Clinical Cases in Early Orthodontic Treatment

Julia Harfin • Somchai Satravaha
Bernd G. Lapatki
Editors

Clinical Cases in Early Orthodontic Treatment

An Atlas of When, How and Why to Treat

Second Edition

Springer

Editors
Julia Harfin
Department of Orthodontics
Maimonides University
Buenos Aires, Argentina

Health Sciences Maimonides University
Buenos Aires, Argentina

Bernd G. Lapatki
Department of Orthodontics and Dentofacial Orthopedics
Ulm University Medical Center
Ulm, Germany

Somchai Satravaha
Department of Orthodontics, Faculty of Dentistry
Mahidol University
Bangkok, Thailand

ISBN 978-3-030-95013-2 ISBN 978-3-030-95014-9 (eBook)
https://doi.org/10.1007/978-3-030-95014-9

This Springer imprint is published by the registered company Springer Nature Switzerland AG
The registered company address is: Gewerbestrasse 11, 6330 Cham, Switzerland

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About the Editors

Julia Harfin is Professor and Chair of the Orthodontic Department at the School of Dentistry, Maimónides University, Buenos Aires, Argentina. Dr. Harfin has served as the president of various organizations: the Argentine Society of Orthodontics (1990–1996), ALADO (1999–2008), the Argentine Chapter of the International College of Dentists (1997–2001), the Argentine Chapter of the Pierre Fauchard Academy (1992–1993), and the International College of Dentists Section IV (2010–2012). Currently, she is the Vice President of the National Academy of Dentists. She was a member of the Executive Committee of the World Federation of Orthodontists from 2000 to 2010. She is an honorary member of the Argentine, Chilean, and Polish Orthodontic Societies and in 2010 she became a member of the National Academy of Dentistry. Also in 2010, she was named Woman of the Year in Medicine and Healthcare. Dr. Harfin is the author or editor of several previous books, including *Achieving Clinical Success in Lingual Orthodontics* (Springer, 2014). Dr. Harfin received the 2018 Regional Award of Merit from the World Federation of Orthodontists in recognition of significant contributions to the art and science of orthodontics.

Somchai Satravaha is a Clinical Associate Professor at Mahidol University, Bangkok, Thailand and a Diplomate of the Thai Board of Orthodontics. She received her DDS (Hons) from Chulalongkorn University, Bangkok and later earned the qualification of Zahnärztin für Kieferorthopädie (Orthodontist) from Baden-Württemberg, Germany and the Dr. med. dent. degree (magna cum laude) from Munich, Germany. Dr. Satravaha served as an executive committee member of the World Federation of Orthodontists (WFO) from 2005 to 2015 and is a past president of both the Thai Association of Orthodontists and the Asian Pacific Orthodontic Society. She received a Lifetime Achievement Award from the Thai Association of Orthodontists in 2013 and was a recipient of an Outstanding Alumni Award from Chulalongkorn University Dental Alumni Association in 2014. She obtained later the WFO Regional Award of Merit in 2018 and was recognized an Outstanding Expert in Orthodontics by the Royal College of Dental Surgeons of Thailand in 2019. She is an honorary member of the Association of Philippine Orthodontists, the Indian Orthodontic Society, Ho Chi Minh Association of Orthodontists, the Bangladesh Orthodontic Society, the Orthodontic and Dentofacial Orthopedic Association of Nepal (ODOAN), and honorary fellow of the Asian Pacific Orthodontic Society. She is currently president of the Advisory Board of the Thai Association of Orthodontists.

Bernd G. Lapatki received the degree in dentistry from the University of Freiburg, Germany, in 1994. He defended his thesis leading to the Dr. med. dent. degree in 1998, and his Habilitation Thesis on the pathogenesis and treatment stability of cover-bite and Class II Division 2 malocclusion in 2007. He also received a Ph.D. degree in neurophysiology from Radboud University Nijmegen (NL) in 2010 for the electrophysiological characterization of the facial motor system at a motor unit level. He started his clinical career in 1995 practicing as a general dentist for 2 years before he began his postgraduate study at the Department of Orthodontics, Freiburg University Medical Center. During his clinical work at this department as Specialist in Orthodontics from 2000 to 2009, he was also a Research Fellow at the Department of Clinical

Neurophysiology, Radboud University Nijmegen Medical Center, The Netherlands. Since 2009, he is a Full Professor and Head of the Department of Orthodontics at the University of Ulm. From 2013 to 2019 he was the Director of the Centre of Dentistry, and since 2019 he is the Dean of Studies in Dentistry at this University. Bernd G. Lapatki was awarded in 1999 by the Faculties of Medicine and Applied Sciences of the University of Freiburg the best dissertation in the field of medicine/medicine technique. In 2004, he received the Alex Motsch Award by the German Society of Dentistry and Oral Medicine, and the Arnold Biber Award (the highest scientific award of Orthodontics in Germany) by the German Orthodontic Society in 2007. The research of this group focuses on the development of methods for clinical force-moment monitoring in orthodontics, numerical simulation, and experimental mechanical evaluation of orthodontic treatment approaches including multi-bracket appliances and aligners, and the (patho-) physiology of the facial and masticatory motor systems.

Introduction

1

Julia Harfin

This atlas was written taking into consideration the most common problems that are frequently encountered in young children.

Interceptive treatment is intervening in the developing dentition to allow it to achieve the best occlusion possible, or to make subsequent treatment as simple and short as possible (DiBiase 2002).

There is no doubt that early treatment can be justified if it provides additional benefits to the patient.

The question of when, how, and why is answered in depth in all the clinical cases contained in this atlas. The goal is to focus on functional and skeletal rather than dental correction.

Knowing the diagnosis criteria and which type of cases should be treated early will permit the clinician to offer the most efficient solution for each individual patient. In general, the first phase of treatment in the early mixed dentition has to be followed by the second phase in the permanent dentition.

When and how much growth will occur is unpredictable in some patients, but the direction of growth can be managed (Suresh et al. 2015). However, it is important for the clinician to be able to diagnose and intercept certain developing problems through early treatment.

Many other cases should be supervised, but not treated until the permanent teeth are in place. We must base our decision on a correct diagnosis taking into account that the correction of functional and skeletal imbalances are fundamental before the eruption of all the permanent teeth.

One of the most important advantages to begin the treatment early is to take advantage that in early mixed dentition, the skeletal growth pattern can be modified to a certain point. Other doctors with different protocols suggest that the treatment has to begin after the eruption of the second molars (Behrents 2006). At this time, growth modification will be limited.

Specific indications for early treatment include Class II or Class III malocclusion, with maxillary midface deficiency anterior and posterior crossbite (unilateral and bilateral), midline discrepancies due to early loss of deciduous teeth with a midline shift, severe anterior open-bite, severe deep-bite with palatal impingement, finger-sucking habits, crowding resulting in ectopic positioning of permanent teeth, etc. (Dugoni 1998; Dugoni et al. 2006).

But not all the circumstances are black or white, each patient is unique. For example, the most appropriate timing for the treatment of Class II malocclusion is controversial (Cozzani et al. 2013). Some clinicians advocate starting the first phase in mixed or temporary dentition, but others prefer to wait until the second molars have erupted.

Also, the timing of treatment interventions can be influenced by the severity of the malocclusion, the age, and maturity of the patient at the time the treatment begins.

It is important to emphasize that different types of brackets and wires were used by the authors to treat the patients since there isn't a single type of bracket or wire that performs a correct diagnosis in each clinical case, until now.

The role of the orthodontist is to manage the problem in the most efficient way for a better diagnosis. It is fully recognized that some malocclusions are best treated early for biological, functional, and social reasons.

Different alternatives for each malocclusion will be described step by step in each chapter.

It is evident that to design an efficient treatment plan, the clinician must understand the growth and development process very clearly.

It is well-known that the difference in the response of patients with the same orthodontic treatment is the result of variability in the direction and rate of craniofacial growth.

It is impossible to decide the best time to begin the treatment based solely on the chronological age since the majority of the malocclusions that have to be treated during mixed dentition are the result of multiple factors.

J. Harfin (✉)
Department of Orthodontics, Maimonides University, Buenos Aires, Argentina

Health Sciences Maimonides University, Buenos Aires, Argentina

J. Harfin et al. (eds.), *Clinical Cases in Early Orthodontic Treatment*, https://doi.org/10.1007/978-3-030-95014-9_1

In general, mixed dentition is the best time to start treatment when the correction of habits with or without anterior or lateral transverse crossbite are indicated.

A panoramic radiograph is mandatory at age 8–10 years to confirm the presence or absence of agenesis, supernumerary teeth, cysts, mesiodens, etc.

The last chapter (Chap. 18) analyzes the most main controversies regarding early treatment in depth.

The following examples show the importance of the timing of treatment according to the initial pathology, direction of growth, and the normalization of the functional problems such as nasal breathing and tongue posture at rest or during swallowing. Although they were skeletal and dental Class III at the beginning of the treatment with a similar biotype, the results that were achieved in the long term were completely different.

The parents of this 6-year-old patient asked for a second opinion about the best time to begin his treatment. They were very interested in having him treated very early and avoid the orthognathic procedure that was suggested. The front photographs confirmed a significant negative overjet and overbite that was present in the anterior region (Fig. 1.1a, b).

From the etiological point of view it is important to consider that his two older sisters had Class I molar and canine but two of his seven cousins were Class III and were treated with orthognathic surgery.

The dental front and lateral photographs showed that the lower incisors were in contact with the upper labial gingival tissues and until then and for unknown reasons, he only ate soft meals.

The lateral radiograph confirmed the negative anterior position of the front teeth. Ricketts analysis demonstrated normal convexity with a retruded upper lip and everted lower lip. An increased facial axis was present (95°), along with a short lower anterior height (41°) (Fig. 1.2a, b).

The real question is when would be the best treatment time to begin the correction of this Class III malocclusion? Is it advisable to begin now or to wait until 11–12 or 18 years of age?

There is no doubt that the normalization of the anterior negative crossbite should take place as early as possible since it will help achieve a normal development of the maxilla and to improve the soft tissue profile.

These were the results after 26 months with a functional appliance (Fig. 1.3a, b). Overjet and overbite were improved and midlines were almost normal. The objectives of Phase I of treatment were accomplished. It was important to improve the anterior position of the tongue.

However, the most important question is if the treatment results will remain stable over the long term.

These were the photos 9 years after treatment. The results were maintained or even improved even though some gingival retractions were seen in the upper canine area (Fig. 1.4a, b). Fortunately, in this particular clinical case the second phase of treatment was not necessary.

The comparison between the smile photos at the beginning and 9 years after treatment was the best proof that the results were maintained throughout his whole childhood and adolescence (Fig. 1.5a, b).

As a conclusion, it is possible to affirm that the treatment of very young Class III patients with a significant anterior deep-overbite is more reliable than when the Class III is in combination with a significant open-bite, as it is observed in the second patient.

The next case is very different from the first. It was very clear that early treatment would be beneficial for him, although the success was questionable due to the unfavorable type and direction of growth. She was only 4 years, 9 months of age. Her dental history showed that her parents were skeletal Class III but not her young sister.

The front photographs showed an important dentoalveolar Class III with a significant open bite in the anterior region and crossbite in the lateral areas.

As a consequence of the lower and anterior position of the tongue, significant diastemas were present in the lower arch

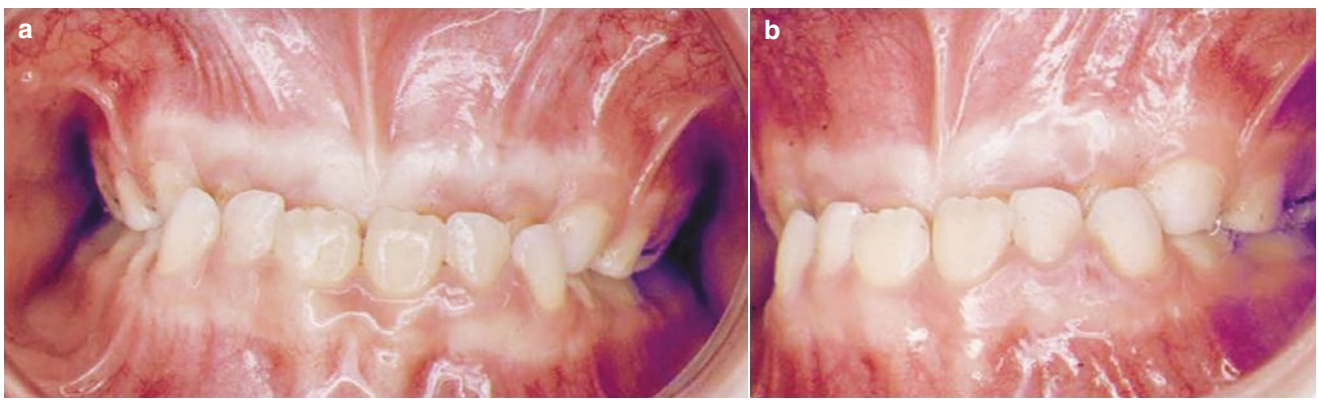

Fig. 1.1 (**a**, **b**) Frontal and lateral pre-treatment photographs. A significant negative overbite was present

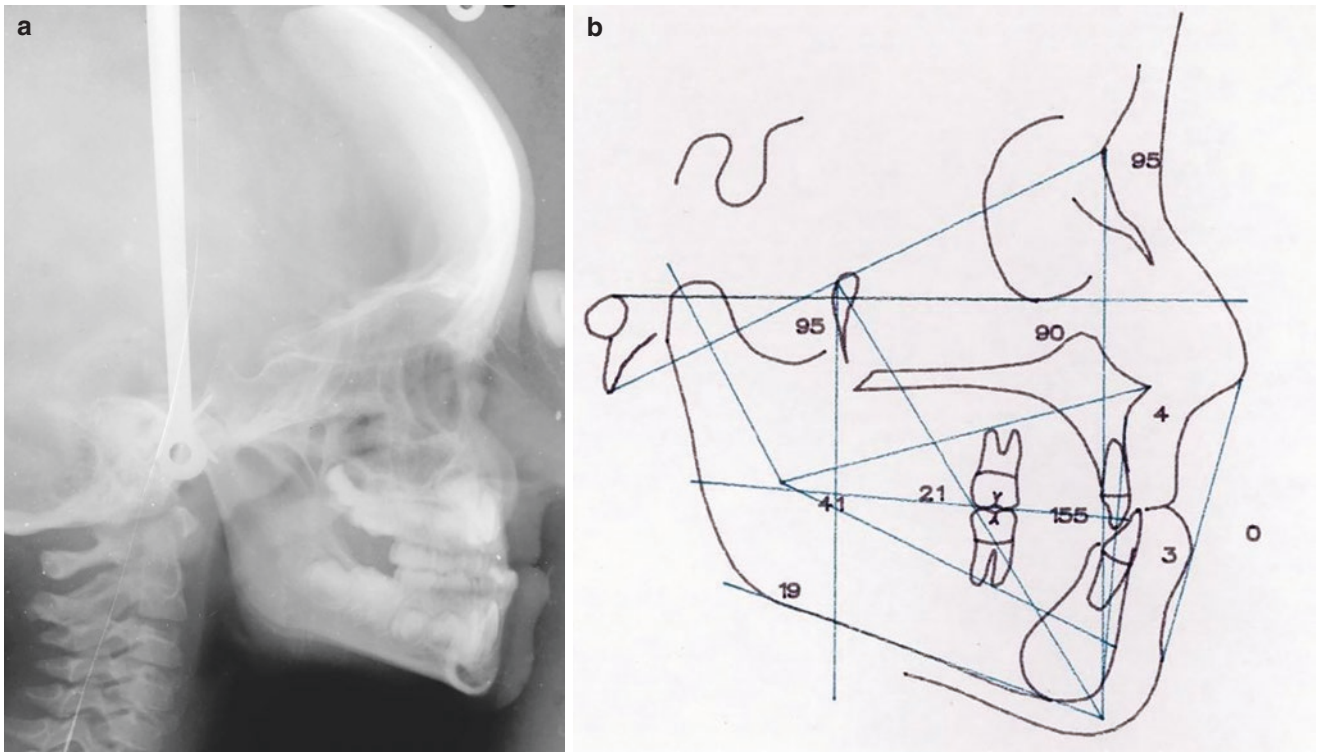

Fig. 1.2 (**a**, **b**) Pre-treatment lateral radiograph and Ricketts analysis

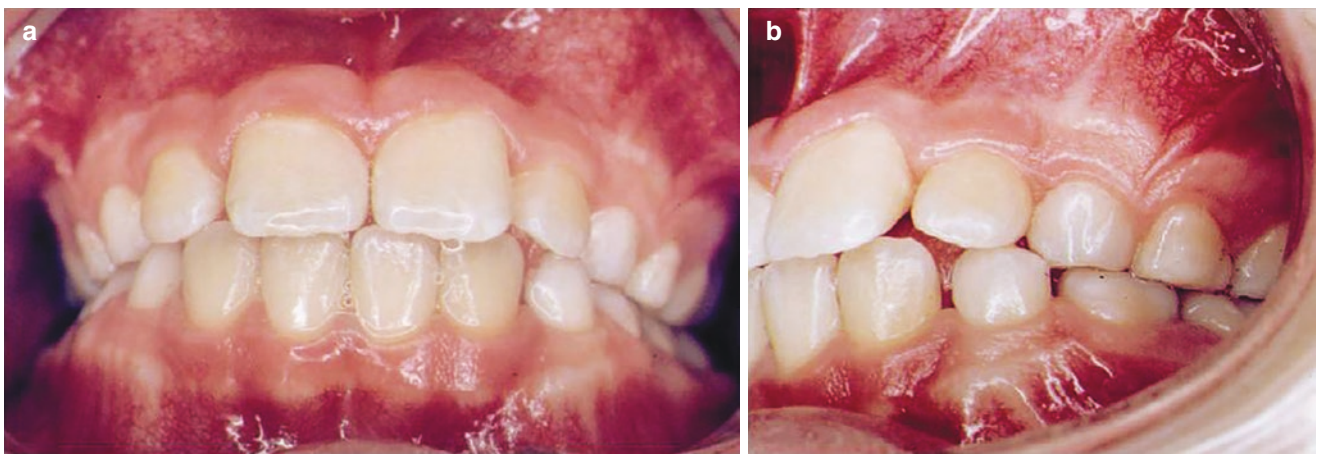

Fig. 1.3 (**a**, **b**) Frontal and lateral post-treatment photographs at the end of Phase I of treatment

(Fig. 1.6a, b). The normalization of the position of the tongue is one of the most difficult issues and requires a lot of time and effort for the patients and their parents.

Although Ricketts analysis was developed for 9-year-old patients, the lateral radiograph confirmed that the patient had a dental and skeletal open-bite—Class III with braquifacial biotype. This combination has the poorest long-term prognosis.

It is very important to take into account that patients with Class III and open-bite are harder to treat than those with Class III and deepbite. The normalization of the tongue posture at rest and in function is mandatory to avoid relapse (Fig. 1.7a, b).

The real question is until when it is possible to redirect growth in these Class III patients and how to know, at an early age, how the mandible will develop.

Evaluation of the overall treatment and post-treatment changes confirm that overcorrection in this first phase of treatment is recommendable (Baccetti and Franchi 2006).

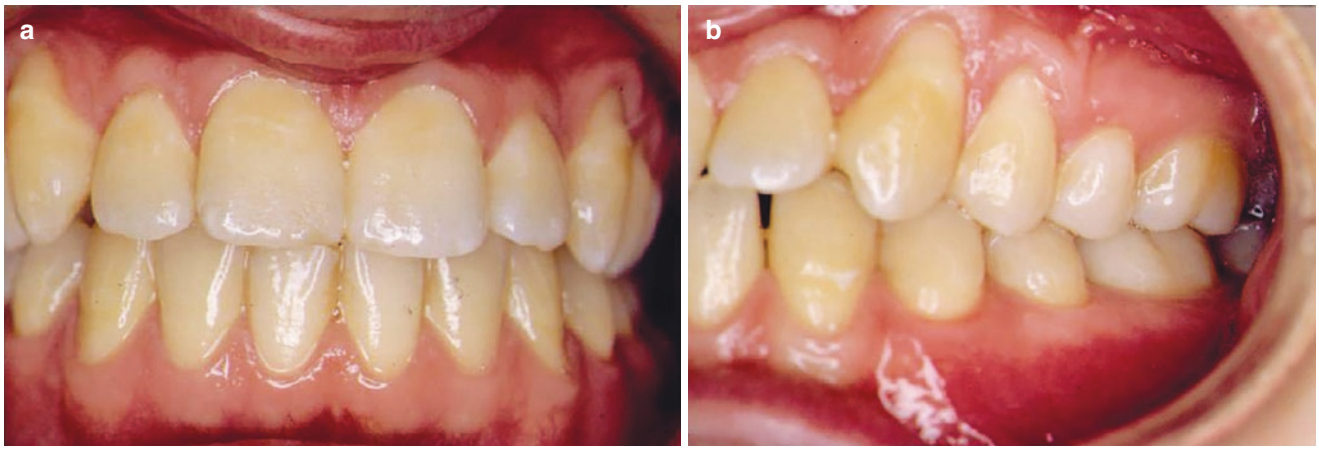

Fig. 1.4 (**a**, **b**) Control 9 years after treatment. The results were maintained. Overjet, overbite, and midlines were improved

Fig. 1.5 (**a**, **b**) Comparison of the smile photographs pre- and 9 years after treatment

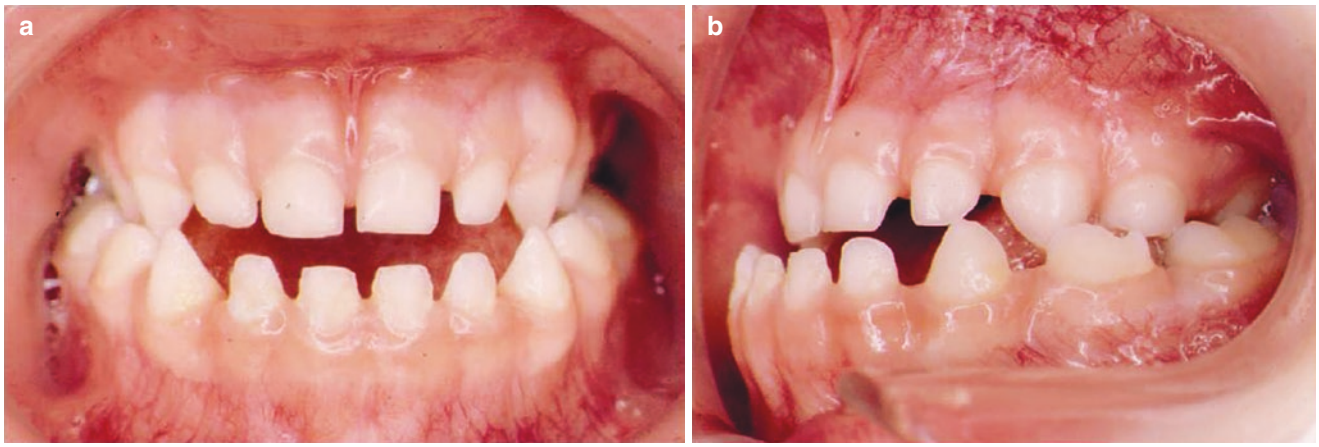

Fig. 1.6 (**a**, **b**) Frontal and lateral pre-treatment photographs. A significant skeletal and dental Class III with a considerable open-bite was present in this 4-year, 9-month girl

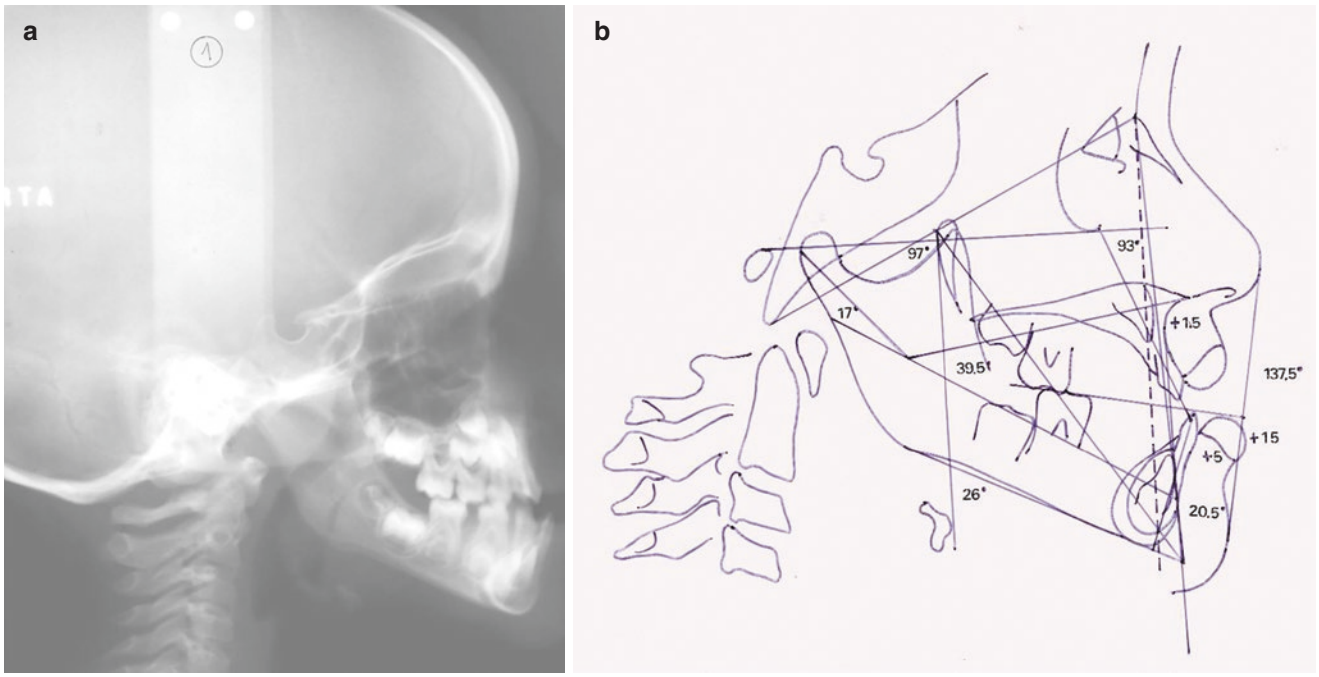

Fig. 1.7 (**a**, **b**) Lateral radiograph and Ricketts analysis at the beginning of the treatment Class III with a significant open-bite was confirmed

The Figs. 1.8 and 1.9 show the results after 3 years of treatment with a rapid maxillary expander in conjunction with a face mask. Although most of the treatment objectives were achieved, it would have been better to finish this first phase of treatment with more overjet and overbite, but the patient and her parents decided to conclude this phase for personal reasons. No speech therapy treatment was recorded.

At the end of this first phase, the posterior crossbite was not totally corrected and midlines were not coincident. The change of color of the right upper central incisor was the result of trauma produced while riding her bicycle (Fig. 1.8a, b).

The lateral radiograph at the end of the first phase of treatment confirmed the clinical results (Fig. 1.9a, b).

The patient returned after 5 years without any previous follow-up. The parents admitted that due to some personal problems they neglected her treatment. She also discontinued the treatment with the speech therapist and never used the retainers. The results were totally unexpected.

The clinical photos clearly showed that the open-bite in conjunction with Class III molar and canine worsened more than expected (Fig. 1.10a, b).

The cephalometric radiograph and Ricketts analysis confirmed the skeletal open-bite—Class III. The treatment plan

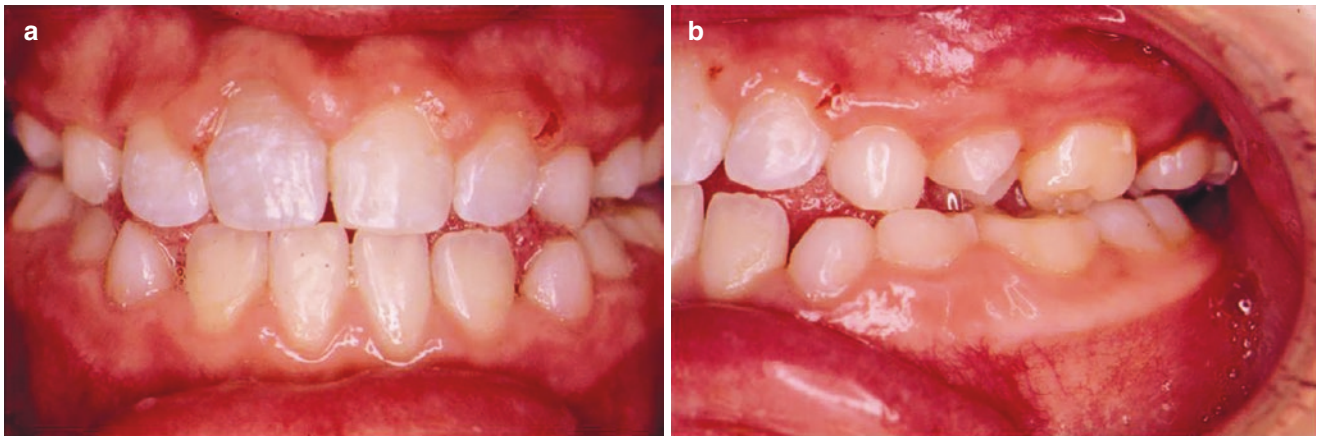

Fig. 1.8 (**a**, **b**) Frontal and lateral photos at the end of this phase of treatment. Not all the objectives for Phase 1 were completed

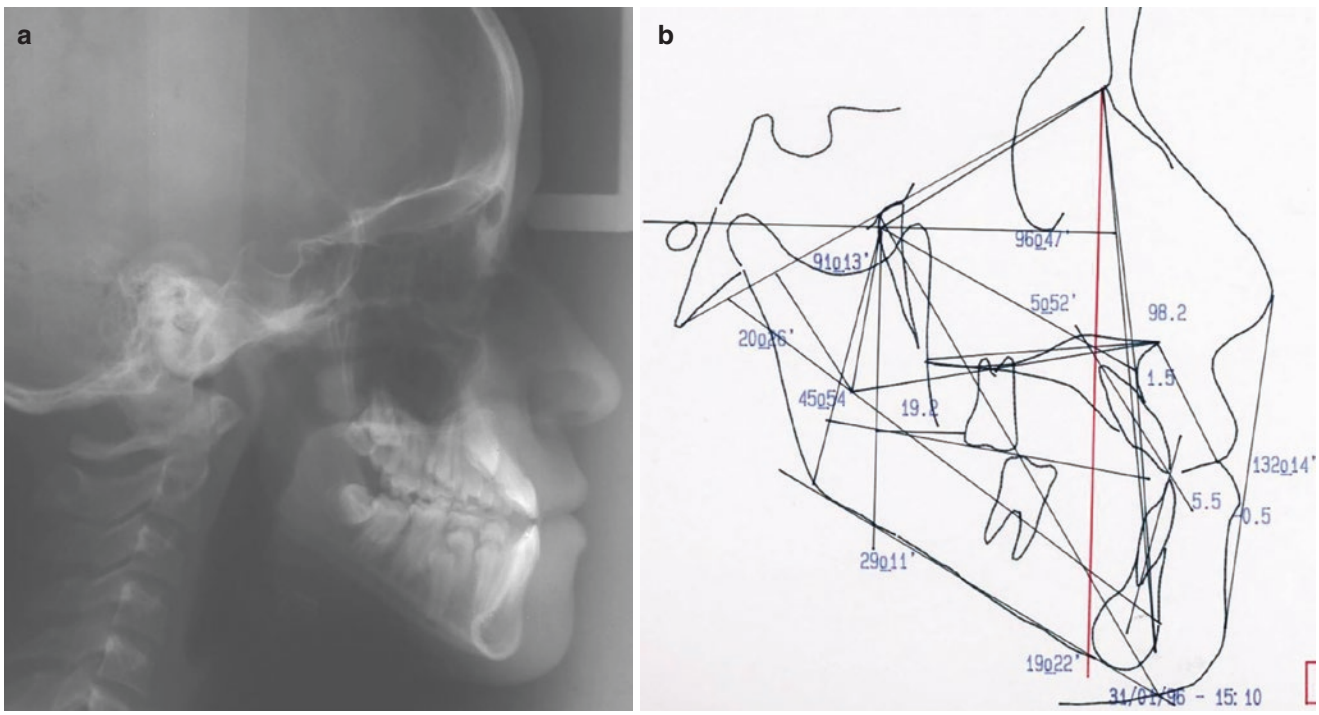

Fig. 1.9 (**a**, **b**) Lateral radiographs and Ricketts cephalogram at the end of the Phase I of treatment. Most of the objectives were fulfilled

at that time had to include an orthognathic surgical procedure when the patient was almost 20 years old (Fig. 1.11a, b).

These two clinical cases clearly demonstrated the importance of the normalization of the function and that the possibility to redirect growth is one of the major goals in this phase of treatment.

The difference in the response of patients with a similar orthodontic treatment protocol is the result of variability in the direction and rate of craniofacial growth as it was demonstrated with these two young Class III patients.

Integrated diagnosis is the basis that will allow us to determine the best treatment plan while considering the direction and quantity of growth.

It is important to take into consideration that maintaining the results for a long term depends on a number of factors: facial biotype, direction of growth, heredity, control of habits, etc.

The early treatment of the following patient was mandatory not only because of his profile but also due to the position and protrusion of the upper incisors (Figs. 1.12, 1.13 and 1.14).

The objectives of the first phase of treatment included the normalization of the position and inclination of the upper incisors to prevent any type of dental or dentoalveolar fracture as a consequence of an accident at home or at school. At the same time, the improvement of the position of the lower lip was necessary (Franchi et al. 2011).

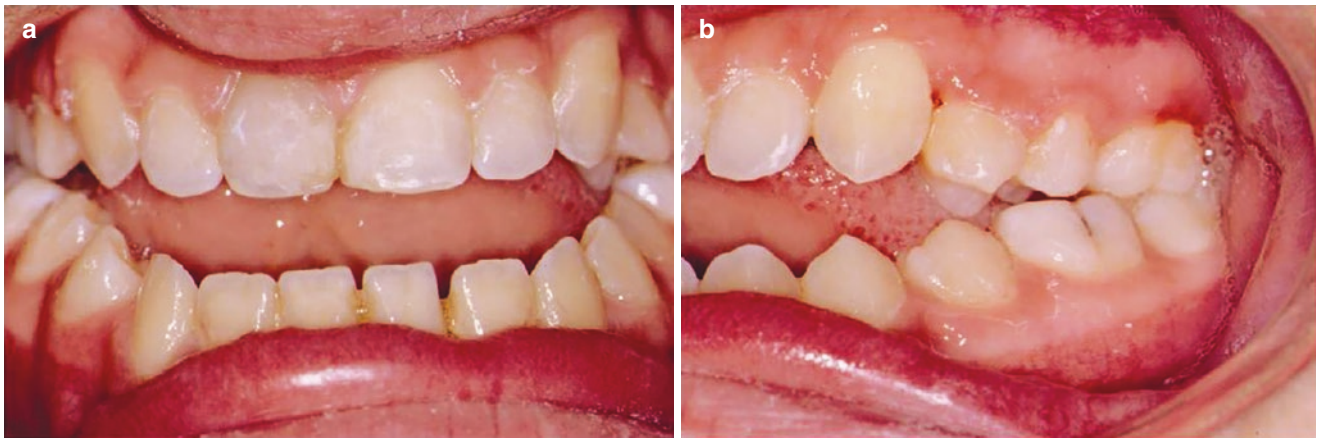

Fig. 1.10 (**a**, **b**) Frontal and lateral photographs 5 years without follow-up. The results were worse than expected

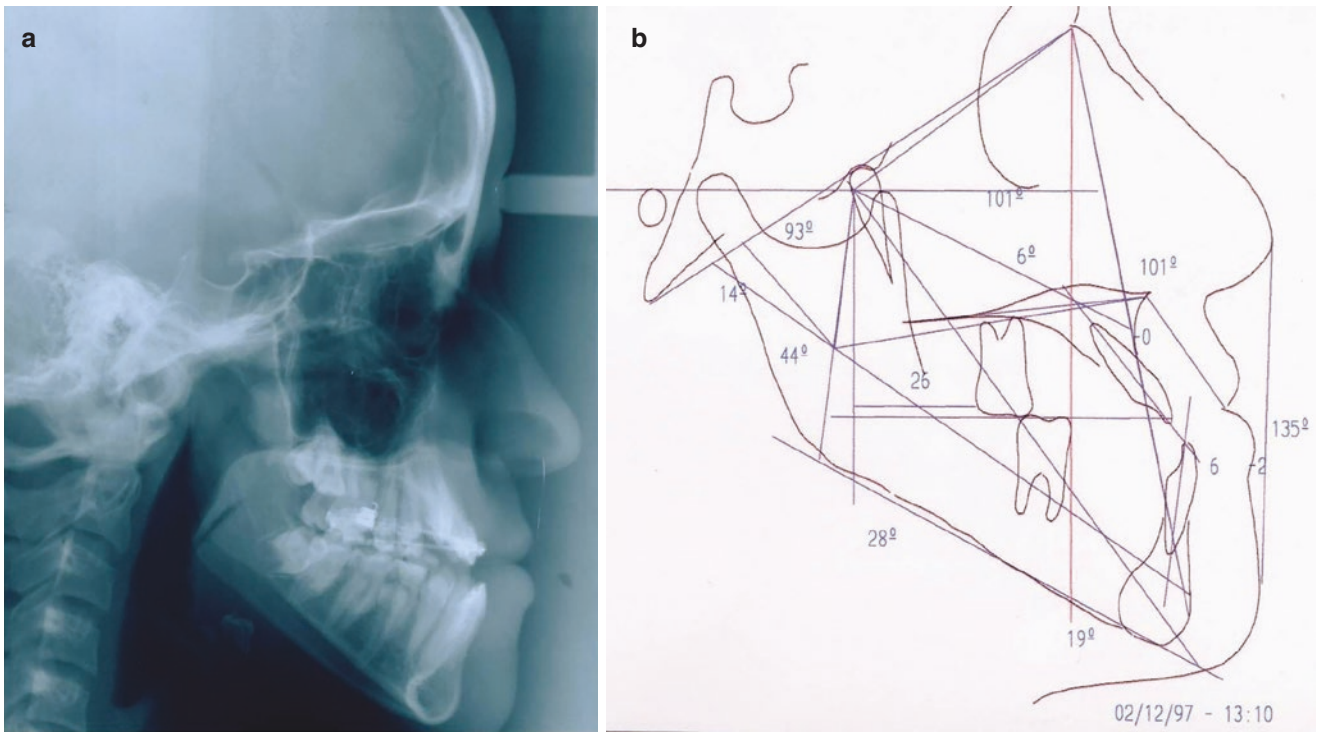

Fig. 1.11 (**a**, **b**) Lateral radiographs and Ricketts analysis 5 years later. The results clearly showed the adverse direction of growth

The consultation with the otorhinolaryngologist was also mandatory because it was necessary for the patient to be able to breathe without any problems in order to re-educate the position of the lips and the tongue.

The real question is what the best orthodontic treatment approach for this specific patient with prominent upper front teeth is. The answer can vary from beginning at that time or waiting until all the permanent teeth erupt.

Since one of the treatment objectives was to avoid the fracture of the anterior upper incisors, there is no doubt that the treatment had to begin at that moment.

A consultation with the otorhinolaryngologist was fundamental since the patient had to learn how to start breathing through his nose.

Before selecting the best treatment plan for this patient, it was necessary to determine which type of Class II he had.

Without knowing the etiology, it is very difficult to determine the correct, individualized treatment plan.

It is well-known that functional matrix facilitates the lower third development in the three directions thus in early mixed dentition the normalization of habits is fundamental to facilitate tooth eruption in normal position.

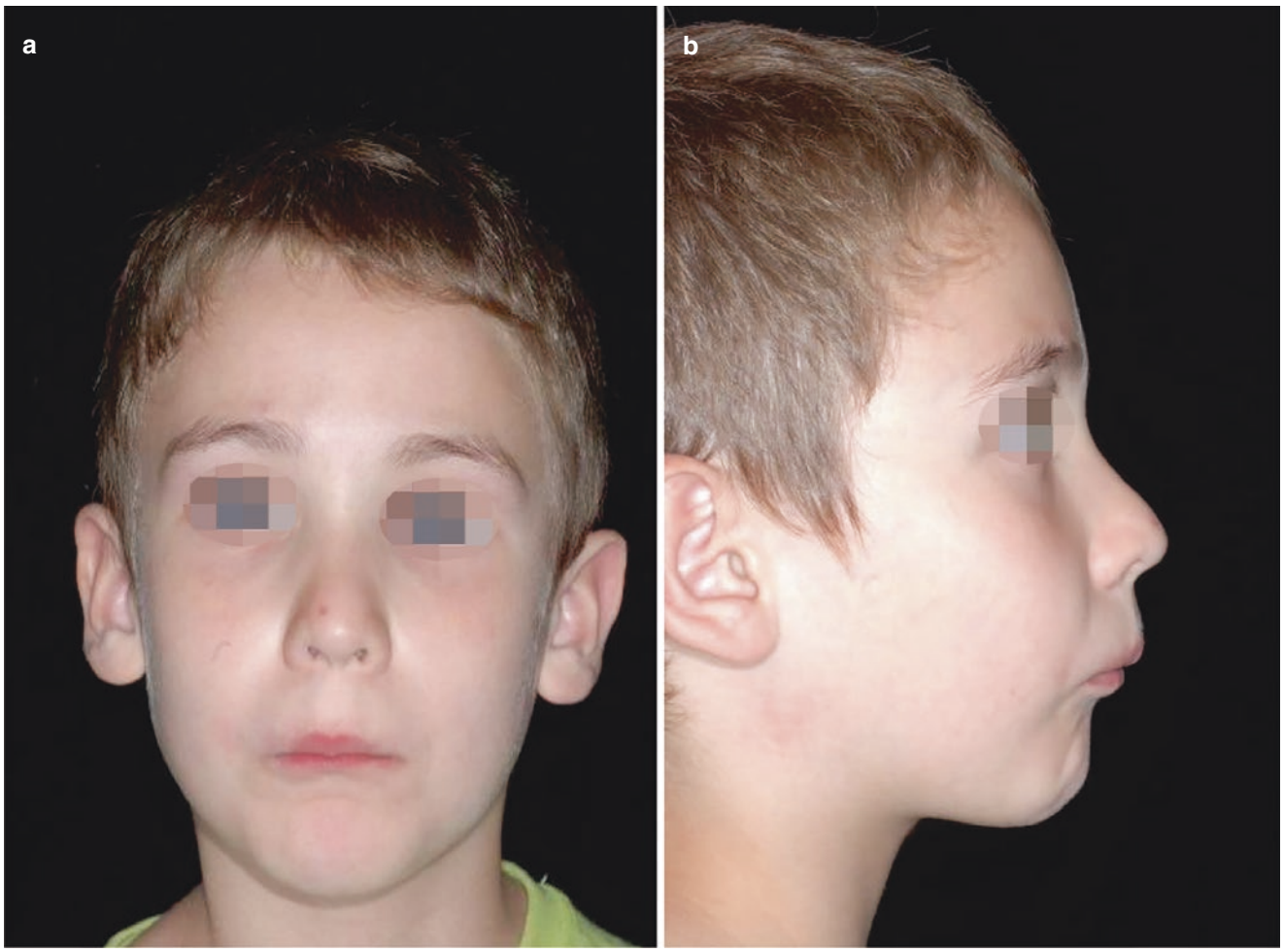

Fig. 1.12 (**a**, **b**) Frontal and lateral facial pre-treatment photographs. Difficulties in closing his mouth were clearly visible

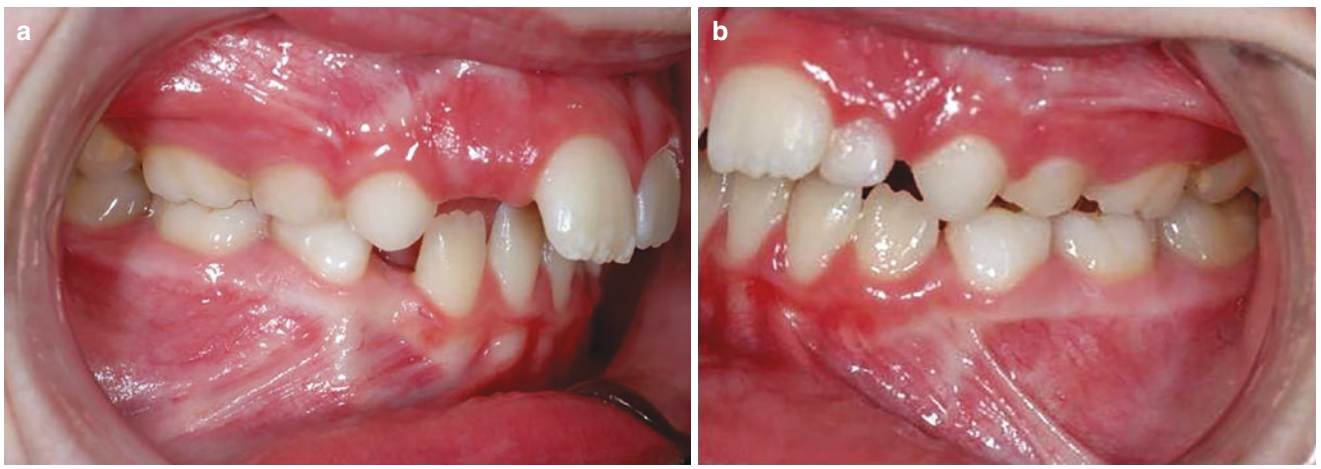

Fig. 1.13 (**a**, **b**) Pre-treatment right and left sides. Total lack of space for the left lower canine was confirmed along with the retroinclination of the lower incisors

To complete the diagnosis protocol, the patient was sent to his pediatrician because he snored loudly at night. He had a convex profile with a closed naso-labial angle in conjunction with difficulties to close his mouth. Also, he had some respiratory problems along with thumb sucking and lower lip interposition (Fig. 1.12a, b).

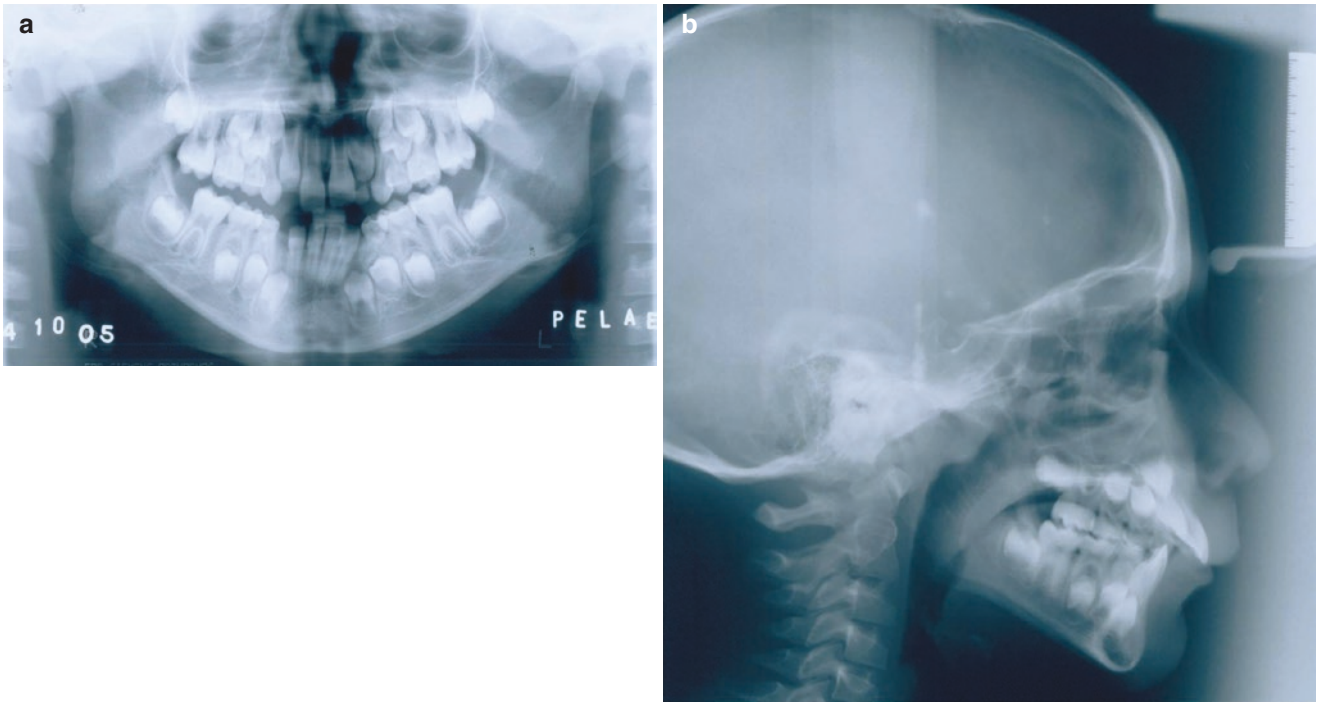

Fig. 1.14 (**a**, **b**) Pre-treatment panoramic and lateral radiograph. The anterior position of the upper incisors was confirmed

In order to determine the best and most efficient treatment protocol, it is necessary to consider if it is only an antero-posterior problem or if it is combined with a transversal one. In this situation, it is highly recommended to treat the transversal discrepancy first (Subtelny 2000). Also, it is advisable to restrain the forward displacement of the maxillary dentition and its alveolar process and at the same time allow the normal development of the mandible.

As a consequence of all the functional problems, the mandibular dentition was retro-positioned with retroinclined mandibular incisors and total lack of space for the lower left canine (Fig. 1.13a, b).

The panoramic radiograph confirmed the normal path of eruption of the other permanent teeth. The lateral radiograph showed the important frontal displacement of the upper incisors. He had a meso-facial biotype with a convexity of 9 mm.

The interincisal angle was 135° and his facial axis 85° (Fig. 1.14a, b).

The evidence suggests that providing early orthodontic treatment for children with prominent upper front teeth is more effective in reducing the incidence of incisal trauma than providing one course of orthodontic treatment when the child is in his adolescence (Thiruvenkatachari et al. 2014).

A myo-functional appliance (Trainer) was suggested in order to normalize nasal breathing and the position of the oral muscles.

The mother and the patient were very enthusiastic about the treatment since another colleague suggested to wait until 18 years of age and then correct the malocclusion with the help of an orthognathic procedure.

The patient was controlled by the orthodontist every 2 months, but he went to the speech therapist twice a week during the first year and then only once a week.

It is advisable that the patient uses the appliance 2 h during the day and all night.

These are the results after 3 years of treatment with a functional appliance that helped to normalized function and as a consequence redirected the position of the erupting teeth (Fig. 1.15a, b).

The patient continued using the appliance every night with a 3 months control. No brackets were bonded until that moment of the treatment, and the mother confirmed that the snoring disappeared.

His profile improved more than expected. No brackets were used during the entire second phase of treatment.

Since he was able to breathe normally, his behavior improved not only at school but also at home with his brothers too (Fig. 1.16a, b). There was an important improvement in his profile and in his dental anterior position.

A control 6 months later confirmed that the results were maintained. The incisors are normally positioned with good overjet and overbite. The gingival line and the occlusal plane were parallel (Fig. 1.17a, b).

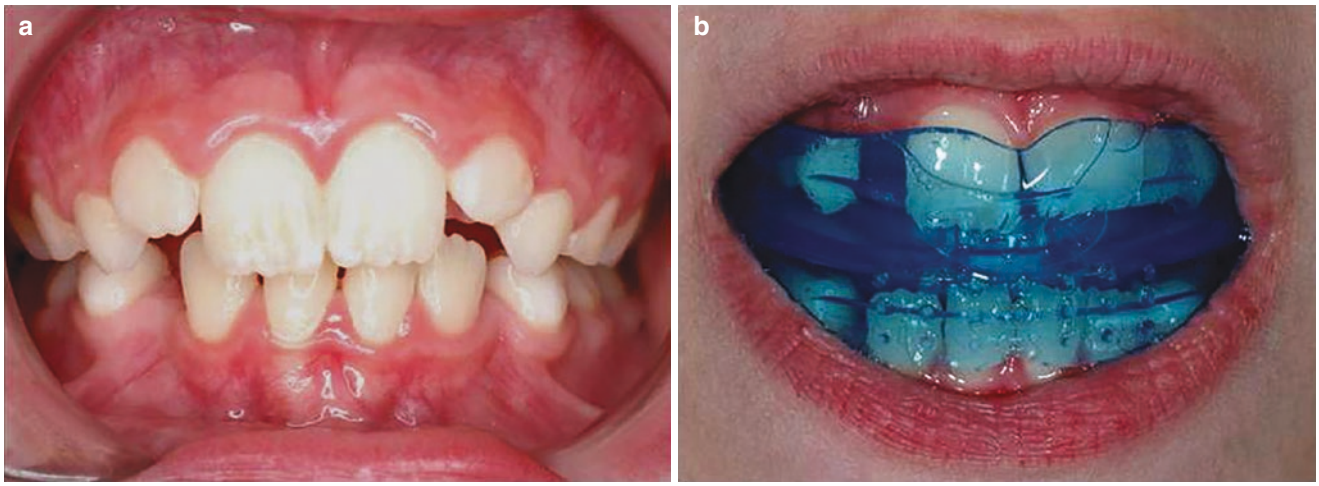

Fig. 1.15 (**a**, **b**) Frontal view with and without the appliance in place after 3 years of treatment

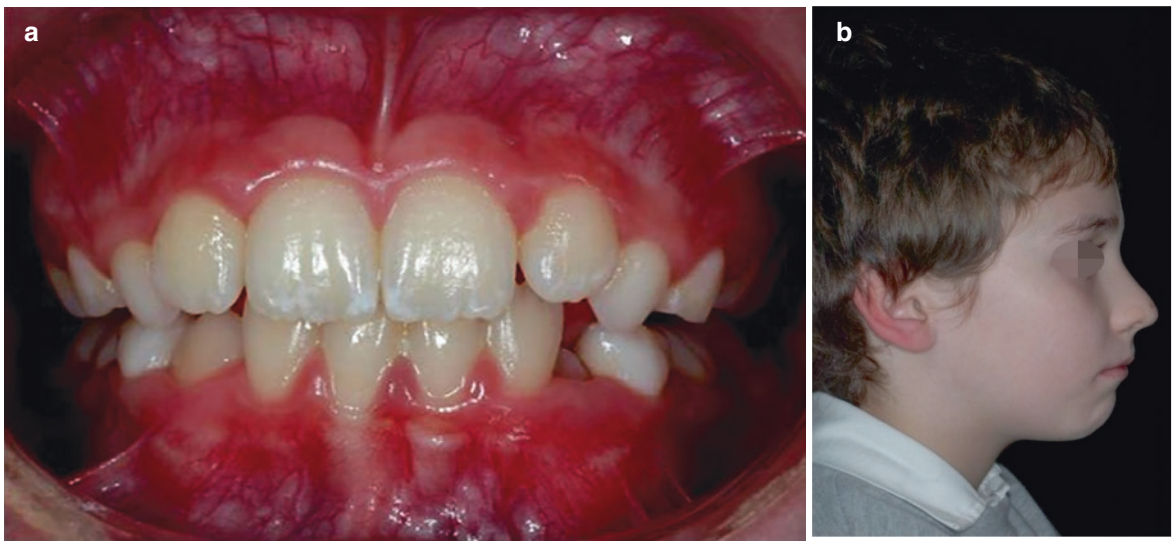

Fig. 1.16 (**a**, **b**) Frontal and profile photograph at this moment of the treatment. The normalization of the anterior occlusion and the position of the lips was remarkable

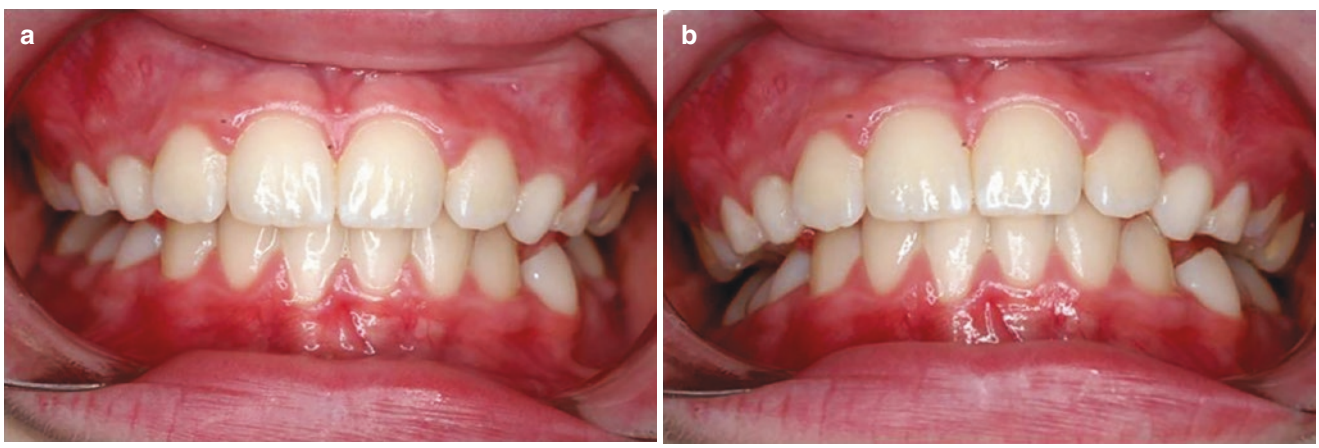

Fig. 1.17 (**a**, **b**) Control 6 months after treatment. Midlines, overjet and overbite were pretty normal

The lateral views confirmed that the lower canines erupted normally although they didn't have sufficient space at the beginning of the treatment (Fig. 1.18a, b).

The normalization of the upper and lower arch was the result of the new function of the oral muscles. Now they were rounded with space for all the permanent teeth (Fig. 1.19a, b).

In order to maintain the results and to control the position of the tongue and the width of the upper and lower arches, a new, more rigid (Phase II) Trainer was recommended (Fig. 1.20a, b).

After analyzing this type of patient, the conclusions would be that the early transitional dentition period seems to be the best time to correct these functional alterations in a very controlled and efficient manner.

The final photographs clearly demonstrated the normalization not only of the frontal teeth but also of the soft tissues. At that point, he could close his mouth without any muscle tension and the naso-labial angle was within normal ranges (Fig. 1.21a, b).

Front and occlusal photographs 1 year after treatment. All the teeth erupted in normal position. Class I canine and molar were achieved and maintained with perfect alignment. The patient had good oral hygiene during the whole treatment (Fig. 1.22a, b).

The comparison between the two profile photographs is the best demonstration of the results that were achieved when the function is recovered. No extractions were performed in the upper arch (Fig. 1.23a, b). The change in the naso-labial angle was better than expected as a consequence of the normalization of the stomatognathic system.

This clinical case strongly supports the benefits of the protocol that include second or third phase treatment. An early and accurate diagnosis is the most important issue, no matter the number of phases that the patient requires to achieve the best result in a more conservative manner with fewer orthognathic procedures.

Another malocclusion that has to be treated very early is the anterior deepbite since the musculature plays an important role before, during, and after treatment during the long

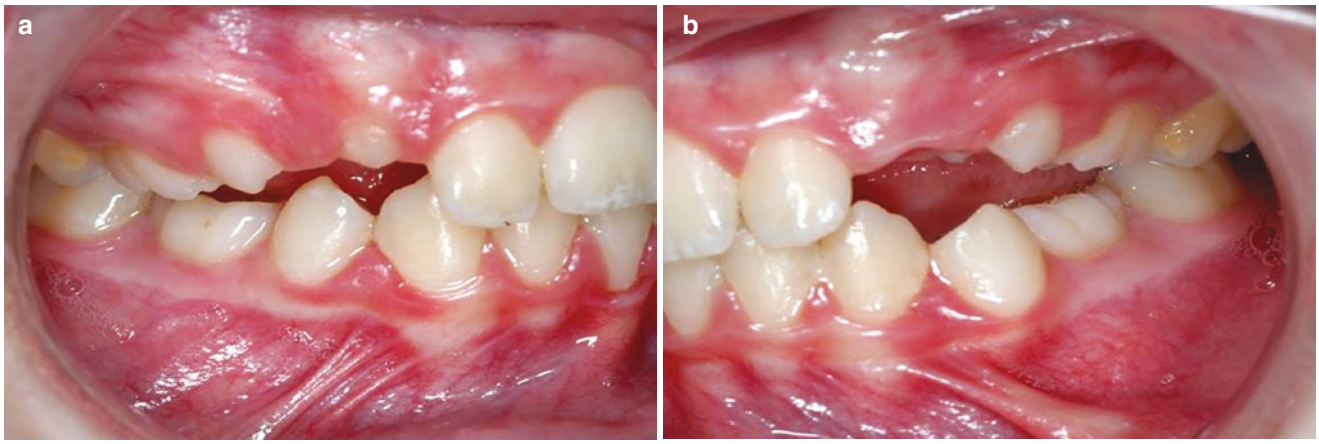

Fig. 1.18 (**a**, **b**) Right and left lateral views. Class I molar was maintained and at this moment the right and left canine had enough space to erupt

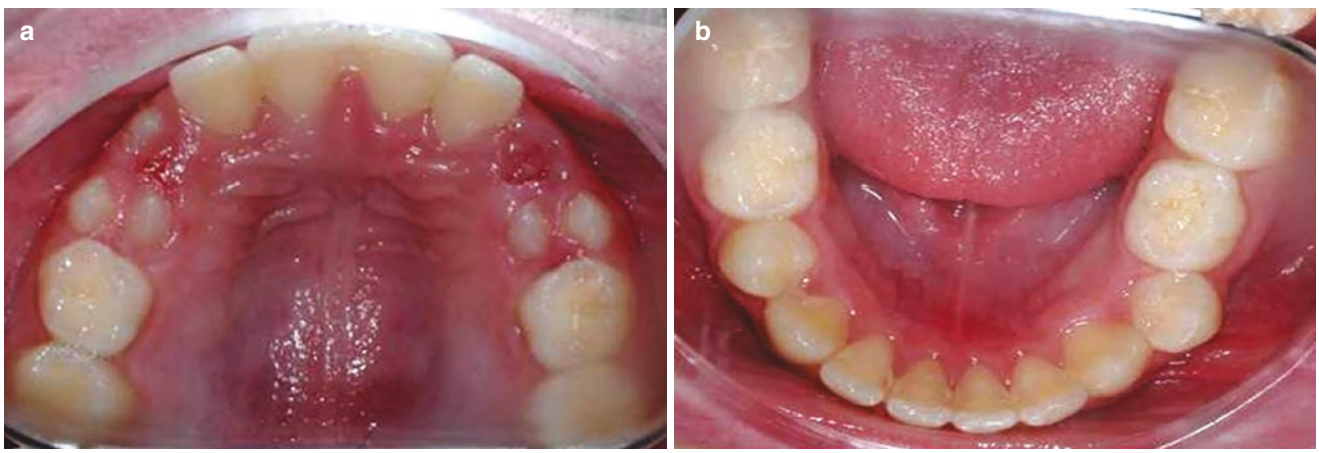

Fig. 1.19 (**a**, **b**) Upper and lower arch at this moment of the treatment. They had normal transverse and antero-posterior dimension

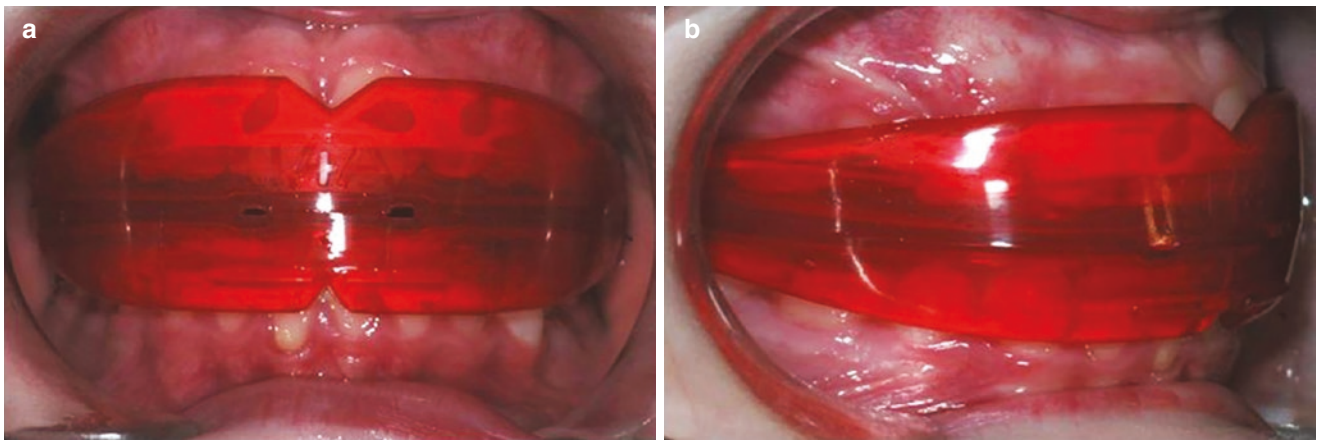

Fig. 1.20 (**a**, **b**) Phase II. Trainer was recommended in order to maintain the excellent results that were achieved

Fig. 1.21 (**a**, **b**) Post-treatment front and profile photographs. The lips closed without any muscular tension and the naso-labial angle was totally normal

retention period. The early treatment protocol to correct the anterior deepbite can be divided into three big groups: intrusion of the anterior teeth, extrusion of the posterior ones, or a combination of both.

To design the best treatment plan, a careful analysis of the smile at rest and during function is fundamental. The position of the upper incisors during the smile determines if the upper incisors have to be intruded or not.

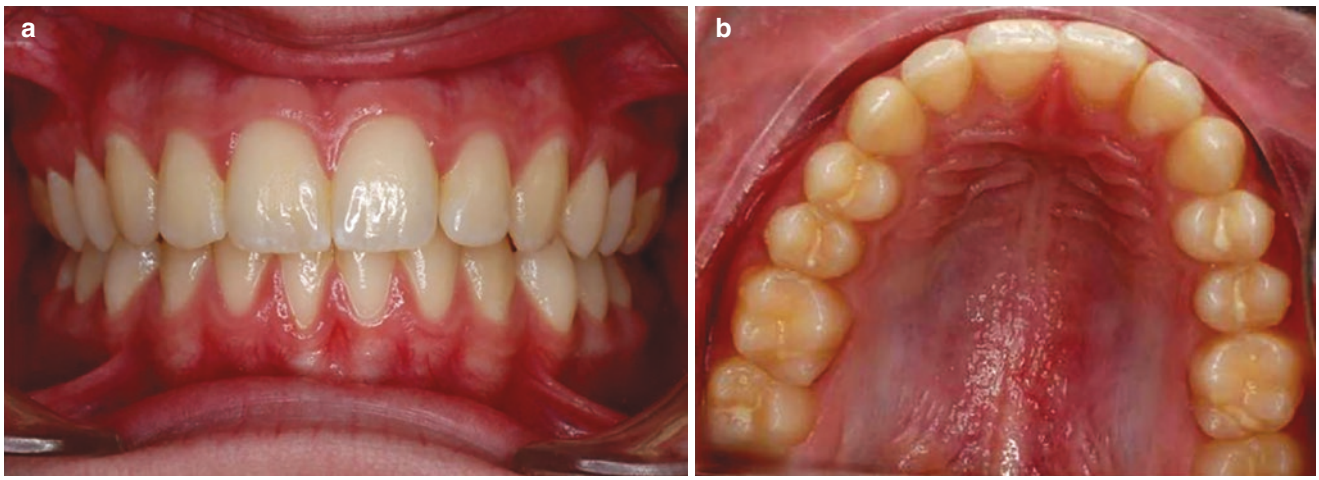

Fig. 1.22 (**a**, **b**) Frontal and occlusal view 1 year after treatment. The results improved with good oral hygiene. Midlines, overjet, and overbite were maintained

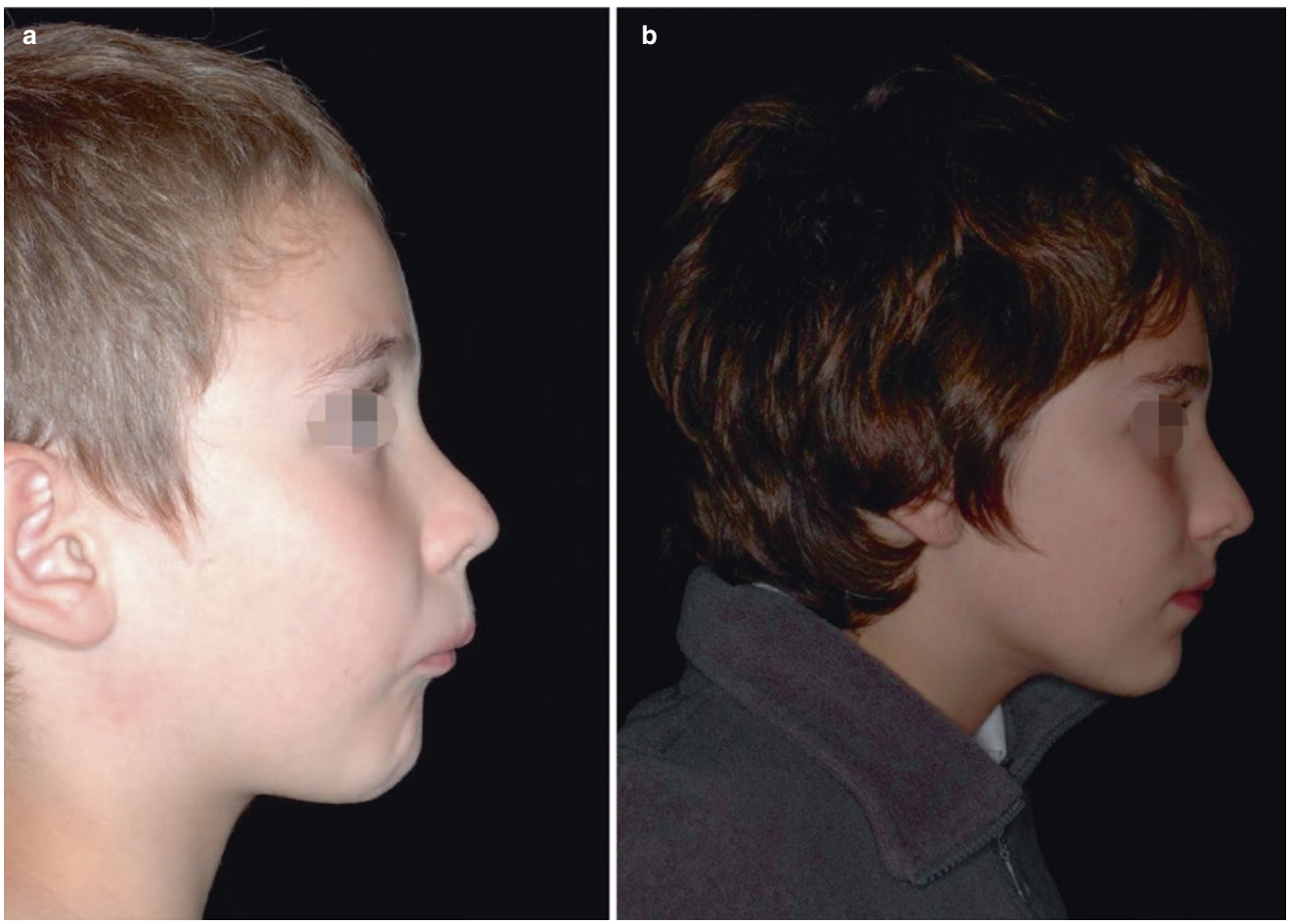

Fig. 1.23 (**a**, **b**) Comparison of pre- and post-treatment profiles. A significant improvement in the soft tissues was achieved and maintained