

Non surgical Orthodontic Camouflage of Skeletal Class III Subdivision Malocclusion with Functional Mandibular Shift Secondary to Occlusal Interference in a Post-pubertal Patient: A Case Report

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ABSTRACT

Skeletal Class III malocclusion is one of the most challenging conditions in orthodontics owing to the complexity of the skeletal, dentoalveolar, and soft-tissue components involved. It could be caused by maxillary hypoplasia, mandibular prognathism, or both, and will commonly be associated with anterior crossbite, facial asymmetries, and occlusal disharmonies. Class III malocclusion management in post-pubertal patients becomes more complicated since skeletal development would already be completed. Orthognathic surgery is often regarded as the ideal treatment modality for post-pubertal skeletal Class III malocclusion however, in carefully selected borderline cases with acceptable facial profile and moderate skeletal discrepancy, orthodontic camouflage can provide satisfactory functional and esthetic outcomes. This particular case presents a non surgical management of Class III subdivision malocclusion in a 17-year-old male patient which is characterised by functional facial asymmetry, anterior crossbite, crowding, and mandibular deviation secondary to occlusal prematurities. Clinical findings show that the patient had a straight profile, asymmetric non consonant smile, reverse overjet, deep bite, and lower midline deviation. Cephalometric analysis shows skeletal Class III with vertical growth pattern as well as retroclined maxillary and upright mandibular incisors. Given the patient's refusal to undergo orthognathic surgical procedures, orthodontic camouflage treatment was indicated and a fixed mechanotherapy utilising 0.022-inch McLaughlin, Bennett, and Trevisi (MBT) appliance system. Treatment included extraction of over-retained deciduous teeth, alignment and leveling with sequential archwire progression, extraction of the lingually erupted mandibular right lateral incisor was carried out as part of the camouflage strategy to relieve lower anterior crowding, and the use of class III elastics to establish a functional occlusion and positive overjet. Following active treatment for 22 months, marked changes were noted in the patient's facial profile, aesthetics of the smile, overjet, overbite, and tooth alignment. A favourable functional and aesthetic outcome was achieved with establishment of class I molar and canine relationships, positive overjet and overbite, and improvement in the soft-tissue profile. Six-months follow-up records demonstrated maintenance of the treatment results. This case highlights the potential of orthodontic camouflage as a non surgical treatment alternative in carefully selected borderline skeletal class III patients.

Keywords: Angle class III, Corrective, Facial asymmetry, Malocclusion, Orthodontic appliances, Orthodontics, Tooth extraction

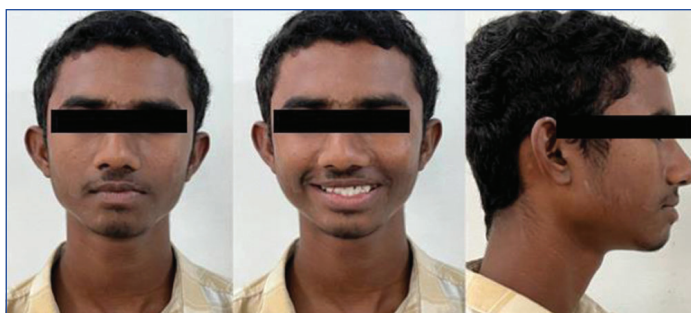
CASE REPORT

A 17-year-old male patient reported to the Department of Orthodontics with the chief complaint of irregularly placed upper and lower front teeth. The patient was concerned about poor dental appearance and difficulty while smiling.

Extraoral examination revealed a leptoprosopic facial form with competent lips and a shallow mentolabial sulcus. The patient exhibited a slightly convex facial profile with chin deviation towards the left-side, contributing to facial asymmetry. Smile analysis demonstrated an asymmetrical and non consonant smile. Functional examination revealed mandibular shift towards the left-side during closure due to premature occlusal contacts on the left-side [Table/Fig-1]. Clinical evaluation demonstrated a discrepancy between centric relation and centric occlusion, indicating a functional mandibular deviation associated with occlusal interference however, no associated signs or symptoms of temporomandibular disorder were present. To further evaluate the nature and extent of the facial asymmetry, a posteroanterior cephalogram was obtained and analysed using Grummons frontal asymmetry analysis. The findings demonstrated only mild right-left skeletal discrepancies,

suggesting that the asymmetry was predominantly functional in nature and associated with mandibular deviation due to occlusal interference.

The intraoral examination revealed that there was a Class III molar relationship on the left-side, whereas Class I molar relationship on the right-side. Bilateral Class III canine relationship was also observed in this case. Moderate Crowding was seen in both maxilla and mandible arches measuring approximately 6 mm in the maxillary arch and 7 mm in the mandibular arch. The maxillary right lateral incisor was palatally displaced, while the mandibular right lateral incisor was severely lingually erupted, rotated, and positioned outside the arch form. An anterior cross bite with a reverse over jet 1 mm and over bite 5 mm was present. Mandibular midline was displaced towards left-side by 3 mm. Over retained primary tooth over 53, 65, 73, and 83 were also seen [Table/Fig-2a-e]. Bolton's analysis demonstrated mandibular tooth material excess, with an anterior ratio 78.2 % and an overall ratio of 90.2%. Ashley Howe analysis yielded a value of 42.3% indicating a borderline discrepancy suitable for orthodontic camouflage treatment.



[Table/Fig-1]: Pretreatment extraoral photographs.



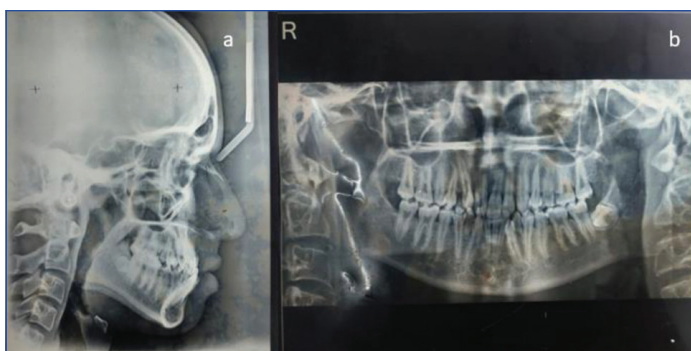
[Table/Fig-2]: Pretreatment intraoral records: a) Maxillary arch; b) Mandibular arch; c) Frontal; d) Right buccal region; e) Left buccal view.

From cephalometric assessment, there was presence of skeletal Class III jaw relationship, vertically growing. This patient had already completed active growth phase Cervical Vertebral Maturation Index (CVMI Stage VI). Pre-treatment cephalometric measurements depicted that the maxillary incisors were retroclined while mandibular incisors were upright [Table/Fig-3,4].

Measurement	Mean value	Pretreatment	Post-treatment
SNA	82°	82°	83°
SNB	80°	83°	83°
ANB	2°	-1°	0°
FMPA	25°	32°	31°
U1-SN Plane	102°	98°	108°
U1-Palatal plane	75°	57°	67°
IMPA	90°	88°	88°
Overjet	4 mm	-1 mm	2 mm
Overbite	2 mm	5 mm	3 mm
Wit's appraisal	0±1 mm	-3 mm	-1 mm
Beta angle	27-35°	40°	40°
Go-Gn to SN	32°	34°	32°
Nasolabial angle	102°	100°	95°
Upper lip prominence	1-2 mm	0 mm	3 mm
Lower lip prominence	1 mm behind	6 mm	2 mm

[Table/Fig-3]: Pretreatment and post-treatment cephalometric values.

SNA: Sella-Nasion-A point angle; SNB: Sella-Nasion-B point angle; ANB: A point-Nasion-B point angle; FMPA: Frankfort Mandibular Plane Angle; U1-SN: Upper Incisor to Sella-Nasion Plane; U1-Palatal Plane: Upper Incisor to Palatal Plane; IMPA: Incisor Mandibular Plane Angle; Go-Gn: Gonion-Gnathion; SN: Sella-Nasion



[Table/Fig-4]: Pre-treatment orthopantomogram and lateral cephalograph.

Based on clinical and cephalometric findings, the case was diagnosed as skeletal Class III malocclusion with dentoalveolar Angle's Class III subdivision malocclusion associated with a vertical growth pattern, anterior crossbite, lower anterior crowding. Posteroanterior cephalometric assessment was performed using Grummons analysis. Linear measurements were evaluated with reference to the Midsagittal Reference Plane (MSR) to assess right-left skeletal symmetry. Analysis was suggestive of mild skeletal asymmetry. The mandibular dental midline was deviated 3 mm towards the left-side [Table/Fig-5]. Considering the clinical findings, functional shift during closure, presence of occlusal interference, and Grummons analysis, the asymmetry was interpreted as predominantly a functional mandibular deviation secondary to occlusal interference rather than a severe skeletal asymmetry.

Measurement	Right (mm)	Left (mm)
Co-Ag	58	61
Ag-me	47	43
Co-MSR	50	49
Nc-MSR	14	13
J-MSR	31	28
Ag-MSR	41	38

[Table/Fig-5]: Grummons analysis.

Co: Condylion; Ag: Antegonion; Me: Menton; Nc: Nasal cavity point; J: Jugale; MSR: Midsagittal reference line; Co-Ag: Condylion to Antegonion; Ag-Me: Antegonion to Menton; Co-MSR: Perpendicular distance from Condylion to the midsagittal reference line; Nc-MSR: Perpendicular distance from Nasal cavity point to the midsagittal reference line; J-MSR: Perpendicular distance from Jugale to the midsagittal reference line; Ag-MSR: Perpendicular distance from Antegonion to the midsagittal reference line

Treatment Objectives

The treatment objectives were to solve the anterior crowding problem as well as the anterior crossbite and obtain ideal overjet and overbite with improved maxillary incisor inclinations. Other goals of treatment include correction of the mandibular deviation and facial asymmetries, creation of a balanced molar and canine occlusion, and improvement of smile aesthetics and soft-tissue profile.

Treatment Alternatives

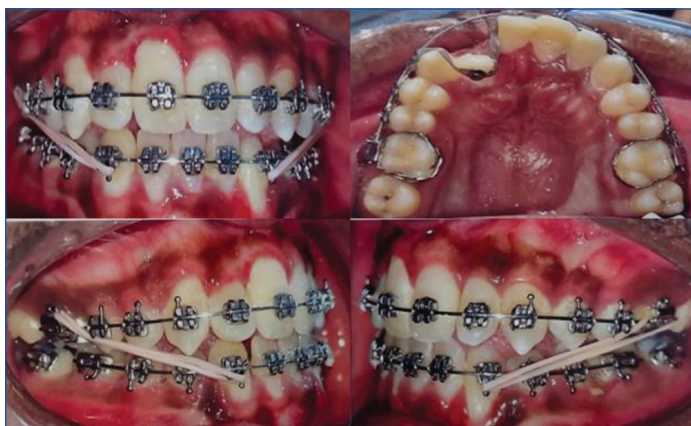
Orthognathic surgery in conjunction with orthodontic treatment was considered the treatment of choice for correction of the underlying skeletal Class III discrepancy. However, comprehensive clinical, cephalometric, and space analyses suggested that the patient represented a borderline skeletal Class III malocclusion with favourable characteristics for orthodontic camouflage. The skeletal discrepancy was moderate in severity, the facial profile was acceptable, and the asymmetry was determined to be predominantly functional in nature secondary to occlusal interference. Furthermore, the presence of mandibular crowding and mandibular tooth material excess provided an opportunity for correction through dentoalveolar compensation. Considering the patient's refusal of surgical intervention and the favourable diagnostic findings, orthodontic camouflage involving extraction of the mandibular right lateral incisor by fixed mechanotherapy was selected as the treatment approach.

Treatment Plan and Progress

Treatment was initiated with extraction of over-retained deciduous teeth 53, 65, 73 and 83. Due to the presence of a 5 mm deep overbite, posterior bite turbos were placed on the maxillary first molars to facilitate bite opening and permit simultaneous bonding of both arches. Fixed orthodontic treatment was carried out using 0.022" MBT prescription appliances. Maxillary and mandibular first and second molars were banded to reinforce anchorage, and both arches were bonded.

Initial leveling and alignment were performed using sequential nickel-titanium (NiTi) archwires progressing from 0.014" NiTi followed by 0.016" NiTi and 0.016×0.022" NiTi arch wires. Further arch

coordination and torque control were achieved using 0.017×0.025" and 0.019×0.025" stainless steel archwires [Table/Fig-6,7].



[Table/Fig-6]: Intraoral progress photographs showing use of Class III inter-maxillary elastics and sling shot mechanics for correction of anterior crossbite with upper right lateral incisor. Successful alignment of the maxillary right lateral incisor contributed to the achievement of proper anterior overjet and improved dental aesthetics.



[Table/Fig-7]: Extraoral and intraoral progress photographs.

Following initial leveling and alignment, the mandibular right lateral incisor (42) was extracted. The extraction decision was based on multiple diagnostic considerations. Clinically, the tooth was severely lingually displaced, rotated and positioned outside the dental arch form. Space analysis revealed approximately 7 mm of crowding in the mandibular arch, while Bolton analysis demonstrated mandibular tooth material excess. In addition, extraction of the mandibular right lateral incisor facilitated correction of the mandibular tooth material discrepancy and provided space for alignment without excessive proclination of the remaining mandibular incisors, thereby enhancing dentoalveolar compensation for the underlying skeletal Class III relationship. The sliding mechanics were combined with Class III elastics in order to close the space and correct the sagittal discrepancy. Finishing and detailing procedures were carried out to establish ideal intercuspation, proper overjet and overbite, and functional occlusion. Total treatment duration was approximately 22 months. Post-treatment retention was provided using Essix retainers in both arches.

Treatment Results

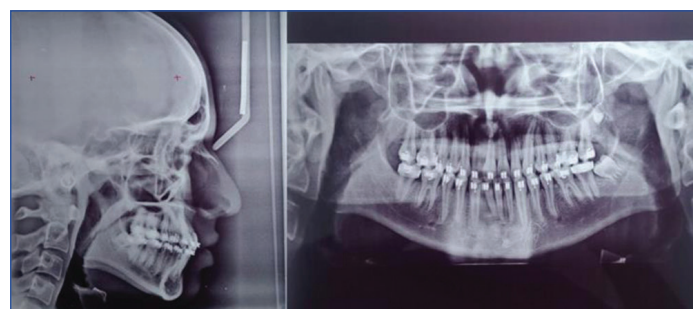
Post-treatment evaluation demonstrated substantial improvement in dental alignment, smile esthetics, and occlusal relationships. Overjet and overbite measurements were at 2 mm and 3 mm, respectively.

Bilateral Class I molar and canine relationships were established, and the mandibular midline discrepancy was markedly improved. The chin deviation and smile asymmetry showed noticeable improvement following elimination of the occlusal interference associated with the functional mandibular deviation. Post-treatment functional examination revealed absence of mandibular deviation during closure and no detectable occlusal prematurities.

Cephalometric evaluation demonstrated SNA of 83°, SNB of 83°, ANB of 0°, IMPA of 88°, and U1-SN of 108°. The apparent improvement in ANB from -1° to 0° was primarily attributable to a 1° increase in SNA, while SNB remained unchanged and the Wit's appraisal improved from -3 mm to -1 mm. Therefore, the correction achieved was predominantly dentoalveolar rather than skeletal in nature. Soft-tissue alterations were also seen after treatment. There was an improvement in the nasolabial angle from 100° to 95° as a result of the alteration in the soft-tissue because of improved maxillary incisors inclination. The change shows an increase in the support of the upper lip. Despite the fact that there was no change in the existing skeletal Class III malocclusion, the soft-tissue response was good for the treatment purposes of orthodontic camouflage. Lower lip prominence relative to the Esthetic line (E-line) decreased from 6 mm pre-treatment to 2 mm post-treatment, indicating a more harmonious lip relationship and contributing to improved facial aesthetics. Improvement in maxillary incisor inclination contributed to correction of the anterior crossbite and establishment of a positive overjet. Although minor residual torque discrepancies were observed in certain teeth, satisfactory intercuspation and the planned treatment objectives were successfully achieved [Table/Fig-8,9]. At six months follow-up, facial aesthetics, dental alignment, positive overjet and overbite, and satisfactory intercuspation were maintained [Table/Fig-10].



[Table/Fig-8]: Post-treatment extraoral and intraoral photographs.



[Table/Fig-9]: Post-treatment OPG and lateral cephalography.



[Table/Fig-10]: Six-month follow-up records demonstrating maintenance of facial aesthetics, dental alignment, positive overjet and overbite, and satisfactory intercuspation.

DISCUSSION

Class III Malocclusion is one of the most difficult problems to manage in orthodontics because it involves both skeletal and dental factors. The incidence of Class III malocclusion differs from one population group to another, and it is often accompanied by functional, aesthetic, and psychological problems [1,2]. Its management is complicated in patients beyond puberty as it is impossible to achieve any growth modification at that point and surgical procedures are preferred.

Orthodontic camouflage is considered a viable treatment option in carefully selected borderline skeletal Class III patients with acceptable facial aesthetics, moderate skeletal discrepancy, and favourable dentoalveolar characteristics, particularly when orthognathic surgery is declined. In the present case, cephalometric evaluation demonstrated an ANB angle of -1° , Wit's appraisal of -3 mm, and a Beta angle of 40° . Although the increased Beta angle suggested a greater skeletal Class III tendency than indicated by the ANB angle alone, treatment planning was based on a comprehensive clinical and cephalometric assessment rather than a single parameter. The patient exhibited acceptable facial aesthetics, a slightly convex profile, mild-to-moderate skeletal discrepancy, and a predominantly functional mandibular deviation secondary to occlusal interference. Furthermore, the presence of mandibular crowding and Bolton tooth-size discrepancy favoured a camouflage approach through dentoalveolar compensation. Similar findings have been reported in recent studies evaluating orthodontic camouflage in adult skeletal Class III patients [3,4].

Camouflage treatment primarily aims to compensate for the skeletal discrepancy through dentoalveolar modifications while maintaining or improving facial aesthetics. Janson G et al., demonstrated that significant dentoalveolar compensation can provide favourable occlusal and facial outcomes in selected Class III patients without surgical intervention [1]. Similarly, Mazzini WU and Torres FM reported successful camouflage management of skeletal Class III malocclusion using extraction therapy and fixed mechanotherapy in adult patients [2].

The present case demonstrated a skeletal Class III subdivision malocclusion associated with a predominantly functional mandibular deviation secondary to occlusal interference, clinical examination revealed a discrepancy between centric relation and centric occlusion, with mandibular deviation toward the left-side during closure. Posteroanterior cephalometric assessment using Grummons analysis identified only mild right-left skeletal discrepancies,

suggesting that the asymmetry was primarily functional rather than severe skeletal in nature. Elimination of the occlusal interference during treatment resulted in improvement of chin deviation and smile symmetry. Ellis E and McNamara JA described that functional mandibular shifts caused by occlusal discrepancies may contribute significantly to asymmetrical presentation in Class III malocclusion patients [5]. Similar correction of functional mandibular deviation through orthodontic treatment has also been reported in recent adult camouflage cases [6].

The patient exhibited completed skeletal growth (CVMI Stage VI), limiting the possibility of orthopedic correction. Therefore, treatment was directed toward dentoalveolar compensation. Ngan P and Moon W stated that camouflage treatment may be considered in mild to moderate skeletal Class III discrepancies when acceptable facial esthetics can be maintained without surgery [7]. Since the patient had a relatively straight profile and declined orthognathic surgery, orthodontic camouflage was considered the most appropriate treatment option.

Extraction of the mandibular right lateral incisor represented a strategic and conservative camouflage approach in the present case. The tooth was severely lingually displaced, rotated, and positioned outside the arch form. In addition, space analysis demonstrated 7mm of mandibular crowding, while Bolton analysis revealed mandibular tooth material excess. Extraction of the mandibular right lateral incisor facilitated alignment, midline correction and reduction of lower anterior crowding without excessive proclination of mandibular incisors. Maintenance of mandibular incisor inclination within acceptable limits was important to preserve periodontal health and facial balance. Similar extraction-based camouflage mechanics have been reported to produce stable outcomes in selected Class III patients [7,8]. Mariscal K et al., also reported successful orthodontic camouflage treatment in skeletal Class III cases using selective extraction strategies to achieve stable dentoalveolar compensation [8]. Soft-tissue changes were also observed after treatment. The nasolabial angle reduced from 100° to 95° because of the changes in soft-tissues in relation to the increased maxillary incisor angulation. This implies an improvement in upper lip support and was useful for the enhancement of the facial aesthetics. While the skeletal Class III relationship did not change, the favourable soft-tissue response supported the treatment objectives of orthodontic camouflage by improving the facial profile through dentoalveolar compensation.

The favourable treatment outcome can be attributed to careful biomechanical control, including sequential archwire progression, extraction-based space management, alignment of the palatally displaced maxillary lateral incisor using sling-shot. Class III elastics contributed to correction of reverse overjet and establishment of functional occlusion. Anchorage control was achieved through maxillary and mandibular second molar bonding and comprehensive fixed mechanotherapy throughout treatment. Cephalometric changes observed in the present case included improvement in ANB angle from -1° to 0° , the Wit's appraisal improved from -3 mm to -1 mm and correction of maxillary incisor retroclination. The improvement achieved was largely dentoalveolar in nature rather than skeletal, which is consistent with previous reports on orthodontic camouflage treatment in non growing patients. The Beta angle did not change from 40 degrees after orthodontic therapy, which means that there was no correction of the skeleton itself due to the existing Class III relationship. This result was predictable, since orthodontic camouflage therapy in skeletally mature individuals provides only dentoalveolar correction and does not change the skeleton itself. Despite obtaining good results in terms of occlusion and aesthetics, it is important to understand that the persistent skeletal discrepancy underscores the importance of careful case selection, appropriate retention, and long-term follow-up, as the inherent skeletal pattern remains unchanged and may influence long-term stability. Thiem LC et al., demonstrated that orthodontic camouflage based on

extraction can yield dentoalveolar compensation and occlusal results that are highly satisfactory in well-chosen skeletal Class III patients. The above findings are relevant to the treatment performed in the current case [9].

Daher W et al., demonstrated that non surgical orthodontic treatment in adult skeletal Class III patients can provide favourable esthetic and functional outcomes through controlled dentoalveolar adaptation [10]. Long-term stability remains a concern in Class III camouflage cases, particularly in patients with vertical growth tendency and initial anterior crossbite [5]. Lopez-Gavito G et al., emphasised the importance of proper retention and occlusal stability in preventing relapse of open bite and Class III cases [11].

Considering the complexity of the present case, which involved skeletal Class III camouflage, extraction of a mandibular lateral incisor, and correction of a functional mandibular deviation, a strict retention protocol was considered essential. Essix retainers were selected because of their ability to maintain anterior alignment, preserve overjet correction, and support occlusal stability. The patient was instructed to wear the retainers full-time during the initial retention phase, followed by night-time wear. The 6-month follow-up records demonstrated satisfactory maintenance of the achieved treatment results; however, continued retention and long-term monitoring remain important because camouflage treated Class III cases may be susceptible to relapse [11,12].

A limitation of the present case report is the absence of cephalometric superimposition records and long-term follow-up beyond six months. Nevertheless, the available follow-up records demonstrated satisfactory maintenance of the achieved treatment outcomes.

Proper case selection remains the key factor for successful orthodontic camouflage in skeletal Class III malocclusion. Patients with mild to moderate skeletal discrepancy, acceptable soft-tissue profile, minimal transverse discrepancy, and absence of severe mandibular prognathism are considered favourable candidates for non surgical camouflage therapy. In the present case, controlled dentoalveolar compensation and maintenance of mandibular incisor inclination contributed to improved facial esthetics and functional occlusion without compromising periodontal stability.

CONCLUSION(S)

In this particular case, the fact is evident that orthodontic camouflage is a viable choice of treatment in properly selected cases of skeletal Class III malocclusion after the pubertal period in individuals with moderate skeletal difference and facial asymmetry. Camouflage treatment along with extraction and mechanotherapy proved to be successful in resolving the issues such as anterior crossbite, crowding, and discrepancies in the occlusion along with increasing facial symmetry and smile aesthetics.

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