



## Case study

## Orthodontic treatment of class three malocclusion using clear aligners: A case report

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## ABSTRACT

Class III malocclusion is a growth-related challenging condition for orthodontists. We present a case of a 11-year-old girl with a skeletal class III malocclusion with bilateral cross bite, and a functional shift of the lower dental midline. A multiphase clear aligners' treatment was scheduled with the aim of removing all dental interferences which involved an anterior displacement of the mandible. At one-year follow-up, clear aligners' therapy resulted in skeletal and dental improvements. Clear aligners therapy represents a valid alternative to fixed appliance therapy in the early interception of class III malocclusion. The present manuscript was prepared following the CARE guidelines.

## 1. Introduction

Class III malocclusion is a challenging dentoalveolar growth deformity, affecting between 5.5% and 19.4% of the population.<sup>1</sup> Early timely treatment of class III malocclusion involves the removal of all occlusal interferences which pathologically determine a forward slide of the mandible.<sup>2</sup> Clear aligners have been recently employed in the correction of mild to moderate malocclusions in non-growing patients, gaining great success.<sup>3</sup> However, there is a lack of evidence regarding the use of clear aligners in the management of growing patients; a case of a young patient with class III malocclusion, treated with clear aligners and supportive myofunctional therapy, is presented.

## 2. Materials and methods

## 2.1. Diagnosis and etiology

The patient was a 11.8-years-old Caucasian female with a chief complaint of irregular front teeth (Fig. 1). The general medical history was negative for illness, allergy; the patient did not present any familiarity for class III malocclusion.

Facial photographs revealed a prognathic profile, an obtuse gonial angle, and a lower third asymmetry. Intraoral photographs revealed a transverse skeletal discrepancy, with anterior cross bite affecting upper and lower left lateral incisors. Pseudo-class III malocclusion was excluded, since no discrepancy between centric occlusion and centric

relation was noticed.<sup>4</sup> At intraoral evaluation, the patient presented a late mixed dentition with a bilateral class III malocclusion, along with a functional mandibular lateral deviation towards the patient's left side, without any sign or symptom of temporomandibular joint disorders. A parafunctional tongue thrust habit and swallowing dysfunction were detected. Panoramic radiography revealed no teeth anomalies. The pre-treatment cephalometric analysis showed a skeletal class III relationship. Referring to the anterior cranial base (Sella-Nasion), the patient presented a retruded maxilla with proclined incisors and a relatively proclined mandible (Table 1). The Sassouni's analysis of vertical facial proportions revealed an open bite tendency, resulting from clockwise rotation of the mandible; this was evident since the palatal plane, occlusal plane, and mandibular plane tended to converge relatively close to the face.

According to the cervical vertebral maturation method, the patient had almost completed her active craniofacial growth (CS4).<sup>4</sup>

## 2.2. Treatment objectives

The primary objective was to correct class III malocclusion and establish a favorable growth environment.

Additional objectives were to correct the transverse skeletal relationship, to eliminate occlusal interference (dental cross bite) and functional mandibular lateral deviation.

With the aim of establishing physiological tongue posture, an myofunctional therapy was indicated.

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**Table 1**  
Cephalometric values.

Values	Case patient		Norm	
	Pre-treatment	Follow-up	Mean	SD
SNA	79°	82°	82°	± 2°
SNB	82°	80°	80°	± 2°
ANB	−3°	2°	3°	± 2°
Wits	−10 mm	0 mm	2 mm	± 2 mm
FMA	27°	25°	25°	± 3°
U1-SN	111°	105°	103°	± 5°
IMPA	86°	88°	88°	–

SNA, Sella-Nasion-Subspinale Angle; SNB, Sella-Nasion-Supramentale Angle; ANB, Subspinale-Nasion-Supramentale Angle; Wits, Wits Appraisal; FMA, Frankfort Mandibular Plane Angle; U1-SN, Upper Incisor to Sella-Nasion Angle; IMPA, Incisor Mandibular Plane Angle.

### 2.3. Treatment alternatives

The first treatment option was a conventional fixed orthodontic therapy which includes the use of class III interarch elastics. However, the patient and her parents refused conventional fixed multibracket appliances.

A multi-phase Invisalign® “Teen” package was chosen, in order to ask for additional aligners when tooth eruption was completed. Compliance indicators were provided on the buccal area of the aligners in order to monitor patient's adherence during treatment.

### 2.4. Treatment progress

Upper and lower arch impressions and bite registration were taken with iTero Element intraoral scanner (3Shape Dental Systems, Copenhagen, Denmark) and sent to Align Technology®. A three-dimensional virtual planning of tooth movement was performed through ClinCheck® software (version 5.6, Align Technology, San Jose, CA, USA) (Suppl. Fig. 1). Written informed consent was obtained from the patient for publication of this short report and any accompanying images.

The treatment started when the patient was 11.11-year-old. Sixty-one aligners were scheduled, and a two-weeks-change protocol was adopted. Optimized attachments were placed over anterior teeth, left canine and right first bicuspid in the upper arch and over canines and first bicuspids in the lower arch. In order to provide retention for interarch elastics use, precision cuts were designed on the aligner surface, while horizontal and vertical rectangular attachments were placed on upper first molars and lower canines, respectively. 3M Unitek elastics were chosen, with 45 oz. force and 1/4-inch lumen size.

On the anterior lower arch, an interproximal reduction of 3.5 mm was performed, with a maximum amount of 0.5 mm per interproximal region.<sup>4</sup> The patient was instructed to wear aligners and elastics at least 20/22 h a day, except for meals and brushing. The patient was motivated to maintain good oral hygiene. No discomfort or speech impairment were reported.

According to the protocol described by Van Dyck et al. the supportive myofunctional therapy was carried out during the orthodontic treatment: 20 weekly in-office sessions of 30' were scheduled in-office, and training exercises were performed at home. The myofunctional therapy aimed at the coordination of tongue and lip muscles, the removal of parafunctional habits, and the establishment of a physiological swallowing pattern.<sup>5</sup>

Tongue exercises include strengthening and coordination of tongue muscles (i.e., pushing the tongue tip upward against the anterior palatal rugae, positioning the entire tongue against the hard and soft palate).

Facial exercises involve the recruitment of perioral muscles (i.e., increasing tone of the orbicularis oris), buccinators (i.e., suction movements and application of intraoral finger pressure against the

buccinator muscles outward), and jaw muscles (i.e., gaining control of bilateral jaw movements).

In addition, patients were instructed to perform specific stomatognathic exercises (i.e., swallowing in maximum intercuspation, forcing tongue in the palate without perioral contraction, and alternating chewing sides).

## 3. Results

The duration of the aligner therapy was thirty-one months and included sixty-three aligners overall.

Intraoral examination reveals the achievement of all planned objectives, namely dental class I, centered midlines, and crowding correction, with proper incisor inclination and ideal overjet and overbite.

Post-treatment panoramic radiography showed good root parallelism, without any sign of crestal bone loss, and apical root resorption.

Post-treatment lateral telerradiography showed a significant improvement in the sagittal jaw's relationship, along with good vertical control, and a correct inclination of upper and lower incisors (Fig. 2) Table 1. A good proportion between upper and lower arch width and shape was achieved, along with the correction of anterior cross bite (Suppl. Fig. 2).

Coincident dental midlines and the absence of mandibular lateral deviation were observed.

Physiological tongue posture and swallowing function were re-established after the myofunctional therapy.

<sup>1</sup>The patient was reexamined after treatment, and functional and esthetic outcomes were stable at one-year follow-up.

## 4. Discussion

The case presented suggests a new approach of class III malocclusion with the use of clear aligners.

To the best of our knowledge, there is no evidence regarding the use of clear aligners for the management of class III malocclusion. A patient presenting a class III malocclusion was treated using a series of ClearPath aligners.<sup>6</sup> Compared to this case, the use of clear aligners was combined with class III interarch elastics applied over precision cuts. Orthodontic treatment using clear aligners have many advantages.

Due to the hyperdivergent skeletal pattern, an optimal control of the occlusal vertical dimension (OVD) was indicated. In a class III relationship, elastics use may be responsible of some clockwise occlusal plane rotation, due to maxillary first molars extrusion, which was unwarranted in this patient. The bite block effect provided by the aligners thickness could be used to optimize OVD control and prevent bite openings which may result from class III elastics use.

Even if the overall treatment time was comparable to conventional fixed appliances, the use of transparent aligners may have played a significant role in maintaining a very compliant attitude towards patients' esthetic and hygienic treatment demands.<sup>7</sup>

Another advantage of the aligners approach is time efficiency: considering that follow-ups were scheduled every 1.4 months, and the estimated length of the appointments is half than conventional fixed appliance therapy.<sup>8</sup>

Despite the many advantages of clear aligners use, caution is imperative. The elastics force is controlled by the retentive force of the attachments; therefore, it is important to check aligner fit and retention before the delivery of auxiliaries.

Different tooth movements have significantly different levels of predictability, the clinician should be qualified and experienced in order to provide a precise treatment. In addition, since the clinical efficacy depends on the use of the aligners and the interarch elastics, uncertain results can be expected if the patient is not fully compliant.<sup>9</sup>

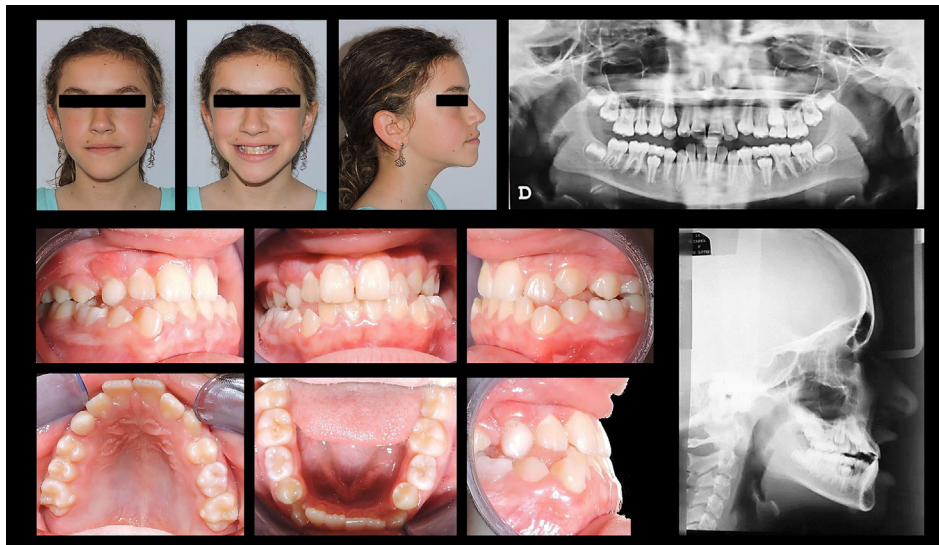


Fig. 1. Pre-treatment intraoral, extraoral photographs, and radiographic examinations.



Fig. 2. Post-treatment intraoral, extraoral photographs, and radiographic examinations.

## 5. Conclusion

In a class III malocclusion where the craniofacial growth is completed, successful conservative treatment and stable outcomes can be achieved using clear aligners. Myofunctional supportive therapy is suggested when parafunctional tongue habits are present.

## Authorship

**ES:** conceptualization, methodology, investigation, writing - original draft preparation.

**SM:** software, data curation, writing - review and editing.

**PG:** resources, project administration, supervision.

All authors read and approved the final manuscript.

## Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.jobcr.2019.09.004>.

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