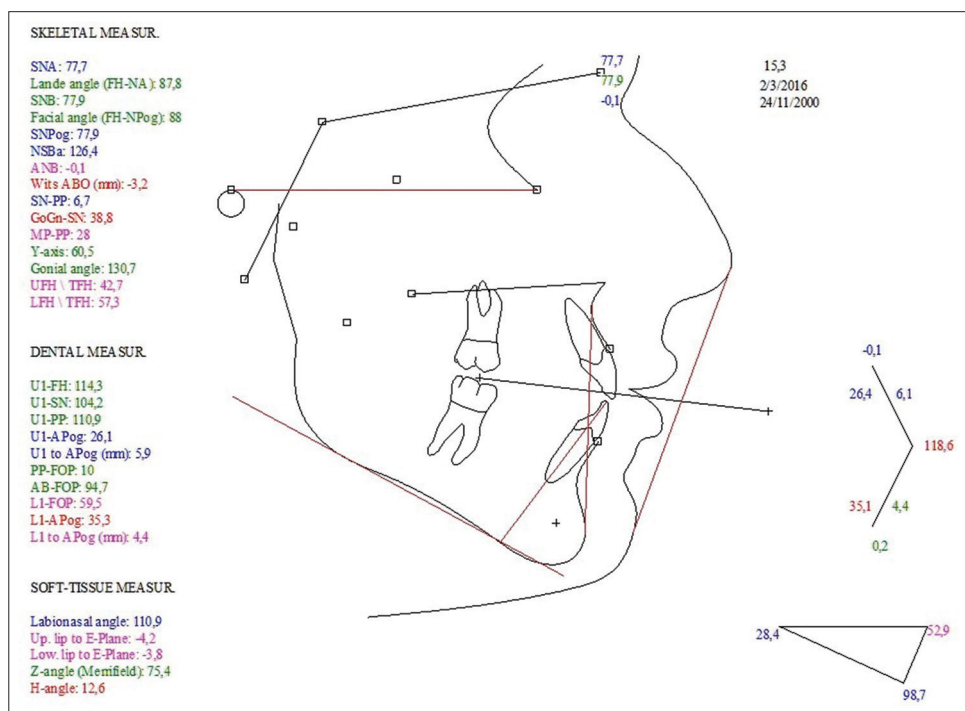


Figure 4: Initial cephalometric values confirming the increased GoGn-SN angle and mandibular plane angle. ANB at -0.1° and Wits at -3.2 mm. Upper and lower lip retrusive to facial profile.



Figure 5: Hyrax appliance to correct the posterior crossbite. Fixed appliances in progress, used after the hyrax appliance and the surgical exposure and luxation of the upper left second molar. The lower third molars were also extracted.



Figure 6: Final facial and intraoral photographs.

0.18 × 0.025 SS. Triangular elastics were used toward the end of treatment to stabilize the occlusion.

Despite all the very questionable treatment dilemmas, the orthodontic treatment progressed excellently with

conventional treatment modalities. Not only the premolars erupted rapidly into position but also with the exposure, the luxation, and the time is given, the upper left second molar erupted into the arch. To our great satisfaction, fears of primary failure of eruption were not confirmed.

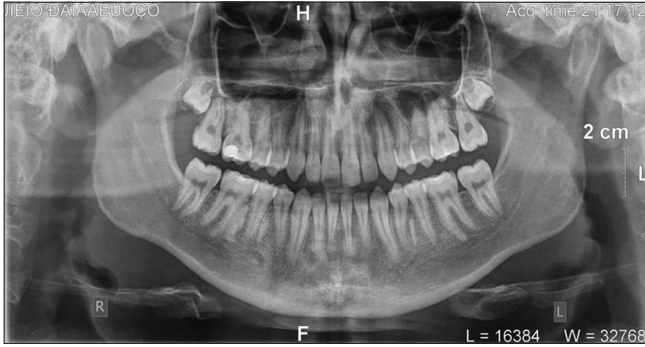


Figure 7: Panoramic examination in the end of treatment revealed that ideal root inclination and parallelism were achieved at the completion of treatment and the alveolar growth in the upper left and lower second premolar region, achieved its normal height.

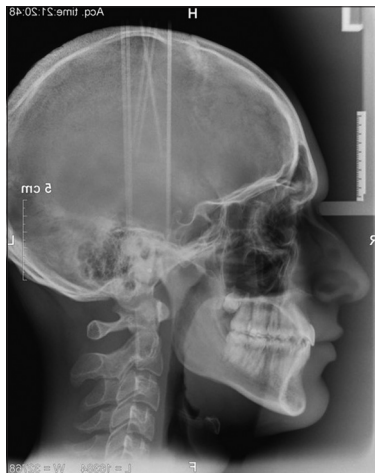


Figure 8: Final cephalogram age: 18 years, 5 months.

Treatment results

The treatment outcome of this very challenging case is considered to be excellent. The orthodontic treatment addressed fully the patient’s chief complain of an inability to bite and chew. Class I fully functional occlusion was obtained and the anterior and posterior open bites were fully corrected with excellent interdigitation. Normal overjet and overbite were achieved, along with a balanced face and a beautiful smile [Figures 6-10]. From an almost non-existent smile, with a minimum exposure of the upper central incisors, a full, harmonious, and symmetrical smile was achieved. Comparison of panoramic radiographs revealed eruption of all permanent teeth except from upper third molars that the patient will address at a later stage. Impacted lower third molars had been extracted at the beginning of treatment. Ideal root parallelism was achieved at the completion of treatment and the alveolar growth in the upper left and lower second premolar region, achieved its normal height.

RETENTION

Maxillary Hawley’s and mandibular fixed lingual retainer were given. The patient was instructed to wear the upper Hawley almost full time in the first 6 months, switching to night time use after that period. Hawley retainer was used instead of an Essix, to allow better occlusal interdigitation and enhance stability.

DISCUSSION

It is an indisputable fact that there are various difficulties in treating patients with the dental and skeletal characteristics associated with this vertical discrepancy, because of their multifactorial etiology and their very high relapse rate. Dental open bites are a specific type of malocclusion caused primarily by local or environmental factors. Often local etiology is correlated with habits or trauma. When a skeletal component is present, the etiology lies in heredity and other health-related issues including allergies, hypertrophy of the lymphatic tissues, muscular hypotonicity, syndromes, and neurologic problems as possible contributors to the malocclusion.^[18]

Complex open bites that extend farther into the premolar and molar regions and those that do not resolve by the end of the mixed dentition years may require orthodontic and/or surgical intervention. Vertical malocclusion develops as a result of the interaction of many different etiologic factors including thumb and finger sucking, lip and tongue habits, airway obstruction, and true skeletal growth abnormalities.^[19]

In this case, the patient was treated conservatively, commensurate with his young age and the parents’ wishes. Orthodontic treatment initiated with the use of a hyrax appliance to correct the posterior crossbite after the ankylosed deciduous teeth were extracted. The appliance was then retained for stability and time allowance to the premolars to erupt. The lower third molars were also to be extracted, due to the proximity to the second molars’ roots. However, the second molar would not show any kind of eruption activity despite the patient’s dental and chronological age. At this time, surgical exposure and luxation were decided to allow further orthodontic movement with considerable success. This technique assumes that, if a tooth is moved enough to disrupt the area of ankylosis, but maintains a periapical blood supply, the subsequent inflammatory reaction could result in formation of a new fibrous ligament in the area of ankylosis. Biederman advocated surgical luxation of an ankylosed permanent tooth and, if no change was apparent after 6 months, a second procedure should be performed.^[20] Fortunately, the second molar had gained eruption activity after the procedure described, and the initial fear of possible primary failure of eruption of the second molar, specifically the inability of eruption of a non-ankylosed tooth even in the absence of any mechanical obstruction or application of

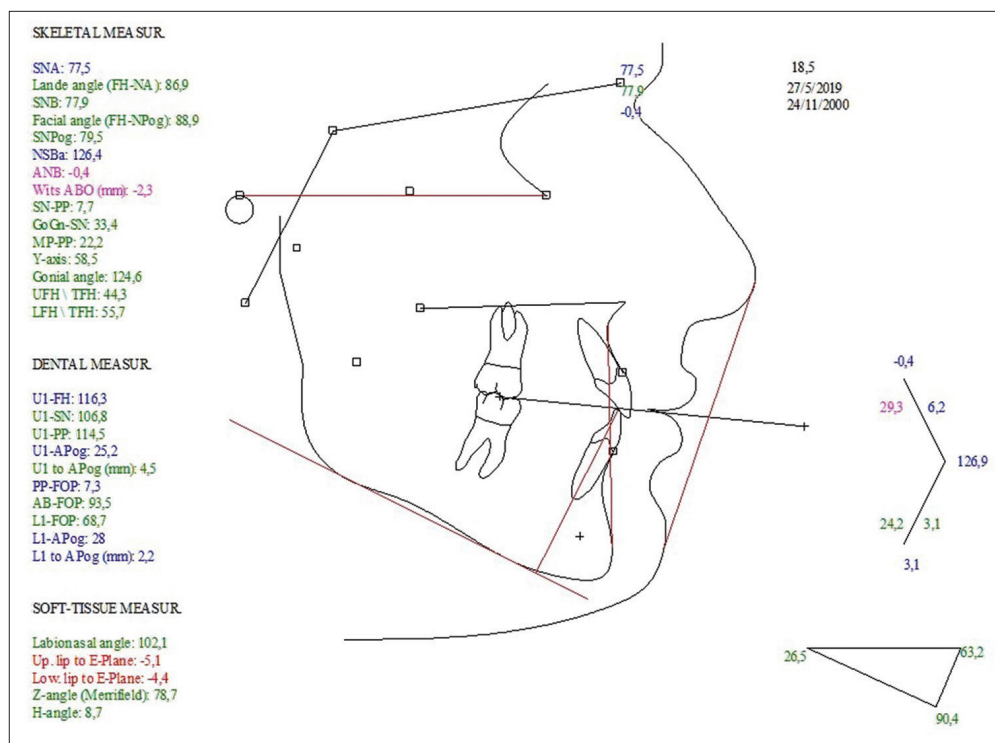


Figure 9: Final cephalometric values confirming decreased GoGn-SN angle and mandibular plane angles. Wits value decreased and further growth at pogonion counts for the decreased lip to E plane values.

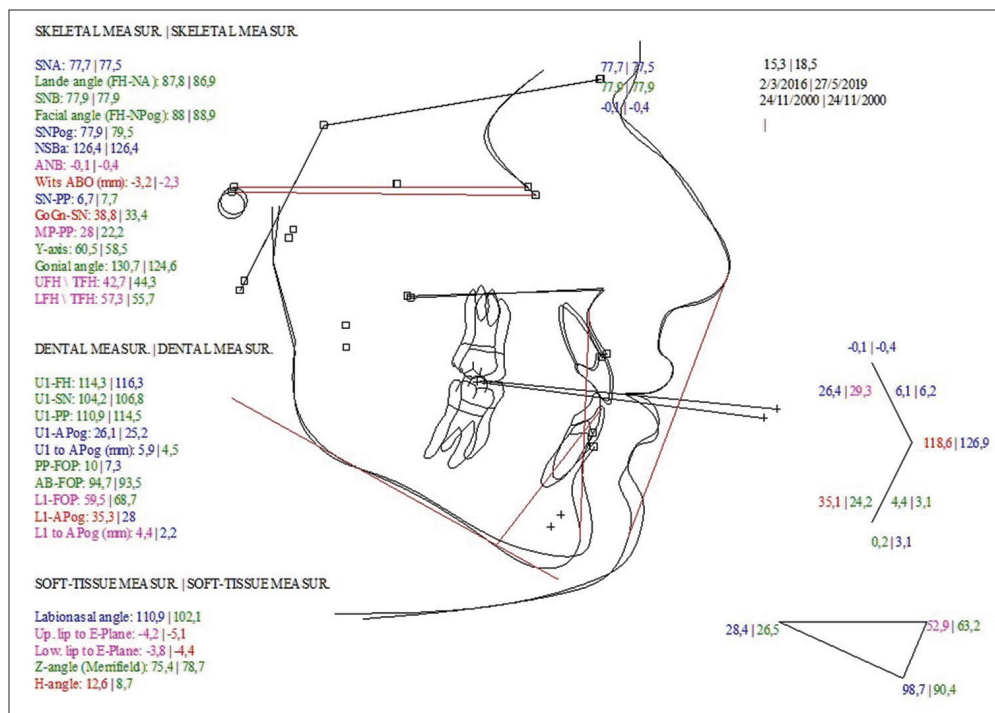


Figure 10: Superimpositions showing the effectiveness of the mechanotherapy used. Measurements GoGn-SN, MP-PP, Y-axis, upper facial height/total facial height (TFH), and lower facial height/TFH improved at the end of treatment. Extra mandibular growth at pogonion is also a factor when evaluating results, but nevertheless orthodontic treatment achieved excellent results. Due to the dolichofacial pattern of the patient, it was crucial not to increase measurements involving the vertical dimension.

orthodontic forces, was abandoned. Fixed 0.022 straight wire appliances were used with extreme caution of preserving the vertical dimension. Proper bracket and molar tube placement, as well as ideal torque of all teeth were crucial to eliminate any interferences, especially those related to the palatal cusps of the first and second upper molars.

Treatment duration was acceptable based on the absence of the patient for long periods due to summer and studies engagements.

CONCLUSIONS

Proper orthodontic treatment of anterior and posterior open bite can be achieved through detailed treatment planning and execution. In severe combined open bite cases as the one presented, the ideal outcome has a major impact not only on the patient's occlusion but also on the patient's speech, mastication, and oral health quality of life index.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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