

MANAGEMENT OF SEVERE SKELETAL AND DENTAL CLASS III MALOCCLUSION IN YOUNG GROWING CHILD

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Abstract

Management of severe Class III malocclusion in young growing child

Case report:

A 14-year-old male presented complaining of dissatisfaction with his appearance and requesting that his facial esthetics be enhanced by aligning his jaws. The clinical examination revealed Class III malocclusion mid face deficiency. Phase 1 treatment was carried out using Rapid Maxillary expansion combined with face mask to expand and protract the maxilla. This was followed by phase II treatment with fixed appliance to align and adjust the occlusion. The total time for active treatment was forty-two months. At the end of this time, esthetic and functional objectives were achieved meeting the expectations of the patient and his parents.

Key words: Class III malocclusion, early treatment, Face mask, Maxillary deficiency.

Hayder Hashim. Management of severe skeletal and dental Class III malocclusion.

CASE REPORT

Introduction:

Class III malocclusions are classified as being dental or skeletal. According to Edward Angle a dental Class III malocclusion defines the case where the lower first molar is positioned mesial relative to the upper first molar. A skeletal Class III, in contrast, was defined by the sagittal relationship of the maxillary-mandibular complexes arising from maxillary skeletal retrusion, mandibular skeletal protrusion, or a combination of both [1].

Clinically, when interference is encountered during intercuspation, the mandible may displace anteriorly. While avoiding the interference, this displacement increases the negativity of the overjet and decreases the anterior facial height, a condition referred to as 'pseudo Class III'. In young patients, this displacement is an indication for early interceptive orthodontic treatment. Intervention at an early stage in such cases precludes the development of facial asymmetry,

and the accompanying esthetic and psychological ramifications associated with overclosure of the mandible [1-3]. A pseudo Class III malocclusion is diagnosed when it is possible to guide the mandible into centric relation. This cannot be done in the case of a skeletal Class III. Young patients can be treated with a removable appliance incorporating a z-spring. In addition, cases with maxillary deficiency can be treated with a maxillary protrusion appliance (Dalre mask functional appliance) with or without rapid maxillary expansion. [4-6]

In the case of adult patients, camouflage treatment is achieved by proclining the maxillary incisors and retroclining the mandibular incisors with or without extractions. This treatment approach improves the occlusion. However, a drawback is the possibility of worsening the profile by increasing the prominence of the chin and detracting from the esthetics of the smile.[7]

The etiology of Class III malocclusion includes heredity (Hapsburg Royal Family) and environmental factors including anterior functional shifts of the mandible or mouth breathing in addition to pathologies (pituitary tumors responsible for acromegaly) [3,8].

Ellis and McNamara [9] reported the incidence of Class III malocclusions due to maxillary deficiency to be between 57% and 65% and stated that "Although there was considerable variation among patients, the most common combination of variables was a retrusive maxilla, protrusive maxillary incisors, retrusive mandibular incisors, a protrusive mandible, and a long lower facial height". Guyer *et al* [10] reported a lower incidence with 57% of the patients in their sample who displayed a normal or prognathic mandible also having a deficient maxilla.

Several studies have compared the prevalence of this condition amongst different races. Results varied from 5% to 8% amongst blacks, 4% to 14% amongst Asians and 4% to 15% amongst white race [11-13].

A variety of treating devices have been used in the management of Class III malocclusions Jamilian [14-15] *et al.* utilized a tongue appliance and concluded that a tongue plate might be an acceptable alternative to extra-oral appliances in Class III cases with maxillary deficiency.

Miniscrews have also been used in the treatment of this condition. [16-19].

One frequently used approach for correcting a Class III into a Class I relationship is premolar extractions combined with class III elastics or a temporary anchorage device for mandibular arch en-masse distalization.[20]

This case report aims to describe the successful treatment of a severe Class III malocclusion using a face mask with a rapid maxillary expansion screw and extraction of the mandibular premolars.

Cases History

A fourteen-year-old male presented to the orthodontic clinic seeking an enhancement of his facial esthetics and correction of his dental crowding. No facial asymmetry was detectable. On smiling in excess of fifty percent of the labial surfaces of the maxillary incisors were apparent, without gingival exposure.

Extra oral examination:

The face was oval with a concave profile due to maxillary retrusion; the nasolabial angle was slightly obtuse while the labio-mental fold was normal. (Fig 1).

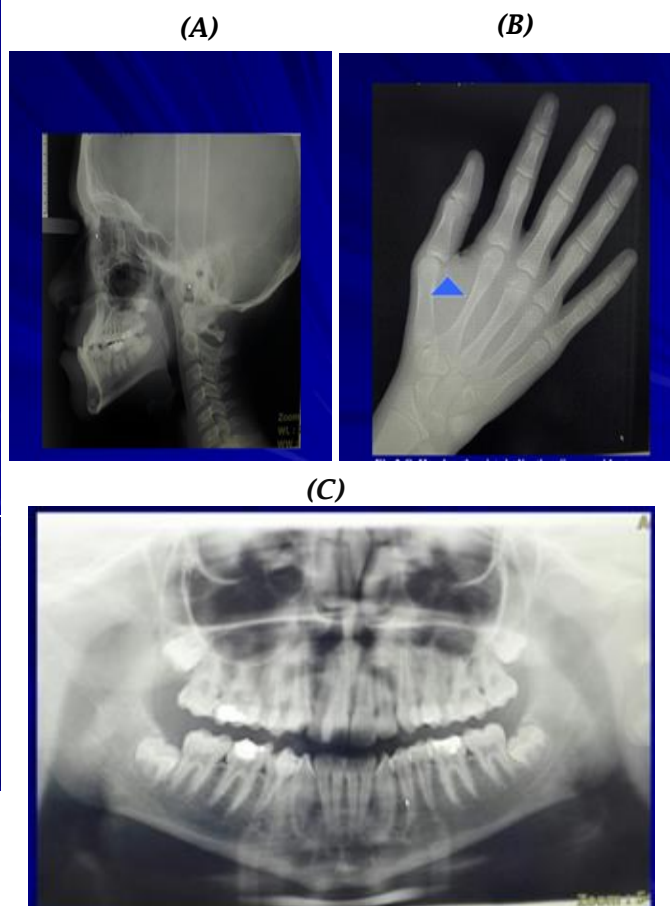
Intra oral view:

A complete dentition was present, including third molars. The maxillary arch was broad while the mandibular arch was parabolic in shape with a lingually inclined mandibular right second premolar. Both right first molars and the mandibular left first molar were heavily restored. A bilateral Class III molar and canine relationship was present with severe crowding in both jaws. The maxillary teeth from the right lateral incisor to the left lateral incisor were in crossbite (palatally displaced). Dental and facial midlines were coincident. Both overjet and overbite were negative. (Fig 1)

Fig 1. Pretreatment intra and extraoral view



Fig 2. Pretreatment (A) cephalometric, (B) Hand & Wrist radiograph and (C) orthopantomography



Radiographic examination:

Cephalometric analysis confirmed a skeletal Class III malocclusion (ANB -5) with severe retruded maxilla (SNA 73) and SNB (78) in the lower range of normal. Dental compensation was evidenced by proclination of the maxillary incisors (U1 to NA, 26) and retroclination of the mandibular incisors (L1 to NB, 20). The over jet and overbite were both negative. The facial index depicted decreased lower facial height (84) %. Soft tissue values indicate normal upper and lower lip relationship to esthetic line while the nasolabial angle was slightly obtuse (Fig 2 A). (Table 1).

Hand and wrist radiographs indicated that the patient was in the Sessamoid stage, suggesting that face mask should be used to harness growth. (Fig. 2B).

The Orthopantomogram (OPG) verified the presence of all permanent teeth including third molars. No pathology, neither of bone nor of dentition was observed; the appearance of the temporomandibular joint was normal, and the restorations appeared sound. (Fig.2 C).

Treatment objectives

The objectives of treatment were to improve the patient's smile and soft tissue balance, correct the anterior cross bite, and achieve a Class I canine relationship. Additional goals were to correct the over jet and overbite, relieve the severe crowding, and align the jaws while creating a stable functional occlusion.

Treatment Plan:

The treatment plan was discussed with the patient and his parents. It was decided to divide treatment into two phases in order to correct the skeletal discrepancies, achieve harmonious facial esthetics and a satisfactory functional occlusion. Phase I, would include the use of a face mask and rapid maxillary expansion to reduce the skeletal discrepancy. Phase II would involve fixed appliance therapy to align the arches and create a stable, functional occlusion and enhanced esthetics. Orthognathic surgery at the age of eighteen years was also discussed as an option

should the outcome not meet expectations. The parents declined this last option and agreed to extraoral appliance therapy and extractions. Written consent for their son to undergo the proposed treatment was secured prior to the commencement of treatment.

Treatment Progress:

Phase I: Preliminary Therapy:

Treatment commenced by cementing in place a Rapid Maxillary Expander (RME) appliance for use with a face mask. The aim of this was to gain space for the palatally displaced lateral incisors (12 and 22) and at the same time to advance the maxilla and correct the anterior cross bite. The patient was instructed to wear the face mask for a minimum of ten hours per day. (Figure 3)

Fig 3. Phase 1, Rapid maxillary expander combine with face mask.



Phase II: Fixed Orthodontic Appliance Therapy

Upon the creation of adequate space for the alignment of teeth 12 and 22 and alignment of the incisors into an edge to edge relationship, the rapid maxillary expansion appliance was removed. It was replaced with a modified Nance appliance which incorporated hooks in the canine region to allow continued use of the face mask. Subsequently, edgewise brackets (MBT Slot 0.022) were bonded onto the maxillary dentition. Tooth movement began with a 0.016 Nitinol arch wire for leveling followed by a 0.016 Stainless Steel arch wire (Figure 4).

Fig 4. Phase 2. Bonding both arches, extraction of 34 and 44 and, removal of RME Replaced by fixed anterior bite raising plate to disengage the bite for retraction of lower incisors to achieve positive overjet and over bite



Once the cross bite had been corrected, 0.017x0.025 Nitinol arch wire was inserted and subsequently followed by 0.016 Nitinol arch for re-leveling and alignment. Finishing was achieved with 0.018 x 0.025 stainless steel arch wire followed by 0.019 x 0.025 Nitinol arch wire. This is to get the maximum expression of torque and angulation build in the brackets. (Figure5).

Fig 5. Lower canines in Class I relationship, lower contraction arch to retract the Lower incisors to close the extraction space mesial to 33 and 43. Thus, achieve Positive overjet and overbite.



Prior to commencing treatment on the mandibular arch, the patient was referred for bilateral mandibular first premolar extractions. Upon completion of the extractions the mandibular arch was bonded. The arch sequence commenced with 0.016 Nitinol arch wire, 0.016 stainless steel, followed by 0.016 x 0.022 Stainless Steel. During this phase Nitinol Coil spring retractors were used to distalize the mandibular permanent canines (33 & 43) into a Class I relationship and then followed by 0.017x 0.025 Nitinol arch wire. The residual space created by the extractions was closed with a 0.018 x 0.025 Stainless Steel contraction arch which incorporated bull loops. It was activated to achieve a positive over jet and overbite by retraction of the mandibular incisor segment. 0.016 Nitinol arch wire was used for re-leveling and alignment and was followed by 0.019 x 0.025 Nitinol arch wire to finish and adjust the occlusion (Figure 6). Active treatment lasted 42 months.

Fig 6. Finishing stage. Both arches were aligned, and positive overjet and overbite were achieved. Midline were coinciding, class I canine relation, 12 and 22 cross bite was corrected.



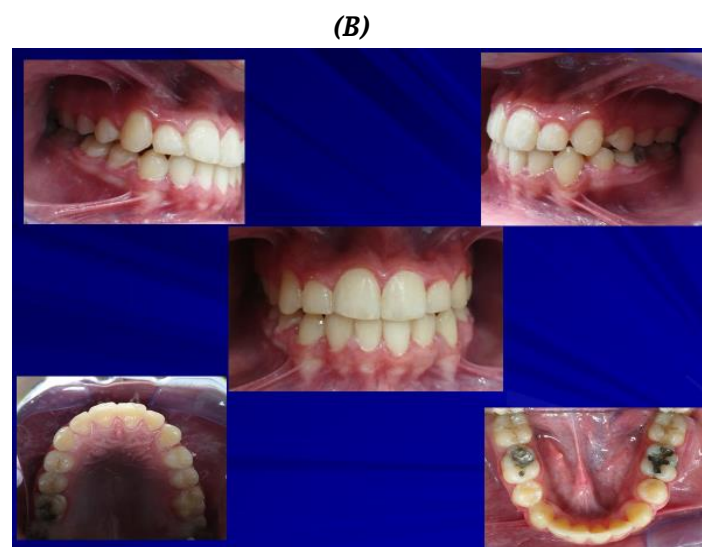
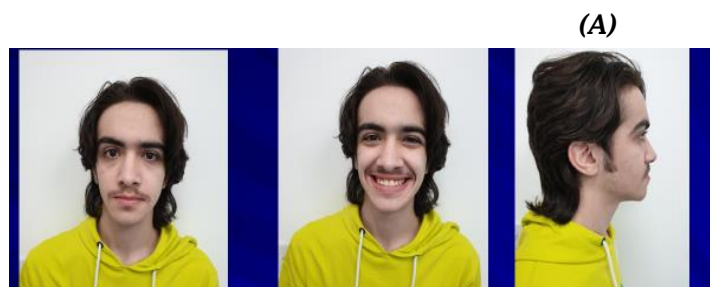
Upon achieving the treatment goals, both maxillary and mandibular brackets were debonded. Upper and lower alginate impressions were taken, and vacuum retainers fabricated, along with a removable Retractor appliance incorporating a lower labial bow resting labial to the lower incisors. The patient was instructed to wear the vacuum retainers throughout the day and the Retractor appliance at night the first year, except while eating, brushing, and engaging in contact sports. In the second year, wearing the vacuum retainers only in the night. (Fig 7 A, B, C) Recall visits will be every three months.

Treatment Results

At the end of forty two months, treatment resulted in the achievement of a positive over jet and overbite and a Class I canine relationship. The class III molar relationship was preserved

(Fig 7-10). The post-treatment cephalometric radiograph showed a favorable increase of 6° in the SNA and 3° in SNB angle. The vertical relationship suggested that there was a slight tendency towards an open basal configuration due to extrusion of the first molar. The dental relationship, on the other hand, exhibited improvement of the interincisal angle resulting from an increase in upper incisor inclination and lower incisor retroclination. The soft tissue relation indicated that there were no significant changes in upper and lower lip protrusion while there was slight increase in the chin prominence and reduction in the nasolabial angle. Table 1.

Fig 7. Patient after deboning (A) Extraoral, (B) Intraoral view without retainers and (C) ntraoral view with Vacuum form retainer and passive Retractor.



(C)



Fig 8, Posttreatment (A) orthopantograph and (B) cephalometric radiograph

(A)

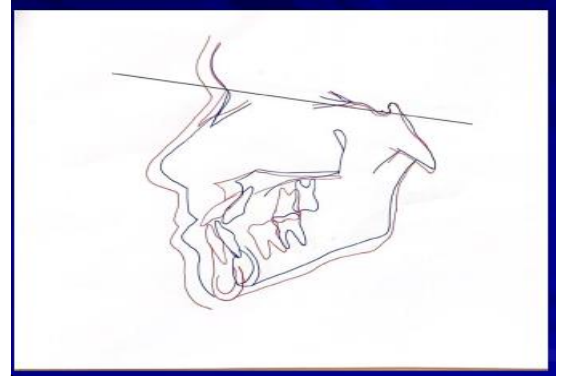


(B)

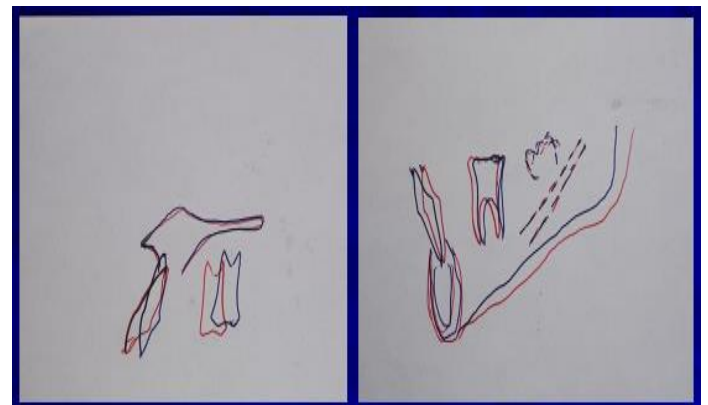


Fig 9, (A) Over all treatment changes and Dental changes in (B) maxilla and (C) mandible

(A)



(a)



(A)

(C)

Black colour: pretreatment

Red colour: After treatment

Fig 10. Early treatment of class III malocclusion using Retractor appliance



Table1. Pretreatment and post treatment values.

| Variables | Steiner Norms | Pre-treatment | Post-treatment |
|----------------------------|---------------|---------------|----------------|
| SNA | 82 | 74 | 80 |
| SNB | 80 | 78 | 81 |
| ANB | 2 | -4 | -1 |
| SNPog | 81 | 78 | 81 |
| N-S-Ba | 130 | 130 | 130 |
| SN Line - Maxillary Line | 8.5 | 15 | 16 |
| SN Line - Mandibular Line | 23.5 | 22 | 22 |
| Maxillary Mandibular angle | 32 | 37 | 38 |
| Ar-tgo-Me. | 126 | 127 | 126 |
| Upper incisor to NA Line | 22 | 26 | 30 |
| Upper incisor to NA Line | 4mm | 7 mm | 8 mm |
| Lower incisor to NB Line | 25 | 21 | 19 |
| Lower incisor to NB Line | 4mm | 5 mm | 4 mm |
| Interincisal angle | 130 | 113 | 131 |
| Facial index | 79% | 84% | 79% |
| Upper facial height | | 5.3mm | 5.5 |
| Lower facial height | | 6.3 | 6.9 |
| Upper lip to Esthetic Line | 2mm | 5 mm | 5 mm |
| Lower lip to Esthetic Line | 0mm | 0 mm | 0 mm |
| Naso-labial angle | 90 -110 | 125 | 115 |
| N-angle (Chin angle) | 57 | 67 | 69 |

Discussion:

The rationale for early intervention aims to avoid progressive and irreversible soft tissue or bony changes, improve skeletal discrepancies, provide a more favorable environment for future growth, and improve occlusal function.

The treatment of Class III malocclusions poses a challenge due to the multifactorial aetiology of the condition.[10]. Early intervention in the case of a skeletal Class III malocclusion is advisable in order to harness growth prior to consolidation (calcification) of the circumaxillary sutures. This will enhance growth in the deficient maxilla and diminish the need for complex surgical intervention in the future.

Multiple approaches exist for treating a Class III malocclusion. The simplest of these consists of using a removable appliance which incorporates a z-spring, or a functional appliance such as a chin cap or face mask. The latter has been used to treat Class III malocclusions attributed to a maxillary deficiency [4,5,15,21,22,] However, functional appliances such as these have their drawbacks: they are unsightly (e.g. Delare Mask), resulting in reduced patient compliance and a compromised outcome. Also, they may give rise to discomfort, although in the few patients where skin abrasions do develop, these can usually be overcome

without medication. [5,21,23]. This approach to treatment should only be considered in situations where the child displays favourable levels of growth and cooperation. This will increase the chances of a favourable orthopedic outcome, enhance the long-term stability of the case, and reduce the need for further complex intervention.[24] In moderate to severe cases, fixed orthodontic appliances with or without orthognathic surgery are indicated in order to correct the malocclusion, although most patients seek to avoid surgical intervention.[1.23]

Showkatbakhsh and Jamilian utilized a tongue plate appliance in the treatment of a 6-year-old girl with a skeletal Class III malocclusion due to a maxillary deficiency. They suggested that such an appliance may be a favourable alternative to extra oral appliances considering it being more readily acceptable to patients. In their report they pointed out that the appliance had the disadvantage of tipping the lower incisors lingually due to it eliminating tongue pressure on the lingual surfaces of the teeth, thus altering the neutral zone. They stated, this lingual tipping could be corrected after removal of the appliance. [25]

The tongue plate appliance mentioned in the previous paragraph was not applicable in this case report. This is attributed to the fact that the patient in this report was in the Sesamoid stage of growth when treatment was commenced, suggesting that half of the anticipated growth had already gone unharnessed, unlike the patient in the tongue palate case referred to. Since the maxillary sutures would already have been partially calcified, they would have needed to have been broken loose in order to protract or advance the maxilla. This was not the case in the Showkatbakhsh and Jamilian [25] patient, where the sutures were not yet calcified, and considerable pressure could be brought to bear upon the deficient maxilla.

Cephalometric data from the present case reveal that there were skeletal and dentoalveolar changes in the sagittal relationship between the maxilla and the mandible. Furthermore, changes in the inclination of the upper incisors were detected with resultant improvement of the interincisal angle, and the establishment of a normal over jet and overbite. Slight changes were detected in the naso-labial angle and vertical relation. Rabie *et al*

[26] conducted a study to compare the skeletal and dental changes contributing to the correction of Class III malocclusion using a 2 × 4 appliance versus reverse headgear in the mixed dentition. They concluded that 'there was a similar amount of over jet correction in the 2 × 4 and reverse headgear groups. Overjet correction by the simple fixed appliance was produced by dental changes whereas in the reverse headgear group, it was produced by both dental (60%) and (40%) skeletal changes". The findings of the present study are in line with previous reports in the literature [24, 27-29] and contradict others [30].

Cephalometric data from this case confirm a skeletal change in the sagittal relationship of the maxilla to the mandible in addition to an improvement of the interincisal angle achieved through an alteration to the inclination of the maxillary mandibular incisors. No significant changes were noticed in the naso-labial angle or vertical dimension. This is in accordance with previous reports in the literature [24,26-28] but contradicts the findings of Kwak *et a* [30].

Differential rates of growth between the maxilla and mandible have been implicated as the main cause of relapse in treated Class III malocclusions.[30] The successful outcome in the present case is attributed to early intervention utilizing orthopedic maxillary expansion with facemask therapy. This, along with compliance on the part of the patient, yielded significant improvement in skeletal, dental, and soft tissue domains.

Achieving a desirable degree of overbite, overjet, and favourable intercuspation all contributed to a successful outcome in this case. In addition to vacuum retainers, the patient was instructed to wear a retractor appliance at night (Fig 10). The retractor appliance incorporated a labial bow resting on the labial surfaces of the mandibular incisors. The goal was to restrict and control any residual mandibular growth and proclination of lower incisors. The patient was followed up at three monthly intervals until the cessation of growth.

The Retractor appliance is a simple modified Hawley removable appliance with a posterior bite plate and z- spring or screw used to tip the maxillary incisors labially. A mandibular labial

bow rests on the labial surfaces of lower incisors and prevents these teeth from tipping labially while at the same time restricting the mandible from protruding as mentioned earlier. It finds its application mostly in the early mixed dentition stage for patients with pseudo Class III malocclusions attributable to an anterior displacement of the mandible and lingual inclination of the maxillary central incisors. It is highly effective in achieving the correction of an anterior cross bite within 2 to 4 months and prevents gingival recession around the mandibular incisors arising from the lingually inclined central and lateral maxillary incisors. Fig 10 exhibits the outcome on a patient who was treated for four months with the Retractor appliance. It has the distinct advantage of being less bulky than the tongue plate advocated by Showkatbakhsh and Jamilian [25].

In light of the scant evidence in the literature regarding long-term stability of changes achieved using a face mask, further investigation applying cone beam computed tomography (CBCT) is indicated [31,32] The outcome of such studies will supply the orthodontist with valuable information applicable to diagnosis and treatment planning.

In the case of the patient being reported upon, both esthetic and functional goals were achieved, meeting the expectations of the patient and his parents.

Conclusions:

- 1) Early intervention in the management of a Class III malocclusion will reduce the complexity of the case and diminish the need for orthognathic surgery.
- 2) Achieving favourable intercuspation along with adequate degrees of overbite and overjet are essential for long term stability of the case.
- 3) Regular follow up and a compliant patient are mandatory for success and long-term stability.

Acknowledgment

The author would like to express his sincere appreciation to Dr. Keith AL-Pine for his help and support in editing the manuscript.

Financial support and sponsorship: Nil.

Conflicts of interest: There are no conflicts of interest.

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