

Management of bimaxillary protrusion with missing molar using T-loop and couple force

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ABSTRACT

Background: Management of bimaxillary protrusion can be challenging and should be used with maximum anchorage to prevent loss of anchorage and improve the facial profile. In addition, a patient with a missing molar is often found in a dental clinic. Space closure can cause tipping movement rather than bodily, so couple force should be used. **Purpose:** This case report aims to manage the bimaxillary protrusion with a missing molar using a T-loop and a transpalatal arch (TPA) as maximum anchorage for correction of the facial profile and couple force to create bodily movement for the space closure of a missing first molar. **Case:** A 21-year-old female patient complained about her protruding teeth. An intraoral examination indicated Angle's Class I malocclusion on the left molar relation, with the lower-right first molar missing, mild crowding maxilla and mandible, 6 mm of overjet and 5 mm of overbite, and midline shift at the maxilla and mandible. **Case Management:** The treatment plan was the extraction of teeth 14, 24, 34; alignment with pre-adjusted McLaughlin Bennett Trevisi (MBT) 0.022; retraction of the anterior segment with a T-loop, TPA, and close spacing of the missing first molar with couple force on the buccal and lingual side and tip back. Retention was done with removable retainers. At the end of the treatment, normal incisive inclination and closed space of the missing first molar were achieved, along with an improvement of the facial profile. **Conclusion:** Bimaxillary protrusion can be successfully treated by means of extraction of the premolar(s), space closure for correction of the profile with T-loop and TPA, and closing the space of the missing molar with couple force on the buccal and lingual sides and tip back.

Keywords: bimaxillary protrusion; medicine; missing molar; malocclusion; orthodontics

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INTRODUCTION

Bimaxillary dental protrusion or bimaxillary protrusion is a condition where the anterior teeth of the maxilla and mandible are protruded relative to the maxilla and mandible basal bones.¹⁻³ The characteristics seen are an incompetent lip in a resting position, an excessive effort to close the lips completely, thus creating lip strain and prominent lips.¹⁻³ Bimaxillary dental protrusion is affected by race and ethnicity.^{1,3} This condition is often found in Asian, African, and American patients.^{1,3} Bimaxillary protrusion etiology is multi-factorial. There are genetic factors, as well as environmental factors, such as mouth breathing, habitual movement of the lips and tongue, and tongue volume.⁴ The

main goals of treatment of bimaxillary protrusion are to reduce the inclination of the maxilla and mandible incisors with extraction of the premolar(s) by using maximum anchorage, so that the dentofacial aesthetics and smile can be improved.⁵ From the patient's perspective, they seek orthodontic treatment to reduce their protrusive profile because they have psychosocial problems.³

Bimaxillary protrusion correction includes incisive retraction using the first premolar extraction at both jawbones (depending on the case) and retraction of the anterior segment at the extraction site.¹ Anchorage control is important for obtaining the treatment goals and correcting the profile.⁶ In this case, anchorage is the resistance of the posterior segment to the force of anterior retraction. If there

were anchorage loss, when the posterior segment slides to the anterior segment because of the reciprocal force, the treatment goals cannot be achieved. Another indicator of anchorage loss is mesial tipping of the maxillary molars, which leads to changes to the occlusal plane.⁶

Patients with missing molars can find orthodontic treatment in a clinic. The treatment choice is closing the space or inserting a dental prosthesis into the space.^{7,8} In some cases, replacement of the edentulous area with neighboring teeth has proven to be an excellent treatment outcome. However, moving the neighboring teeth must be performed by bodily movement without any inclination because it could change the vertical dimension.⁸ A missing lower molar is more complex than an upper molar because the mandible has a thick cortical bone and a small trabecular bone, and the roots of the lower molar are wider.⁸ Therefore, this case aims to report on the management of bimaxillary protrusion with a missing molar using a T-loop and transpalatal arch (TPA) as the maximum anchorage to correct the profile and couple force to create bodily movement for close spacing of the missing first molar.

CASE

A 21-year-old female patient came to the Dental Hospital of Universitas Airlangga with a chief complaint of teeth protrusion. An extra-oral examination showed a convex-type profile with incompetent lips (Figure 1). An intraoral examination indicated Angle's Class I on the left molar, with the lower-right first molar missing, mild crowding

maxilla and mandible, 6 mm of overjet, and 5 mm of overbite. In addition, there was a shift at the maxilla median 1 mm to the left and at the mandible 2 mm to the left. Oral hygiene and periodontal tissues were good (Figure 2).

The arch length discrepancy was presented in both the maxillary arch (10 mm) and the mandibular arch (4 mm). According to the patient, her father has a similar convex profile with protruding teeth. There were no clinical signs of clicking or discomfort in temporomandibular joints, and there was no restriction or deviation in jaw movement.

The lateral cephalometric analysis indicates that \angle SNA 84° , \angle SNB 76° , and ANB 8° refer to the skeletal pattern Class II malocclusion. Dental measurements indicated that upper and lower incisors were proclined, with \angle I-NA 35° , \angle I-NB 32° , and \angle Inter Incisal 100° . The patient has a convex skeletal profile (FH-NP 81.5° , NAP 15°), with mandible clockwise rotation with \angle MP-FH 36° and mandible retrognathic with \angle NAP 15° . Rickett's Lip Analysis and Steiner's Lip Analysis indicated the lips were far in front of the E and S lines (Table 1). The intraoral photograph shown in the Figure 3. A panoramic radiograph indicated teeth 28, 38, and 48 were impacted (Figure 4).

CASE MANAGEMENT

The treatment's objectives were to improve the occlusion, including correcting the profile and the crowding protrusion maxilla and mandible, correcting the midline shift, and correcting the lower-right posterior diastema due to the absence of 46. Based on the clinical examination, diagnostic records, and cephalometric analysis, it was planned to use a



Figure 1. (A) Pre-treatment and (B) post-treatment extraoral photographs. Facial photos of the frontal view at rest, smiling, and lateral view.



Figure 2. Pre-treatment intraoral photographs. Intraoral view of upper-occlusal, lower occlusal, right lateral, frontal, and left lateral.



Figure 3. During treatment, intraoral photographs. Intraoral view of upper-occlusal, lower occlusal, right lateral, frontal, and left lateral.

Table 1. Pre and post treatment Cephalogram’s measurements

Measurement	Surabayan	Subject	
		Pre	Post
∠SNA	84.3	84	83
∠SNB	81.4	76	77
∠ANB	3	8	6
∠OP–SN	15–32	24	23
∠MP–SN	20–40	36	35
∠I–NA	26	35	17
I–NA (mm)	6.3 mm	10 mm	3 mm
∠I–NB	29	32	28
I–NB (mm)	7.9 mm	12 mm	8 mm
Nasolabial Angle	110, 120°	118°	120°
Upper lips – E line	-2–3 mm	+4 mm	+1 mm
Lower lips - E line	-1–2 mm	+10 mm	+2 mm
Upper lips – S line	0	+4 mm	+4 mm
Lower lips – S line	0	+11 mm	+4 mm

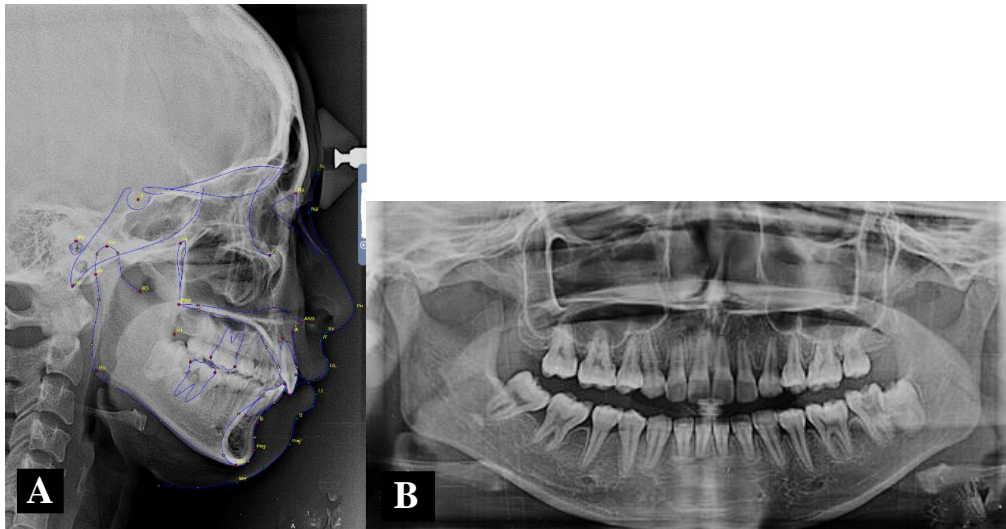


Figure 4. (A) Pre-treatment and (B) post-treatment lateral cephalometric and panoramic radiographs.



Figure 5. Post-treatment intraoral photographs. Intraoral view of (a) upper occlusal, (b) lower occlusal, (c) right lateral, (d) frontal, and (e) left lateral.



Figure 6. Superimposition of lateral cephalometric on pre- (black) and post-treatment (red). Note: there were changes in maxilla and mandibular incisor angulation and the lip position.

fixed appliance along with the extraction of the premolars. The treatment plan was suggested as follows: (1) extraction of teeth 14, 24, 34; (2) alignment of the upper and lower teeth with pre-adjusted McLaughlin Bennett Trevisi (MBT) 0.022; and (3) retention with the upper and lower Hawley removable retainers.

After extraction of the premolars, the treatment was started by bonding the brackets and buccal tubes using 0.022 slots with pre-adjusted edgewise brackets, MBT. The patient was treated with the conventional anchorage system consisting of the TPA to limit the anchorage loss risk for the upper jaw.

The first step was processing alignment and leveling with 0.012, 0.014, 0.016, and 0.016 x 0.016 Nickel–Titanium wire. The second step was retracting the canine using stainless steel wire 0.016 x 0.022 and a power chain until the relation of the canine became Class I. The third step was retracting the anterior teeth using a T-loop (0.016 x 0.022 TMA wire), and then 47 was mesialized with a power chain on the buccal and lingual sides by using a tip back. The last step was to arch compatibility by using a stainless-steel wire 0.017 x 0.025.

After 49 months of treatment, the brackets and buccal tubes were debonded and Hawley retainers were used for stability on both the upper and lower arches. Soft-tissue analysis indicated that the position of the upper and lower lips was more backward in the end of the treatment. The crowding on the maxilla and mandible was corrected, an ideal overjet and overbite were obtained, the midline shift was corrected, the posterior diastema due to the absence of 46 was corrected, and a clockwise mandible rotation was obtained. The incisive inclination of the maxilla and mandible was normal, but the relation between the maxilla and mandible was still indicated as skeletal Class II (Figures 5 and 6).

DISCUSSION

Teeth extraction in orthodontic treatment is still being debated in the orthodontic field. However, it has become a fundamental consideration in some cases. The affected factors in an extraction decision are features of malocclusion, the purpose of the treatment, and the techniques used to provide the desired outcomes. The discrepancy of dental arches also affects the extraction decision. The first extraction selected is of the premolar because it will provide good long-term stability. Patients with more proclined incisors and more protrusive lips may be better with an extraction treatment plan to help compensate.⁹ Incisive retraction needs a space in the jaw arches to reduce prominent lips.¹

In this case, there was a 10-mm maxilla and 4 mm mandible discrepancy and an incisive protrusion of the maxilla and mandible. Therefore, the first treatment selected was premolar extraction. There was no extraction in the fourth region due to a gap from the absence of the

lower-right molar, so a closed space was conducted. During leveling and aligning, a TPA was used as an additional tool to create maximum anchorage. TPA is economical, easy to fabricate, and the most reliable method.² Although TPA cannot be used as an absolute anchor, it can be used as an additional tool during orthodontic treatment to control vertical, transversal, and sagittal dimension anchoring (anteroposterior).¹⁰

Anterior retraction is divided into one-step (en-masse) and two-step retractions (single canine retraction).^{1,11,12} The canine retraction is separated and followed by incisive retraction so it can keep posterior anchorage.¹¹ This step can prevent mesialization of the posterior segment due to retraction of the anterior segment because lighter force had been used.² An indication for single canine retraction is a case of crowding and midline shift.¹¹ In this case, single canine retraction is conducted due to midline shift and anterior crowding.

After leveling and aligning are successful, retraction canine is conducted by using the “sliding mechanics” technique. This technique applies force between two teeth or a segment of teeth, and a straight wire is inserted into the respective brackets. Therefore, there will be friction between the wire and the bracket surface. Sliding mechanics is selected because it is more controlled during space closure (reduced rotation effect and tipping), increasing patient comfort and avoiding excessive force.¹²

After canine retraction is completed, anterior retraction with the “segmental mechanics” method is conducted by using T-loop and step-up. Step-up is used to correct a deep bite. The second premolar, canine, and first molar comprise a segment that serves as an anchor or passive segment. Four incisor teeth serve as an active segment. Therefore, both segments are not connected by a wire (the teeth are not moving on the wire) so this technique can be called “frictionless mechanics.”¹² During anterior retraction, a midline shift correction is also conducted.

While performing a space closure, the distance between the force and the center of resistance must be considered to provide moments. This is often called the moment-to-force (M/F) ratio.¹³ In this case, anterior retraction requires bodily movement; therefore, a high M/F ratio on the posterior segment is required. If using a T-loop, the M/F ratio can be increased by increasing the height of the T-loop because the wire is more flexible and releases less force.¹³ The height of the T-loop varies between 6 mm and 10.45 mm.¹³ The M/F ratio can also be increased by adding apical length, but this is never ideal for controlled inclination and translation due to anatomy limitations.¹³ Thus, it is recommended to make preactivation bends.¹³ The preactivation bend can sometimes reach 180° from the horizontal, according to the anchorage needs of the case. A 0.016 x 0.022-inch TMA T-loop preactivated to 180° and activated 6 mm horizontally delivers approximately less than 243 g.¹² Apical lengths vary from 10 mm to 16 mm.¹³

In this case, although protraction of the second molar was time-consuming and relatively difficult, the decision

was still to protract 47 because the periodontal health was good, and the protraction of 47 can control the wisdom tooth (48) positioning. Space reopening for dental prosthesis would be indicated if the periodontal health of the second molar were not good or if the wisdom tooth were absent.⁷ Close spacing of the missing 46 was conducted by using sliding mechanics. Protraction of 47 used couple force with a power chain at the buccal and lingual (using the lingual button) and tip back. Couple force or balancing lingual force was used to prevent mesial rotation, tipping, and buccal sweep of the molar.^{7,8} An effective tip back angle was 20°–30° and slightly in to prevent mesiolingual rotation.¹⁴ At the end of this case, the molar was slightly tipped distally during protraction (Figure 5). To make a bodily movement, the tip back angle should be 10°.¹⁴

After orthodontic treatment, canine relation Class I was achieved on both sides. The overjet and overbite were normal, the crowding of the maxilla and mandible was corrected, the incisive inclination was normal, the shift midline was corrected, and the posterior diastema was corrected. At the end of the treatment, the soft tissue of the patient improved, and the goals of the treatment were achieved (Figure 5).

However, the limitation of treatment for this case is that the relation between the maxilla and mandible was still indicated as skeletal Class II. This might be due to the use of an anchorage that should have been an absolute anchorage to prevent zero anchorage loss or movement of the anchorage unit. The alternative treatment is to use temporary anchorage devices as an absolute anchorage to prevent the distal movement of the anterior teeth or posterior teeth (or both) without anchorage loss.⁵

In conclusion, an orthodontic patient was treated with a bimaxillary protrusion case that included maxilla and mandible incisive retraction. The treatment was conducted by extraction of the first premolars. A retraction can be conducted by using sliding mechanics or segmental mechanics. Closing the space of the missing molar was achieved with couple force on the buccal and lingual sides and the tip back. At the end of the treatment, there was

normal incisive inclination and improvement of the smile and facial profile.

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