IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)
e-ISSN: 2279-0853, p-ISSN: 2279-0861.Volume 14, Issue 11 Ver. III (Nov. 2015), PP 87-95
www.iosrjournals.org

Fixed and removable orthodontic appliance application for class III malocclusion with anterior locked bite

[1*]Mohammad Khursheed Alam, [2]Nor Fatiyah Che M Nasir,
[3]Kathiravan Purmal, [4]Shaifulizan Abdul Rahman
School of Dental Sciences, Health Campus, Universiti Sains Malaysia.
**Corresponding Author: dralam@gmail.com*

Abstract: *The patient was a 25-years-old Malaysian man whose chief complaints were unaesthetic appearance of the front teeth. A study model and radiograph were used to identify the problem and treatment options. Selection of the treatment options were explained to patient. However, bracket for fixed appliance cannot be attached to the teeth due to the anterior locked bite. Thus, removable appliance with posterior bite plane was use to raise the bite together with fixed appliance attachment. Although multiple appliances were used during treatment, the outcome was excellent which provide satisfaction to patient.*

Key words: *Class III malocclusion, locked bite, removable appliance, fixed appliance*

I. Introduction

Class III malocclusion is defined by Angle1 as "characterized by mesial occlusion in both lateral halves of the dental arches. The extent to which the mesial occlusion must exist in order to place the case in the occlusion of this class is slightly more than one-half the width of a single cusp on each side." [1]

Further study on class III malocclusion stated that it is associated with a deviation in the sagittal relationship of the maxilla and the mandible, characterized by a deficiency and/or a backward position of the maxilla, or by prognathism and/or forward position of the mandible.[2]

As diagnostic capabilities improved, cephalometric investigations have demonstrated that some adults who have Class III malocclusions do not lit this "classic" pattern. In fact, these investigations have shown that a Class III malocclusion can exist with any number of combinations of skeletal and dental components within the facial skeleton. Variations in the dentition with no underlying skeletal malrelationship can produce the malocclusion, as can a retruded maxilla and/or a protruded mandible.[3]

Components of class III malocclusion includes: (1) maxillary skeletal position, (2) maxillary skeletal position (3) mandibular dental position (4) mandibular skeletal position and (5) vertical development.[3] One obvious component of a Class III molar and canine relationship is the posterior positioning of the maxilla relative to other craniofacial structures. Another component of the Class III malocclusion is the position of the maxillary dentition relative to maxillary skeletal structures.[3] Studies have demonstrated that the upper anterior teeth are protruded in the majority of Class III cases.[4,5]

The position of the lower incisors relative to the mandible and to other structures of the face in adults with Class III malocclusion is well known. Retrusion of the lower incisors seems to be the rule in this malocclusion.[5] Mandibular skeletal protrusion is, if not the most prevalent feature, a prominent feature in the majority of the cases.[5] Much has been written regarding the nature of this mandibular protrusion. The question as to whether mandibular protrusion is in fact due to an excessive amount of growth or merely an alteration in the shape of the mandible has evoked some controversy.

Class III malocclusions have been divided into two basic morphologic types-the divergent and the convergent facial types. The expression of vertical proportions is most dramatic in the anterior part of the face, most notably in the lower anterior facial region. It was found that lower-facial-height values were greater in most cases.[4]

Little definitive information is available regarding anterior locked bite in class III maloclussion. This case report demonstrates the successful alignment of the teeth using removable and fixed orthodontic appliance to correct class III malocclusion with anterior locked bite. Challages was encountered to use both appliance in the same arch as it will has contributed to disruption of normal feeding. Thus, full compliance of the patient was mandatory.

II. Diagnosis and Aetiology

A 25-years-old male patient referred to orthodontic unit of Hospital Universiti Sains Malaysia (HUSM) with complaint of unaesthetics appearance of front teeth. The medical history was non-contributory. Orthodontic

treatment planning was carried out in consultation with an orthodontist regarding class III malocclusion with anterior locked bite.

Pre-treatment facial photographs **(Figure 1)** revealed a symmetric facial pattern with a convex soft tissue profile. Intraorally, all permanent teeth were erupted except for maxillary and mandibular third molars. Patient had an Angle Class III malocclusion with reverse overjet 2.5 to 3 mm and anterior crossbite. Edge to edge occlusion noted between tooth 12 and 42. There was presence of crowding of upper and lower anterior teeth with normal facial midline. Upper rotated high canine, 12 mesio-bucally rotated, 11 and 21 were retroclined, 31 and 41 were mesio-lingually rotated with over eruption. Posterior teeth were well-aligned **(Figure 2 and 3)**.

Orthopantomogram (OPG) showed presence of all permanent teeth except for impacted both mandibular and left maxillary third molars while maxillary right third molar was missing **(Figure 4)**.

Table 1 shows the cephalometric measurements of the present case. We performed Steiner's, Tweed's and some other measurements for the diagnosis and treatment planning. SNA and value was within the normal range and SNB and ANB showed increased and reduced value respectively, which indicates the skeletal class III relationship. Interincisal angle showed slightly increased value whereas U1 to NA and maxillary incisor to maxillary plane angle showed decreased value, which indicated retroclined upper incisor. Based on the cephalometric analysis, results suggested, retruded maxilla with normal mandible in class III skeletal relationship (<ANB). Maxillary incisors were retruded while normal inclination of mandibular incisors **(Figure 4)**. Lateral cephalogram tracing with various planes and angle of the Steiner and Tweed analysis drawn and measured are shown in figure 5.

III. Treatment Objectives

The objectives of the orthodontic treatment were to (1) to correct anterior locked bite and (2) to align maxillary and mandibular teeth.

Treatment Alternatives

Class III malocclusion is one of the most difficult anomalies to understand. Because not all Class III patients are candidates for surgical correction, patient assessment and selection remain main issues in diagnosis and treatment planning.[6]

Studies conducted to identify the etiological features of a Class III malocclusion showed that the deformity is not restricted to the jaws but involves the total craniofacial complex. Most persons with Class III malocclusions show combinations of skeletal and dentoalveolar components. The factors contributing to the anomaly are complex. They may act synergistically or in isolation, or they may cancel each other out.[7]

By means of stepwise discriminant analysis done, separation of adult Class III malocclusion patients who can be treated by orthodontic therapy alone from those who need orthognathic surgery was successful in 92% of the cases.[6] Thus, orthognathic surgery was not a common decision for correction of class III malocclusion. By further discussion to the patients, fixed and removable appliance was chosen to procline maxillary teeth. Upper removable appliance with posterior bite plane used after discing of tooth 13 and 23 followed by fixed appliance with Nickel titanium (NiTi) wire. Treatment pregress shown in **Table 2.**

Treatment results

The orthodontic fixed appliance was bonded using 0.022 MBT Preadjusted Edgewise Appliance with continuous arch wires, restarting with 0.012-inch nickel-titanium and working up to 0.017- × 0.025-inch stainless steel. Posterior bite plane used to raise the bite to unlock pathway of movement of upper incisors **(Figure 6)**. After application of fixed and removable appliance to patient, the malocclusion was successfully corrected by 19 months. All appliance was removed and Essix-form retainer was used for retention.

Active orthodontic treatment was completed in 19 months. Patient cooperation in maintenance of oral hygiene was moderate, and the examination after active orthodontic treatment revealed that the clinical status and radiographic results observed at the completion of the treatment was excellent **(Figures 7, 8, 9 and 10)**. Superimposition of the pre and post-treatment lateral cephalogram tracing shown in **figure 11**. The cephalometric superimposition done based on SN (Sella and Nasion) reference plane to see the overall changes. Maxillary plane and mandibular plane was used to see the changes in maxillary and mandibular incisor respectively. The results clearly shown in the cephalometric superimposition as proclination of maxillary incisor and slight retroclination of mandibular incisor to achieve normal overjet (**Figure 11**). Post-treatment cephalometric measurements also showed the changes in interincisal angle become decreased, U1 to NA and maxillary incisor to maxillary plane angle are increased (**Table 1**).

Patient was completely satisfied with the results of the fixed and removable orthodontic treatment. More then a year after debonding, the results were well maintained. Patient is still under regular follow-up. Follow-up clinical status showed satisfactory maintenance of accomplished treatments **(Figure 11 and 12)**.

IV. Discussion

In the Asian populations, the incidence of class III malocclusion ranges from 9% to 19% which relatively high to compare with white population that has been reported to be 1% to 5% and Latin populations, the incidence is approximately 5%.[8,9,10] Class III incisor relationship / anterior crossbite significantly affects facial aesthetics and the function of the stomatognathic system. This type of malocclusion has a tendency to worsen with age. Class III incisor relationship /anterior crossbite often present with a hypoplastic maxilla together with a hyperplastic mandible as well as along with or retruded maxillary incisor.

Thus, early treatment of the Class III malocclusion has been strongly recommended by many authors for the favorable results on growth and occlusal relationship.[11] Skeletal Class III malocclusion is reported to be the most frequent anomaly corrected by combined orthognathic surgery and orthodontic treatment.[12] However, soft tissue profile will be relatively variable, which can change in quantity and/or distribution under different conditions, including individual characteristics, nutrition, and age.[13]

In Orthodontics for the treatment of Class III malocclusion, different treatment mechanics are useful, which range from interception, for the patient at an early age, orthodontic-surgical management in adults. Orthodontic camouflage may be applied in certain cases as an alternative compensatory orthodontic management. The prime purpose of this is to favor satisfactory occlusion by dental compensations, however changes in facial esthetics are significant.

In this case, the maxillary central incisors are tipped backward. Moreover, the lower incisors hide the maxillary central incisors completely. This type of exaggerated vertical covering is called anterior locked bite. The maxillary left lateral incisors which are tipped forward unlike the central incisors. Retroclined maxillary incisors resulted an aesthetic impairement. This type of maloclusion has a strong genetic linkage.

In this report, fixed appliance alone was not indicated as patient was having anterior locked bite that cause minimal space for bracket adhesion. Thus, upper removable appliance with Adam's clasp on tooth 17 and 27 and posterior bite plane was used to increase the bite for alignment of teeth with fixed orthodontic appliance. Maxillary anterior teeth was proclined to achive Class I incisor relationships. Both appliance was used in the same time which required full compliance from patient. Thus this combined therapy to unlock the bite using upper removable appliance incorporate with posterior bite plane and fixed appliance for labial flaring of the maxillary incisors were done parallaly to achieve successful normal occlusion for better function and esthetics. However, non-surgical functional correction is difficult to achieve in adult patients given the completion of growth and development.

Both appliance was removed after the correction was achieved and Essix-formed retainer was used to prevent relapse. Skeletal relapse is the most common complication after orthognathic surgery while no surgery was indicated for this patient.[14] However, so far, the literature does not contain an accurate model to distinguish between adult Class III patients who can be properly treated by orthodontic mechanotherapy alone and those who require orthognathic surgery.[6] Etiology of Class III malocclusion are complex. Genetics also plays a major role.[15] Craniofacial morphology also varies population to population[16-20] specially in relation to Class III malocclusion.[21] The patient's compliance, esthetics, caries risk, function, and age should all be considered when deciding treatment options. A diagnostic setup model and radiograpgh were effective and important in determining the appropriate treatment plan. Nevertheless, the result was excellent.

During orthodontic treatment, special consideration must be given to force application, particulary its magnitude and duration in a dentition. Alignment of retroclined or crowded or malposed teeth should be an advantage to maintain proper oral hygiene. Patient cooperation in maintenance of oral hygiene was excellent. Orthodontic treatment also contributes to the promotion of oral health of the patient.

V. Conclusion

This case demonstrates successful treatment for class III malocclusion with anterior locked bite using removable and fixed orthodontic appliance. The mechanics was complex but the treatment was short thus providing better outcome and compliance to the patient.

Acknowledgement: USM short term grant (304/PPSG/61313103).

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Figure 1. Pre-treatment facial photograph

Figure 2. Pre-treatment intraoral photograph.

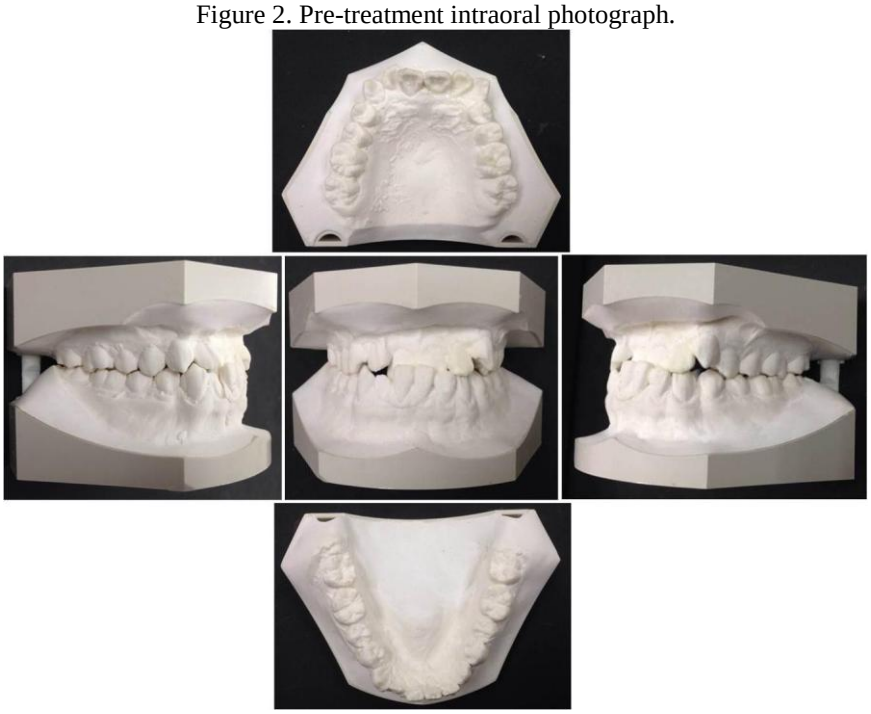

Figure 3. Pre-treatment model photograph.

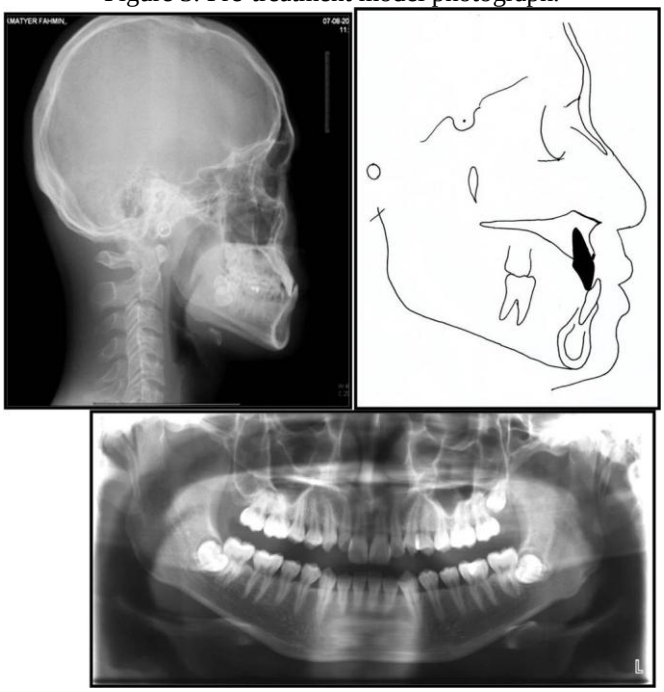

Figure 4. Pre-treatment lateral cephalogram and OPG.

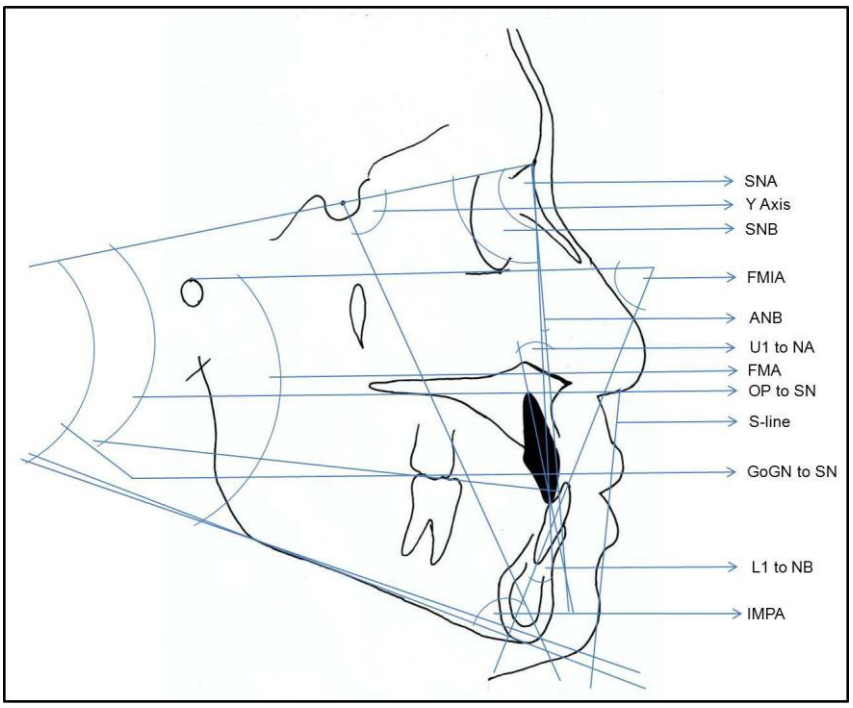

Figure 5. Lateral cephalogram tracing. Various planes and angle of the Steiner and Tweed analysis drawn and measured.

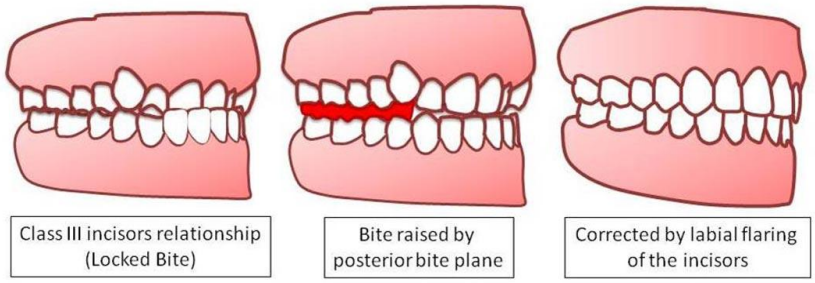

Figure 6. Posterior bite plane used to raise the bite to unlock pathway of movement of upper incisors.

Figure 7. Post-treatment facial photograph.

Figure 8. Post-treatment intraoral photograph.

Figure 9. Post-treatment model photograph.

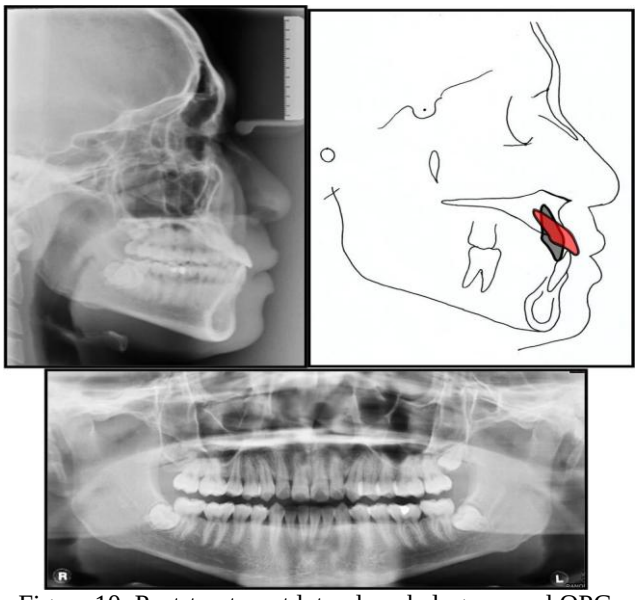

Figure 10. Post-treatment lateral cephalogram and OPG.

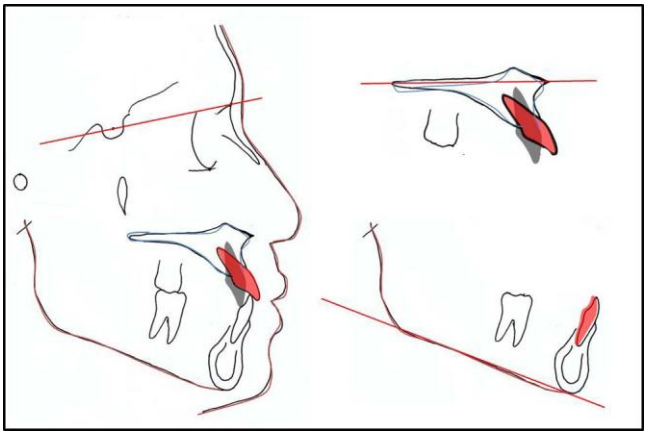

Figure 11. Superimposition of pre and post-treatment lateral Cephalogram tracing. SN plane was used as reference plane for over all changes. Maxillary plane and mandibular plane was used to see the changes in maxillary and mandibular incisor respectively.

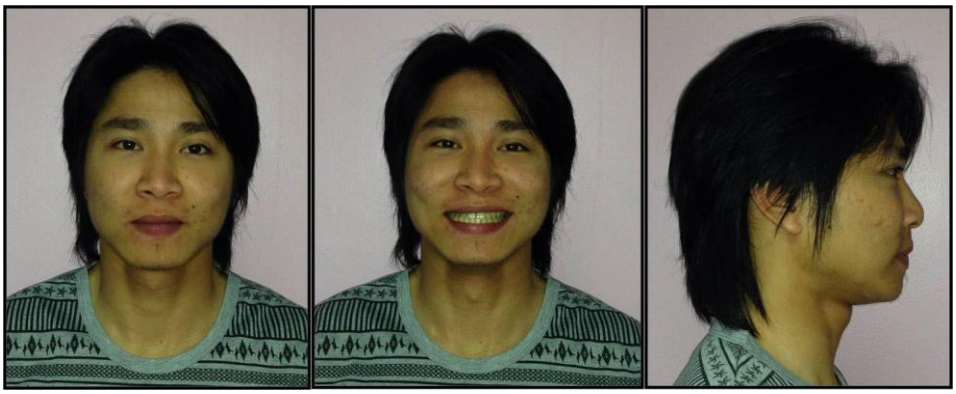

Figure 12. Follow-up facial photograph.

Figure 13. Follow-up intraoral photograph.

Table 1. Pre-treatment and Post-treatment cephalometric analysis

Variable	Pretreatment (^{0})	Posttreatment (^{0})
Steiner's Analysis		
SNA	81.5	82.5
SNB	**81.0**	**81.0**
ANB	**0.5**	**1.5**
Interincisal angle	**140**	**120**
U1 to NA	**17**	**27**
L1 to NB	24	23
OP to SN	15	15
GoGN to SN	33	33
Tweed's Analysis		
FMA	25	25
FMIA	64	65
IMPA	91	90
Others measurements		
Maxillary incisor to maxillary plane angle	**96**	**114**
Maxillary-mandibular angle	22	24
Facial Proportion	52	52

Table 2. Treatment progress.

Visit	Treatment	Arch wire Sequence	Action
1.	Brace set, URA with Post bite plane, 3-3 Discing. [Upper]	0.012 NITI	Levelling and Labial flaring
2.	Elastic module changed	0.016 NITI	Levelling and Labial flaring
3.	Elastic module changed	0.018 NITI	Levelling and Labial flaring
4.	Elastic module changed	0.017 × 0.025 NITI	Levelling
5.	Brace Set [Lower]	0.014 NITI [L]	Levelling
6.	Elastic module changed	0.017 × 0.025 NITI [U]	Levelling
	3-3 Discing.	0.016 NITI [L]	
7.	Elastic module changed	0.017 × 0.025 SS [U]	Alignment
		0.018 SS [L]	
8.	Elastics (Box + Diagonal)	0.017 × 0.025 SS [U and L]	Alignment
9.	3-3 Discing. Elastics Cont.	0.017 × 0.025 SS	Alignment
10.	Close Power Chain. Elastics for vertical interdigitation.	0.017 × 0.025 SS	Alignment
11.	Same Cont.	0.017 × 0.025 SS	Stabilization
12.	Same Cont.	0.017 × 0.025 SS	Stabilization
13.	Essix form retener set	Debond	Retention