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Integrative Conservative Treatment for Class III Malocclusion: A Clinical Perspective

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ABSTRACT

An 18-year-old male sought orthodontic consultation due to dissatisfaction with the appearance of his upper front teeth, which were positioned behind the lower incisors, resulting in posterior dental compression. Cephalometric analysis revealed a retruded maxilla with a downward and backward mandibular rotation, leading to an anterior crossbite. Treatment began with a rapid maxillary expander and face mask to correct the maxillary crossbite. Posterior bite ramps were placed on the lower first molars to disengage the bite, facilitate crossbite correction, and prevent upper molar extrusion during expansion and forward movement of the upper incisors. This was followed by comprehensive fixed orthodontic treatment using the 0.022 MBT system. Utilizing a rapid maxillary expansion device combined with a face mask a simple and easily adjustable appliance enabled the patient to achieve a functional occlusion and an improved facial appearance, thereby enhancing self-esteem and confidence.

Keywords

Class III malocclusion, Conservative treatment, Orthodontic.

Introduction and Review of Literature

Class III malocclusion poses a significant challenge in orthodontic treatment due to its complex and variable nature. Important factors in treatment planning include deciding between extractions or non-extraction approaches and determining whether the patient is still growing. For growing patients, orthopedic or functional appliances can address skeletal discrepancies early, while adults may require a combination of orthodontic treatment and orthognathic surgery to achieve optimal aesthetic and functional outcomes.

Class III malocclusion, according to Angle's classification, is defined by a mesial positioning of the lower first molar relative to the upper first molar [1,2]. This malocclusion, often described as a "reverse bite," occurs when the lower jaw (mandible) is positioned forward relative to the upper jaw (maxilla), leading to both aesthetic and functional concerns. It may result from a skeletal discrepancy (e.g., a large mandible, a small maxilla, or both) or a dental relationship where the lower teeth are positioned ahead of the upper teeth.

The etiology of Class III malocclusion is frequently hereditary, as observed in the Hapsburg family, and influenced by environmental factors such as anterior mandibular shifts and mouth breathing. Certain pathologies, such as acromegaly, can also contribute to its development [3,4]. Ellis and McNamara's study of 302 adults with Class III malocclusion identified a common pattern of retrusive maxilla, protrusive mandible, and long lower facial height, although individual variation was noted [5]. Additionally, Guyer et al. reported that many Class III cases exhibit maxillary deficiency [6].

Class III malocclusion encompasses skeletal and dental variations, often presenting as mandibular protrusion, maxillary retrusion, or a combination of both, without always showing a distinct skeletal anteroposterior discrepancy [7]. Daniel et al. highlighted racial and geographic differences in the prevalence of Class III malocclusion,

with higher rates found in Chinese and Malaysian populations compared to lower rates in Indian populations [8]. Studies suggest prevalence rates of 1-4% in White populations, 5-8% in Black populations, and 4-14% in Asian populations [9-11].

Advancements in imaging technology, such as cone-beam computed tomography (CBCT), have significantly improved the diagnosis of Class III malocclusion. CBCT provides detailed 3D imaging, allowing for accurate differentiation between skeletal and dental forms of Class III malocclusion, thus enabling more precise treatment planning. Despite its advantages, CBCT usage is limited due to concerns over radiation exposure, especially in pediatric patients. However, ongoing improvements in CBCT technology, including better detectors and adjustable collimation to reduce radiation exposure, aim to enhance its safety and effectiveness in orthodontic practice [12]. When treating Class III malocclusion, assessing the patient's growth status is crucial for determining the appropriate treatment approach. Treatment options vary based on the patient's age, the severity of the malocclusion, and whether the issue is skeletal or dental. For growing patients, orthopedic appliances such as face masks or reverse-pull headgear are often used to encourage maxillary growth or limit mandibular growth. Functional appliances like the Frankel III or modified protraction devices can support favorable growth in mild skeletal discrepancies. Expansion appliances, such as rapid maxillary expansion (RME) combined with protraction headgear, can address maxillary deficiencies.

For non-growing patients, orthodontic camouflage involves using braces and elastics to mask mild skeletal Class III discrepancies, typically by retracting lower teeth or advancing upper teeth. Extraction of lower premolars may be indicated to help retract lower anterior teeth in mild to moderate cases, provided that facial aesthetics are maintained. For severe skeletal discrepancies, orthognathic surgery, often combined with orthodontics, may be required to achieve optimal results. Treatment strategies vary based on the age and severity of the malocclusion. For mild-to-moderate discrepancies, orthodontic treatment alone may suffice [13-15].

Nikia et al. noted that camouflaging Class III malocclusion can involve maxillary incisor proclination and mandibular incisor reclination, improving dental occlusion but not addressing the underlying skeletal issues. Significant dental and soft-tissue changes can occur with careful planning in young patients to avoid negative outcomes [16].

Westwood et al. conducted a cephalometric study to assess the long-term effects of RME and facemask therapy in Class III patients. Their findings suggest that aggressive over-correction toward a Class II occlusal relationship, with the establishment of positive overbite and overjet, supports long-term treatment stability [17]. Similarly, Huynh et al. (2020) studied the long-term stability of RME/FM therapy in Class III malocclusion patients, noting that while improvements in maxillary position are achieved in the short term, these changes may not be fully maintained over time due to skeletal relapse. These studies emphasize both the benefits and limitations of RME/FM in early intervention, particularly concerning long-term stability [18].

Yuyao et al. compared the effectiveness of maxillary protraction with a modified Alt-RAMEC protocol to traditional methods for early treatment of skeletal Class III malocclusion. Their results indicated that the Alt-RAMEC/FM approach led to significantly greater maxillary advancement and superior skeletal correction of overjet without substantial mandibular rotations, highlighting its efficacy in early Class III treatment [19].

Case Report 1

An 18-year-old male patient sought orthodontic consultation due to dissatisfaction with the appearance of his upper front teeth, which were positioned behind his lower incisors, causing compression of his posterior teeth. Extraoral examination revealed no visible facial asymmetry; however, the mandible was protrusive, and the profile appeared concave. Upon smiling, more than half of the clinical crown height of the maxillary incisors was visible without gingival display (Figure 1).

Figure 1: Extraoral view.

Intraoral examination, exhibited the patient had a complete dentition, including third molars. A Class III incisor relationship was present on both sides, with a severely narrow (v-shaped) maxillary arch. Both sides of the maxillary teeth were in crossbite, with the dental and facial midlines aligned. Negative overjet and overbite were observed on both sides. The lateral incisors were positioned palatally and both canines were displaced buccally. Mild crowding was also noted in the mandibular arch. Written consent was obtained from the patient prior to treatment initiation and publication of this report (Figure 2).

Figure 2: Intra oral view before treatment.

Radiographic Examination

The OPG radiograph showed all permanent teeth were present. The lower right and left third molars were impacted (Figure 3).

Figure 3: Panto-mograph before treatment.

The cephalometric radiograph demonstrated a retruded maxilla and while the mandible is rotated downward and backward. Anterior cross bite was evident due to the maxilary retrusion (Figure 4).

Figure 4: Cephaograph before treatment.

Introductory Treatment

Treatment commenced with the cementation of Rapid maxillary expander and face mask to correct the cross bite in the maxillary arch. lower posterior bite ramps were done on lower right and left first molars to disengage the bite and allow cross bite correction and prevent extrusion of upper first molars during expansion (Figure 5 & Figure 6).

Figure 5: Introductory treatment: RME + Face mask to expand the maxilary arch and maxillary protraction.

Leveling Phase

Upper Arch

Subsequently, edgewise brackets (MBT Slot 0.022) were placed on all maxillary teeth and 0.014, 0.016 Nitinol arch wire was ligated for leveling and alignment of the upper arch Once cross bite correction was achieved, refer for extraction of upper right first premolar (14) to give space for buccally displaced upper right canine (Figure 7a and Figure 7b).

Figure 6: Diastema opened after 2 weeks of activation.

After extraction of 14 done, power chain was placed from 13 to 16 to redirect the 13 moved distally. When 13 in position 0.012 nitinol arch wire was ligated to pull 12 labially out of the cross bite (Figure 8). When 12 in place, an 0.016 ss arch wire was ligated + class 3 elastic 3/16 4.5 OZ and class 2 elastic on right side to move 15 and 13 mesially to achieve class I canine relationship. (25/1/2022), and also to correct upper midline deviation. 0.017x0.025 nitinol arch wire followed by 0.018x0.025 nitinol wire.to relevel and aligned both arches (Figure 9).

Lower Arch

The lower arch was bonded. The arch sequence started with 0.016 nitinol arch wire, and continued with 0.016 stainless steel, 0.017x 0.025 nitinol and 0.018x0.025 nitinol then 0.019x0.025 nitinol (Figure 8).

Figure 7a: Leveling phase right and left buccal segment + front view.

Figure 7b: Leveling phase upper and lower arch.

Movement Phase

Figure 8: Movement phase, power chain to distalize upper right canine after extraction of 14. And to distalize upper left permanent canine.

Figure 9: Class 2 elastic on left and class 3 elastic on right side 3/16 4.5 OZ.

Adjustments Phase

Upper and lower 0.016 nitinol combined with vertical triangle elastic 3/16 4.5 OZ and class 2 elastic on left side while on the right side, triangle elastic 3/16 OZ and class 3 (Figure 10).

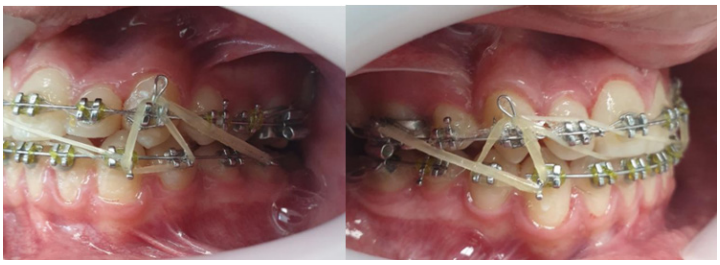

Figure 10: Vertical elastics to adjust the occlusion on left and right side.

Finishing Phase

The finishing arch was 0.019x0.025 nitinol in both arches (Figure 11).

Figure 11: Finishing phase. Correction of midline in upper arch class 2 on left side and class 3 on right side

Result After Treatment

When all treatment objectives had been achieved, both arches were de-bonded (Figure 12a, 12b and 12c).

Figure 12a: Extraoral view after treatment.

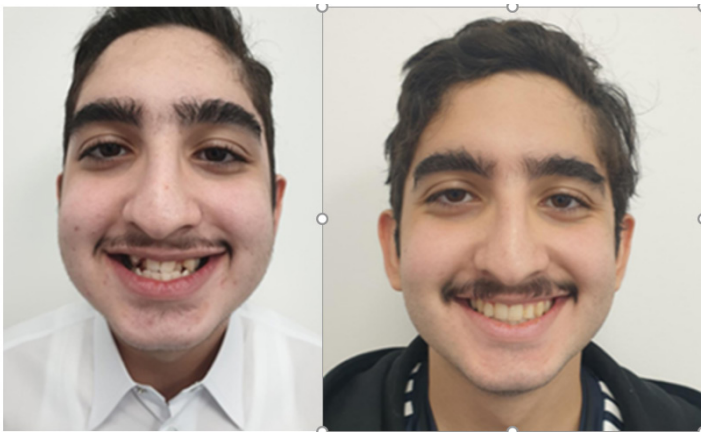

Figure 12b: Extraoral front view before (left) and after treatment (right). Notice improved smile.

Figure 12c: Intra oralview after Ddbonding upper and lower arch.

Retention Phase

Upper and lower Hawley retainers were given; the patient was instructed to wear these continuously during the first year (except when eating or drinking hot drinks), and at night only throughout the second year (Figure 13). Figure 14a, and 14 b showed the posttreatment radiographs.

Figure 13: Upper and lower Hawley retainer.

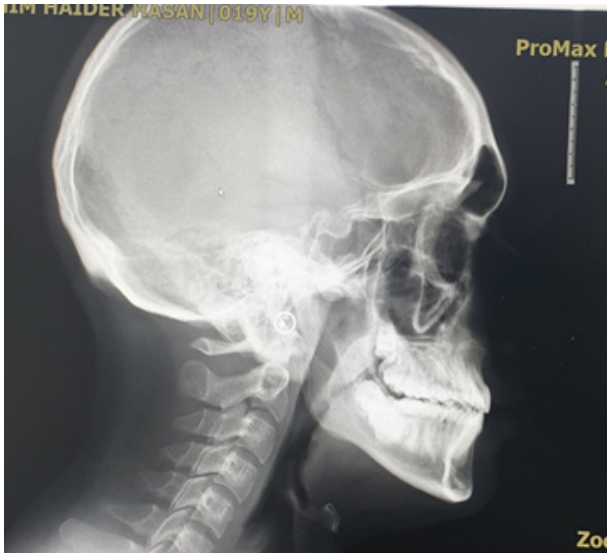

Figure 14a: Post treatment cephalometric radiograph.

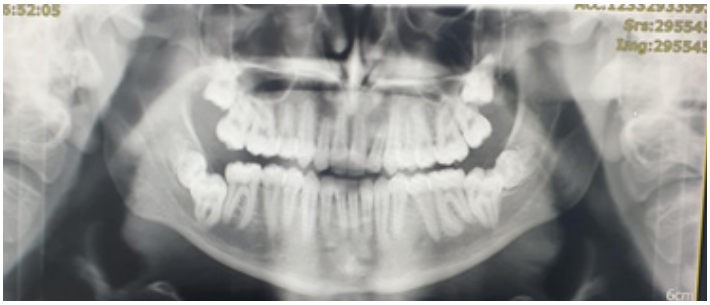

Figure 14b: Post treatment OPG radiograph.

Result

Table 1: Before and after treatment result according to Steiner's analysis.

Variables	Mean	SD	Before treatment	After treatment
Sagittal relation				
SNA	81.77 deg	3.6	79.82 deg	80.68 deg
SNB	90.42 deg	3.1	81.45 deg	81.57 deg
ANB	2.05 deg	1.8	-1.63 deg	-0.89 deg
Vertical relation				
SN-MAX. LINE	8 deg	3	6.36 deg	8.93 deg
SN-MAND. LINE	32 deg	4	28.63 deg	29.76 deg
MAX-MAND. LINE	27 deg	5	22.27 deg	20.83 deg
Ar -Go-Me	122.38 deg	4.9	124.90 deg	127.01 deg
Dental relation ship				
UI -NA ANGLE	22 deg	5	25.95 deg	29.41 deg
UI-NA MM	4 mm	3	5.26 mm	3.48 mm
LI – NB ANGLE	25 deg	5	17.31 deg	21.93 deg
LI – NB MM	4 mm	2.	0.42 mm	3.45 mm
UI -LI ANGLE	130 deg	5.8	138.36 deg	129.54 deg
Soft tissue relation				
UL-E-LINE	-4.7mm	2	-9.97 mm	-6.24 mm
LL-E-LINE	-2 mm	2	-5,48 mm	-2 mm
NASOLABIAL ANGLE	95 deg	5	82.19 deg	84.76 deg

Table 1 show the changes in the different angular and linear measurement before and after orthodontic. treatment.

Sagittal Skeletal Relationship: Before and After Treatment, Based on Steiner's Analysis

The Treatment Aimed to Address

a **skeletal Class III malocclusion** characterized by a retrusive maxilla and mandible. Post-treatment, there was: - Slight forward movement of the maxilla (SNA). - Minimal improvement in mandibular position (SNB). - Improved maxillary-mandibular balance, as seen in the less negative ANB angle.

Vertical Skeletal Relationships Before and After Treatment

Maxillary Positioning: a) Maintained within normal limits with minor adjustments in upward orientation. b). Mandibular Adjustments: Counterclockwise rotation reduced vertical facial height, improving skeletal balance. c). **Maxilla-Mandibular Relationship: Decreased angles indicate improved vertical interrelation and alignment. d). **Posterior Facial Proportions: Slight changes in Ar-Go-Me angle reflect improved facial aesthetics and functional relationships.

The Dental Relationships Changes of the Upper and Lower Incisors Relative to Skeletal and Soft Tissue Landmarks

a). Upper Incisors: - Tend to show mild proclination based on the angle values, though the linear measurements suggest they are within acceptable limits. b) Lower Incisors: - Appear more upright or slightly retroclined, with the angle and linear measurements reflecting potential lingual positioning in some cases. c). Interincisal Relationship: Displays variability: one scenario suggests excessive upright incisors (increased interincisal angle), while the other aligns closer to the standard norm.

Soft Tissue Changes Before and After Treatment

Both lips are retrusive compared to the E-line, with a more pronounced retrusion in the upper lip. - The increased nasolabial angle supports the retrusive upper lip findings.

Discussion

An anterior cross-bite can significantly affect both facial aesthetics and function, with severity often increasing if early treatment is not provided. This can lead to gingival recession of the mandibular incisors. Treatment options for Class III malocclusion include approaches with and without extractions, sometimes involving premolars or mandibular incisors, depending on individual cases. For severe skeletal discrepancies, surgical correction may be necessary due to the complexity of management and the high risk of relapse [20]. In this case report, the patient, satisfied with his facial appearance, declined orthognathic surgery. However, a non-surgical treatment plan still achieved successful results.

To correct the cross-bite, a fixed Rapid Maxillary Expander (RME) was applied in combination with a face mask to protract the maxilla. Within two weeks, a diastema developed between the upper central incisors, indicating successful opening of the palatal

suture and forward movement of the maxilla, which corrected both the anterior and buccal cross-bites. Maxillary expansion also created space to align the right and left lateral incisors, but to properly align the upper right canine, extraction of the upper right first premolar was necessary. This approach differs from that of Wissam et al., who used RME with a face mask and an open coil spring, combined with mandibular incisor extraction, to address an anterior cross-bite in a 43-year-old patient with skeletal and dental Class III malocclusion [3]. Marcel et al. treated a similar case with mini-implants and an open coil, finding mini-implants effective for distal tooth movement in a Class III patient who declined surgery [21]. In this case, Class I molar and canine relationships were achieved without mini implants, resulting in proper overjet and overbite. Liu et al. have highlighted that early intervention often facilitates edge-to-edge occlusion of the anterior teeth, likely due to adjustments in masticatory muscles [22]. Some clinicians advocate using a lower removable bite plate to prevent molar extrusion and to reduce temporomandibular joint stress by disengaging the bite, allowing smoother movement of cross-bite teeth. However, in this case, bite ramps were used instead, as they were more convenient for the patient, studies have noted that anterior cross-bite patients often exhibit altered condylar positioning, which early treatment can correct [23,24]. Although this patient's treatment was somewhat delayed, no facial asymmetry or gingival recession was present.

The treatment corrected incisal inclination and established stable canine and molar occlusion. Despite only one upper premolar extraction to create space for the buccally displaced upper right canine, a Class I relationship and Class II molar relationship on the right side, as well as a Class I canine and class 1 molar relationship on the left side, were achieved.

Maintaining upper and lower midline alignment with the facial midline was a key consideration, and this alignment was successfully achieved. Overall, functional occlusion and aesthetic appeal were improved, which helped prevent risks like tooth loss, gingival recession, and bone loss often associated with severe anterior cross-bite. Achieving stable intercuspation, overjet, and overbite is crucial for sustaining outcomes in Class III malocclusion cases [25]. Although minor relapse occurred in the lower arch despite consistent retainer use, research indicates maxillary vacuum form retainers have a failure rate of 10% over two years and up to 17% within six months due to insufficient occlusal force distribution. To enhance stability in this case report, a fixed retainer was applied between the upper right second premolar and canine, which helped prevent extraction space reopening and distal canine movement, thereby preserving stable occlusion. On the other hand, upper and lower Hawley retainers were also used, which the patient preferred over vacuum retainers, as Hawley retainers support tooth settling. Dalya et al. and others found limited evidence supporting one retainer type over another concerning periodontal health, risk of failure, and cost-effectiveness [26,27].

For slight cross-bite cases without mandibular shift, stability can be enhanced through maxillary expansion, though a one-third relapse rate is common. A minimum of three months of retention, using either fixed or removable retainers, is recommended to minimize relapse [28,29]. Baccetti et al. found early cross-bite intervention usually results in better outcomes, while untreated posterior cross-bite can lead to skeletal changes, necessitating more complex treatments [30,31]. The approach taken in this patient provided good functional occlusion and an aesthetically pleasing smile, greatly enhancing the patient's quality of life, self-image, and confidence all achieved without surgical intervention. The patient was referred for removal of all third molars which will allow self-eruption of mesially inclined 37 and 47.

Summary of Clinical Implications:

1. **Sagittal Skeletal Relationships** Moderate improvements indicate progress toward correcting sagittal discrepancies, aiding skeletal balance.
2. **Vertical Skeletal Relationships** Enhanced vertical harmony, including mandibular counterclockwise rotation and reduced vertical angles, benefits facial aesthetics and occlusal function, particularly in cases with excessive facial height or vertical growth tendencies.
3. **Dental Relationships**. Upper Incisor Proclination**: May enhance aesthetics but could strain lip closure. **Lower Incisor Retroclination**: Might reduce lip support and impact occlusal harmony. **Interincisal Angle Variability**: Reflects individual differences influencing occlusion, speech, and aesthetics, with treatment tailored to the skeletal pattern and facial aesthetics.
4. **Soft Tissue Changes**. May reveal underlying skeletal discrepancies, such as retrognathism or maxillary hypoplasia. Post-treatment changes might indicate profile flattening due to orthodontic retraction.

Conclusion

The approach outlined in this report highlights the effectiveness of treating adult patients with Class III malocclusion without resorting to surgical intervention. Utilizing a rapid maxillary expansion device combined with a face mask a simple and easily adjustable appliance enabled the patient to achieve a functional occlusion and an improved facial appearance, thereby enhancing self-esteem and confidence.

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