



# Orthopedic Treatment of Skeletal Class III Malocclusion with an Innovative Technique

Soukaina Sahim\*, Salma Sair, Farid El Quars

Department of Orthodontic, Faculty of Dentistry, University Hassan II, Casablanca, Morocco

Email: \*souki-2s@hotmail.fr

**How to cite this paper:** Sahim, S., Sair, S. and El Quars, F. (2024) Orthopedic Treatment of Skeletal Class III Malocclusion with an Innovative Technique. *Open Access Library Journal*, 11: e11719. <https://doi.org/10.4236/oalib.1111719>

**Received:** May 20, 2024

**Accepted:** June 27, 2024

**Published:** June 30, 2024

Copyright © 2024 by author(s) and Open Access Library Inc.

This work is licensed under the Creative Commons Attribution International License (CC BY 4.0).

<http://creativecommons.org/licenses/by/4.0/>



Open Access

## Abstract

Skeletal class III malocclusion is prevalent among orthodontic patients and is often associated with serious aesthetic, functional and social repercussions for patients. Class III with maxillary retrusion can be intercepted early in order to allow a more favorable environment for dentofacial growth and simplify subsequent orthodontic procedures. The current clinical case of a 5-year-old girl discusses the particularities of the early treatment of Class III malocclusion of maxillary origin using Delaire facemask associated with an innovative technique that improved the orthopedic effect by pulling the maxilla as a block with fewer dentoalveolar side effects. The facemask therapy enabled anterior maxillary displacement with the establishment of positive overjet. It also allowed the restoration of class I canine and molar relationships as well as a significant improvement in the patient's profile and smile aesthetics.

## Subject Areas

Orthodontics, Orthopedics

## Keywords

Orthopedics, Early Treatment, Class III Malocclusion, Facemask, Interception

## 1. Introduction

Class III malocclusion is an orthodontic anomaly where the mandibular arch is in a mesial position in comparison to the maxillary arch. It is thought to have a primarily hereditary etiology, though environmental factors like habits and mouth breathing may also be involved [1].

It is characterized predominantly by forward positioning of the mandible relative to the maxilla either as an isolated trait or as a part of a syndrome. Reasons for Class III malocclusion can be found in mandibular prognathism, maxillary

retrognathism or combination of both [2] [3].

Age and severity of the class III malocclusion influence the choice of treatment. Class III malocclusion of maxillary origin can be orthopedically treated through maxillary advancement using reverse traction forces by facemask appliance in the pre-pubertal age.

Due to the difficulty in management and the less predictable outcome over time compared to Class I and II malocclusions, the early treatment of Class III malocclusion is a subject that receives a lot of attention in the literature [4].

The choice of the right timing of treatment for the Class III malocclusion is crucial, as the goal must be to cancel or reduce skeletal discrepancies, stimulating the jaw sutures before they turn into synostosis, thus transforming this area into a bone growth site [5].

The aim of this article is to discuss, through a clinical case, the particularities of the early treatment of Class III malocclusion of maxillary origin using Delaire facemask associated with an innovative technique improving the orthopedic effect.

## 2. Case Description

### 2.1. Diagnosis and Etiology

A 5-year-old girl was referred to the Department of Orthodontics of the Ibn Rochd University Hospital of Casablanca, with the main complaint of anterior crossbite. She had no underlying medical problems and no signs of temporomandibular joint dysfunction. A familial history of similar malocclusion was noted.

Pretreatment facial photographs showed a symmetrical oval face with a flat profile, passive lip seal and normal lower facial height. Soft tissues partially masked the maxillary position (**Figure 1A**).

Intraoral examination revealed good hygiene, reverse overjet in maximum occlusion. The patient presented a low insertion of the inter-incisal frenulum, and type I diastemas of Baume classification. She had an Angle Class III canine and molar relationships (**Figure 1B**).

Panoramic radiograph showed a complete dental formula and normal skeletal and alveolar structures. The patient was in a stable temporary dentition phase (**Figure 2a**). The lateral cephalogram revealed clear airways and a normodivergent pattern (**Figure 2b**).

The cephalometric analysis showed a normodivergent skeletal Class III with maxillary retrusion ( $SNA = 78^\circ$ ;  $SNB = 79^\circ$ ;  $GoGN/SN = 35^\circ$ ) and normoposition of upper incisors ( $I/NA = 24^\circ$ ) (**Table 1**).

### 2.2. Treatment Objectives

The purpose of treatment was to correct the sagittal arch discrepancies through stimulation of maxillary growth and redirection of mandibular growth; correct the anterior crossbite; and obtain Class I molar and canine relationships with correct overbite and overjet.



**Figure 1.** A. Pretreatment extraoral photographs. a. Frontal at rest; b. profile; c. frontal smiling; d. lateral smiling. B. Pretreatment intraoral photographs. a. Right lateral; b. frontal; c. left lateral; d. maxillary occlusal; e. mandibular occlusal.



**Figure 2.** Pretreatment radiographs. a. Panoramic radiograph; b. Lateral cephalogram.

**Table 1.** Cephalometric analysis before and after treatment

		PRE TRT	POST TRT
SNA	82°	78°	82°
SNB	80°	79°	80°
ANB	2°	-1°	2°
SND	76°	74°	77°
I to NA	22°	24°	26°
I to NA mm	4 mm	3 mm	5 mm
i to NB	25°	15°	17°
i to NB mm	4 mm	1 mm	2 mm
Po to NB		1 mm	1 mm
GoGn to SN	32°	35°	36°

**Continued**

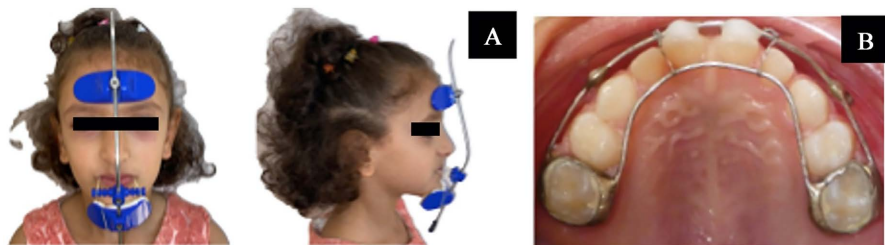
FMA	25° ± 3	23°	26°
FMIA	67° ± 3	82°	71°
IMPA	88° ± 3	75°	83°
AoBo	-2 to +2 mm	-3 mm	-1 mm
Z-angle	75° ± 5	88°	99°
Upper lip	/	11 mm	8 mm
Total Chin	/	8 mm	8 mm
Facial index		0.52	0.48

**2.3. Treatment Alternatives**

An alternative to early treatment was to delay fixed-appliance therapy until the permanent dentition had erupted and the growth spurt had ended. This option, however, would have required a more complex treatment plan. Furthermore, the implementation of early protraction facemask therapy has the potential to significantly diminish skeletal discrepancies, simplifying subsequent orthodontic procedures and minimizing the tendency to relapse. The patient was young enough that a positive response could be expected.

**2.4. Treatment Progress**

The treatment plan included protraction of the maxilla by a reverse pull Delaire facemask, using extra-oral forces (**Figure 3A**).



**Figure 3.** A. Delaire Facemask (headgear and chin cup). B. Double-arch buccal and lingual appliance with metal ligatures between the central and lateral incisors, and composite on the 51 and 61.

An innovative technique was carried out after previously being used in other patients and giving positive results. It consisted of making metal ligatures between the central and lateral incisors joining the buccal and lingual segments of the double arch, and bonding the latter with composite on the buccal surface of the central incisors (51 and 61) (**Figure 3B**). This technique maximized forces and the maxilla was pulled with the appliance as a single unit optimizing the orthopedic effect.

A 350-g force was applied on each side 14 hours a day. After two months of treatment, an edge-to-edge incisor occlusion was obtained (**Figure 4a**). After

five months of treatment, an overjet of 1 mm was achieved, then an overcorrection was carried out (Figure 4b).

At nine months of treatment, a normal overjet of 3 mm was achieved (Figure 4c). This was followed by a retention phase of two months with the appliance worn every other day.



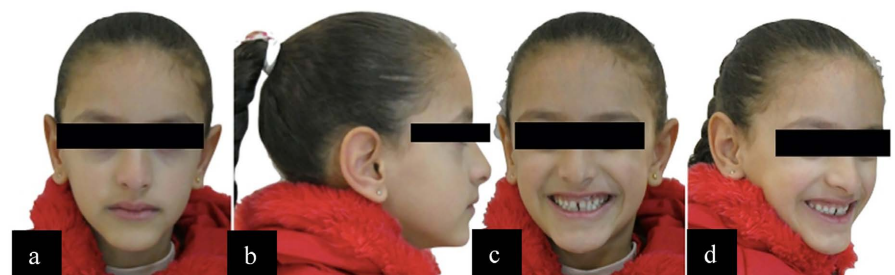
**Figure 4.** Intraoral images a. after two months of treatment: edge-to-edge incisor occlusion; b. after five months of treatment: overjet of 1 mm; c. after nine months of treatment: overcorrection with overjet of 3 mm.

## 2.5. Treatment Results

After nine months, treatment was completed once the anterior crossbite was successfully corrected. The appliance was removed after the retention phase of two months.

The post-treatment facial photographs showed a significant improvement in facial profile and smile aesthetics (Figure 5).

Intraorally, the patient displayed a bilateral Class I canine occlusion and a Class I molar relationship with an overjet of 3 mm and an overbite of 1 mm (Figure 6).



**Figure 5.** Post treatment extraoral photographs after appliance removal (11 months). (a) Frontal at rest; (b) profile; (c) frontal smiling; (d) lateral smiling.

In the panoramic radiograph, dental and periodontal health were maintained

(**Figure 7a**). The lateral cephalogram revealed the improvement of the facial profile and the correction of the anterior crossbite (**Figure 7b**).

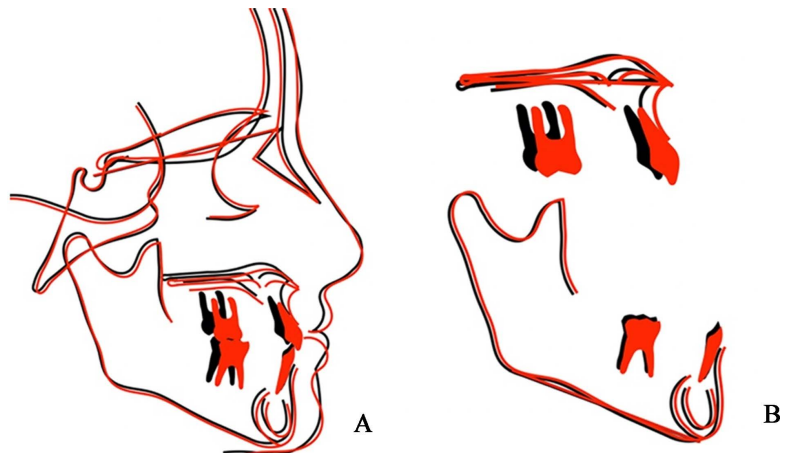


**Figure 6.** Intraoral images after appliance removal (11 months).



**Figure 7.** Post treatment radiographs a. Panoramic radiograph, b. Lateral cephalogram.

Final cephalometric analysis showed that the SNA angle increased (from  $78^\circ$  of SNA to  $82^\circ$ ) resulting in a normal jaw relationship ( $ANB = 2^\circ$ ) with slight proclination of upper incisors ( $I/NA = 5 \text{ mm}$ ) (**Table 1**). Cephalometric superimposition demonstrated the maintenance of the lower facial height, the forward movement of maxilla as well as the improvement of the patient profile (**Figure 8**).



**Figure 8.** Total superimposition (A), maxillary and mandibular superimpositions (B) of initial (black) and final (red) cephalometric tracing.

### 3. Discussion

Class III malocclusion is one of the most difficult malocclusions to correct in orthodontics [6]. The prognosis and the treatment of Class III malocclusion as well as the stability of results depend on the etiopathogenic diagnosis. It can be

related to hereditary causes, hormonal causes, muscular and functional environment as well as labiolingual muscular environment [5] [7]. The treatment of Class III malocclusion is extremely challenging especially because the uncertainty of achieving a stable result over time [4].

Approximately 30% - 40% of Class III patients show some degree of maxillary deficiency. Hence, maxillary protraction appliances can be used for early treatment [3]. The best time to start maxillary protraction is when a child is in primary dentition and the first transitional stage of mixed dentition, which is around the age of 6. This is because the orthopedic benefits are more expressive during these times [8]. Early orthopedic intervention is necessary to speed up the incisal coverage and to standardize functions to guide the residual growth and re-establish correct maxillofacial relationships [7].

In order to maximize forces and optimize the orthopedic effect, the maxilla must be pulled with the appliance as a single unit. To do so, in our case, we used an innovative technique which has shown good results in many previously treated patients. This technique consisted of adding metal ligatures between the central and lateral incisors joining the buccal and lingual segments of the double arch, and bonding the latter with composite on the buccal surface of the central incisors (51 and 61). It allowed forward movement of maxilla with fewer alveolar side effects on upper incisors. Indeed, the upper incisors were slightly proclined (I/NA = 5 mm) at the end of treatment.

To minimize the tipping of the palatal plane, the protraction elastics were attached near the maxillary canines with a downward and forward pull of 30 degrees to the occlusal plane. The patient was instructed to wear the appliance 14 hours/day (night time included). Maxillary protraction usually requires 300 - 600 g of force per side, depending on the age of the patient [9] [10] [11]. For our patient, we used 350 g of maxillary protraction force on each side.

Skeletal changes in early Class III treatment are always the main focus of studies and were mostly reported as values for ANB angle. For the facemask appliance, the reported ANB changes ranged from 2° to 5° [11] [12] [13]. In our patient, we went from ANB of -1° to ANB of 2°. The improvement of the sagittal maxillomandibular skeletal relationship was crucial in establishing a correct anterior overjet.

The anterior crossbite was corrected after five months, with an overjet of 1 mm. An overcorrection was necessary to ensure the stability of the orthopedic treatment. In fact, hypercorrection is highly recommended in the literature, to compensate the negative factors such as maxillary and/or mandibular skeletal involvement, growth potential, family history and genetic influence [1] [14]. Therefore, the patient continued to wear the appliance for a further four months, with an overjet of 3 mm at the end of this phase. This was followed by a retention phase of two months, with the appliance worn every other day for greater stability. After 11 months, the appliance was removed. A follow-up period of 1 month, 2 months, 3 months and then every 6 months was planned to monitor the transition to permanent dentition, with all the occlusal changes that will take

place.

Early intervention in class III malocclusion may have benefits for the child's emotional well-being, the growth potential available at this developmental stage, greater treatment collaboration, the possibility of a second phase that is simpler, and a potential decrease in extractions during the corrective phase of treatment [8] [15]. The orthodontist, parent, and child triad must all cooperate well in order to achieve excellent results [4] [16].

#### 4. Conclusion

Class III malocclusion should be intercepted early, particularly when the primary cause is maxillary retrusion, in order to redirect dentofacial growth.

The facemask therapy in the current clinical case was associated with an innovative technique that pulled the maxilla as a block, thus reducing dentoalveolar side effects. The technique allowed forward movement of the maxilla with reestablishment of positive overjet and significant improvement in the patient's profile and smile aesthetics.

Successful early treatment of class III malocclusion depends on the effective use of orthopedic appliances with proper application of force intensity and direction as well as the patient compliance.

#### Ethics Approval and Consent to Participate

The patient gave an individual consent to participate.

#### Acknowledgements

Special thanks to the Department of Orthodontics of the Faculty of Dentistry of the University Hassan II of Casablanca.

#### Conflicts of Interest

The authors declare no conflicts of interest.

#### References

- [1] Sandić, M.Ž., Juloski, J., Stefanović, N., Šćepan, I. and Glišić, B. (2015) The Treatment of Class III Malocclusion in Early Mixed Dentition: Two Case Reports. *Stomatoloski glasnik Srbije*, **62**, 80-88. <https://doi.org/10.1515/sdj-2015-0009>
- [2] Singh, K., Verma, V.K., Panda, S. and Sachan, A. (2014) Management of Skeletal Class III Malocclusion in an Early Mixed Dentition with Face Mask Therapy: A Case Report. *Journal of Dental Research*, **1**, 55-60. [https://www.ramauniversityjournal.com/pdf\\_file/55-60.pdf](https://www.ramauniversityjournal.com/pdf_file/55-60.pdf)
- [3] Azamian, Z. and Shirban, F. (2016) Treatment Options for Class III Malocclusion in Growing Patients with Emphasis on Maxillary Protraction. *Scientifica*, **2016**, Article ID: 8105163. <https://doi.org/10.1155/2016/8105163>
- [4] Quinzi, V., Salvati, S.E., Pisaneschi, A., Palermi, M. and Marzo, G. (2023) Class III Malocclusions in Deciduous or Early Mixed Dentition: An Early Orthopaedic Treatment. *European Journal of Paediatric Dentistry*, **24**, 42-44.



- <https://pubmed.ncbi.nlm.nih.gov/36853215/>
- [5] Zere, E., Chaudhari, P.K., Saran, J., Dhingra, K. and Tiwari, N. (2018) Developing Class III Malocclusions: Challenges and Solutions. *Clinical, Cosmetic and Investigational Dentistry*, **10**, 99-116. <https://doi.org/10.2147/ccide.s134303>
- [6] Celikoglu, M. and Oktay, H. (2013) Effects of Maxillary Protraction for Early Correction of Class III Malocclusion. *The European Journal of Orthodontics*, **36**, 86-92. <https://doi.org/10.1093/ejo/cjt006>
- [7] Soyer, Y. (2017) Interception of Class-III Malocclusions. *Journal of Dentofacial Anomalies and Orthodontics*, **20**, Article No. 207. <https://doi.org/10.1051/odfen/2016051>
- [8] Da Silva, D.B.H. and Gonzaga, A.S. (2020) Importance of Orthodontic Intervention of the Class III Malocclusion in Mixed Dentition. *Dental Press Journal of Orthodontics*, **25**, 57-65. <https://doi.org/10.1590/2177-6709.25.5.057-065.bbo>
- [9] Parayaruthottam, P., Antony, V., Francis, P., Hassan, K. and Muhamed Shalooob, K. (2014) Interception of a Developing Class III Malocclusion with Facemask Therapy. *Journal of Orthodontic Research*, **2**, 38-41. <https://doi.org/10.4103/2321-3825.125925>
- [10] Mercy, V., Savitha, N.S. and Krishanmoorthy, S.H. (2023) A Case Report on Growth Modification Using Facemask Therapy in the Management of Class III Malocclusion in a Young Patient. *International Journal of Pedodontic Rehabilitation*, **8**, 21-27. <https://doi.org/10.56501/intjpedorehab.v8i1.762>
- [11] Woon, S.C. and Thiruvengkatachari, B. (2017) Early Orthodontic Treatment for Class III Malocclusion: A Systematic Review and Meta-Analysis. *American Journal of Orthodontics and Dentofacial Orthopedics*, **151**, 28-52. <https://doi.org/10.1016/j.ajodo.2016.07.017>
- [12] Anne Mandall, N., Cousley, R., DiBiase, A., Dyer, F., Littlewood, S., Mattick, R., et al. (2012) Is Early Class III Protraction Facemask Treatment Effective? A Multicentre, Randomized, Controlled Trial: 3-Year Follow-up. *Journal of Orthodontics*, **39**, 176-185. <https://doi.org/10.1179/1465312512z.00000000028>
- [13] Vaughn, G.A., Mason, B., Moon, H. and Turley, P.K. (2005) The Effects of Maxillary Protraction Therapy with or without Rapid Palatal Expansion: A Prospective, Randomized Clinical Trial. *American Journal of Orthodontics and Dentofacial Orthopedics*, **128**, 299-309. <https://doi.org/10.1016/j.ajodo.2005.04.030>
- [14] Oltramari-Navarro, P.V.P., Almeida, R.R.D., Conti, A.C.D.C.F., Navarro, R.D.L., Almeida, M.R.D. and Fernandes, L.S.F.P. (2013) Early Treatment Protocol for Skeletal Class III Malocclusion. *Brazilian Dental Journal*, **24**, 167-173. <https://doi.org/10.1590/0103-6440201301588>
- [15] Grippaudo, M.M., Quinzi, V., Manai, A., Paolantonio, E.G., Valente, F., La Torre, G., et al. (2020) Orthodontic Treatment Need and Timing: Assessment of Evolutive Malocclusion Conditions and Associated Risk Factors. *European Journal of Paediatric Dentistry*, **21**, 203-208. <https://pubmed.ncbi.nlm.nih.gov/32893653/>
- [16] Abdulhussein, Z.A. and Aksoy, A. (2022) Compliance of Patients with Class III Malocclusion to Orthodontic Treatment. *Journal of Baghdad College of Dentistry*, **34**, 12-24. <https://doi.org/10.26477/jbcd.v34i1.3087>