

Treatment of severe maxillary protrusion with bilateral agenesis of maxillary permanent canines: A case report

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Abstract

Background: Management of severe maxillary protrusion with tooth agenesis can be challenging and should be used with maximum anchorage to prevent loss of anchorage and improve the facial profile.

Purpose: This case report aims to manage severe maxillary protrusion with bilateral agenesis of maxillary permanent canines using a non-extraction method.

Case: This is a case report of an 18-year-old adult male with complaints of protruding and gapped front teeth. An intraoral examination indicated Angle's Class I malocclusion with maxillary protrusion, deep bite, multiple diastemas, 10 mm of overjet, 7 mm of overbite, deep curve of Spee, and retention of maxillary primary canines.

Management: Orthodontic treatment was performed using fixed orthodontic appliances pre-adjusted Roth 0.018 without extraction of permanent teeth. Orthodontic treatment included correction of maxillary protrusion and multiple diastemas, then continued with correction of deep bite and curve of Spee. After 1 year and 4 months of treatment, the goal of orthodontic treatment to correct the patient's aesthetics was achieved. Incisive inclination became normal, overjet and overbite became normal, curve of Spee approached flat, and lips became competent.

Conclusion: Severe maxillary protrusion with bilateral maxillary canine agenesis can be treated by retaining the primary canines and using fixed orthodontic appliances without extraction of permanent teeth, followed by restorative management.

Keywords: Maxillary Protrusion; Agenesis; Malocclusion; Orthodontics Treatment

1. Introduction

Protrusion is a condition in which the maxilla's anterior teeth protrude relative to its basal bones. This condition causes prominent lips and a convex face. It is called bimaxillary protrusion when the condition occurs in both the maxilla and mandible [1]. The observed characteristics include insufficient lip closure in a resting position and an excessive effort to completely seal the lips. This malocclusion is commonly found in Asian, African, and American patients [2–4]. The etiology of protrusion is multifactorial. There are both hereditary and environmental aspects to consider, including mouth breathing, habitual lip and tongue movement, and tongue volume [5].

The aim of orthodontic treatment in a bimaxillary protrusion case is to obtain an esthetically pleasing face with a harmonious soft tissue profile, stable occlusion, and pleasant smile [6]. Maxillary protrusion correction consists of

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incisive retraction with the initial premolar extraction (depending on the case) and retraction of the anterior segment at the extraction site [7]. Anchorage management is essential for achieving treatment objectives and correcting the profile. In this example, anchorage refers to the posterior segment's resistance to anterior retraction forces. If there is anchorage loss and the posterior segment slides to the anterior segment due to reciprocal force, the therapeutic goals cannot be achieved [8].

Patient with tooth agenesis is a relatively common condition. Tooth agenesis is the developmental absence of one or more of the 'normal' complement of 20 teeth in the primary dentition and/or 32 teeth in the permanent dentition. Agenesis type is defined by the number of developmentally missing teeth, which often excludes the permanent third molars [9]. Tooth agenesis is linked to a multitude of genetic and environmental variables. It may arise alone or in conjunction with other dental defects and/or general medical problems. It can be accompanied by substantial functional, aesthetic, and psychological issues, necessitating multidisciplinary and interdisciplinary management [10].

Hypodontia refers to the agenesis of one to five teeth; oligodontia, when six or more teeth are lost congenitally; and anodontia, the lack of complete tooth production. Agenesis of one or more tooth parts is the most prevalent dental development abnormality in humans (9). Exclusive agenesis of both maxillary canines is an extremely rare occurrence and only a few cases have been reported. Previous studies showed that the prevalence of maxillary canine agenesis varies between 0.07 and 0.13% [11]. There is evidence that the frequency of permanent canine agenesis is higher in females, and it most usually affects the maxilla, particularly the left side [12, 13].

Dental anomalies are the result of complex interactions between genetic, epigenetic, and environmental variables that occur during dental development [14]. Agenesis's cause could be dietary, traumatic, viral, genetic, or phylogenetic. The majority of dental agenesis cases are hereditary, resulting from chromosomal abnormalities or mutations during DNA chromosome replication [15]. The isolated agenesis of maxillary permanent canines has been associated with mutations of the WNT10A gene [12].

The treatment of protrusion cases with multiple diastemas is based on an assessment of the space requirements to determine whether or not permanent tooth extraction is required. A comprehensive treatment plan is developed based on the individual needs of the patient, taking into account the assessment of space requirements and the desired outcome of treatment [16].

The present case illustrates orthodontic treatment of a patient with tooth agenesis involving both maxillary canines and over-retained primary maxillary canines. This patient was diagnosed with Class I Angle Malocclusion, which includes severe maxillary protrusion, deep bite, multiple diastemas, and bilateral agenition of the maxillary permanent canines . Orthodontic treatment that is performed without extraction of permanent teeth in the upper or lower jaw followed by restorative management.

2. Case report

An 18-year-old male with a chief complaint of unaesthetic facial appearance due to protruding and gapped front teeth. The patient felt insecure about his condition. The patient had never been treated with orthodontics before. Extraoral examination showed a convex facial profile, a symmetrical face, and potentially competent lips (Figure 1. A, B). The history revealed that the patient had a bad habit of thumb sucking until the age of 7 years, but it was confirmed that the bad habit had stopped completely. Another etiological factor causing the malocclusion was maternal protrusion.

Intraoral examination revealed a neutroclusion first molar relation, protruded maxillary incisive inclination, overjet of 10 mm and overbite of 7 mm, no midline shift, multiple diastemas, and mild crowding in the mandible. The right and left maxillary primary canines were persistent, there was an absence of teeth 13 and 23, and the curve of Spee was positive. The arch length discrepancy was present in both the maxillary arch 9 mm and the mandibular arch 4.5 mm. The teeth were generally caries-free, and the periodontal tissues were in good condition (Figure 1. C, D, E).

The pretreatment cephalometric analysis showed the values $\angle SNA 81^\circ$, $\angle SNB 76^\circ$, and $\angle ANB 5^\circ$ referring to the skeletal pattern Class II Malocclusion. The angle of the upper incisor to N-A is highly protrusive, and the angle of the lower incisor to N-B is normal (Table 1).

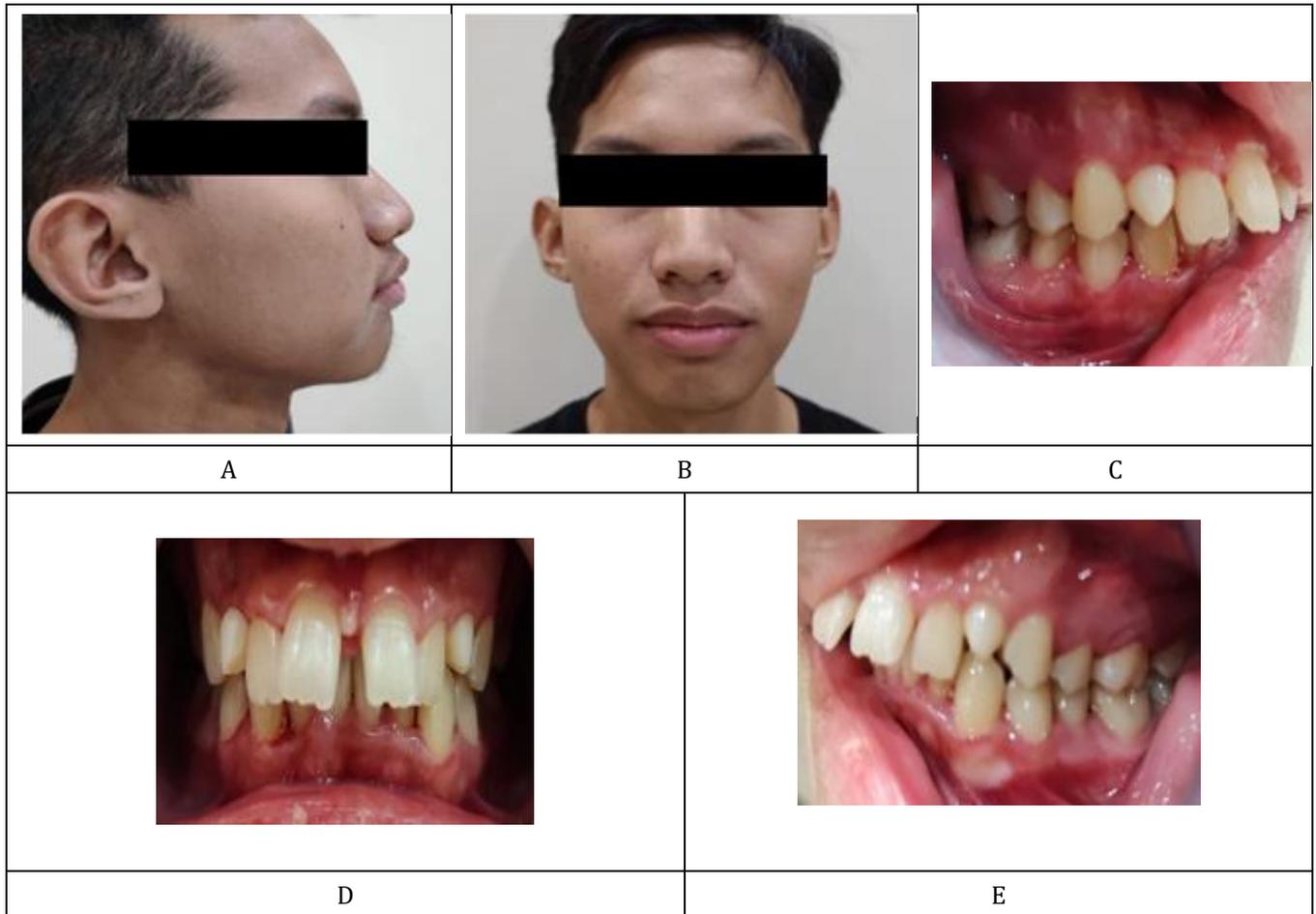


Figure 1 Intra and extra oral examination before orthodontic treatment. A. B Facial Profile photography. C. right occlusion, D. frontal view, E. left occlusion.

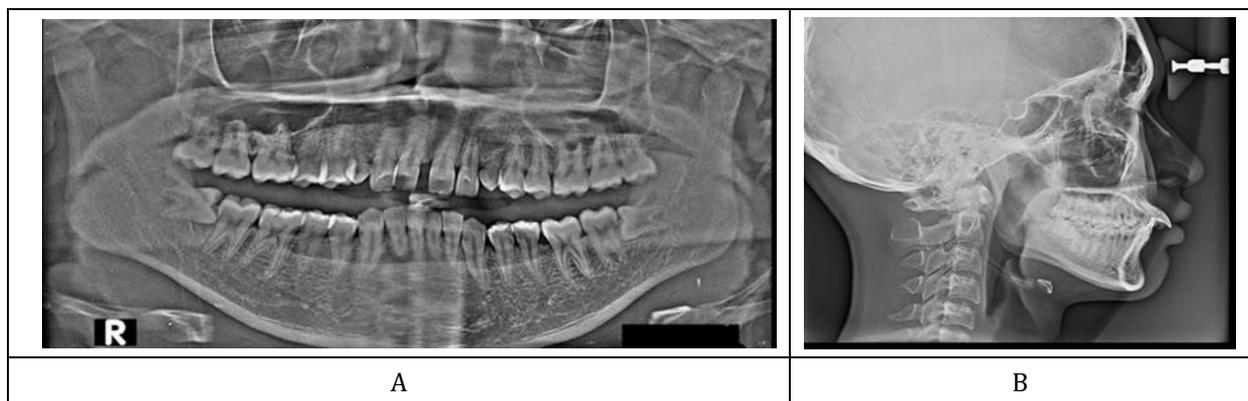


Figure 2 A Panoramic radiography, B. Cephalometric radiography

2.1. Treatment

The treatment plan was implemented without the extraction of permanent teeth and included the retention of primary canines in the upper jaw. Orthodontic treatment began with correction of maxillary protrusion and multiple diastema, then continued with correction of deep bite and curve of Spee so as to obtain class I molar on both sides, normal overjet and overbite with ideal maxillary and mandibular arch shapes. Before installing the fixed orthodontic appliance, scaling was done to control oral hygiene, then maxillary and mandibular tooth alignment, maxillary anterior retraction, and retention after active treatment were completed to obtain stability of tooth position and facial profile.

3. Material dan Method

A preadjusted orthodontic appliance with 0.018" Roth prescription brackets (American Orthodontic) was bonded to maxillary and mandibular arches, including the maxillary deciduous canines in the upper jaw. The buccal tube was placed on the first molar and second molar in the upper and lower jaw using the Roth 0.018" slot as the additional anchorage. Leveling and alignment in the maxillary arch began with round nickel-titanium (NiTi) archwire sizes 0.012", 0.014", 0.016", and 0.018". Anterior retraction was performed using a power chain with rectangular NiTi archwire size 0.016" x 0.016" and size 0.016" x 0.022" in the maxilla.

Anterior retraction in the maxilla was done carefully and gradually with light force because the maxillary primary canines were mobility grade 1. The retraction started by closing the central diastema on the maxillary first incisor and then continued with closing the diastema on the right and left lateral incisors and finally closing the diastema between the maxillary primary canines and the lateral incisors using a power chain. Anterior retraction was performed using stainless steel (SS) wire 0.016" x 0.022" until all spaces were closed. Treatment sequence in mandibular teeth was performed with reverse NiTi 0.014", 0.016", 0.018", reverse rectangular NiTi 0.016" x 0.016", 0.016" x 0.022", and second-order bends using SS wire 0.016" x 0.022" to correct excessive overbite and positive curve of Spee.

Completion of the case began with coordination of the maxillary and mandibular arches using SS 0.016" x 0.022" wire combined with medium force Class II elastic on crimpable hooks attached to the mesial of teeth 14 and 24 to the buccal tube at teeth 37 and 47. After 8 months of treatment and ideal occlusion was obtained, a retention period with ligature wire was continued for 12 months to maintain the stability of the treatment results in the long term.

The treatment results after 16 months showed normal incisive inclination, normal overjet, which was originally 10 mm reduced to 3 mm, and overbite, which was originally 7 mm reduced to 3 mm. Closure of multiple diastemas in the maxilla was successful, as was the retraction of the maxillary anterior teeth and the correction of protrusion. The deep bite and mild crowding in the mandible were corrected, resulting in a nearly flat curve of Spee (Figure 3. B, C, D).

Analysis of the facial profile shows that the convexity of the facial profile is slightly reduced, and the upper and lower lips become competent (Figure 3. A). The lateral cephalometric superimposition before and after the correction is shown in figure 4.

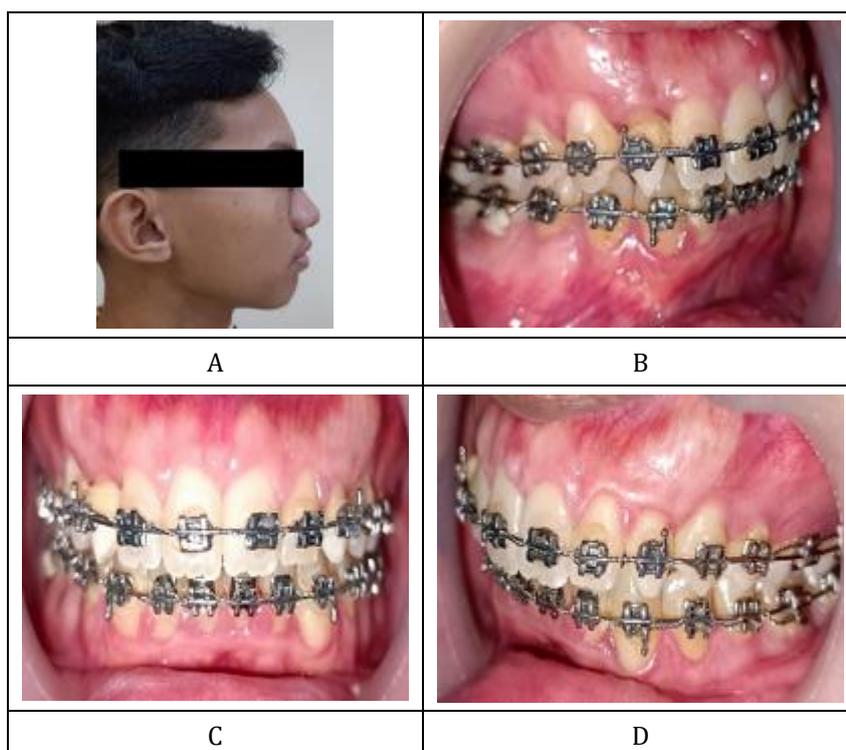


Figure 3 The treatment results after 16 months A. Facial Profile photography. B. C. D Treatment progress in retention period (B. right occlusion, C. frontal view, D. left occlusion)

Table 1 Cephalometry Analysis before and after Orthodontic treatment

Cephalometry	Normal	Pre Treatment	Post Treatment
Skeletal			
SNA°	82	81	80
SNB°	80	76	76,5
ANB°	2	5	3,5
Wits (mm)	0	5	3
Y Axis°	65	74	71
GoGn-Sn°	32	38	35
MP-FH°	21,9	34	34
Dental			
UI-NA°	26	43	22
UI-NA (mm)	6,3	13	5
LI-NB°	29	30	28
LI-NB (mm)	4	8	5
IMPA	90	92	86
Soft Tissue			
Nasolabial Angle°	110-120	114	112
Upper Lip - E Line (mm)	2-3 mm behind E Line	2,5 mm in front of E Line	3 mm behind E Line
Lower lip - E Line (mm)	1-2 mm behind E Line	4 mm in front of E Line	2,5 behind E Line

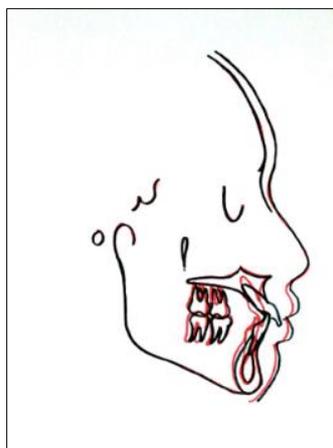


Figure 4 Lateral cephalometric superimposition before and after the treatment (black: before the treatment; red: after the treatment)

4. Discussion

The treatment options for this case were customized according to the classification of the malocclusion, the severity of the malocclusion, and the patient's skeletal profile. Treatment planning for patients with bilateral congenitally absent

maxillary canines is difficult because the permanent canines are critical to both functional occlusion and dentofacial aesthetics. Canines also contribute significantly to aesthetics and functional occlusion [17].

There are two treatment options to replace agenesis, which are space opening for prostheses and space closing with adjacent teeth. The space closing or space opening treatment shall be decided upon considerations of a number of aspects in which the ultimate goal is to achieve good aesthetics, periodontal health, and long-term function [18]. Orthodontic space closure produced better results than prosthetic replacement and promoted periodontal health without influencing the temporomandibular joint function [17].

Most patients with moderate to severe hypodontia will require orthodontics, restorative dentistry, and/or oral surgery treatment to achieve a good outcome. This approach recognizes that the treatment of malocclusion is often a multi-step process, encompassing both correcting the teeth's alignment and addressing any underlying skeletal discrepancies. The aim is to achieve a balanced and harmonious dentofacial appearance [19, 20]. The treatment for this case may involve multidisciplinary management, including orthodontic treatment to correct malocclusion; restorative dentistry after the orthodontic phases to complete the treatment, such as restoring the teeth's shape, size, and function; Post-treatment involves monitoring the patient's progress, making any necessary adjustments, and ensuring that the treatment results are stable [20].

Orthodontic treatment with a fixed appliance to correct the protrusion and multiple diastemas followed by restoration management was a suitable option in this case. If the patient accepts the orthodontic treatment option to extract the primary canines, the next option is replacing the missing canine with a first premolar. Premolar substitution offers a less invasive approach, eliminating the need for surgical procedures and potentially reducing treatment time [21]. The premolar may be reshaped or recontoured to achieve the desired canine shape and size. Due to the high cost of treatment and the patient's refusal to have his primary teeth extracted, the patient preferred to postpone the treatment plan in the near future.

In this case there are different treatment sequences for the upper and lower jaw. In the upper jaw, anterior retraction can be performed after teeth leveling and alignment are complete, while in the lower jaw, correction of deep bite and curve of Spee can be done simultaneously with leveling and alignment. The solution to vertical problems such as deep bite and deep curve of Spee would be to begin vertical correction early and simultaneously with alignment. This technique can be used to improve efficiency or reduce orthodontic treatment time [22].

Restorative management involves reshaping primary canine teeth to resemble permanent canine teeth. Extraction of maxillary primary canines depends on the space discrepancy and the patient's profile. If a significant amount of space is needed to correct a protrusion, extraction of the primary canines might be necessary [16].

Anterior retraction was performed in the maxilla to correct maxillary protrusion, overjet, and multiple diastema. This step was followed by the use of Class II elastics on both sides to bring the mandible forward and obtain Class I relationships in the molars and canines. It is difficult to achieve adequate functional occlusion in patients with maxillary canine agenesis, especially when the patient has excessive overbite or overjet. Patient cooperation is needed to achieve the ultimate goal of this treatment [17].

Anterior retraction in the maxilla was avoided using the retraction loop because the primary canines had grade 1 mobility, and it is not possible to perform anterior retraction with great force. Additional anchorage is very important in cases with severe maxillary protrusion to avoid anchorage loss, so additional anchorage is required on the second molars of both the upper and lower jaws even without extractions [8].

Retention after active treatment is complete necessary in these camouflage cases and requires a long period of time, as relapse is reported in some cases. The choice of retainer uses in some literature suggested that a fixed retainer is better than a removable one [23]. However, because the condition of the maxillary canine teeth is mobility, the plan to make a removable retainer is to choose a clear retainer model rather than a Hawley retainer to minimize mobility of the primary canine teeth.

It is essential that dental care practitioners are aware of the condition's clinical characteristics and management options. Early diagnosis can facilitate appropriate planning and management of issues arising from developmentally absent teeth [20]. It is crucial that dental care practitioners communicate to patients and their families that management may not be straightforward and patient care may require multi- and interdisciplinary management.

5. Conclusion

Angle Class I Malocclusion cases with severe maxillary protrusion, large overjet and overbite, multiple diastemas and bilaterally agenesis of maxillary permanent canine can be treated orthodontically using fixed orthodontic appliances without extraction of permanent teeth followed by restorative management. Combination with Class II elastics can correct maxillary protrusion and large overjet. The treatment for this case may involve multidisciplinary management, including orthodontic treatment, restorative dentistry, and post-treatment involves monitoring the patient's progress and ensuring that the treatment results are stable. Treatment plan in this case is considered based on the skeletal patient's facial profile, tooth number abnormality, and clinical dental condition. Extended retention duration is necessary to maintain the stability of long-term treatment results.

Compliance with ethical standards

Disclosure of conflict of interest

The authors declare that there is no conflict of interest regarding the publication of this article.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

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