Camouflage orthodontic treatment of class I malocclusion with bimaxillary prognathism and risk of apical tooth resorption: a case report

Anggi Arlan[1]
Haru Setyo Anggani[1*]
Maureen Antolis[1]
Deo Develas[1]

[1]Department of Orthodontics, Faculty of Dentistry, Universitas Indonesia, Indonesia
[2]School of Dentistry, Orthodontic Department, Chung Shan Medical University Hospital, Taichung, Taiwan

***Korespondesi**
Email | haruanggani@yahoo.com

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ABSTRACT

Introduction: The primary goal of orthodontic treatment for bimaxillary prognathism is to reduce facial convexity. Treatment options depend on skeletal discrepancies and may involve surgery combined with orthodontics or camouflage orthodontic treatment. However, camouflage orthodontic treatment in cases of severe skeletal discrepancies carries a risk of root resorption. This case report aims to present the orthodontic camouflage treatment of Class I bimaxillary prognathism and its associated risk of root resorption. **Case report:** A 19-year-old female patient presented with a chief complaint of lower teeth crowding. She had a dolichofacial, symmetrical, and balanced face with a convex profile. The relation of incisor and canine on both the right and left sides was Class I. The first molar relation of the right side is class I, and the left is class III with 3 mm overjet and 4 mm overbite. The lower midline shifted 2 mm to the left. Spaces requirement of the treatment based on Kesling's method was a final overjet of 2 mm as follows: Upper Right -4.5 mm, Upper Left -4 mm, Lower Left -5 mm, and Lower right -4 mm. Treatment indication was camouflage orthodontic treatment with extraction using pre-adjusted edgewise MBT 0.022" brackets. The treatments aim to camouflage the convex profile caused by prognathism in both jaws and the degree of protrusion of the maxillary and mandibular anterior teeth. **Conclusion:** The orthodontic camouflage treatment for Class I bimaxillary prognathism using extractions and fixed appliances with preadjusted edgewise MBT 0.022" brackets improved facial and smile aesthetics, as well as masticatory function. However, Root resorption occurred as a complication due to maxillary and mandibular incisor intrusion during deep overbite correction over 27 months of treatment.

Keywords

bimaxillary prognathism, deep overbite, intrusion, malocclusion, root resorption

Perawatan ortodonti kamuflase kasus maloklusi kelas I bimaxillary prognathism dan risiko resorpsi akar gigi: laporan kasus

ABSTRAK

Pendahuluan: *Tujuan utama perawatan ortodonti kasus bimaxillary prognathism adalah mereduksi kecembungan profil wajah pasien. Pilihan perawatan ortodonti kasus bimaxillary prognathism berdasarkan diskrepansi skeletal dapat berupa perawatan kombinasi bedah dan ortodonti atau perawatan ortodonti kamuflase. Tujuan laporan kasus ini adalah melaporkan perawatan ortodonti kamuflase kasus maloklusi kelas I bimaxillary prognathism dan risiko resorpsi akar gigi.* ***Laporan kasus:*** *Pasien perempuan 19 tahun dengan keluhan gigi bawah tumbuh tidak beraturan. Wajah dolichofacial, simetris dan seimbang dengan profil cembung. Relasi insisif serta kaninus kanan dan kiri kelas I. Relasi molar pertama tetap kanan kelas I dan kiri kelas III dengan overjet 3 mm dan overbite 4 mm. Garis tengah lengkung gigi bawah bergeser ke kiri 2 mm. Kebutuhan ruang menurut metode kesling dengan overjet akhir 2mm sebagai berikut: kanan atas -4,5 mm, kiri atas -4 mm, kiri bawah -5 mm, dan kanan bawah -4 mm. Perawatan ortodonti kamuflase indikasi ekstraksi dengan piranti cekat* preadjusted edgewise MBT slot *.022". Tujuan perawatan kasus ini adalah menyamarkan gambaran profil cembung yang disebabkan oleh prognathism pada kedua rahang serta derajat protrusi gigi - gigi anterior rahang atas dan bawah. Paska debonding ditemukan adanya resorpsi akar pada apikal gigi insisif rahang atas dan rahang bawah.* ***Simpulan:*** *Perawatan ortodonti kamuflase kasus maloklusi kelas I bimaxillary prognathism dengan ekstraksi dan* piranti cekat braket preadjusted edgewise MBT slot 022". *memberikan perbaikan estetika/profil wajah dan senyum serta mastikasi pasien. Resorpsi akar yang terjadi merupakan komplikasi akibat dari gerakan intrusi insisif rahang atas dan rahang bawah dalam rangka koreksi deep overbite selama 27 bulan perawatan.*

Kata kunci

maloklusi, bimaxillary prognathism, deep overbite, intrusi, resorpsi akar

INTRODUCTION

Bimaxillary prognathism is a skeletal condition characterized by the protrusion of maxilla, mandibula and all teeth, resulting in increased prominence of the lips. This condition is a common dentofacial characteristic with a prevalence ranging from 3.7% to 68.8%. It is primarily found in populations from Asian countries, such as Indonesia and Malaysia, as well as among African, African-American, and Afro-Caribbean communities. In contrast, the prevalence of bimaxillary prognathism is relatively low among Caucasian populations.

The negative perception of protruding teeth and lips is the primary motivation for patients seeking orthodontic treatment. Consequently, improving facial profile through the reduction of profile flare is the main objective in the treatment of bimaxillary prognathism. The traditional approach in camouflage orthodontic treatment for bimaxillary prognathism cases typically involves the extraction of four premolars, followed by the retraction and uprighting of the anterior teeth with maximum anchorage. The system of anchorage must provide effective stability while ensuring minimal discomfort to patients.[1–6]

Camouflage treatment was introduced in the field of orthodontics in the 1930s and 1940s, during a time when modification to conventional treatments were often ineffective and surgical options were not popular. Camouflage orthodontic treatment aims to disguise skeletal discrepancy through dental compensation. This method is suitable for adult patients with mild to moderate anterior-posterior skeletal discrepancies, provided they have well-proportioned vertical facial dimensions, no transverse skeletal issues, tooth crowding of 4-6 mm or less, and soft tissue conditions within normal limits.

A Class II skeletal condition is more suitable for camouflage orthodontic treatment than a Class III skeletal condition. However, camouflage orthodontic treatment for severe skeletal discrepancies carries risks, including periodontal issues such as gingival recession in the anterior mandible, tooth root resorption, compromised facial aesthetics, and unstable occlusion. The management of malocclusion cases with significant skeletal discrepancies usually involves a combination of orthodontic treatment and surgical intervention.[7–10]

Risk factors for root resorption during orthodontic treatment include short tooth roots that have previously undergone resorption, peg-shaped or blunt roots, traumatized teeth, and iatrogenic factors resulting from excessive force application, tooth intrusion, and prolonged treatment durations. Apical root resorption induced by orthodontic treatment is characterized by the shortening of the permanent roots of one or more teeth, particularly the maxillary and mandibular incisors. This condition is recognized as a potential complication associated with orthodontic treatment.

One in three individuals treated with fixed orthodontic appliances exhibits root resorption greater than 3 mm, with 2-5% of cases experiencing tooth resorption of up to 5 mm. Camouflage orthodontic treatments for bimaxillary prognathism, aimed at profile correction that requires anterior teeth extraction and intrusion, can contribute to root resorption, alveolar bone loss and dehiscence.[11–13]

The following case report will discuss the treatment of a Class I bimaxillary prognathism malocclusion involving the retraction and intrusion of both the maxillary and mandibular anterior teeth. This method aimed to address the skeletal discrepancy and the degree of protrusion of the maxillary and mandibular anterior teeth. It is expected that this orthodontic approach can improve the patient's facial aesthetics. This case highlights the use of camouflage orthodontic treatments in managing severe skeletal discrepancies with a risk of tooth root resorption. This case report aims to present the orthodontic camouflage treatment of Class I bimaxillary prognathism and its associated risk of root resorption.

CASE REPORT

A 19-year-old female patient presented with a complaint of irregular alignment of her lower teeth. She exhibited a dolichofacial facial type with a symmetrical and balanced appearance. Her chin was straight, and her profile was convex, with a nasolabial angle of 88º. The incisor and canine relationships were classified as Class I on both the right and left sides. The right first molar relationship is Class I, while the left is Class III. The patient's overjet measures 3 mm, and the overbite is 4 mm, with a pronounced deep curve of Spee. The upper dental arch midline aligns with the facial midline, whereas the lower dental arch midline is shifted 2 mm to the left. The maxillary dental arch exhibited a triangular shape, and the mandibular dental arch had an oval shape. Occlusal interferences were observed in the horizontal direction, specifically at teeth 23 and 43. These findings are illustrated in Figure 1 below.

Based on Profit and Ackerman's classification of malocclusion, the following findings were noted: the intra-arch alignment crowding was observed on both the maxilla and mandible. Profile examination revealed a convex profile. Transverse deviation examination identified a dental crossbite involving teeth 13-44 and 23-34. Sagittal deviation analyses indicated Class I skeletal malocclusion, while vertical deviation examination revealed an anterior deep overbite.

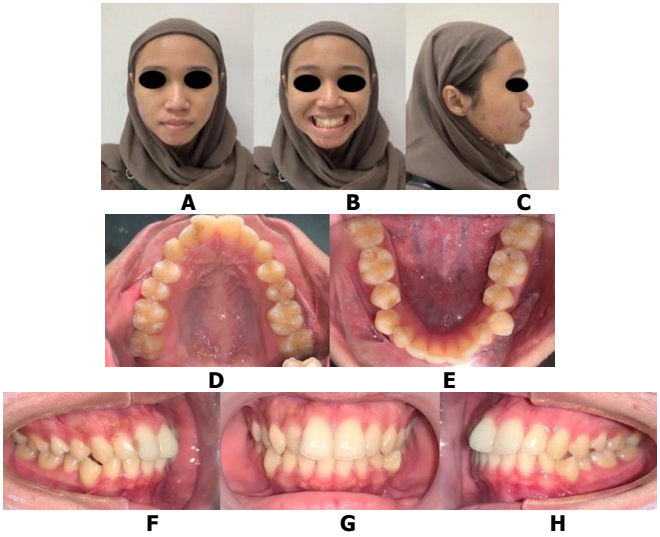


Figure 1. Extraoral and intraoral photographs of the patient before orthodontic treatment: A. Front view extraoral photograph; B. Front view extraoral photograph with smile; C. Side view extraoral photograph; D. Intraoral photograph of the upper jaw; E. Intraoral photograph of the lower jaw; F. Right-side intraoral bite photograph; G. Front view intraoral bite photograph; H. Left-side intraoral bite photograph.

The patient exhibited a Class I jaw relationship with bimaxillary prognathism. Vertical facial growth in the middle and lower thirds of the face was hyperdivergent. The inclination of the upper incisors relative to the lower incisors, cranial base, maxillary plane, and profile was protrusive. Additionally, the positions of the upper and lower incisors in relation to the maxillary and mandibular planes, as well as the profile, were protrusive. Soft tissue assessment revealed that both the upper and lower lips were advanced relative to the E-line. A panoramic radiograph showed impaction of teeth 18, 28, 38, and 48, with non-parallel roots observed in the maxillary and mandibular teeth.

Lundstrom analysis revealed tooth crowding of -4 mm in the upper jaw and -7 mm in the lower jaw. Bolton analysis indicated a mandibular anterior tooth size excess of 3.7 mm and an overall mandibular anterior tooth size excess of 3.8 mm. Space requirement analyses using the Kesling method, with a final overjet of 2 mm, determined the following results: upper right -4.5 mm, upper left -4 mm, lower left -5 mm, and lower right -4 mm. The case was managed by extracting four first premolars in the upper and lower arches, followed by treatment with fixed orthodontic appliances.

Bimaxillary prognathism in this patient was suspected to be due to genetic factors that caused the maxilla and mandible to overgrow antero-posteriorly and vertically and manifesting as a convex profile and dolichofacial facial type. Disharmony between the size of the dental arch and the jaw arch resulted in protrusion of the upper and lower jaw teeth. The early loss of teeth 74 and 84 was one of the etiological factors contributing to the crowding of teeth 34 and 44, as well as midline deviation of the mandibular teeth.

The lateral cephalometric analysis (Figure 3.A) confirmed a Class I jaw relationship with bimaxillary prognathism. The maxilla and mandible were positioned relative to a prognathic cranial base, contributing to a convex skeletal profile. Vertical facial growth in the middle and lower thirds was hyperdivergent. The upper incisors exhibited a protrusive inclination relative to the lower incisors, the cranial base, the maxillary plane, and the overall profile. Similarly, the lower incisors were aligned with the protrusive profile and mandibular plane. Soft tissue evaluation indicated that both the upper and lower lips were positioned forward.

The diagnosis for this case was Class I malocclusion with bimaxillary prognathism and a hyperdivergent growth pattern. The patient presented with a convex profile and protrusive lips. The smile exhibited asymmetry, lacked parallel alignment with the lower lip, and was aesthetically compromised. Mild crowding (4 mm) was observed in the upper dental arch, whereas moderate crowding (7 mm) was noted in the lower dental arch.

The lower dental arch midline was deviated 2 mm to the left. The left molar relationship was classified as Class III, and the upper dental arch had a triangular shape. Teeth 18, 28, 38, and 48 were impacted. Space requirement analysis indicated the need for extractions in both the maxillary and mandibular arches. The prognosis case for this was determined to be moderate. The treatment plan for this case utilized fixed appliances with preadjusted edgewise MBT 0.022" brackets. Treatment began with extractions, followed by leveling and aligning, anterior retraction, and finishing stages.

The treatment goals included resolving maxillary (4 mm) and mandibular (7 mm) crowding to 0 mm. The overjet was to be reduced from 3 mm to 2 mm, and the overbite from 4 mm to 2 mm. The protrusion of the maxillary and mandibular anterior teeth was addressed, with planned reductions as follows: UI-SN from 113° to 110°, UI-PP from 123° to 120°, LI-MP from 92° to 86°, UI-Apg from 12 mm to 4 mm, and LI-Apg from 8 mm to 2 mm.

The Class III molar relationship on the left side was to be corrected to a Class I relationship. The lower dental arch midline was aligned with the centerline of the upper dental arch and facial midline. The patient's convex profile was to be improved to a straighter profile, reducing convexity. The patient was informed of the treatment plan and associated risks and provided informed consent to proceed with treatment using a preadjusted edgewise MBT Slot .022" fixed orthodontic appliance.

The final outcome of orthodontic treatment revealed that the maxillary and mandibular teeth were properly aligned within the dental arches, with uniform tooth height. The overjet and overbite were both reduced to 2 mm. The protrusiveness of the maxillary and mandibular anterior teeth was significantly reduced, as follows: UI-SN from 113° to 111°, UI-PP from 123° to 121°, LI-MP from 92° to 84°, UI-Apg from 12 mm to 6.5 mm, and LI-Apg from 8 mm to 3 mm.

The right and left first molar relationships were successfully corrected to a Class I (Angle) relationship, as did the right and left canine relationships. The patient's profile was

straightened, enhancing overall facial aesthetics. The positions of the upper and lower lips were retracted, improving overall facial harmony, as shown in Figure 2. A panoramic radiograph revealed apical resorption of the maxillary and mandibular incisor tooth roots.

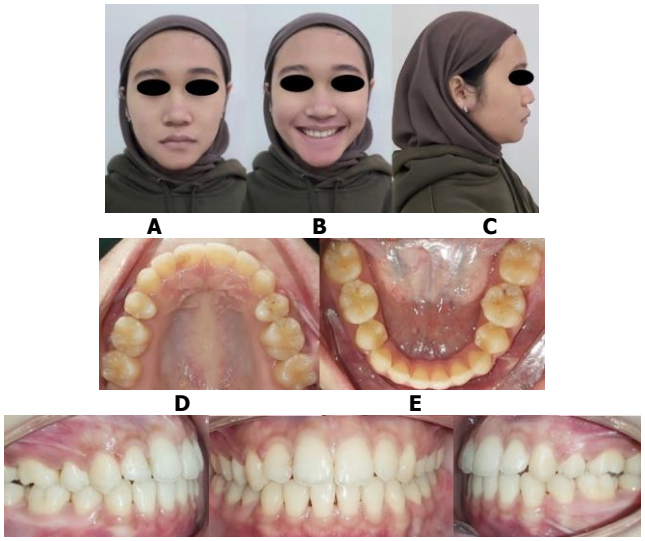


Figure 2. Extraoral and intraoral photographs after orthodontic treatment: A. Front view extraoral photograph; B. Front view extraoral photograph with a smile; C. Side view extraoral photograph; D. Maxillary intraoral photograph; E. Mandibular intraoral photograph; F. Right-side intraoral bite photograph; G. Front view intraoral bite photograph; H. Left-side intraoral bite photograph.

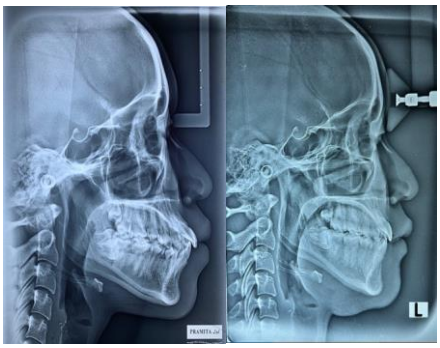


Figure 3. A. Lateral cephalometric radiograph before orthodontic treatment; B. Lateral cephalometric radiograph after orthodontic treatment.

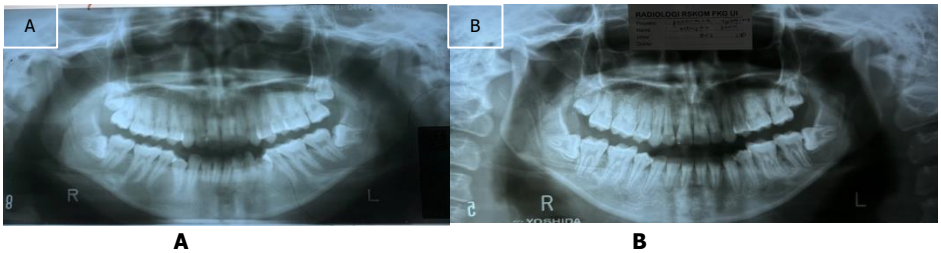
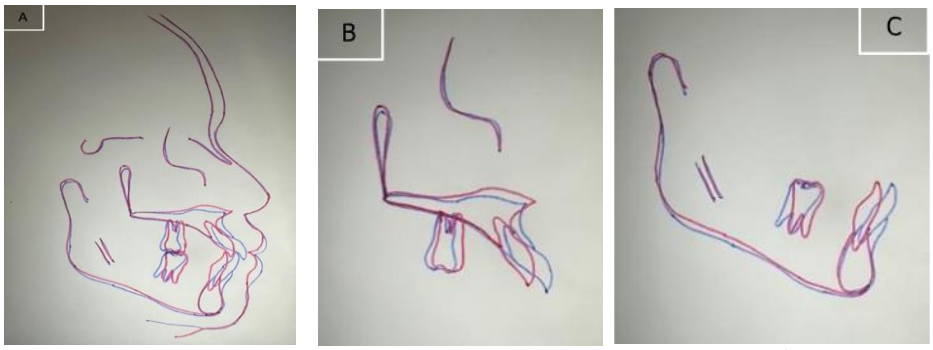


Figure 4. A. Panoramic radiograph before orthodontic treatment; B. Panoramic radiograph after orthodontic treatment.



A **B** **C**

Figure 5. A. Superimposition of lateral cephalometric radiographs before treatment (blue line) and after treatment (red line); B. Superimposition of the maxilla before treatment (blue line) and after treatment (red line); C. Superimposition of the mandible before treatment (blue line) and after treatment (red line)

Table 1. Results of lateral cephalometric analysis before and after orthodontic treatment

Skeletal parameter	Normal score	Before treatment	After treatment
Horizontal			
SNA	81° ±3°	85^0	84^0
SNB	78° ±3°	83^0	83^0
ANB	3° ±2°	2^0	1^0
Angle of Convexity	0° ±10°	6^0	1^0
Vertikal			
SN-MP	32° ±3°	39^0	37^0
MMPA	27° ±4°	37^0	28^0
LAFH	55% ±2%	55,7%	53,04%
Dental			
Interincisal Angle			
UI-SN	135° ±10°	116^0	128^0
UI-PP	104° ±6°	113^0	111^0
UI-NA	109° ±6°	123^0	121^0
UI-Apg	4 mm ±2 mm	10mm	6mm
LI-MP	4 mm ±2 mm	12mm	6,5mm
LI-Apg	90° ±4°	92^0	84^0
LI-NB	2 mm ±2 mm	8mm	3mm
Soft Tissue	4 mm ±2 mm	10mm	4,5mm
E-Line Upper lip	1 mm ±2 mm	+2mm	+1mm
E-Line lower lip	0 mm ±2 mm	+4mm	0mm

DISCUSSION

The pre-orthodontic treatment for this patient commenced with the extraction of teeth 14, 24, 34, and 44. The orthodontic treatment started with the correction of crowding teeth using 0.014" Niti wire, followed by 0.016" Niti wire, and finally 0.016" x 0.022" Niti wire in both arches. The goal was to achieve neatly aligned teeth in the dental arch with uniform tooth height. This stage of treatment, known as the leveling and aligning process, consists of two main components: Leveling refers to the adjustment of the incisal edges of the anterior teeth and the buccal ridges of the posterior teeth to the same horizontal plane. Aligning refers to the arrangement of teeth into a proper arch form to establish normal point contacts. The duration of leveling and aligning varies, typically lasting 6 months for mild crowding, 8 months for moderate crowding, and 1–1.5 years for severe crowding.[14] In this case, the process was completed in 7 months.

Correcting overbite and posterior open bite was achieved by using a 0.016"x 0.022" Niti reverse curve in both the upper jaw and lower jaw for a duration of 12 weeks. According to Martin[15], corrections for deep overbite and the curve of Spee can be performed through two stages: first, using 014" Niti reverse curve for two months, and followed by 0.016"x0.022" Niti for an additional four months. The complete correction of the deep overbite and the Curve of Spee took six months. In this case, the deep overbite was corrected using a Niti reverse curve 0.016"x0.022" wire, with a duration of three months until the desired correction was achieved.[15] Non-surgical deep overbite correction methods include the intrusion of maxillary and mandibular anterior teeth, proclination of maxillary incisors in Class II Division 2 malocclusion cases, extrusion of maxillary and mandibular posterior teeth, clockwise rotation of the maxilla, flattening of the curve of Spee, or a combination of these techniques. The Niti reverse curve corrects deep overbite by facilitating the intrusion of anterior teeth and the extrusion of posterior teeth in both the maxilla and mandible.[16,17]

The deep overbite and posterior open bite were successfully corrected after using 0.016"x0.022" Niti reverse curve. However, an adverse effect of the Niti reverse curve was observed, resulting in proclination of the mandibular incisors and the protrusion of the tooth roots through the labial gingiva in the mandibular anterior region. This condition is consistent with Al Zoubi's study, which revealed that the use of Niti reverse curve may contribute to the proclination of mandibular incisors and the distal tipping of lower molars.16 The position of the tooth roots in the labial-tipping mandibular anterior region was corrected using lingual root torquing method with 0.016"x0.022" stainless steel wire.

According to the study by Alouini et al.,[18] lingual root torquing refers to the application of a lingually directed force on dental crowns, applied in a counterclockwise direction. Following the deep overbite correction, transverse correction was performed to align the centerlines of the upper and lower dental arches with the facial midline. This was followed by anterior retraction to address sagittal discrepancies.[18]

Upper anterior teeth extraction was performed using sliding mechanics technique with crimpable hooks. These hooks were positioned between the lateral incisors and canines (specifically between teeth 12-13, 22-23, 32-33, and 42-43). Paradental anchorage was achieved by ligating the second premolar, first molar, and second molar on 0.017" x 0.025" stainless steel wire. The force for anterior retraction was generated using an elastic chain, supplemented by light-to-medium force elastics positioned in Class II and Class III configurations. According to a study by Singhal et al.,[19] sliding mechanic method can reduce the proclination more effectively during the space closure process, whereas non-sliding mechanic method provides better torque control and prevents an increase in overbite during retraction process.[19]

The sliding mechanics technique involves retracting anterior teeth or closing spaces through frictional interaction between the bracket and the archwire. Precise control of the anterior teeth is essential for successful space closure using a sliding mechanic. The

retraction process continued until the mandibular space was closed, while the maxilla was left with 1.5 mm of space between both the right and left sides, with overjet of 3 mm and overbite of 3 mm. Maxillary retraction was performed using a non-sliding mechanics method, involving teardrop loop with 2.5 mm step up on mesial loop, constructed from 0.016" x 0.022" stainless steel wire. This procedure was further assisted by Class II light-force elastic rubber (see Figure 7). The non-sliding mechanical technique is a space closure using a closing loop on continuous archwire or segmented archwire. The teardrop loop stainless steel wire is one of the simplest bending techniques and offers the force from 1 mm of activation of the loop.[17] In managing this case, a teardrop loop was created with a step-up of the al loop to facilitate retraction while anticipating the increase in overbite that typically occurs during anterior retraction.[20]

Figure 5. Retraction of non-sliding mechanic anterior with teardrop loop.

The orthodontic treatment was performed over 27 months. The treatment outcomes indicated a significant improvement of the patient's profile. The patient's lip position was optimal according to the E-line analysis. The patient's smile appeared more aesthetic, with the smile line aligned with the curvature of the lower lip. The display of the upper incisors was 75% visible, the buccal corridors were symmetrical on both the left and right sides, and the midlines of the upper and lower dental arches were aligned with the facial midline.

Tarvade dan Agrawal[21] described smile analysis, highlighting several components. The smile line should ideally be parallel to the lower lip. The buccal corridor should be no greater than 1/3 of the distance from the midline of the upper dental arch to the canine. The upper gingival margin line should align with the upper lip above the gingival margin of the maxillary central incisors, with an attractive smile characterized by the upper lip resting at the level of the gingival margin and 75-100% of the incisors being visible. Additionally, the midline of the maxillary and mandibular dental arches should be aligned with the facial midline.[21]

The maxillary dental arch was corrected from its previously triangular shape to an oval shape. Good interdigitation was achieved. with a Class I relationship observed for both the canines and right and left molars. Vertical skeletal changes in the lower facial height were noted (MMPA, before: 370 (hyperdivergent); after: 280 (normal) and LAFH, before: 55,7%; after: 53,04%). (Vertical skeletal changes in the lower facial height were noted, as indicated by a decrease in the mandibular-mandibular plane angle (MMPA) from 37 degrees (hyperdivergent) to 28 degrees (normal) and a reduction in lower anterior facial height (LAFH) from 55.7% to 53.04%.) Additionally, the inclination and position of the upper and lower incisors, which were previously protrusive, shifted closer to normal values, resulting in a significantly improved profile for the patient.

The success of camouflage orthodontic treatment for bimaxillary prognathism depends on the appropriate application of retraction and intrusion forces, as well as the control of maxillary incisor torque, the vertical alignment of both maxillary and mandibular teeth. Camouflage treatment, which involves retracting the anterior segment and extracting four first premolars to reduce facial profile convexity, requires effective vertical control throughout the retraction process to minimize the risk of increased overbite.

According to a study by Vishnani[22], the use of Temporary Anchorage Devices (TADs), such as mini-screw anchors, provides effective control during the retraction of protrusive maxillary and mandibular teeth in cases of bimaxillary protrusion. In addition, TADs help correct occlusion and improve facial aesthetics. The application of TADs in patients with bimaxillary protrusion facilitates controlled tooth movement and minimizes the risks of anchorage loss.[22]

The intrusion of maxillary or mandibular anterior teeth during or after the retraction procedure may require mechanotherapy to address the increased risk of overbite. Additionally, the application of excessive and prolonged force during the intrusion procedure can increase the risk of apical root resorption. The prolonged and uncontrolled application of Niti reverse curve wires, such as in patients unable to attend check-ups during the COVID-19 pandemic, posed risks including anterior tooth proclination and distal tipping of the posterior teeth, which could ultimately result in anterior open bite. Furthermore, sustained intrusive forces on the anterior teeth over an extended period can lead to root resorption at the apices of the anterior teeth.[16,21,23]

Post-treatment panoramic radiographic examinations revealed root resorption at the apices of the maxillary and mandibular anterior incisors. The observed root apical resorption is believed to be a side effect of the intrusive movement of the maxillary and mandibular incisors during treatment. Esmat et al.,[24] highlighted that mechanical intrusion are closely associated with an increased incidence of root resorption.[24]

Orthodontic forces concentrated on the root, particularly at the apical region, induce biological changes in the cementum and periodontal ligament, leading to root resorption. In this case, root resorption occurred at the apical region, characterized by shortening of the root tips of the anterior teeth, as shown in Figure 6. Periapical radiographs are commonly used to evaluate apical external root resorption during orthodontic treatment due to their higher accuracy compared to panoramic radiographs and their lower cost compared to CT scans.[24,25]

In this case, root resorption occurred at the apical region of the teeth, with less than 2 mm of damage. This type of resorption is commonly referred to as orthodontically induced external apical root resorption, a known iatrogenic side effect of orthodontic treatment. Mild to moderate root resorption is observed in 40-60% of orthodontic patients, while severe root resorption (>5mm) occurs in only 1-5% of patients undergoing orthodontic treatment.

The classification of tooth root resorption according to the Malmgren Index is as follow: Degree 1 indicates irregular tooth contour; Degree 2 involves root apical resorption of less than 2 mm of the tooth root length; Degree 3 represents apical resorption ranging from 2 mm to one-third of the root length, and Degree 4 indicates the resorption exceeding one-third of the root length. In this case, the tooth resorption was categorized as Degree 2 according to the Malmgren Index.[26]

Tooth resorption in orthodontic cases refers to inflammation-induced pathological resorption. Orthodontic forces transmitted to the teeth lead to the formation of hyalinized areas in the periodontal tissues. In addition, cementum plays a role in reducing these hyalinized tissues. The resorption process is initiated by dentinoclasts, while osteoclast-like cells, known as odontoclasts, further induces resorption.

Resorption, as observed radiologically, frequently occurs at the apical region of the tooth root. This phenomenon occurs because one-third of the root is covered by cellular cementum, which contains active cells and vascular support. The composition of blood vessels in the toot root reveals that 47% are located in the apical area, while only 4% in the cervical area. Furthermore, the decreasing hardness and elastic modulus of the cementum from the cervical area to the apical region make the apical area more prone to resorption.[27,28]

The root resorption that the patient experienced during treatment was an iatrogenic side effect. The patient was informed about this potential side effect prior to the treatment.

To address the issue of root resorption involved regular check-ups, which aimed at evaluating whether the resorption persisted post-treatment or ceased following the treatment. Evaluation is conducted through anamnesis to identify any post-treatment patient complaints. A clinical evaluation is performed to assess the presence or absence of tooth mobility, periodontal issues, and to conduct a periapical radiographic examination, which helps evaluate the apical condition of the post-treatment tooth roots.

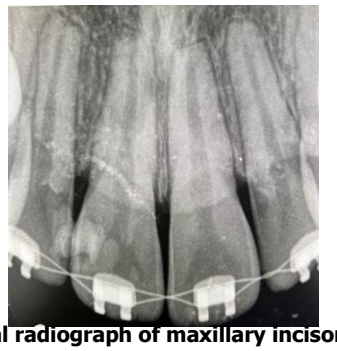


Figure 6. Periapical radiograph of maxillary incisor before debonding

A key recommendation for treating similar cases is to apply appropriate orthodontic forces to prevent apical resorption of the anterior tooth roots. Excessive intrusive forces beyond the optimal threshold for orthodontic tooth movement carry a risk of apical resorption of the tooth roots. The presented case report has limitations, including the assessment of root resorption, which was conducted solely through periapical X-ray examinations.

Further research is required to assess the incidence of root resorption in bimaxillary prognathism cases. Consequently, the information obtained was limited compared to evaluations performed using Cone Beam Computed Tomography (CBCT), which offers a three-dimensional and more detailed view. Treatment for bimaxillary prognathism typically involves preadjusted edgewise MBT brackets, which exert greater force compared to self-ligating brackets.

CONCLUSION

Orthodontic camouflage treatment of Class I bimaxillary prognathism involving extractions and fixed appliances with preadjusted edgewise MBT 0.022" brackets resulted in enhanced facial aesthetics, smile, and masticatory function. Root resorption emerged as a complication due to maxillary and mandibular incisor intrusion during deep overbite correction over 27 months of treatment period. The implication of this case report is expected to provide insights and considerations for managing bimaxillary prognathism cases requiring significant retraction, as the risk of root resorption must always be considered.

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REFERENCES

1. Hoyte T, Ali A, Bearn D. Prevalence of bimaxillary protrusion: a systematic review. Open J Epidem. 2020;11(1):37–46. https://doi.org/10.4236/ojepi.2021.111004
2. Huang YW, Liang Kuo C, Liu IH, Tsai YL, Wang CL, Yang CH. Orthodontic treatment of severe bimaxillar dentoalveolar protrusion with skeletal class ii malocclusion without using miniscrews. Taiwanese J Orthod. 2022;34(1):60–8. https://doi.org/10.38209/2708-2636.1121
3. Mukti N, Noviaranny I, Venkiteswaran A, Ghani S. Clinical characteristics of bimaxillary protrusion in different population. Compend Oral Sci. 2017;4(1):1–7. https://doi.org/10.24191/cos.v4i0.17508
4. Tolulase Abosede Yemitan, Tolulope Bolanle Esan, Ummukhaya Titilope Adebayo, Oluwafolakemi Adebusola Egunjobi. Bimaxillary protrusion: A literature review. Int J Biol Pharm Sci Arch. 2022;3(2):141–6. https://doi.org/10.53771/ijbpsa.2022.3.2.0067
5. Jawale DB, Rodrigues DL, Belludi DA, Ashtekar DS, Patil DA, Rk D. "Treatment of severe crowding and bimaxillary dental protrusion in a patient with angle's class I malocclusion and a vertical growth pattern" – A Case Report on Orthodontic Camouflage. 2021; https://doi.org/10.36348/sjodr.2021.v06i05.006
6. Chaudhary NK, Giri J, Gyawali R, Pokharel PR. Bi-maxillary Protrusion: An Orthodontic Management. Kathmandu Univ Med J. 2022;20(4):528–31. https://doi.org/10.3126/kumj.v20i4.54296
7. Burgaz MA, Eraydın F, Esener SD, Ülkür E. Patient with severe skeletal class ii malocclusion: double jaw surgery with multipiece Le Fort I. Turk J Orthod. 2018;31(3):95–102. https://doi.org/10.5152/TurkJOrthod.2018.17039
8. Raposo R, Peleteiro B, Paço M, Pinho T. Orthodontic camouflage versus orthodontic-orthognathic surgical treatment in class II malocclusion: a systematic review and meta-analysis. Inter J Oral and Maxillofacial Surgery. 2018;47(4):445–55. https://doi.org/10.1016/j.ijom.2017.09.003
9. Incorvati C, Gulotta C, Mirabile FMC, Badiali G, Marchetti C. Current Trends in Skeletal Borderline Patients: Surgical versus Orthodontic Treatment Decisions—What Is the Evidence? Applied Sciences. 2022;12(9):4636. https://doi.org/10.3390/app12094636
10. Araujo MT de S, Squeff LR. Orthodontic camouflage as a treatment alternative for skeletal Class III. Dental Press J Orthod. 2021;26:e21bbo4. https://doi.org/10.1590/2177-6709.26.4.e21bbo4
11. Karnati PKR, Seth P, Zamzuri ATB, Tharwani P. Orthodontically Induced External Apical Root Resorption in Class II Malocclusion. Case Reports in Dentistry. 2021;2021:e8290429. https://doi.org/10.1155/2021/8290429
12. Littlewood SJ, Mitchell L. An Introduction to Orthodontics. 5th ed. United Kingdom: OUP Oxford; 2019.
13. Chen Y, Liu D. Morphologic evaluation of root resorption after miniscrew assisted en mass retraction in adult bialveolar protrusion patients. Head & Face Medicine. 2020;16(1):16. https://doi.org/10.1186/s13005-020-00229-z
14. Genji L, Varghese RM, Subramaniyan AK. Comparison Of Duration Of Leveling And Aligning In Different Types Of Crowding In Lower Anteriors. Journal of Pharmaceutical Negative Results. 2022;13(8):1255–62. https://doi.org/10.47750/pnr.2022.13.S08.155
15. Martins RP. Early vertical correction of the deep curve of Spee. Dental Press J Orthod. 22(2):118–25. http://dx.doi.org/10.1590/2177-6709.22.2.118-125.sar
16. Al-Zoubi EM, Al-Nimri KS. A comparative study between the effect of reverse curve of Spee archwires and anterior bite turbos in the treatment of deep overbite cases: Angle Orthod. 2022;92(1):36–44. https://doi.org/10.2319/020921-117.1
17. Valarelli F, Carniel R, Cotrin P, Patel M, Cançado R, Freitas KM, et al. Treatment of a Class II Malocclusion with Deep Overbite in an Adult Patient Using Intermaxillary Elastics and Spee Curve Controlling with Reverse and Accentuated Archwires. Contemporary Clinical Dentistry. 2017;8:672. https://doi.org/10.4103/ccd.ccd_625_17
18. Alouini O, Knösel M, Blanck-Lubarsch M, Helms HJ, Wiechmann D. Controlling incisor torque with completely customized lingual appliances. J Orofac Orthop. 2020;81(5):328–39. https://doi.org/10.1007/s00056-020-00231-9
19. Singhal C, Goyal V, Singh G, Izhar A, Singh R, Gupta N. To Evaluate and Compare the Rate of Space Closure and Incisor Retraction between Sliding Mechanics and CNA Mushroom Loop Archwire Using Indirect Anchorage. Journal of Contemporary Orthodontics. 3(4):13–8. https://doi.org/10.18231/j.jco.2019.034
20. Ribeiro GLU, Jacob HB. Understanding the basis of space closure in Orthodontics for a more efficient orthodontic treatment. Dental Press J Orthod. 2016;21(2):115–25. https://doi.org/10.1590/2177-6709.21.2.115-125.sar
21. Tarvade SM, Agrawal G. Smile analysis: A review Part II. International Journal of Contemporary Dental and Medical Reviews. 2015;1–4. https://doi.org/10.15713/ins.ijcdmr.68
22. Vishnani R, Gilani R, Singh S, Rathi S, Kathade A. Mini-Screw-Assisted Orthodontic Retraction of Class I Malocclusion in a Bimaxillary Protrusion Patient Using Sliding Mechanics: A Case Report. Cureus. 2024 Apr 5;16(4):e57665. https://doi.org/10.7759/cureus.57665
23. Shih-Ying Lin, Kai-Wen Yu, Tai-ting Lai, Chung-Ji Liu, Li-Fang Hsu. Orthodontic Correction of Bimaxillary Protrusion with with Mini-screws in Class II Hyperdivergent Patient. Taiwanese Journal of Orthodontics. 2019;31(2). https://doi.org/10.30036/TJO.201906_31(2).0006
24. Esmat OA, Dakroury AEE, Hassan A, HamdyAboelfetouh M. The Effect of Intrusive Forces on Root Resorption of Anterior Teeth in Class II Division 2 Deep Bite Cases Induced by Placement of Mini-Screw Implants and Intrusive Archwires. A Randomized Clinical Trial. IOSR J Dent Med Scie (IOSR-JDMS). 2018;17(11):45–55. https://doi.org/10.9790/0853-1711124555
25. Maués CPR, Nascimento RR do, Vilella O de V. Severe root resorption resulting from orthodontic treatment: Prevalence and risk factors. Dental Press J Orthod. 2015;20:52–8. https://doi.org/10.1590/2176-9451.20.1.052-058.oar
26. Sameshima GT, Iglesias-Linares A. Orthodontic root resorption. J World Federat Orthod. 2021;10(4):135–43. https://doi.org/10.1016/j.ejwf.2021.09.003
27. Krishnan V. Root Resorption with Orthodontic Mechanics: Pertinent Areas Revisited. Australian Dent J. 2017;62(S1):71–7. https://doi.org/10.1111/adj.12483
28. Dindaroğlu F, Doğan S. Root Resorption in Orthodontics. Turk J Orthod. 2016;29(4):103–8. https://doi.org/10.5152/TurkJOrthod.2016.16021