

Non-extraction Orthodontic Treatment in Angle Class I Malocclusion with Severe Crowding, Deep Bite, and Midline Shifting: A Case Report

Ida Bagus Narmada, DDS, PhD, Ort., Ike Sesaria P., DDS, Ort. and Syafiri Sami' A., DDS

Department of Orthodontics, Faculty of Dental Medicine, Universitas Airlangga, Surabaya, Indonesia

ABSTRACT

Crowding is the most common dental case worldwide. This case report describes the diagnosis and management of a 20-year-old woman with severe crowding, deep bite, and midline shifting. The patient presented with the chief complaint of crowding and an unaesthetic smile. Upon examination, the patient had Angle Class I Malocclusion. The severe crowding was treated comprehensively and successfully corrected using fixed orthodontic appliances and without extraction, only interproximal reduction (IPR).

Keywords: Class I malocclusion, severe crowding, non-extraction, interproximal reduction, IPR

INTRODUCTION

Angle Class I Malocclusion is the most common malocclusion in the world, more than Angle Class II or Class III.¹ Angle Class I Malocclusion is a normal molar relationship; however, the occlusal plane is incorrect because there are malposed teeth, rotation, or other causes.² Other anomalies, such as crowding and a deep bite, are usually present with Class I Malocclusion. Crowding in the maxillary and mandibular arches is one of the most commonly reported malocclusion in this group.³ The most prevalent issue in adults is crowding, which affects roughly 24% of women and 14% of men.⁴ Dental crowding is characterized as an irregularity between some of the teeth and the size of the jaw, resulting in imbrications and rotation due to the presence of third molars and the mesial component of force.^{5,6}

The primary purpose of orthodontic therapy is to maintain a normal relationship between the teeth and facial features. It is generally recognized that orthodontic treatment will obtain a good impact on facial proportions in some way.⁷ This case presented how to treat the severe crowding, deep bite, and midline shifting in class I Angle malocclusion using fixed orthodontic appliances without some extraction and interproximal reduction (IPR) only.

CASE REPORT

A 20-year-old woman came to Dental Hospital of Universitas Airlangga with the chief complaint of her crowding teeth in the upper and lower arches and ectopic of upper right canines; she had never done orthodontic consultation before, and wanted to be treated to improve the appearance of her teeth and facial aesthetic.



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Corresponding author: Ida Bagus Narmada, DDS, PhD, Ort.
Department of Orthodontics
Faculty of Dental Medicine
Universitas Airlangga
Jl. Mayjen Prof. Dr. Moestopo No.47,
Pacar Kembang, Tambak Sari,
Surabaya, East Java, Indonesia 60132
Email: dr_narmada@yahoo.com
ORCID: <https://orcid.org/0000-0003-2453-9601>

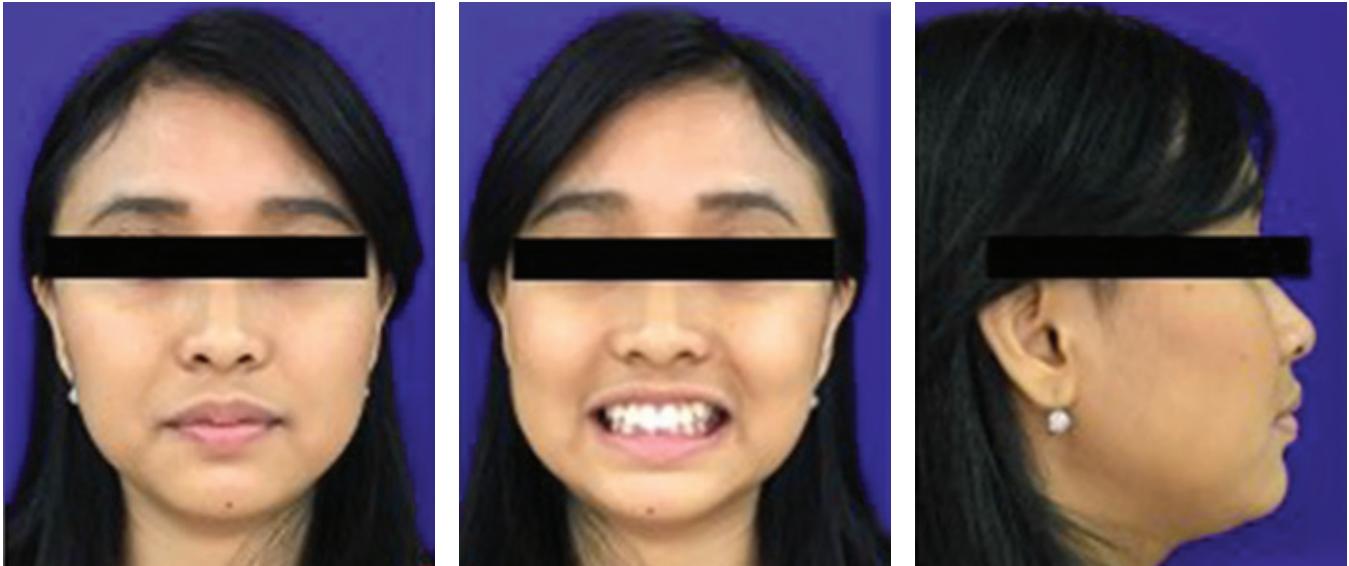


Figure 1. Pre-treatment extraoral photographs.



Figure 2. Pre-treatment intraoral photographs.

Extraoral examination showed that the patient had a straight profile, medium face type, mesocephalic head shape, a symmetrical face, and competent lips. She also had normal speech function, and no bad habits (Figure 1).

Intraoral examination showed that patient had good oral hygiene, normal mucosa, a normal palatum, and normal tongue. There was severe crowding in both arches, either anterior and posterior segment; with deep bite of 4.5 mm and overjet of 2.5 mm; there was midline shift to the right on the lower arch of 0.5 mm; the sagittal relationship of the left and right canine was edge to edge, and there was edge to edge

on the left and right molar also (Figure 2). The transversal relationship was normal. Dental casts analysis indicated discrepancy in the upper arch of -9 mm; discrepancy in the lower arch of -10 mm, and curve of Spee of 4 mm positive. The arch shape of the maxilla and mandibular were normal. There were no clinical signs of clicking or discomfort in the temporomandibular joints; there was no restriction or deviation in jaw movement.

The OPG's patient showed that patient had impacted on the lower third molar. There were no other pathologic findings were detected from the panoramic radiograph.

Table 1. Pre- and post-treatment cephalogram's measurements

Variable	Pre-treatment	Post-treatment
∠ FH-NPog	79.5°	79.5°
∠ N-APog	6.5°	7°
∠ SNA	82°	82°
∠ SNB	79°	79°
∠ ANB	3°	3°
AO-BO	1.5 mm	1.5 mm
∠ I RA-NA	18.5°	19.5°
∠ I RB-NB	28°	31°
∠ IMPA	93°	102°
∠ FMA	36°	36°
∠ IMPA	55°	42°
∠ FMA	90°	92°
Ricket's Lip Analysis	<ul style="list-style-type: none"> • Upper lip: 0 mm right on E line • Lower lip: 0 mm right on E line 	<ul style="list-style-type: none"> • Upper lip: 0 mm right on E line • Lower lip: 1.5 mm beyond E line
Steiner's Lip Analysis	<ul style="list-style-type: none"> • Upper lip: 2 mm beyond S line • Lower lip: 1 mm beyond S line 	<ul style="list-style-type: none"> • Upper lip: 2 mm beyond S line • Lower lip: 2.5 mm beyond S line

From cephalometric analysis revealed that the patient had Class I skeletal relationship with ∠SNA 82°, ∠SNB 79°, ∠ANB 3°, and Wit's appraisal of 1.5 mm (Figure 3). The dental inclination of the maxillary incisors was the tendency of retrusive with a value of ∠I RA-NA 18.5°, and the mandibular incisors were normal with a value of ∠I RB-NB 28° and ∠IMPA 93°. Patient had a straight face profile with the value of FH-NP 79.5° and NAP 6.5°. Soft tissue analysis showed protrusive lips with a nasolabial angle 90°; this was also shown in the Rickett's and Steiner's lip analysis of the upper and lower lips.

Diagnosis

Angle Class I Malocclusion with crowding in maxilla and mandibula, deep bite, and midline shifting.

Etiology

The etiology of this case was premature loss on the deciduous teeth (71, 72, 82, 85) and retained 81. The patient said that there were no hereditary traits for her malocclusion.

Treatment objectives

Treatment objectives were to correct the maxillary and mandibular crowding, the deep bite, and the midline shifting on the lower arch, and to achieve a Class I relationship with an ideal arch form, overjet, and overbite.

Treatment plan

According to the information gathered from both clinical examination and diagnostic records, including dental and orthodontic history, extraoral and intraoral photographs examination, and radiograph photos, we planned to correct the maxillary and mandibular crowding using fixed orthodontic appliances with preadjusted brackets. In this case, the author planned to do some extraction to relieve the severe crowding, but the patient refused and the author did IPR only in both arches. In the final treatment, this case was concluded by removal of the retainers on both arches.

Treatment progress

Informed consent was obtained and a medical record was documented for the patient. Preliminary treatment such as scaling was done to prepare the bracket placement. Since it was not necessary for any tooth extraction, the treatment was continued with bonded of the 0.022" slots bracket of MBT prescription in both arches. All the first and second molars were bonded with buccal tubes using 0.022" slots. Leveling and aligning were done using Nickel-Titanium Thermal

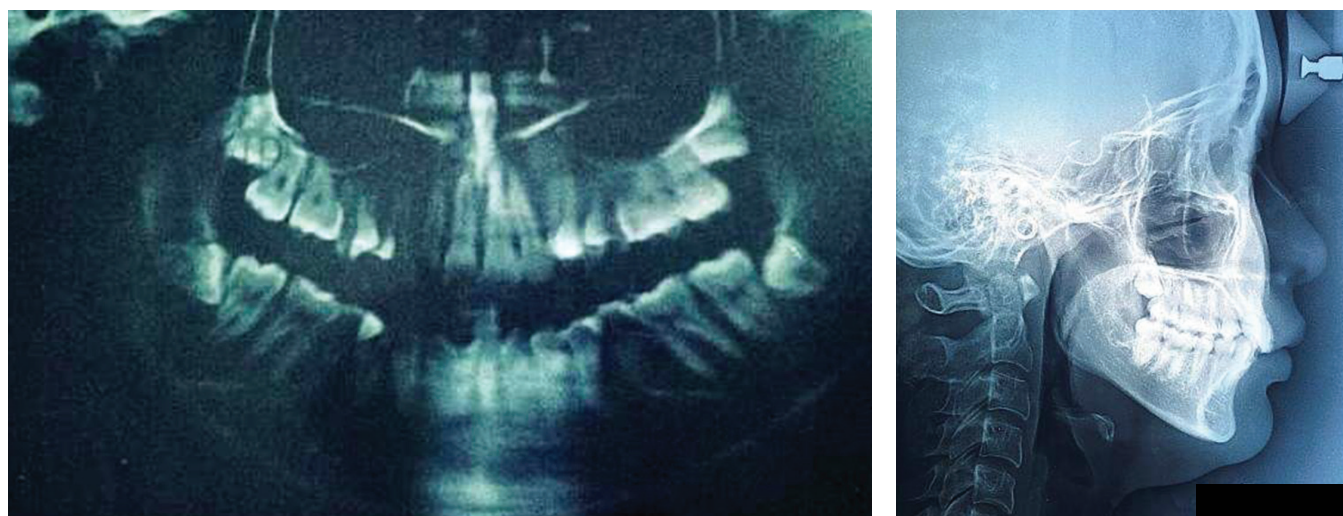


Figure 3. Patient's pre-treatment orthopantomogram and cephalogram.

wire starting from size 0.012, 0.014, 0.016 until 0.016 x 0.016 in both arches. After that, the treatment continued with IPR on each tooth either anterior and posterior teeth, which was done by motor-driven abrasive strips with slow speed contra-angle handpiece (Almight set, China). The next stage was arch compatibility using stainless steel wire size 0.016 x 0.022 and using up and down elastic. When the arch compatibility was achieved, finishing and detailing using stainless steel wire size 0.017 x 0.025 were done. After the orthodontic treatment, crowding in the upper and lower arch was corrected, normal overbite and overjet were obtained (2 mm for overbite and overjet), class I molar and canine relationship has been maintained. The curve of Spee has also been flattened. Almost 3 years later, all the fixed appliances were removed. This extension of the treatment time was done because the patient did not comply with scheduled follow-ups. A Hawley retainer was chosen for both arches.

DISCUSSION

This case report discussed the 20-year-old woman who came to the Dental Hospital of Universitas Airlangga with the chief complaint of crowding in both arches. The patient felt the need to improve their appearance with fixed orthodontic appliances. The problem was that the patient did not want any tooth extraction. A great controversy exists between the extraction and non-extraction treatment protocol.⁸ To decide on extraction or non-extraction treatment, the clinician had to concern the entire problem list of a case. The decision to extract teeth was influenced by the patient's medical history, attitude toward treatment, dental hygiene, caries rate, and tooth quality.⁹⁻¹¹ IPR (stripping), expansion, uprighting, derotation, lateral movement of canines, distalization of the posterior teeth, and extraction are all used to treat class I crowding.^{8,12}

Arch length deficiency is one of the critical factors in choosing between the treatment protocols.⁸ Based on arch length-tooth material discrepancy by Proffit et al., guidelines recommend that for Class I crowding of less than 4 mm arch length discrepancy, extraction is rarely indicated. For a 5–9 mm arch length discrepancy, non-extraction or extraction is possible depending on the details of the therapy. For a 10 mm or more arch length discrepancy, extraction is almost always required. In this case, patient had a discrepancy of 7 mm for the upper arch and 8 mm for the lower arch so that the authors didn't do any tooth extraction for this patient. As a replacement, patient was planned for IPR.

Based on the OPG of the patient, there were 38 and 48 that warranted odontectomy to prevent a pathological process, such as root resorption or caries in the second molars, pericoronitis, odontogenic cysts, dental crowding, and periodontal disease in the distal surface of second molars. Impaction of the mandibular third molar may also lead to damage of the nerve.¹³ After obtaining the consent from the patient, odontectomy was performed.

The etiology of this case was the premature loss of the deciduous teeth (71, 72, 82, 85) and retained 81. The early loss of primary teeth can affect the period of natural eruption of permanent successors by inhibiting or accelerating their eruption.¹⁴ It is reflected in occlusal and location differences in mixed and permanent teeth as a qualifying cause.¹⁵ Early primary tooth loss is commonly thought to be linked to a deficiency in outer space, malocclusion, and midline variations in permanent teeth.¹⁶ Furthermore, the early loss of primary teeth minimizes the arch length required for the subsequent teeth, hence preventing impaction crowding and rotation of permanent teeth. Retained primary teeth can cause the position of permanent teeth to be located outside the dental arch.¹⁷

In this case, the patient used fixed orthodontic appliances. Fixed orthodontic appliances are indicated whenever multiple tooth movement is required, e.g., bodily movement, intrusion, extrusion, derotation, controlled space closure at extraction sites, torque control, which were needed by this patient.³ In this patient, we used MBT brackets with 0.22 slots that could perform more freedom of movement of initial aligning arch wires in the larger slot. They also help to keep force light so that patient feels more comfortable on the phases of levelling and aligning.^{18,19} This MBT prescription had been chosen because it was necessary to build extra torque to incisor and molar teeth in order to obtain clinical goals and treatment objectives with a minimum of wire bending. Furthermore, in this case, the patient had a slightly retruded upper incisor that needs this versatility of MBT to be more protruded.

Stage of leveling and aligning in this case used sequence of NiTi (Nickel Titanium) Thermal round archwire started size 0.012, 0.014, 0.016, then continued with 0.016 x 0.016 wire in both arches. NiTi has the advantage of shape memory, with improved performance of the wire, especially during the leveling stage. To relieve the crowding, patient underwent IPR. IPR was done on each tooth, both anterior and posterior, in the upper and lower arch using a slicing bur. IPR is a procedure that can be employed during orthodontic treatment to offer extra intra-arch space in individuals who have lack of space in the dental arch is 4–8 mm and the patient refused to remove some of her teeth to relieve the severe crowding. IPR also has the benefit of reducing treatment time and preventing interdental gingival retraction. Several approaches that can be used to carry out the procedure are: (1) using fine tungsten-carbide or diamond burs to strip air rotors, (2) using diamond-coated stripping disks, or (3) using a hand-held or motor-driven abrasive strips.^{20,21} IPR of enamel involves the removal of outer enamel (0.3–0.5 mm) on the interproximal surfaces of teeth.

Arch compatibility was obtained with stainless steel wire size 0.016 x 0.022, and followed by 0.017 x 0.025 for finishing and detailing in both arches. Furthermore, up and down elastic was used to help correct the midline shifting and improve the interdigitation. Class II elastics were applied



Figure 4. Post-treatment extraoral photographs.



Figure 5. Post-treatment intraoral photographs.

for one month. Hereafter, the patient had passive stage for two months before debonding. The case was debonded after almost three years of active treatment; the crowding was corrected in both dental arches, followed by deep bite correction. Midline shifting was also corrected; the facial profile was still straight with an increase of the nasolabial angle (Figures 4 and 5). The cephalogram measurements also showed satisfactory results (Table 1, Figure 6); the skeletal relation was still class I and there were slightly protruded lower incisors. The final orthopantomogram of the patient showed the parallel roots (Figure 7). Maxillary and

mandibular Hawley retainers were placed after debonding. The patient was instructed to wear the retainers full time for 12 months and then at night only during a progressive phase-out of 12 additional months.

Moreover, non-extraction orthodontic treatment in Angle Class I Malocclusion with severe crowding, deep bite, and midline shifting is a complex case. To treat this case, an accurate diagnosis and appropriate treatment plan are needed to provide the best results for the patient. With good bracket selection and prescription, wire type and sequencing, leveling-aligning obtains satisfactory results.

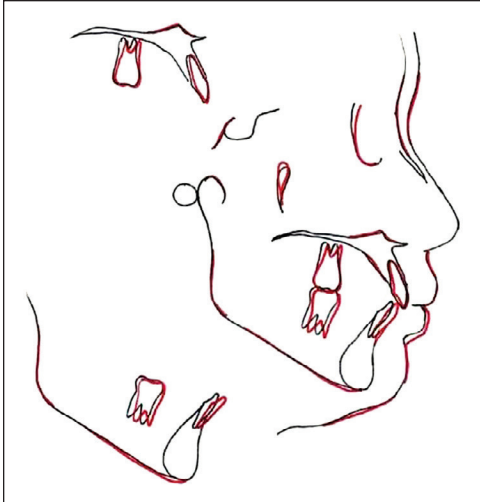


Figure 6. Superimposed pre-treatment (black) and post-treatment (red).



Figure 7. Patient's post-treatment orthopantomogram.

CONCLUSION

Generally, all treatment objectives were achieved successfully. In this case, we did not do extraction of any teeth and instead recommended IPR on each tooth to relieve the crowding in the upper and lower arches. In patients with Class I malocclusion and crowding, IPR is helpful. In the final phase of our treatment, we achieved a Class I molar and canine relationship and normal overjet and overbite. Deep bite and midline shifting were corrected, and the curve of Spee was flattened.

The choice of treatment plan, whether to extract or not to extract, is based on many factors such as: discrepancy, incisors inclination, profile, and skeletal problem. With combination of sequence wire and elastic, treatment goals could be achieved.

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Statement of Authorship

All authors participated in the data collection and analysis and approved the final version submitted.

Author Disclosure

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