Extraction vs Nonextraction Approach for Skeletal Class III in Growing Individuals: A Case Series

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ABSTRACT

Early treatment of skeletal class III becomes necessary in growing patients to prevent the future deterioration of the existing malocclusion and avoiding the complex orthognathic surgical procedures to correct the same. This case series explains two different treatment modalities for growing patients with skeletal class III malocclusion with anterior crossbite, who have differing degree of growth potential, growth pattern, facial profile, lip competency and strain, amount of skeletal discrepancy, and intra-arch relationships. The treatment goals have been achieved efficiently in each situation, due to prompt diagnosis and utilization of proper treatment mechanics.

Keywords: Extraction and nonextraction, Facemask, Fixed posterior bite plane, Growing patient, Skeletal class III.

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BACKGROUND

An efficient orthodontist makes use of the variety of treatment approaches such as the myofunctional, orthopedic, orthodontic, or surgical therapy to the fullest based on the growth potential of the patient and the proper diagnosis of the malocclusion, both dentally and skeletally.

Skeletal malocclusions either as a result of abnormal maxilla, mandible, or both is much complex to treat than the dental counterpart. Skeletal class III malocclusion describes abnormality in size and/or position of the jaws in sagittal plane. The malocclusion occurs due to retrognathic or small-sized maxilla and prognathic or large-sized mandible or combination of either of the two, resulting in a more aged look of the individual. These patients often present concave or straight facial profile depending on the severity of the malocclusion, prominent chin, and dentally with an anterior crossbite. The anterior crossbite in the earlier phases of development plays an important role in impeding the growth of the maxilla.

The skeletal class III can be either a true malocclusion or a pseudomalocclusion. The pseudo-class III is often associated with a functional shift of the mandible, pertaining to the habitual forward positioning of the mandible, as a result of prematurities in occlusion, enlarged or inflamed adenoids, and early loss of the deciduous dentition. These patients present as normal skeletal pattern in centric relation, but as class III in centric occlusion resulting in a centric occlusion—centric relation shift.¹

It is always necessary for the orthodontist to deliver the right appliance to the patient at the right time. If the growing phase of the child is not utilized to correct the developing malocclusion, then it will result in a more intricate and multifaceted malocclusion which can only be treated through surgical approach. The skeletal class III malocclusion with defect in the maxilla can be corrected to a comparatively less degree than the mandibular defect owing to the sagittal aspect of envelope of discrepancy. Also, it was found that skeletal class III malocclusion worsens more with age and earlier correction becomes vitally important.²

Also, accordingly the dental malocclusions should also be taken into considerations. Modalities such as arch expansion can be

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used to gain space and to bring the proper interarch relationships. Therapeutic extractions are multifactorial dependent and are done based on the growth potential of the patient, the amount of crowding present, type of dental malocclusion, Bolton's discrepancy, height of the lower third of the face, mandibular plane angle, the facial profile of the patient, and various other factors.

This article categorizes and compares two patients with extraction and nonextraction approaches for growing patients with similar skeletal malocclusion, but with a different growth potential. Proper diagnosing and treatment is necessary for carrying out the orthodontic therapy successfully and satisfactory both to the clinician and the patient.

CASE DESCRIPTION

Case 1

Diagnosis

A female patient aged 11 years reported with a complaint of forwardly placed lower front teeth. Extraoral examination of the patient revealed that the patient had mesocephalic head form, mesoprosopic facial form, concave facial profile, and anterior divergence. The lips were presented as potentially competent and the lower lip was more protruded than the upper lip. The clinical mandibular plane angle was average. The smile exposed 3 mm

of the upper incisor and 5 mm of the lower incisor. The intraoral examination revealed anterior crossbite in relation to 43, 42, 41, 31, 33, and lingually placed 32. Intra-arch relationships described crowding in relation to the maxillary and mandibular anterior teeth. Lower second deciduous molar on both sides were present during the first phase of the treatment. Class I molar relation and class III canine relationship were present on both sides. Class III incisor relationship pertaining to the anterior crossbite was present with a reverse overjet of 2 mm (Figs 1 and 2).

The cephalometric evaluation of the patient was summarized as class III skeletal base, retrognathic maxilla, and prognathic mandible with an average growth pattern. The soft analysis revealed protrusive lower lip, strained upper lip and acute nasolabial angle (Fig. 3 and Table 1).

The model analysis presented overall Bolton's excess in the mandible by 4.4 mm and the arch length—total tooth material

discrepancy showed of 6 mm in maxilla and 5 mm in the mandible, suggestive of crowding in both the arches and extraction of first premolar as inference from model analysis.

Treatment Objectives

- To correct the retrognathic maxilla.
- To achieve ideal intermaxillary relationship between the jaws and obtain class I skeletal pattern.
- To correct the anterior crossbite.
- To correct the crowding in relation to the upper and lower anteriors.
- To achieve ideal overjet, overbite, and obtain class I incisor relation.
- To correct the protrusive lower lip and the upper lip strain.
- To achieve pleasing esthetics smile.

Fig. 1: Pretreatment extraoral photographs—Case 1

Fig. 2: Pretreatment intraoral photographs—Case 1

Fig. 3: Pretreatment lateral cephalogram and orthopantomograph—Case 1

Table 1: Comparison of pre- and posttreatment cephalometric values of Case 1

Parameters	Pretreatment	Posttreatment
SNA angle	80°	87°
SNB angle	86°	86°
ANB angle	−6°	1°
GoGn to SN (MPA)	41°	45°
U1 to NA (angle, linear)	21° and 3 mm	25° and 4 mm
L1 to NB (angle, linear)	20° and 2 mm	28° and 4 mm
Upper lip to S line	−2 mm	0 mm
Upper lip thickness	13 mm	13 mm
Upper lip strain	17 mm	13 mm
Lower lip to H line	9 mm	3 mm

Treatment Plan

Since the growth potential of the patient was still available, the treatment was planned to be done in two phases, the first being the orthopedic phase followed by the second orthodontic phase. The orthopedic phase involved the use of reverse head gear or facemask therapy, alongside hyrax which was placed on the maxillary arch for loosening up the midpalatine sutures. This phase was aimed at correcting the skeletal discrepancies. The orthodontic phase involved the use of fixed appliance therapy, using McLaughlin, Bennett, Trevisi (MBT) prescription 0.022" slot metal brackets. This phase was followed to treat the dental discrepancies.

Treatment Progress

Bonded hyrax was fabricated using acrylic blocks on both the maxillary premolars and first molar on both sides. A hook was placed buccally on both sides to engage the extraoral elastics to the facemask (Fig. 4). Petit type of facemask was used, with the crossbar adjusted in a position of 10° to the occlusal plane. This was done with a motive to pull the maxilla downward and outward. The facemask therapy was continued for a period of 8 months (Fig. 5). At the end of orthopedic phase of treatment, the patient presented with corrected anterior crossbite and lateral deep bite dentally (Fig. 6).

Skeletally the retrognathic maxilla had been protracted, which was evaluated using the lateral cephalogram. Also, there was significant improvement in the patient profile. By the end of the orthopedic phase, the lower second premolars on both sides had erupted. The orthopedic phase was followed by the orthodontic phase in which 0.022" MBT brackets were bonded from second premolar of one side to another on both arches and first molars were banded (Fig. 7). It was not possible to achieve ideal overjet,

Fig. 4: Orthopedic maxillary expansion using bonded hyrax—Case 1

align, and level all teeth without extraction, considering the crowding present in both the arches. Therapeutic extraction of first premolars on all four quadrants was planned, keeping in mind the degree of dental malocclusion toward the anterior region of the arches (Figs 8 to 10).

Leveling and alignment was initiated from round 0.012" nickel-titanium (NiTi) to rectangular 0.019 × 0.025" NiTi wires. Space closure was done using friction mechanics (Fig. 11).

Treatment Results

At the end of orthopedic and orthodontic phases, the lateral cephalogram revealed that the skeletal class III had been transformed to skeletal class I with convex facial profile. The ideal overjet and overbite had been achieved, correcting the anterior crossbite. All the teeth were leveled and aligned after therapeutic

Fig. 5: Orthopedic facemask extraoral photographs—Case 1

Fig. 6: Postorthopedic appliance intraoral photographs—Case 1

Fig. 7: Fixed orthodontic treatment strap-up intraoral photographs—Case 1

Fig. 8: Fixed orthodontic treatment strap-up extraoral photographs—Case 1

Fig. 9: Post alignment and extraction intraoral photographs—Case 1

extraction of the first premolars. Space closure was done using friction mechanics on 0.019 × 0.025" stainless steel archwire. The patient had achieved an esthetically pleasing smile and there was significant improvement in the patient's facial profile (Fig. 12).

Case 2

Diagnosis

A female patient aged 15 years reported with a complaint of forwardly placed lower front teeth. Extraoral examination of the patient revealed that the patient had mesocephalic head form, mesoprosopic facial form, straight facial profile, and anterior divergence. The lips were presented as competent and the lower lip was slightly protruded than the upper lip. The clinical mandibular plane angle was low. The smile exposed 3 mm of the upper incisor and 6 mm of the lower incisor. The intraoral examination revealed anterior crossbite in relation to 43, 42, 41, 31, and 33. Intra-arch relationships described crowding in relation to the maxillary anterior teeth and spacing in relation to the mandibular anterior teeth. The patient complained of pain in the temporomandibular joint (TMJ) when she closes her mouth for longer duration. Class I molar relation and class I canine relationship were present on the right side. Class III incisor relationship pertaining to the anterior crossbite was present with a reverse overjet of 2 mm (Figs 13 and 14).

The cephalometric evaluation of the patient was summarized as Class III skeletal base with ANB (Point A-Nasion-Point B) of 1° (which is very minimal amount of interarch discrepancy), orthognathic maxilla, and prognathic mandible with horizontal growth pattern. The soft analysis revealed the protrusive lower lip and the retrusive upper lip, which was not strained (Fig. 15 and Table 2).

The model analysis presented overall Bolton's excess in the mandible by 2.9 mm and the arch length—total tooth material

Fig. 10: Post alignment and extraction lateral cephalogram and orthopantomograph—Case 1

Fig. 11: Space closure intraoral photographs—Case 1

Fig. 12: Space closure extraoral photographs—Case 1

Fig. 13: Pretreatment extraoral photographs—Case 2

discrepancy showed of -6 mm in maxilla and -5 mm in the mandible, suggestive of spacing in both the arches.

Treatment Objectives

- To correct the anterior crossbite
- To correct the spacing in relation to the upper anteriors and crowding in relation to the lower anteriors
- To achieve ideal overjet, overbite, and obtain class I incisor relation
- To correct the protrusive lower lip
- To maintain the straight facial profile of the patient
- To achieve pleasing esthetics smile

Treatment Plan

Since the growth potential of the patient was almost over, orthopedic or myofunctional appliances could not deliver effective results. Also, the minimal discrepancy suggested no necessity in correcting the skeletal malocclusion, but to maintain it. But it was necessary to correct the dental malocclusion to prevent further worsening of the skeletal malocclusion. Fixed mechanotherapy using MBT 0.022 inch slot was planned. The anterior crossbite was planned to be corrected by opening the bite, by means of

incorporating fixed bite plane. After the desired amount of overjet was achieved by leveling and alignment of the upper teeth, the posterior bite block was to be removed. Following which the settling of posterior occlusion, leveling, and alignment of the lower teeth would be done. The spacing would later be closed in both the arches.

Treatment Progress

0.022" MBT brackets were bonded from second premolar of one side to other side on both the arches and all the first molars were banded. Alongside, fixed bite plane was fabricated using acrylic. The bite block covered both the premolars and first molar on both sides of the lower arch. The bite blocks of either side were connected using 18-gauge heavy wire. This assembly was then cemented using glass ionomer cement onto the lower teeth. 0.014 NiTi wire was placed on the lower teeth, as there was no gross malalignment present. Leveling and alignment of the maxillary teeth was initiated from round 0.012" NiTi to rectangular 0.019 $\times$ 0.025" NiTi wires (Fig. 16).

The bite plane was removed and the overjet was checked. It was analyzed that the required amount of overjet had been achieved. It was no longer necessary to fix the bite plane again. The glass ionomer cement from the occlusal surfaces of the lower teeth was removed. The posterior occlusion was checked and it was noticed

Fig. 14: Pretreatment intraoral photographs—Case 2

Fig. 15: Pretreatment lateral cephalogram and orthopantomograph—Case 2

that there was no proper interdigitation in the posterior region. The force exerted by fixed bite plane on the teeth and added occlusal forces caused this discrepancy (Fig. 17). To correct this, lower 0.014" wire was segmented between the canine and first premolar on

both sides. The segment of first premolar, second premolar, and first molar were ligated to form a single unit and a segment of archwire was placed, followed by the eruption of the unit as a whole and attaining proper interdigitation for a period of 2 months. This was later followed by the leveling and alignment of the lower teeth till rectangular 0.019 × 0.025" NiTi wires. Space closure in both arches was initiated using friction mechanics on 0.019 × 0.025" stainless steel archwire (Fig. 18).

Table 2: Comparison of pre- and posttreatment cephalometric values of Case 2

Parameters	Pretreatment	Posttreatment
SNA angle	82°	86°
SNB angle	83°	87°
ANB angle	−1°	−1°
GoGn to SN (MPA)	25°	24°
U1 to NA (angle, linear)	20° and 2 mm	26° and 4 mm
L1 to NB (angle, linear)	27° and 6 mm	25° and 4 mm
Upper lip to S line	−2 mm	0 mm
Upper lip thickness	15 mm	14 mm
Upper lip strain	12 mm	13 mm
Lower lip to H line	4 mm	2 mm

Treatment Results

After the placement of the posterior bite block, the patient did not experience any TMJ pain and the issue had completely resolved thereon. After the alignment of the upper teeth, the overjet improved significantly from reverse to overjet of about 2 mm. The lateral cephalogram revealed that the skeletal class III had not been worsened and was maintained as that of pretreatment. The ideal overjet and overbite had been achieved satisfactory to the patient. Retrusive upper lip and protrusive lower lip had been corrected. The anterior crossbite had been corrected and the patient had an esthetically pleasing smile (Figs 19 and 20).

Fig. 16: Fixed posterior bite plane bonded to lower teeth—Case 2

Fig. 17: Postremoval of posterior bite plane, with posterior disocclusion present—Case 2

Fig. 18: Space closure intraoral photographs—Case 2

Fig. 19: Postremoval of posterior bite plane and correction of anterior crossbite extraoral photograph—Case 2

DISCUSSION

Earlier and prompt treatment of the skeletal class III in growing patient becomes an important requisite, as delaying the treatment would unfortunately worsen the condition and lead to orthognathic surgery.^{3,4} The skeletal class III malocclusion was attributed to differential growth between the maxilla and the mandible.⁵ The earlier treatment of developing skeletal class III with maxillary retrusion is necessary than that with mandibular discrepancy, because the mandibular growth ceases before the mandibular growth.⁶

The literature provides a wide range of treatment options for the developing skeletal class III malocclusion. From myofunctional appliances such as reverse bionator,⁷ double plate appliance with facemask,⁸ and modified tandem appliance,⁹ orthopedic appliances

such as chin cap therapy,¹⁰ mandibular cervical headgear,¹¹ facemask alone¹² and palatal expansion device with custom protraction headgear¹³ to fixed posterior bite plane,¹⁴ and anterior guiding plane¹⁵ along with fixed appliances. The various treatment modalities are planned based on the degree of growth potential present, the growth pattern, degree of skeletal malocclusion, facial profile and divergence, lip competency, lip strain, dental intra-arch and interarch relationships, habits, and other environmental factors.

This case series describes complex to simplified treatment mechanics for skeletal class III primarily based on growth potential and the fraction of dental discrepancies.

The first case described in this article is a patient with significant amount of growth potential available. The patient had concave facial profile, concerning the retrognathic maxilla and crowding in relation to both the maxillary and mandibular anterior regions along with anterior crossbite. Reverse headgear/facemask with hyrax was advocated to correct the retrognathic maxilla, owing to the amount of growth potential available. After attaining proper interarch relationship skeletally along with satisfactory facial profile, the dental malocclusion was treated. Therapeutic extraction of all first premolars was done to correct the anterior crowding, maintaining the class I molar relationship. Alignment and leveling was possible efficiently, followed by space closure, consummating the occlusion to be beau ideal situation.

Reverse headgear or facemask therapy is believed to be widely used modality in correcting skeletal class III, which can displace the maxillary apparatus anteriorly and stimulate its growth in the given direction.¹⁶ Foersch et al. emphasized that the use of maxillary expansion devices enhanced the maxillary development and also there was improved results in the sagittal effect, when facemask was used along with expansion devices, rather than facemask therapy used alone.¹⁷ This contributed to the fact that midpalatal expansion affects circum-maxillary sutures alongside the palatine sutures.

Fig. 20: Correction of anterior crossbite and space closure lateral cephalogram and orthopantomograph—Case 2

Menéndez-Díaz et al.¹⁶ studied the effectiveness of orthopedic facemask with maxillary expansion for treatment of skeletal class III in growing patients and he emphasized that skeletal changes were found to be stable for a period of 18 months alongside maintaining the overjet and molar relationship.^{18,19}

Case 2 describes a patient with minimum amount of growth potential available. The patient had straight facial profile with orthognathic maxilla and slightly prognathic mandible (SNB-83°). Spacing was present in relation to both maxillary and mandibular anteriors along with anterior crossbite. Fixed appliance therapy along with posterior fixed bite plane was advocated to correct the dental crossbite. Orthopedic appliances were not encouraged owing to the minimal growth potential available. After attaining proper interarch relationship dentally along with the maintained facial profile, the fixed bite plane was removed. The fixed bite plane had disoccluded the posterior interdigitation which were later brought into occlusion. The skeletal and dental molar relationships were maintained. Alignment and leveling was done followed by space closure, consummating the occlusion to be beau ideal situation.

Gawthaman et al. advocated the use of fixed partial appliances for correcting single tooth crossbite for growing patients. Fixed appliance proved to be simple and effective method in the treatment of incisor malocclusion, with not much laboratory cost and armamentarium used.¹⁴ The NiTi archwire used was majorly responsible in correcting the incisor relation and it is the masterpiece of the mechanic here. This was contributed to its superelasticity, shape memory property, and its ability to deliver continuous forces.^{20,21}

CONCLUSION

The treatment of class III skeletal pattern with dental angle's class I with Dewey's modification type III (anterior crossbite) in a growing patient is necessitated, bearing in mind its influence in aggravating the malocclusion and preventing the surgical approach to correct it in future.

The treatment is solely based on proper diagnosis and treatment planning, which may differ from complex modalities such as facemask with hyrax, posterior fixed bite plane to simple mechanics such as raising the posterior occlusion using glass ionomer cement or composite bonding onto the occlusal surfaces

of the posterior teeth. It becomes obligatory to decide which treatment to manoeuvre for particular circumstances of the patient.

Recent advances and combination of the available treatment mechanics along with expertise in diagnosis and planning the treatment can augment the success in treating skeletal class III in growing patients.

CLINICAL SIGNIFICANCE

It becomes mandatory to treat anterior crossbite and the developing skeletal class III malocclusion. This article emphasizes that early corrective treatment will prevent future mishappening of the existing scenario. The anterior crossbite would impede the maxillary growth, making earlier intervention indispensable.

This article provides an outlook on earlier treatment of patients with skeletal class III with dental angle's class I with Dewey's modification type III, differing on extraction and nonextraction bases.

These case reports deliver an idea on treatment of skeletal class III with anterior crossbite using posterior bite plane for individual with minimum growth potential and using facemask with hyrax for individual with considerable amount of growth potential present.

Also, these reports provide insight into indications of extraction and nonextraction for growing individuals to achieve at the desirable treatment results. Also, brief influence of the factors contributing in aggravating the skeletal malocclusion and the factors affecting treatment plan is also explained.

Meticulous diagnosis and treatment planning is necessary for the orthodontist in delivering efficacious end results, satisfactory, and acceptable to the clinician as well as the patients.

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