

Non-Surgical Orthodontic/Orthopedic Treatment of a Young Adult Class III Patient



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Abstract

Objective: To report and evaluate the outcomes of nonsurgical orthodontic treatment of a young adult female patient with Class III malocclusion and hyperdivergent growth pattern.

Material and Methods: The 15-year-old patient with moderate skeletal Class III malocclusion and hyperdivergent growth pattern was treated by the Authors (MK-M and AK). The treatment started after growth completion (CS6 in cervical vertebral maturation) and consisted of the combined use of a face mask, Haas-type expansion appliance, a lower fixed appliance and Class III elastics for the first phase of treatment followed by full fixed appliance. Lateral cephalometric radiographs were taken at the beginning (T1) and at the end (T2) of treatment. Selected cephalometric analyses and superimpositions were used to evaluate dental, skeletal and facial changes with treatment. The patient was followed for 7 years to document the stability of non-surgical orthodontic/orthopedic treatment.

Results: Patient treatment improved the skeletal relationship, dental relationship and visible enhancement in the appearance of the midface, lip profile and the position of the chin. Improvement in the anteroposterior skeletal relationship was demonstrated by an improvement in the ANB angle and Wits appraisal. The vertical dimension was maintained with an improvement of the overbite. Upper and lower incisors were uprighted to a more correct position. Treatment results were stable for 7 years.

Conclusion: Successful non-surgical orthodontic treatment can be achieved in young adult Class III patient with a hyperdivergent growth pattern with a combination of orthopedic and fixed appliances. It can be an alternative treatment for patients who decline the option of surgical treatment.

Keywords

Hyperdivergent Class III malocclusion, nonsurgical Class III treatment, orthopedic face mask treatment, expansion with acrylic Haas appliance

INTRODUCTION

Treatment of patients with Class III malocclusion remains a challenge to practicing orthodontists. The etiology of Class III malocclusion includes the following factors:

- 1) genetic which can lead to skeletal disharmony;
- 2) functional or muscular which can lead to forward positioning of the mandible;
- 3) dysfunctional or mouth breathing which can lead to maxillary deficiency¹.

The differential contribution of these factors results in various combinations of dentoalveolar and skeletal discrepancies in one or both jaws in Class III patients.

Successful treatment of young patients with Class III malocclusion and midface deficiency has been reported in the literature²⁻⁶. The long-term success of early treatment depends however on growth potential after treatment^{2,7,8}. Despite the fact that many researchers have attempted

to find the best formula for predicting the outcome of Class III therapy in patients with excessive mandibular growth, it remains unpredictable^{2,9-16}. During the pubertal growth spurt, one out of 3 patients with early Class III treatment shows relapse while others develop a Class III relationship for the first time^{3,7,8,17,18}. The anteroposterior discrepancy between the maxilla and the mandible has been attributed to a larger growth of the mandible, a longer pubertal growth period of Class III malocclusion compared to Class I individuals, and a smaller maxilla^{7,8,18}. Nonsurgical treatment of adult patients with Class III skeletal problems is an option which has not received sufficient attention in the literature. For many years the best choice of treatment for such patients has been to wait for the completion of facial growth and then to treat subjects with orthodontics combined with orthognathic surgery¹⁹. There have been only a few reports on non-surgical treatment of skeletal Class III malocclusion in

the available literature²⁰⁻²⁵. The use of Haas expansion appliance for correcting mild to moderate Class III malocclusions has been reported as early as the 1960s²⁶⁻²⁹. However, until now the use of expansion appliances in older patients has been considered a controversial method despite the fact that the appliance can induce maxillary dentoalveolar expansion at any developmental stage and enable forward maxillary traction^{3,17,29}. Furthermore, the risks and costs related to surgical treatment are not always accepted by patients or their parents. Alternative treatment methods related to the correction of this skeletal discrepancy therefore warrants further investigation. The aim of the paper was to report and evaluate the outcomes of nonsurgical orthodontic treatment of a patient with Class III hyperdivergent malocclusion.

MATERIALS AND METHODS

A 15-year-old female patient presented with growth maturation CS6 according to the Cervical Vertebral Maturation (CVM) method² skeletal Class III malocclusion and a hyperdivergent growth pattern (Fig. 1, 2).

The option of orthodontic/orthognathic surgery had been offered to the patient due to the severity of the skeletal deformity and skeletal maturation. The patient declined the surgical option and accepted the combined orthodontic-orthopedic treatment protocol described below.



Figure 1: A 15-year-old female patient with dental and skeletal Class III malocclusion with deviation of mandibular dental midline before the orthopedic/orthodontic treatment (a-g).

The non-surgical treatment consisted of two stages. The first stage, which lasted over a period of 6 months, consisted of a Haas-type expander on acrylic splints, a face mask and a lower fixed appliance, combined with intraoral long Class III elastics worn full time to enhance the forward maxillary traction²¹. The acrylic splints of the appliance were formed higher

in its posterior part in order to induce a mandibular clockwise rotation simultaneously with intrusion of lower molars and the change in the mandibular plane angle to minimize the elongation of lower face height. The patient was asked to turn the screw of the expander once a day in the late evening until the desired transverse width was achieved (28 turns) and

then was immobilized. After the tenth turn the patient was instructed to begin wearing the face mask with pads fitted at the chin and forehead. Extraoral elastics were stretched from the posterior hooks on the expander to the support bar of the face mask in a downward and forward vector. The patient was advised to wear the face mask for 14 hours daily (from 7 pm to 7 am and 2 hours during daytime), five days a week and the whole day at weekends. The elastic force applied from the posterior hooks on the Haas appliance to the face mask was 450-550 g per side. At the same time, long Class III elastics were applied to the posterior hooks on the Haas appliance (placed between second premolars and first molars) and the hooks on the lower canine brackets. These were stretched with an initial force of 200 g per side. The patient was instructed to wear the intraoral elastics full time.

After correction of the anterior crossbite and overcorrection of the molars to a more Class I and Class II canine relationship, the Haas-type expander was removed and replaced by an upper fixed appliance and a palatal expander used in the second stage of orthodontic treatment²¹. The final bite adjustment was then made by means of short and long Class III and Class I elastics worn 24 hours daily with the initial force of 200 g per side. The treatment objective was to eliminate the anterior crossbite and achieve a

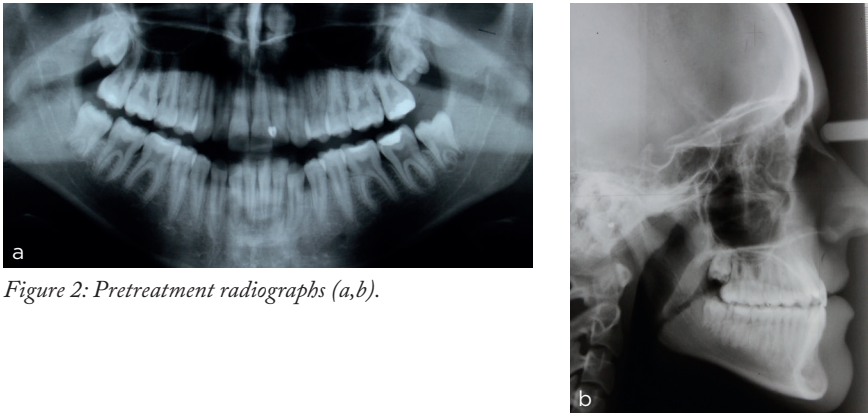


Figure 2: Pretreatment radiographs (a,b).

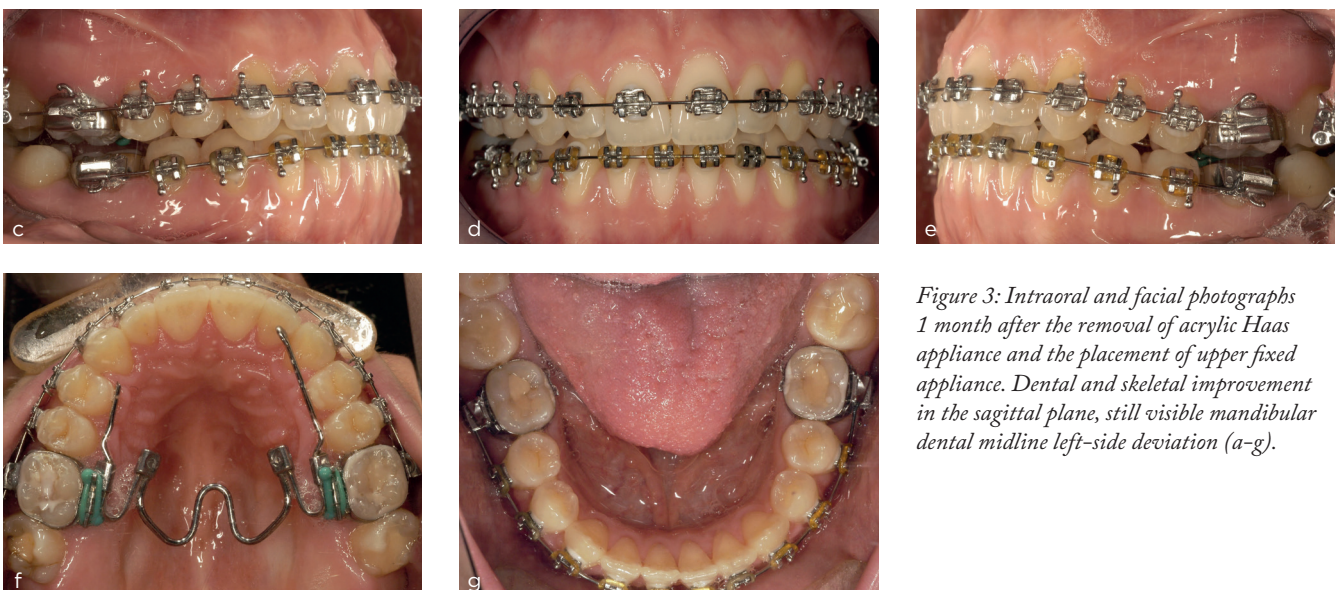


Figure 3: Intraoral and facial photographs 1 month after the removal of acrylic Haas appliance and the placement of upper fixed appliance. Dental and skeletal improvement in the sagittal plane, still visible mandibular dental midline left-side deviation (a-g).

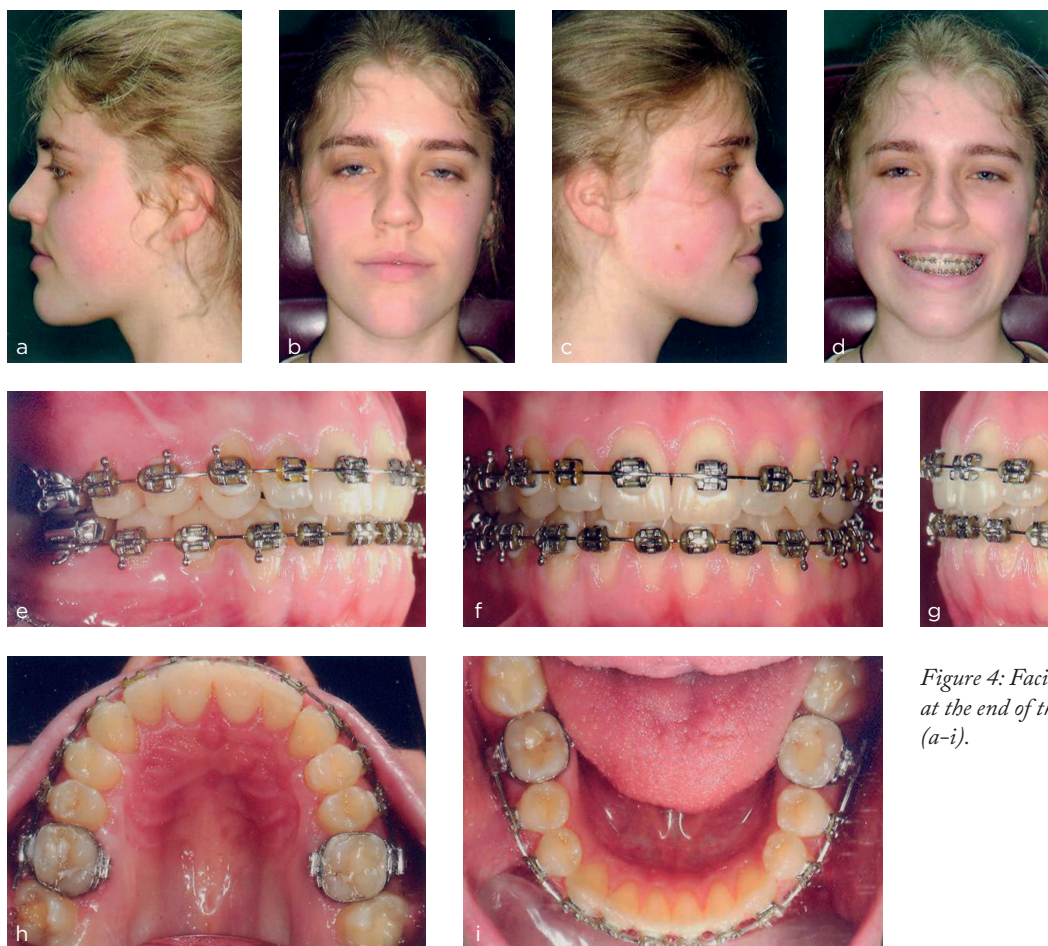


Figure 4: Facial and intraoral photographs at the end of the second stage of the treatment (a-i).

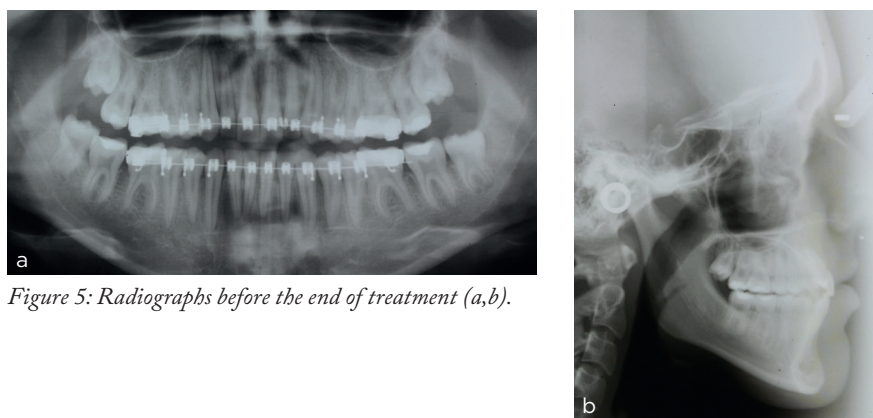


Figure 5: Radiographs before the end of treatment (a,b).

proper Class I dental relationship. The second objective was to minimize the skeletal discrepancy by inducing a forward/downward movement of the maxilla and downward/backward rotation of the chin.

RESULTS

The first stage of treatment was completed within 6 months with the anterior crossbite corrected

and achieved a more Class I molar relationship and intrusion of lower first molars (Fig. 3). The soft tissue profile also improved significantly after the initial phase of treatment (Fig. 3).

In the second stage the Haas appliance was removed and replaced with upper fixed appliance and palatal expander to control vertical position of upper first molars. The completion of the second stage of treatment with the full

fixed appliance and Class III elastics on the right side and Class II elastics on the left side took 10 months (Fig. 4, 5).

The full fixed appliance was then left for an additional 5 months with triangular elastics stretched between upper first premolars and lower first and second premolars to stabilize the treatment results. The patient was compliant and lower third molars were extracted at the end of the treatment. Figure 6 shows the final result after the second phase of orthodontic treatment. The patient achieved a better skeletal and dental relationship. The soft tissue profile improved significantly due to forward movement of the midface (infraorbital ridge, cheeks, nose and the upper lip were moved forward). The chin moved backward and slightly downward.

Cephalometric evaluation made before and after active treatment showed a considerable improvement in the Wits appraisal (5 mm); the SNA

	Case 1		
Cephalometric values	T1	T2	T1-T2
Age and treatment duration	15y 2m	16y 11m	21m
CS	6	6	
SNA (deg)	74,5	75,5	+1
SNB (deg)	76,5	75,5	-1
SNPg (deg)	77,5	76,5	-1
ANB (deg)	-2	0	+2
ANPg (deg)	-3	-1	+2
Wits (mm)	-5	0	+5
Co-A (mm)	91	95	+4
Co-Gn (mm)	129	129	0
SN to Palatal Plane (deg)	7	7	0
SN to Mand. Plane (deg)	37	37	0
Palatal Plane to Mand. Plane (deg)	30	30	0
Co-Go-Me (deg)	128,5	124,5	-4
ANS-Me (mm)	76	79	+3
Upper Inc. to Palatal Plane (deg)	107	111	+4
Lower Inc. to Mand. Plane (deg)	86	89	+3

Abbreviations: T1: beginning of the treatment; T2: end of the treatment; CS: Cervical stage; deg: degrees; y: years; m: months; Mand. Plane: Mandibular Plane; Co: Condylion; Gn: gnathion; Me: Menton; ANS: Anterior Nasal Spine; Upper Inc.: Upper incisor; Lower Inc.: Lower incisor

Table 1: Values of the cephalometric variables before (T1) and after treatment (T2).

angle (1 degree); and the ANB angle (2 degrees). SNB and SNPg angles were decreased by 1 degree (Table 1). Superimposition of the pre- and post-treatment radiographs (Fig. 7) revealed a slight elongation of the lower face and some chin retraction due to a downward displacement of the maxilla, extrusion of lower molars and a clockwise rotation of the mandible (greater ANS-Me 3 mm). The patient showed proclination of the upper incisors (4 degrees) to an almost ideal position and proclination of lower incisors (3 degrees) to a more correct position (Table 1).

The patient was re-evaluated every 6 months after active treatment for 2 years and then once a year for the next 5 years and retained good dental relationship and continuous improvement in facial appearance (Fig. 8, 9).

The patient did not develop temporomandibular disorder during or after treatment.

DISCUSSION

Twenty years ago orthognathic surgery was considered to be “the only viable option” for Class III patients after the completion of growth¹⁹. The use of maxillary expansion in conjunction with face mask therapy was limited to the deciduous or early mixed dentition^{2-4,17}. The use of miniplates may be used for orthopedic treatment in Class III patients up to early adolescence^{5,6}. However, after this age, the changes in a skeletal position of the maxilla were insignificant with orthopedic treatment³ and surgical procedure was considered the main solution to adult skeletal Class III patients^{19,30}.

Significant movements of the upper and/or lower jaws with orthognathic surgery and associated with problems of stability³¹. These problems are associated with difficulties in neuromuscular adaptation and the stretch of the surrounding soft

tissues³⁰⁻³². The orthodontic-orthopedic treatment proposed in the present case report can produce modifications in the position of both jaws over a long period (6-9 months), thereby making these changes acceptable to the neuromuscular system and providing time for adaptation to a new skeletal environment. Moreover, from what is known and observed in clinical settings, most Class III patients have their individual functional adaptations to dental discrepancies, which leads to a forward functional shift of the lower jaw. Thus the use of elastics can alter the spatial position of the lower jaw.

In 1997, it was reported that maxillary protraction is possible with good results up to 12 years of age in the Chinese population³³. The fact that maxillary protraction is possible in young adults may be related to the latest findings relevant to spheno-occipital synchondrosis (SOS) using computed tomography³⁴. Growth at the SOS translates the maxilla upward and forward relative to the mandible. Current research has shown that rapid maxillary expansion has significant effects on the SOS length and an increase in posterior cranial base length (Ba-SOS) in young individuals^{34,35}. The variation of the timing of SOS fusion between and within populations is broad, with reports of complete fusion in individuals aged 11 and non-fusion in adults well before 25 years of age³⁶⁻³⁸. If fusion of SOS is not complete in young adults, it can be assumed that antero-posterior traction of the maxillary complex can still change the spatial position of the maxilla in adults and the use of the Haas expander appliance may enable this movement. The force of Class III elastics of about 200 grams per side applied to the dental arches in our treatment is similar to that applied to the miniplates used in younger patients^{5,6}. The 400-600 gram force of elastics per side exerted from the Haas appliance to the face mask is also similar to the recommendations reported in the literature^{1-5,33}. In the present case report, the A-point advancement of 4.0 mm in the patient is smaller than the results obtained by combining skeletal anchorage and face mask therapy (7.0mm) in a younger patient³⁹. However, it was better than the average results obtained by rapid

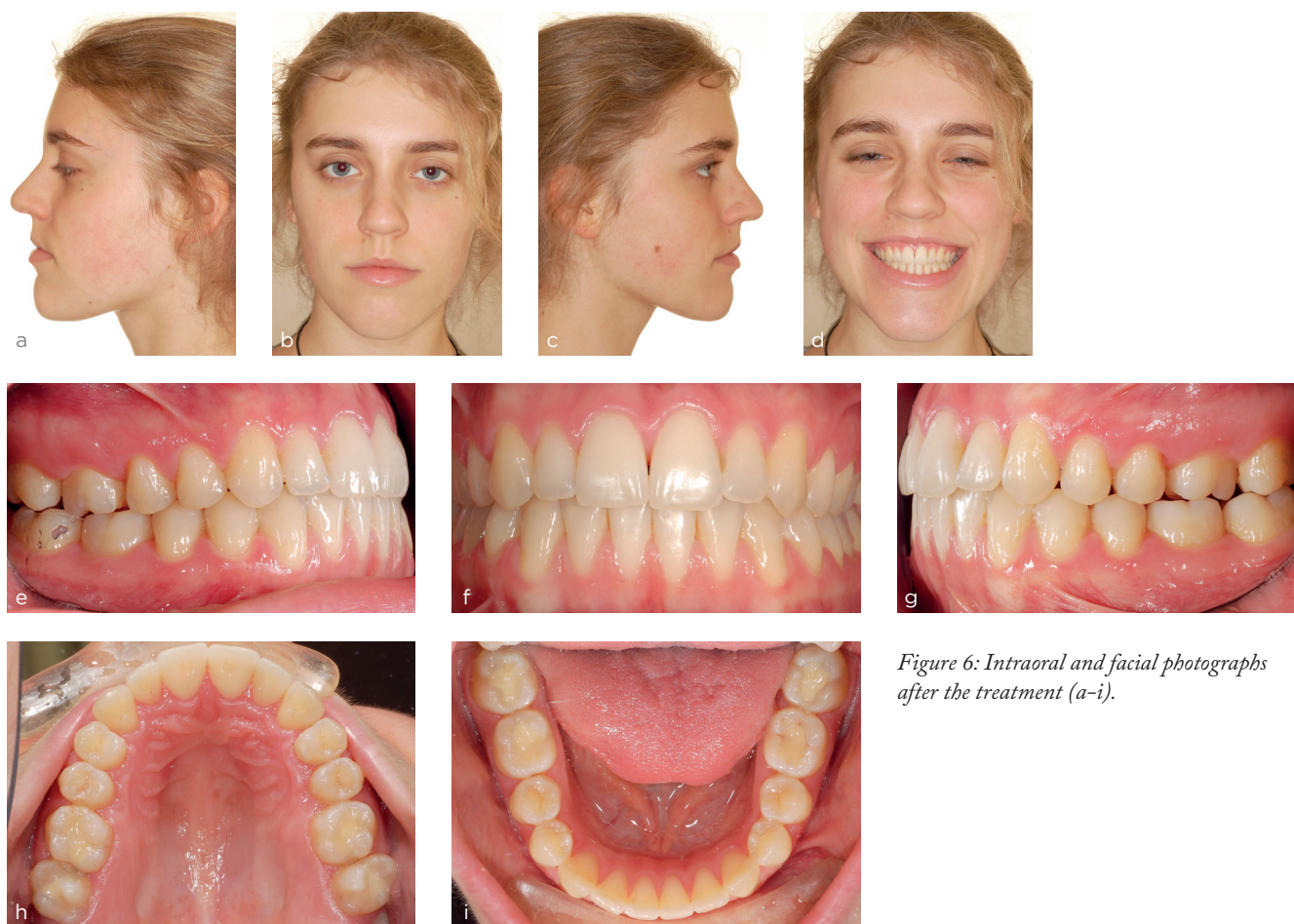


Figure 6: Intraoral and facial photographs after the treatment (a-i).

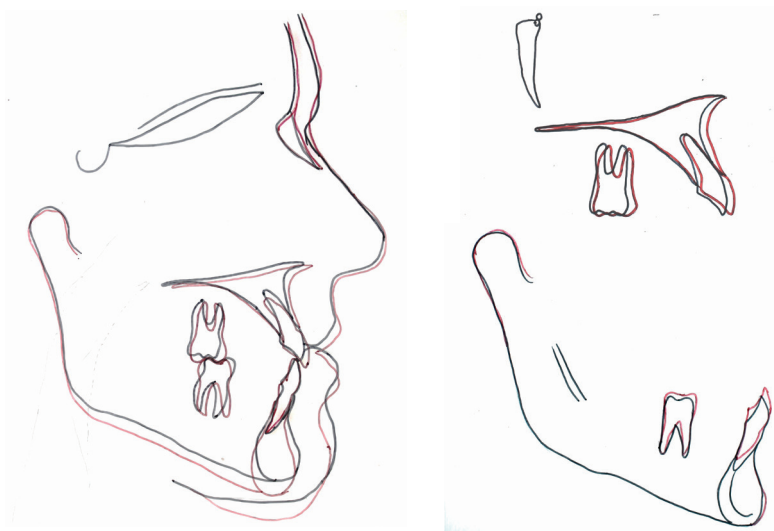


Figure 7: Superimpositions of pretreatment (black) and posttreatment (red) cephalometric tracings show skeletal maxillary advancement and slight forward displacement of maxillary dentition.

maxillary expansion and face mask (2.4 mm) and smaller (1.3 mm) than those reported in the bone-anchored maxillary protraction protocol in

prepubertal patients^{3,5,6}. It should be noted that the success of orthopedic treatment in young adults relies on patient compliance in wearing

the elastics full time to thereby deliver a continuous force on the cranial sutures, including the SOS. The study on the effectiveness of forces on sutures demonstrates that a continuous force ensures ~ 65% more favorable results as compared with intermittent forces⁴⁰. When patients use a face mask for 14 hours daily, together with full-day use of Class III elastics, a force is exerted 24 hours a day on the circummaxillary sutures, temporomandibular joints and the lower jaw^{19,26,27,30,33}. The improvement in facial appearance, which was visible after the first month of the therapy, resulted in very good patient compliance.

The most visible change during the treatment regimen described above was emphasized by the comparison of the Wits measurement before and after treatment (+5mm). Treatment duration was relatively short, lasting 21 months. It can therefore be concluded that an improvement in the skeletal and dental relationships was achieved



Figure 8: Intraoral and facial photographs 7 years after treatment (a-i). The occlusion and skeletal changes were stable. The patient wore Essex retainers on both arches for 2 years.

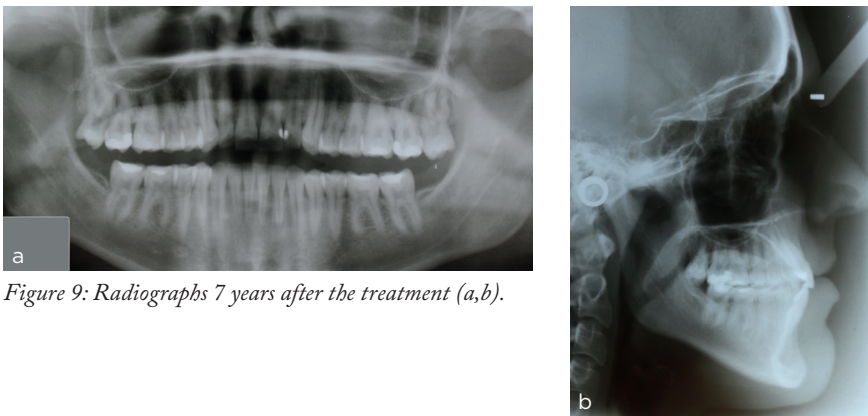


Figure 9: Radiographs 7 years after the treatment (a,b).

These results need however to be confirmed with a larger sample with a long observation period.

CONCLUSIONS

Combined orthodontic treatment of our patient using the Haas expansion appliance, face mask, fixed appliances and Class III elastics worn full time, resulted in a correct dental relationship, better skeletal relationship and an improved facial appearance in the patient with moderate skeletal Class III malocclusion. Such treatment may be useful in young adult patients, even in hyperdivergent patients and may be an alternative to combined surgical-orthodontic therapy. Patient compliance remains one of the main factors for successful outcome.

faster and, more importantly, remained stable in young adult Class III patient because continuing growth did not impinge on the positive outcome of the treatment, as usually happens in the case of patients treated in earlier stages of growth. In summary, the final outcomes of the treatment described here consisted of positive changes in three different components:

- 1) dentoalveolar compensation in both jaws;
- 2) favorable skeletal changes consisting in the forward displacement of the midface and a subsequent mandibular clockwise rotation;
- 3) a backward functional shift of the mandible facilitated by the disarticulation of the majority of teeth on the acrylic splints of the Haas appliance.

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