Correction of the Transverse Problems

8

Julia Harfin

Normalization of the upper arch has always been one of the most important issues in the treatment of young children with constricted maxillary arch with uni- or bilateral crossbite.

The etiology is multifactorial and the functional problems play an important role. The environmental factors are determinant not only in the beginning but also in the maintenance of the malocclusion. It can be present in Class I, II, or III patients with or without crowding.

It is acknowledged worldwide that transverse problems have to be normalized in temporary or early mixed dentition to allow a normal eruption of the bicuspids and cuspids.

It is well accepted that the younger the patient, the easier it is to achieve excellent results with fewer chances of relapse. The most appropriate timing for treatment appears to be before the eruption of the permanent lateral incisors.

The recovery of the normal maxillary width not only allows the gaining of space in the lateral areas but also gives the tongue more space to function in the correct position and maintain the results until adulthood.

After the treatment not only is the normalization of the arch perimeter achieved but in most of the cases the patients recover normal nose breathing (day and night) and stop snoring.

Expansion is one of the noninvasive methods of gaining or recover space in the transverse dimension.

It can be classified in slow or rapid expansion according to the rate of activation and also it can be uni- or bilateral according to its direction.

Dentoalveolar expansion produces dental expansion without any skeletal change and in general a removable appliance is used. This type of appliance is able to tip the teeth buccally but are not able to open the midpalatal suture (Fig. 8.1a and b).

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Dr. Emelson C. Angell in 1860 described this treatment for the first time. He is considered the father of the rapid maxillary expansion. In 1950, Korhauss and Andrew Hass reintroduced this appliance, and now its use is highly recommendable no matter what type of other appliances is combined.

Rapid maxillary expansion (RME) is considered as dentofacial orthopedic appliance that produces a splint at the middle palate suture. Teeth are generally used as anchorage units (Hass), but in the last years bone-teeth or skeletal anchorage appliances are described with very interesting results (Wilmes).

Indications for maxillary rapid expansion include uni- or bilateral posterior or anterior crossbite, constricted maxillary arches with mouth breathing tendency, tooth size-arch length discrepancy, etc.

Moreover, limited information is available about the long-term stability of the changes of the airway produced by RME (McNamara). Some studies have shown that maxillary constriction has a very close relationship with apnea in children, and this is an important issue to take into account.

To maintain the results, a fixed quad-helix appliance is suggested in almost all the young patients until the complete growth period is finalized.

When the diagnosis indicates that a skeletal expansion is recommendable, it has to be performed by a fixed appliance, and the result is the movement of the maxillary shelves away from each other (Fig. 8.2a and b). The pre- and post-occlusal radiographs after 2 weeks of activation of a rapid palatal expander showed the expansion that was produced in the midpalatal suture very clearly.

It is highly recommendable that this procedure be initiated prior the ossification of the midpalatal suture. There is an individual variation among all the patients but it is recognized that in general girls complete their growth period between 12 and 14 years of age and boys a little later (14–17 years old).

This procedure is always used in order to increase maxillary arch perimeter, correct uni- or bilateral cross-

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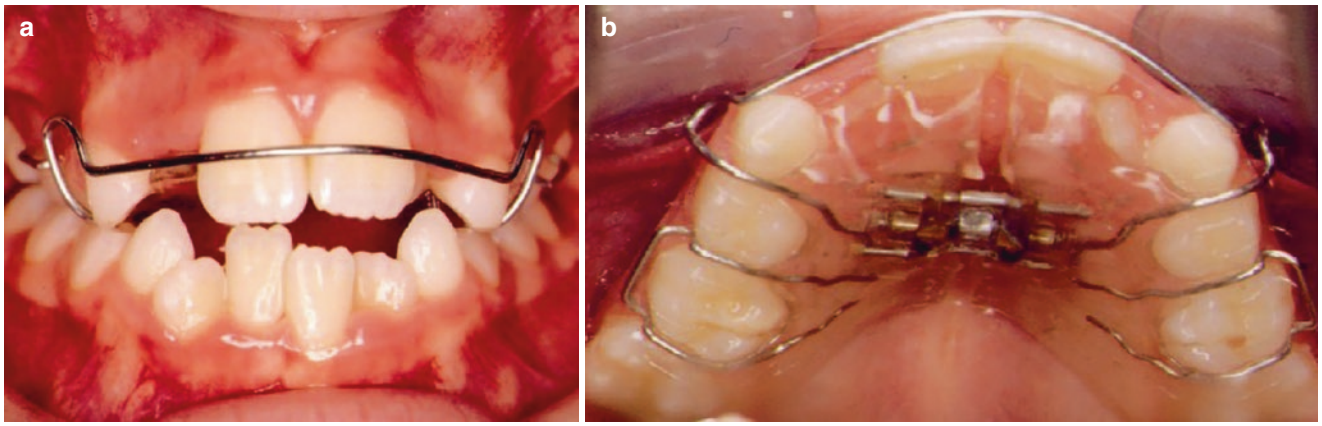


Fig. 8.1 (**a** and **b**) Example of a removable appliance to correct a slight transverse problem

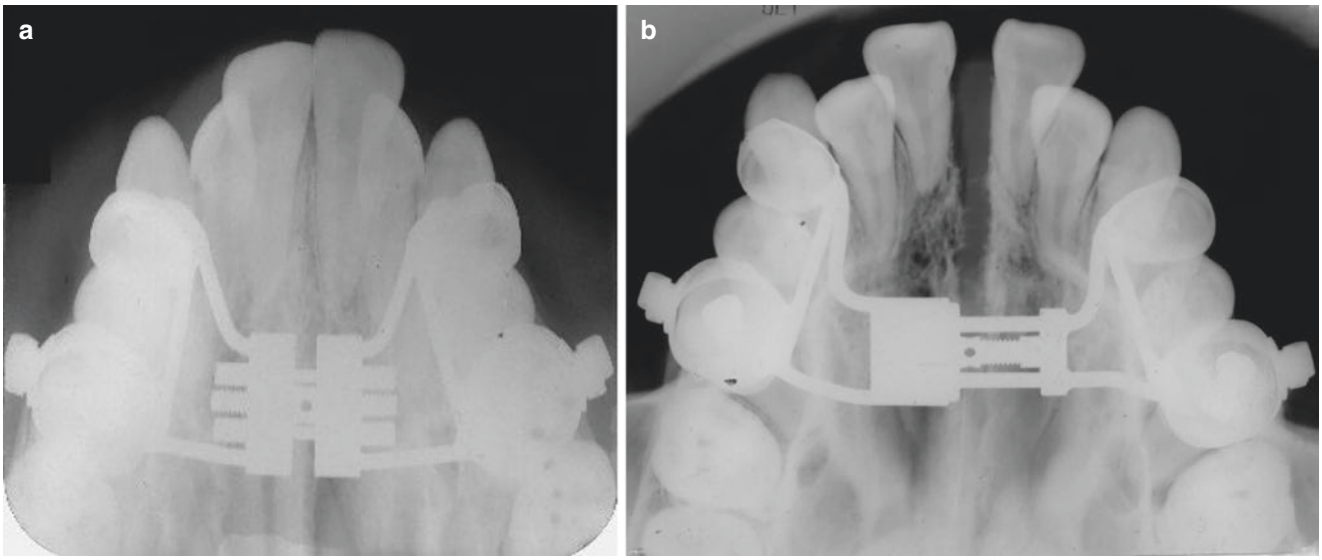


Fig. 8.2 (**a** and **b**) Pre- and post-occlusal radiographs after the use of a rapid maxillary expander for 2 weeks

bite, improve anterior crossbite, and in some cases improve airway flow.

According to the diagnosis and treatment plan, all the appliances have a similar design with bands on the first molars or metallic crowns on the first and second temporary molars. Different designs were described by different authors (bonded or cemented) but all of them include a central expansion screw.

The activation protocol involves the generation of orthopedic forces that could split the midpalatal suture. The screw has to be activated 1, 2, or 3 times a day (one quarter turn) according to the individualized treatment objectives. No pain and little discomfort could be present during the first days. The parents and the patients have to be instructed on the maintenance of the appliance and strict oral hygiene is necessary. Very few difficulties in speech and mastication could be present during the first 3–4 days.

It is advisable to give the patient an instruction sheet listing the schedule of activation and all the cares to take into account during the whole procedure. The parents' help is invaluable.

Normally the suture will open between 6 and 10 days.

An important interincisal diastema is always present when the midpalatal suture is set apart and then closes spontaneously after 2–3 weeks due to the action of the supracrestal fibers. The patient has to be controlled once a week to monitor the treatment during the expansion phase.

The lack of space in the anterior region is also an indication for using RME during the early mixed dentition period (Rosa). This procedure does not require any patient

cooperation and allows the increase of the perimeter of the upper arch.

In general, raising of the bite is not necessary in meso-, braqui-, or dolichofacial patients. The results are very predictable in a relatively short period of time.

Different types of RME can be used (Fig. 8.3a and b).

The following patients are a clear example of the results that can be achieved using this protocol.

The first one is an 8-year-old patient that was sent to the office by the family dentist due to lack of space for the eruption of the upper lateral incisors. The mother was worried about the central interincisal diastema. Mild constriction of the upper arch was present at the beginning of the treatment (Fig. 8.4a and b).

To increase the transversal width of the upper arch, a standard rapid maxillary expander was bonded with bands on the second temporary upper molars in order to protect the first molars and avoid eventual decalcifications or cavities. A distal extension wire was welded to the screw toward the right and left first molars and a mesial one until the temporary canines (Fig. 8.5a). The screw was activated twice a day (once in the morning and again after dinner). The results were achieved in two weeks and, as always, the interincisal diastema became wider (Fig. 8.5b).

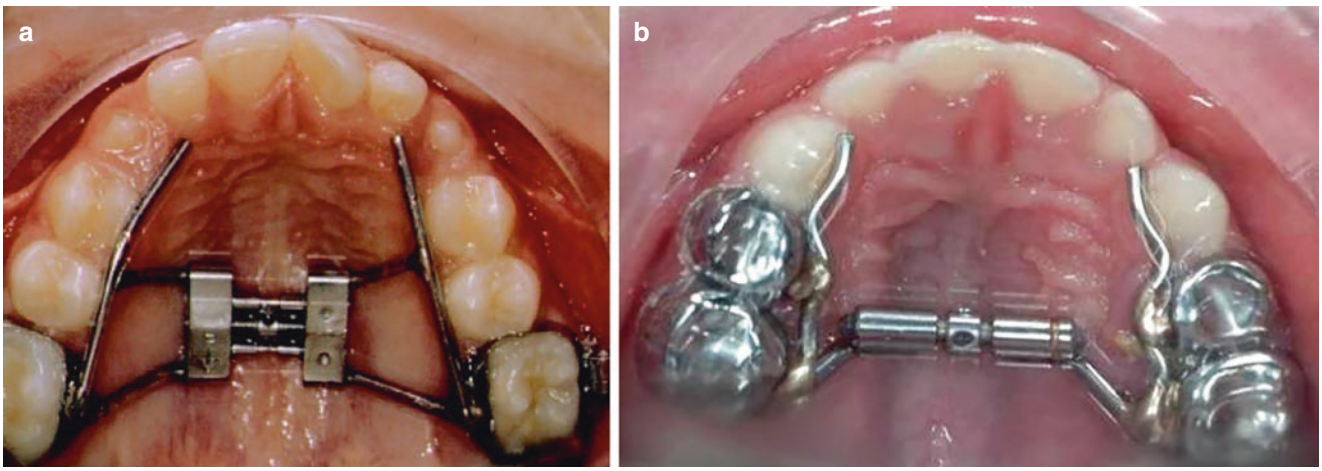


Fig. 8.3 (**a** and **b**) Different types of RME can be used with the same protocol of activation

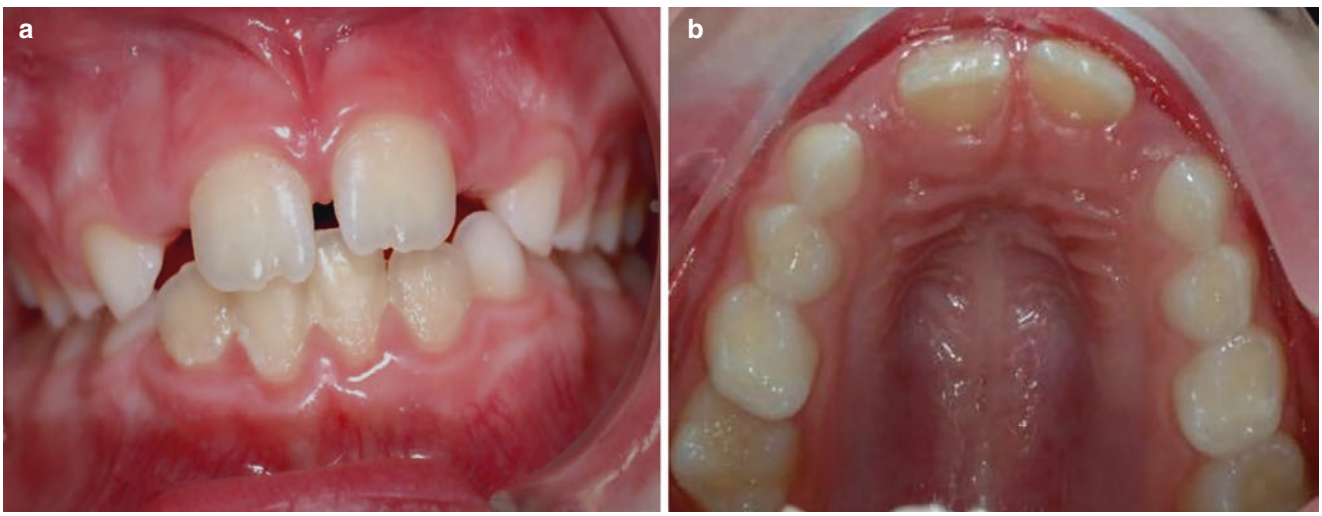


Fig. 8.4 (**a** and **b**) Pretreatment intraoral photographs. The lack of space for the upper lateral incisors was evident

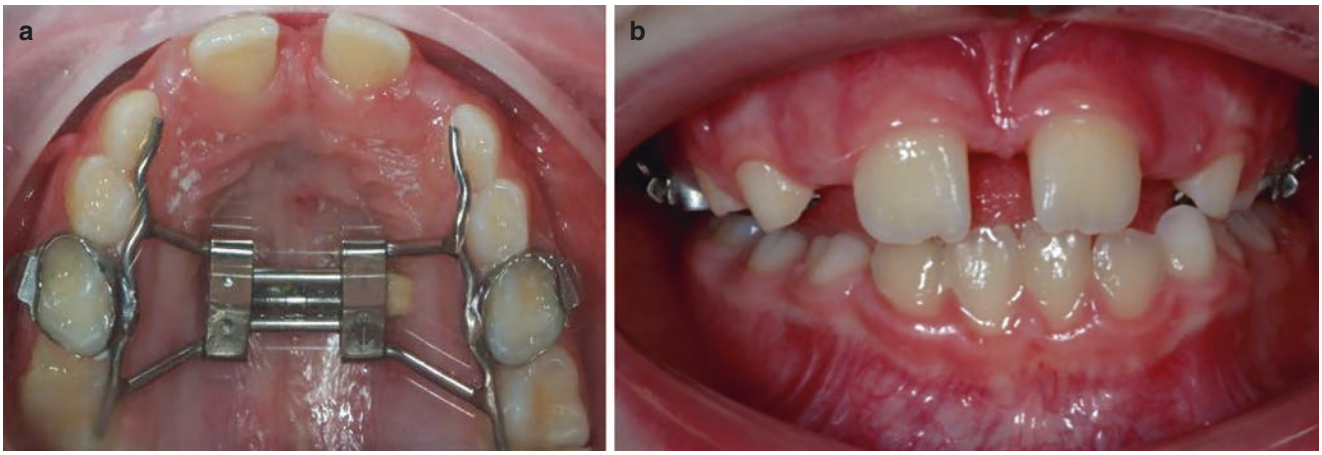


Fig. 8.5 (**a** and **b**) Results after 14 days of activation. A wider diastema was clearly visible

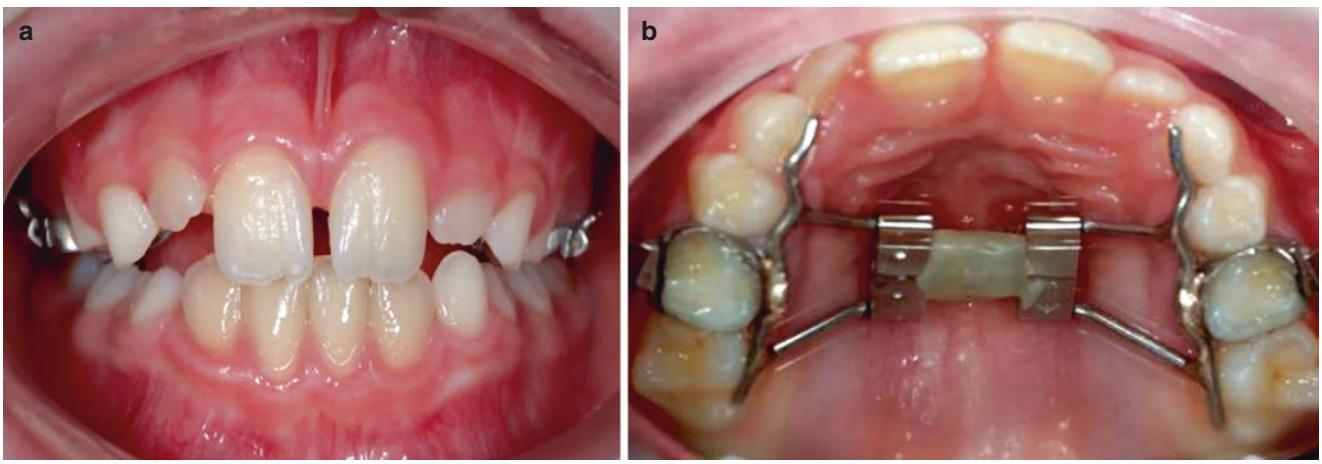


Fig. 8.6 (**a** and **b**) After 3 weeks the diastema was almost closed. The expander screw was fixed with composite

As was expected 3 weeks later, the diastema was almost closed and the upper lateral incisors began to erupt. The expander's screw was fixed with composite. In these cases, it is highly recommendable that the same appliance be used as a fixed retainer for a period of 6 months at least (Fig. 8.6a and b).

For personal reasons the patient returned 3 years later, and no other orthodontic treatment had been performed in that span of time. The upper lateral incisors erupted and the interincisal diastema was closed. The occlusal photograph showed that the bicuspids erupted in their right position, and the width of the upper arch was maintained (Fig. 8.7a and b).

This patient is a clear example of the importance of the normalization of the arch perimeter in the early mixed dentition.

In cases where the extraction of bicuspids is necessary, it is important that they be postponed until the rapid maxillary expansion process is concluded.

In general, a retention period of 6 months with the appliance in place is recommendable in order to control any type of relapse and permit a complete reorganization of the suture and all the surrounding tissues. This time is also important to allow the adaptation of the facial muscles to the new transverse dimension of the maxillary arch.

Otherwise, relapse will be the consequence. It is important to keep in mind that muscles play an important role in maintaining the results achieved in the transverse dimension.

In general, when the RME appliance is placed on the temporary molars, a slight normalization of the position of the incisors is achieved as result of the anterior expansion of the upper arch perimeter in the early mixed dentition.

There is no doubt about the effectiveness of the RME when it is cemented on the temporary molars with a wire welded to the palatal surfaces of the first permanent molars. In general expansion is achieved in the first permanent molar area too (Mutinelli) (Fig. 8.8).

The efficacy of this appliance is well acknowledged by all the orthodontists. The relationship between arch perimeter

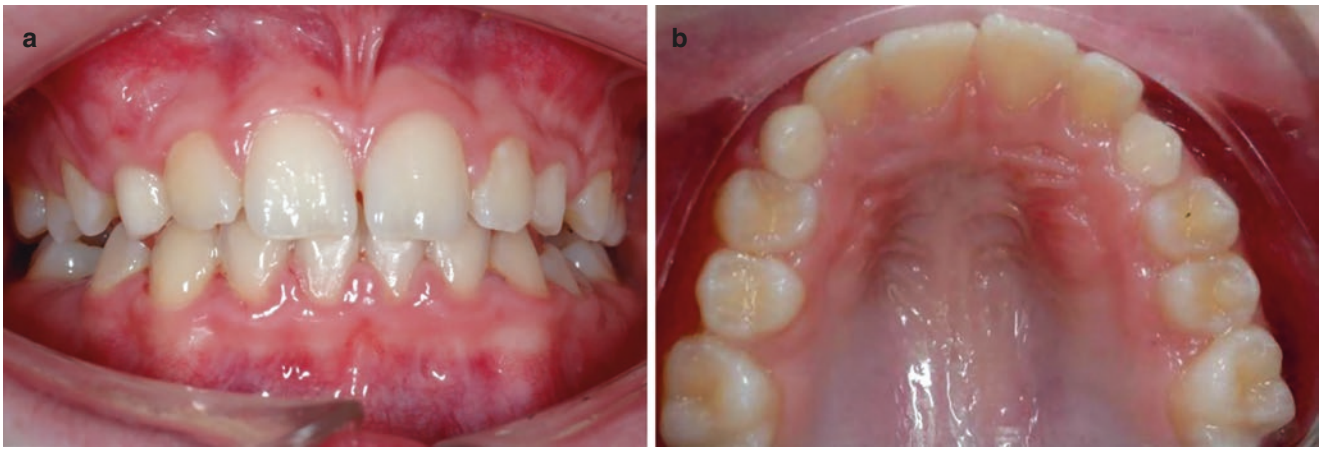


Fig. 8.7 (**a** and **b**) Results 3 years later without any orthodontic treatment. All the treatment objectives were achieved

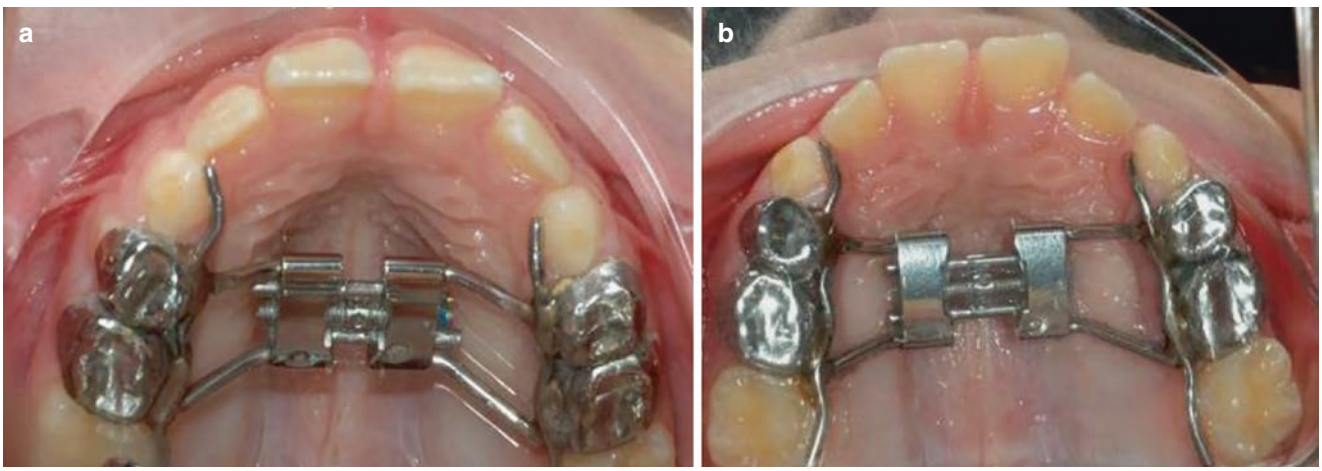


Fig. 8.8 (**a** and **b**) An example of an RME bonded on the temporary molars. The use of crowns on the temporary molars is advisable for better retention

and arch expansion was very well studied by Adkins and coworkers. They concluded that an average of 0,7 mm arch perimeter is increased after 1 mm of transpalatal width enlargement, but these proportions could vary according to the age and patient facial biotype.

The next 8-year-old patient was sent to the office by her mother, a pediatric neumonologist, who was worried about the triangular shape of her maxillary arch (Fig. 8.9a). The child was a mouth breather until 6 years of age, and after a 1 year treatment with a speech therapist, she was able to correct this habit. To normalize the shape of the upper arch and at the same time make sufficient space for the upper incisors, an RME was placed with bands on the first molars and extension wires bonded to the temporary canines. The activation protocol was two turns a day. The interincisal diastema was visible after the first week of treatment (Fig. 8.9b).

After 8 months, metal preprogrammed brackets (0.022″) were bonded on the rotated upper incisors and temporary canines to correct their position with a SS 0,016″ archwire for a 6-month period (Fig. 8.10a). Excellent results were achieved 7 months later. The cuspids and bicuspids erupted in the correct position without any additional appliance. The arch width was maintained and a removable retention was placed (Fig. 8.10b).

The comparison between the pre- and posttreatment smile clearly showed its improvement. This is one of the best protocols to obtain a broad smile in a very controlled procedure (Fig. 8.11a and b).

The lateral smile photographs confirmed how the thickness of the upper lip changed. Since the facial biotype plays an important role in the maintenance of the results, it is important to determine an individualized treatment plan. A 6-month follow-up was recommended until the second molars fully erupted (Fig. 8.12a and b).

Silva and coworkers describe that after RME, the maxilla is displaced downward and backward. Meanwhile, Hass

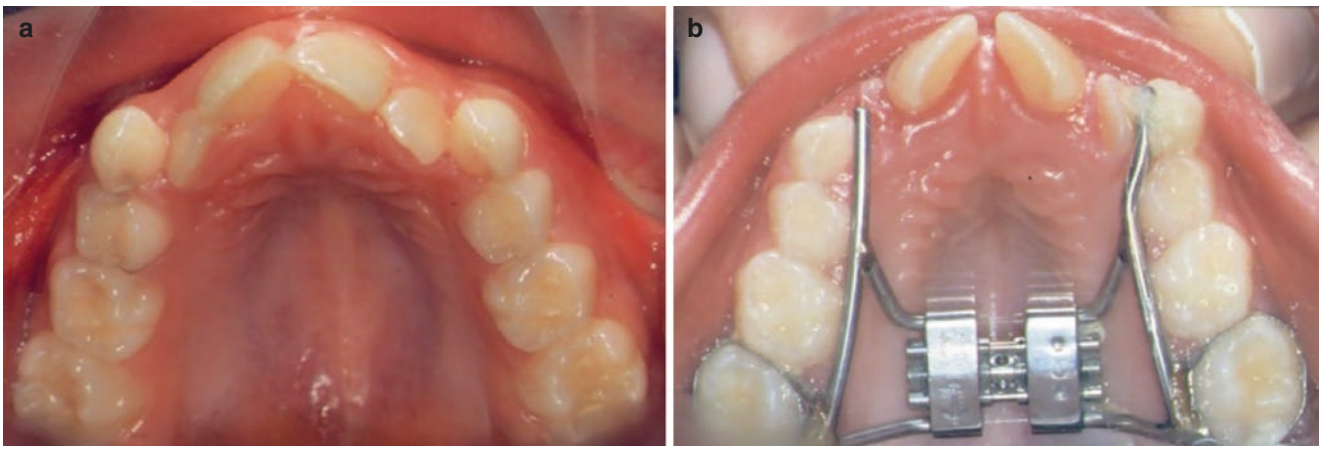


Fig. 8.9 (**a** and **b**) Pretreatment occlusal photograph and 1 week after the activation of an RME

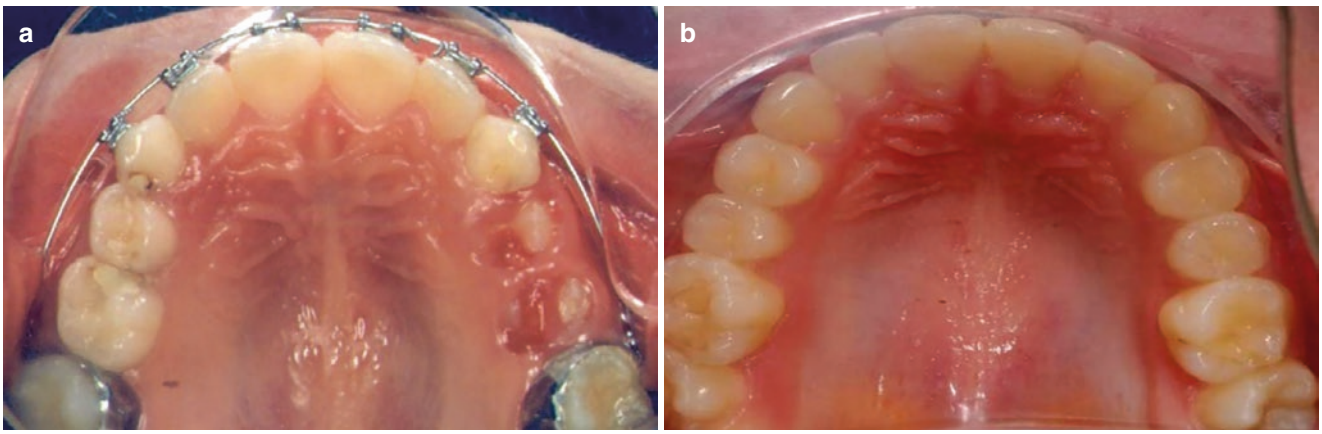


Fig. 8.10 (**a** and **b**) Occlusal photographs during the second phase of treatment and at the end of the active procedure

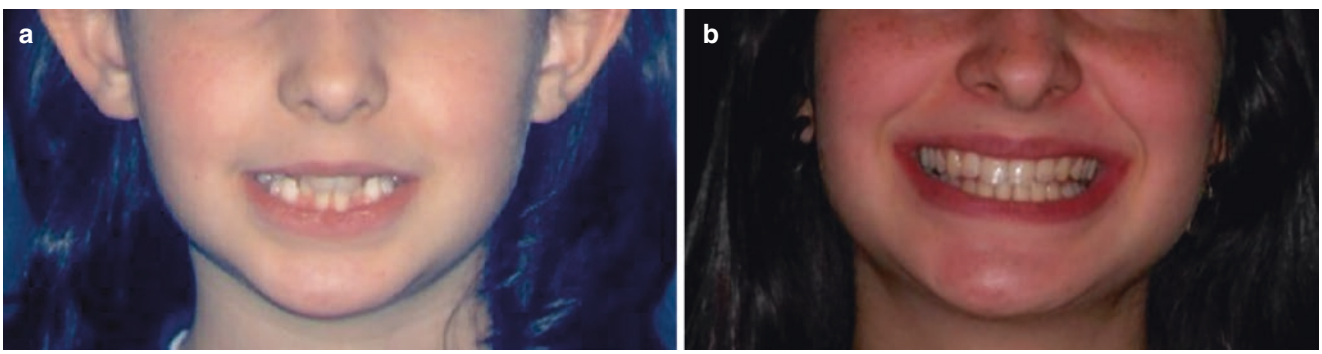


Fig. 8.11 (**a** and **b**) Comparison of pre- and posttreatment frontal smile. A significant improvement was achieved

showed that the result is a slight bite opening and a forward displacement of Point A. It is very difficult to compare all these studies.

The retention protocol could change according to various circumstances and includes a removable palatal plate such as a Hawley or Scwartz appliance or functional appliances like Trainers (myofunctional appliances). There is no specific period of time for all patients but a minimum of 12 months is required in order to give the reorganization of the soft and hard tissues enough time to avoid relapse.

The following case is another interesting example of correction of transverse problems. The following patient was

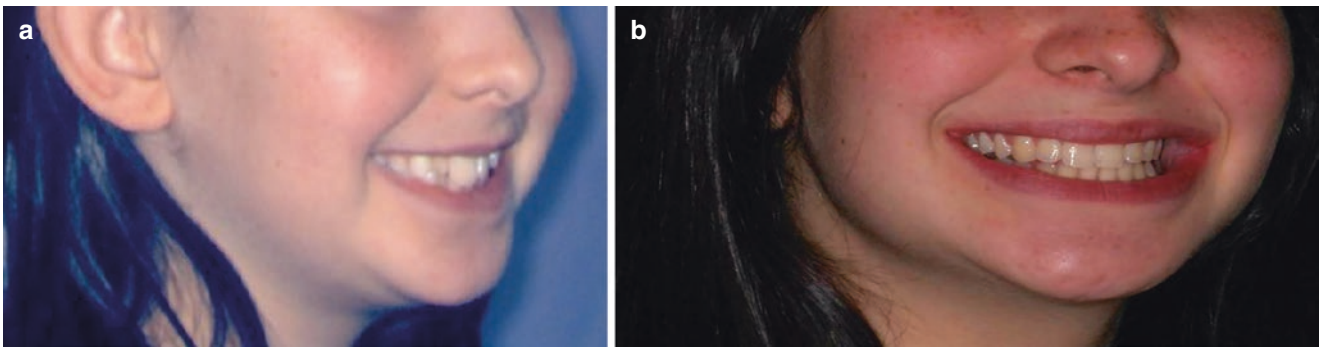


Fig. 8.12 (**a** and **b**) The improvement in the thickness of the upper lip in concordance with a broadened smile was more than satisfactory

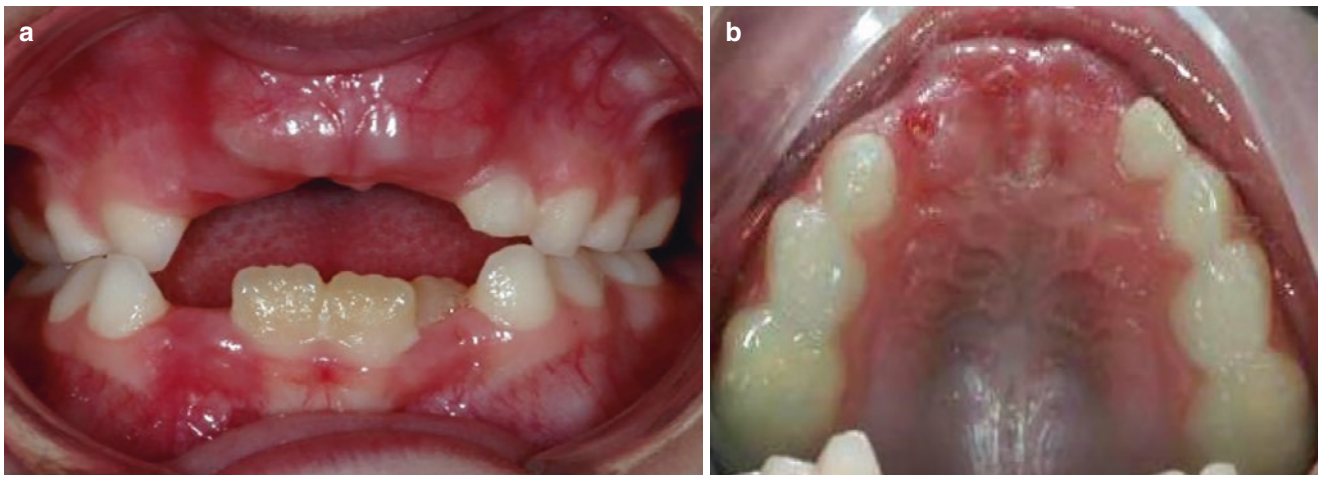


Fig. 8.13 (**a** and **b**) Pretreatment frontal and occlusal photographs of a 7-year and 6-month-old patient

7 years and 6 months of age in the first consultation. He was the youngest of four children, three of them with class III molar and canine.

No important medical history was present.

She had difficulties with the pronunciation of some consonants due to the absence of the upper incisors in conjunction with the anterior position of the tongue (Fig. 8.13a and b).

Upon analyzing the lateral views, a slight compression in the temporary canine and molar region was present. The right canines were in crossbite position (Fig. 8.14a and b).

The panoramic radiograph showed that there were no agenesis nor supernumerary teeth (Fig. 8.15a), and the lateral radiograph confirmed that the patient would have a mesofacial growth. The lips were closed without tension with a normal nasolabial angle (Fig. 8.15b).

The treatment objectives were as follows:

1. Normalize the transverse dimension.
2. Normalize overjet and overbite.
3. Maintain Class I canine and molar.
4. Long-term stability.

To fulfil the treatment objectives, a two-phase treatment was suggested. During the first phase, a Haas expander was placed with metallic bands on the second temporary molars and extension wires bonded on the temporary canines. An activation twice a day was recommended along with a weekly control. This protocol has been demonstrated to be efficient at this age (Fig. 8.16a and b). No brackets were placed on the lower arch to correct the anterior crowding during this phase of treatment.

One of the disadvantages of the RME is that in some clinical cases the anterior open bite can be increased when the molars are crossed to the labial position (Fig. 8.17a). To monitor the position of the tongue, a removable functional appliance (Trainers) was used to enhance tongue position and nasal breathing. Its use was recommended 3–4 hours during the day and all night (Fig. 8.17b).

A 3 –month follow-up later showed the improvement in the position of the upper incisors while the RME was still in place as a retention appliance. No molar tipping was observed (Fig. 8.18a and b). The patient had to continue using the Trainer to control the position of the tongue.

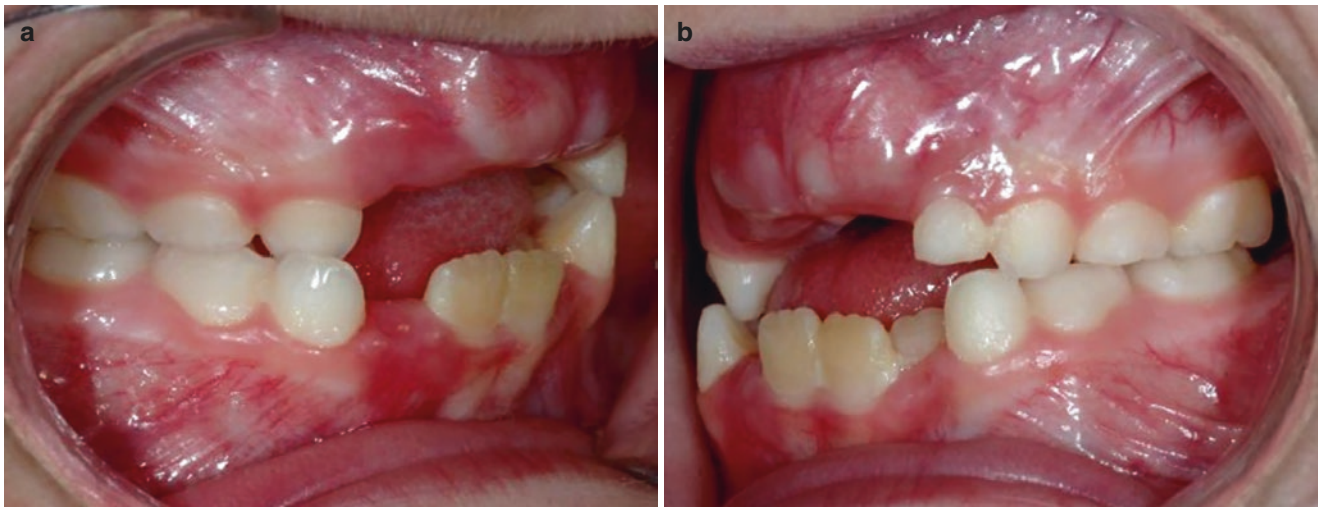
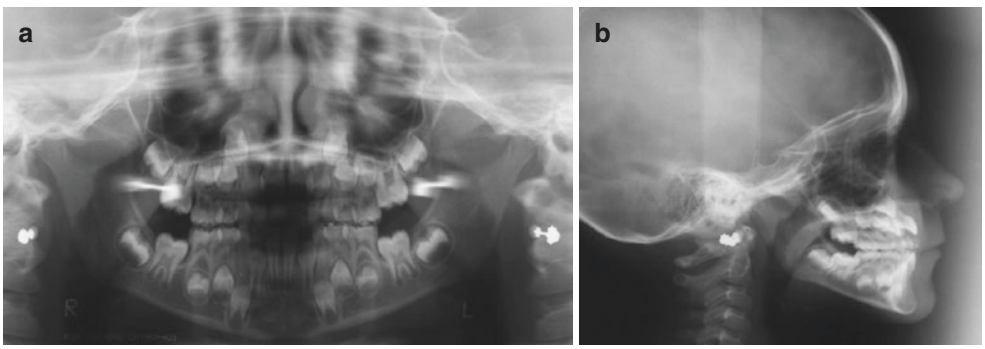


Fig. 8.14 (**a** and **b**) Lateral views at the beginning of the treatment. A crossbite relationship was present on the right side

Fig. 8.15 (**a** and **b**) Pretreatment panoramic and lateral radiograph



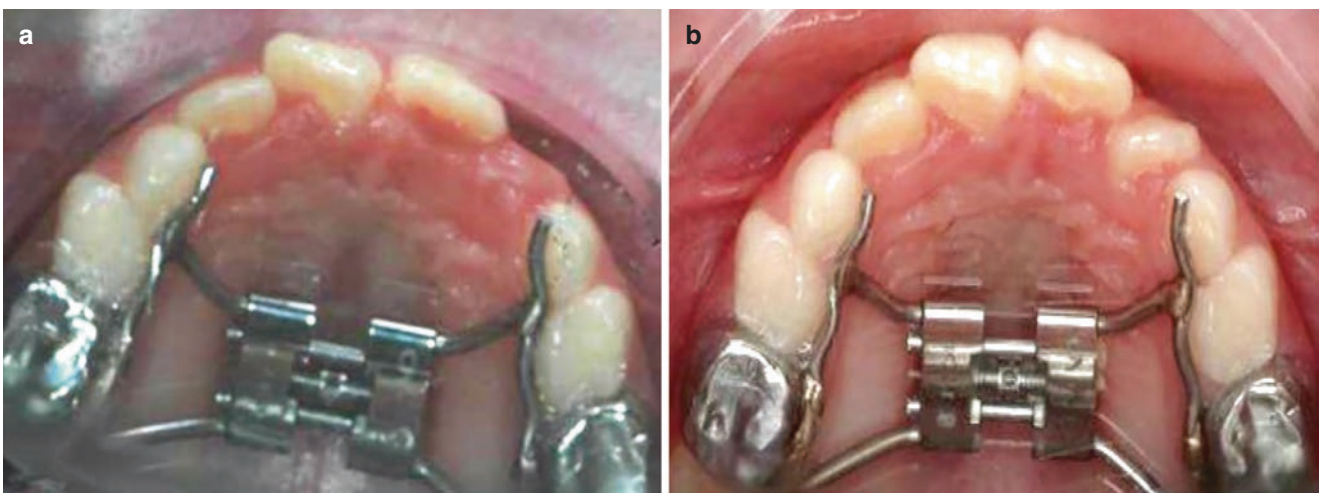


Fig. 8.16 (**a** and **b**) First phase of treatment. RME in place with bands on the temporary upper second molars

The patient was ready for the second phase of treatment, 1 year later. The open bite was totally closed. Esthetic brackets (0,022″ slot) with an esthetic 0,016” SS archwire were placed in the upper and lower arches. To recover the space for the upper canines, an open coil spring was placed on the right and left side with more activation on the left quarter to correct midlines (Fig. 8.19a and b).

Since there was enough room for the eruption of the canine on the right side, but not on the left side, additional activation of the left open coil spring was necessary. To correct anterior

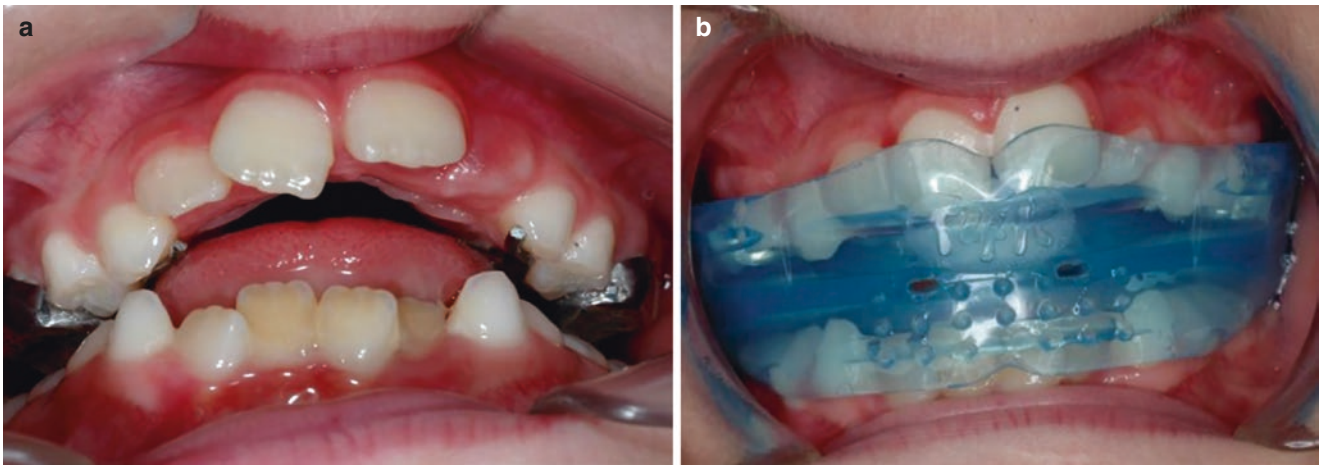


Fig. 8.17 (**a** and **b**) The use of a removable functional appliance to normalize nasal breathing and tongue position is highly advisable (Trainer Myofunctional Research)

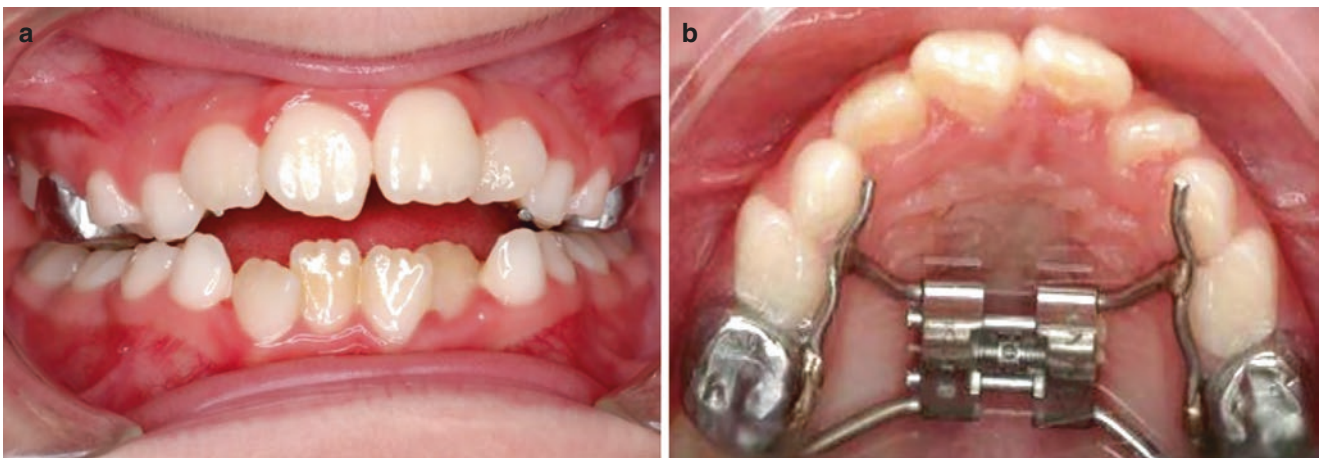


Fig. 8.18 (**a** and **b**) A 3-month follow-up later with the RME in place as a retention device in conjunction with the use of the Trainer to normalize the position of the tongue

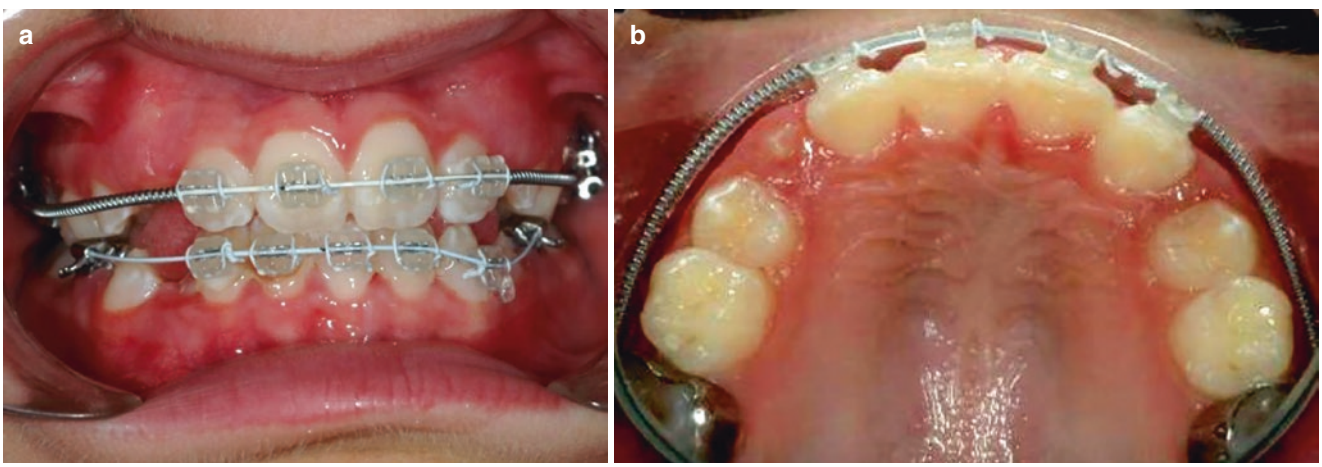


Fig. 8.19 (**a** and **b**) At the beginning of the second phase of treatment, the upper and lower 0.022″ esthetic brackets were bonded. An activated coil spring on the left side was placed to achieve the space for the left canine

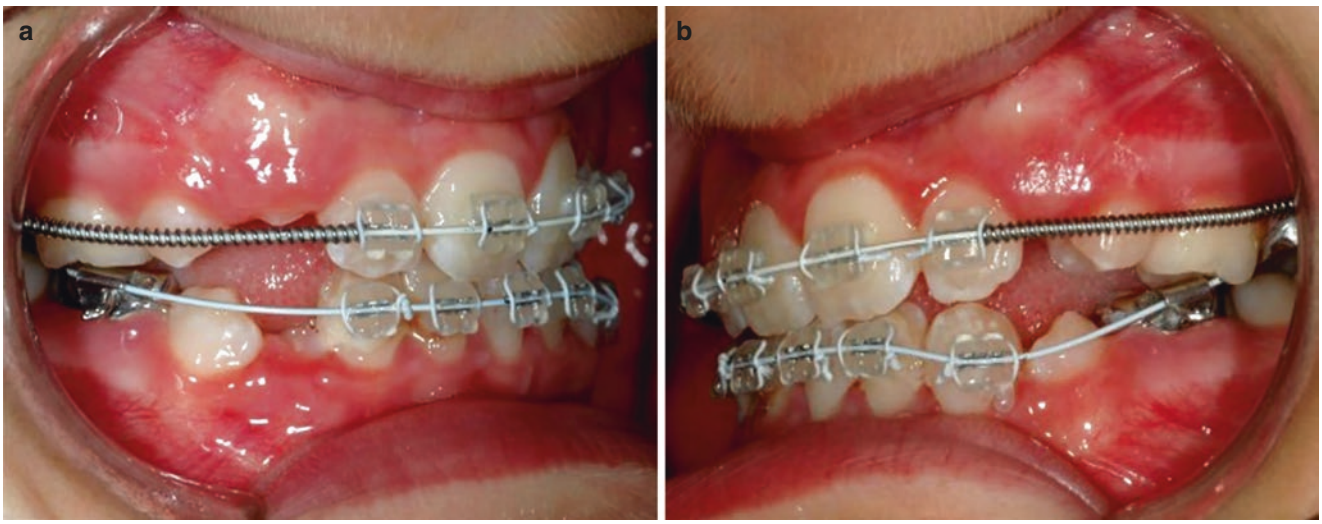


Fig. 8.20 (**a** and **b**) Right and left side at this stage of the treatment. A coil spring was placed on the left side and activated more

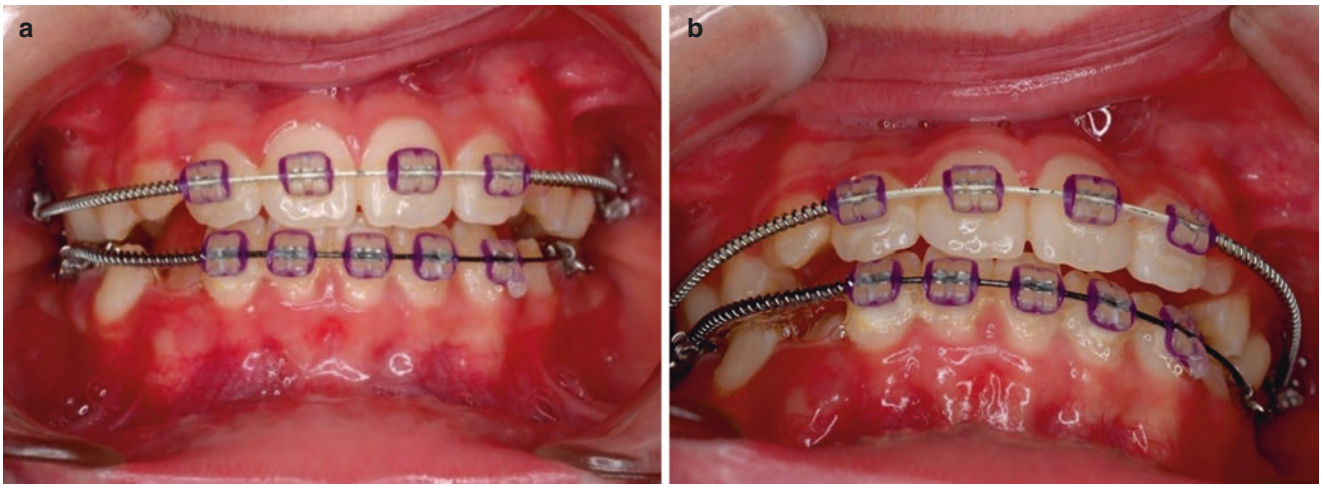


Fig. 8.21 (**a** and **b**) Follow-up 3 months later. The anterior lower crowding was almost corrected

crowding, the same type of brackets were bonded on the lower arch with bands on the temporary second molars along with a 0,014" NI-Ti wire (Fig. 8.20a and b).

Follow-up 3 months later showed a considerable improvement. Overjet and overbite were almost normal. The oral hygiene was fairly good (Fig. 8.21a and b).

Although the patient was 11 years old, the upper canines began to erupt before the second bicuspids. To improve anterior torque, the upper coil springs along with a 0,016″ × 0,022" SS esthetic archwire were maintained until the eruption of all the bicuspids. A 0.018" Ni-ti lower archwire with an open coil spring was placed on the left side to gain space for the left canine and first bicuspid (Fig. 8.22a and b).

The evaluation of the upper and lower arch confirmed that all the first bicuspids erupted and no crowding was present. Lower bands were still in place on the temporary second molars (Fig. 8.23a and b).

Final front photographs. All the objectives were fulfilled: midlines were almost coincident, gingival line was parallel to the occlusal plane, and overjet and overbite were within the normal values (Fig. 8.24a and b).

The lateral views corroborated that all the treatment objectives of the second phase of treatment were achieved. The normalization of the occlusal plane as well as the gingival line was achieved with Class I canine and molar (Fig. 8.25a and b).

The retention plan included upper and lower fixed retention wires at least until the third molars erupted (Fig. 8.26a and b).

The final radiographs confirmed the parallelism of the roots. Also, the second and third upper and lower molars were erupting normally (Fig. 8.27a and b).

The comparison of the front photographs pre- and post-treatment showed the significant improvement that was

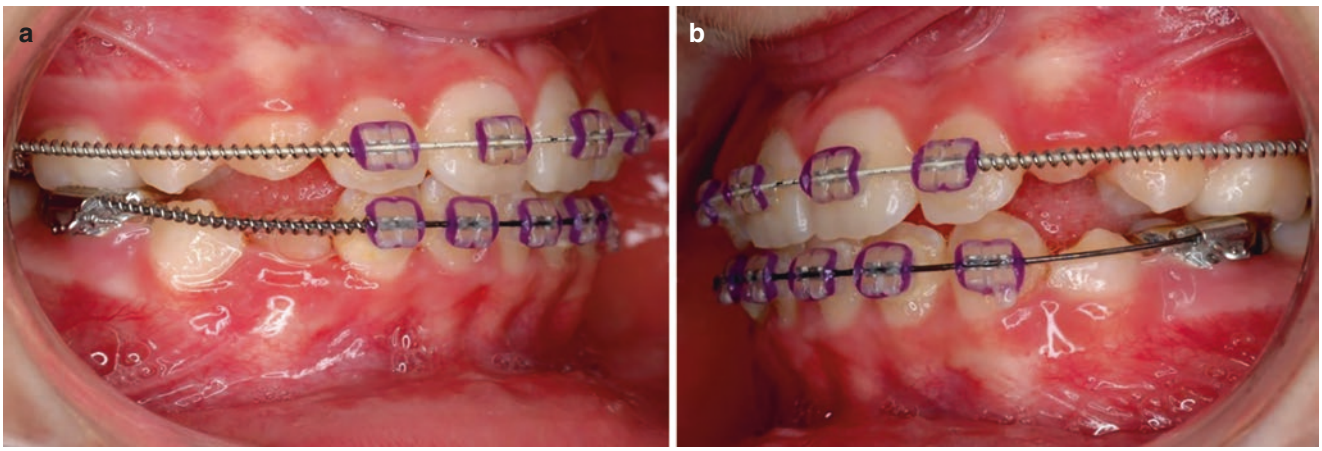


Fig. 8.22 (**a** and **b**) Lateral views at this stage of treatment. Right and left upper canines began their eruption path before the second bicuspids

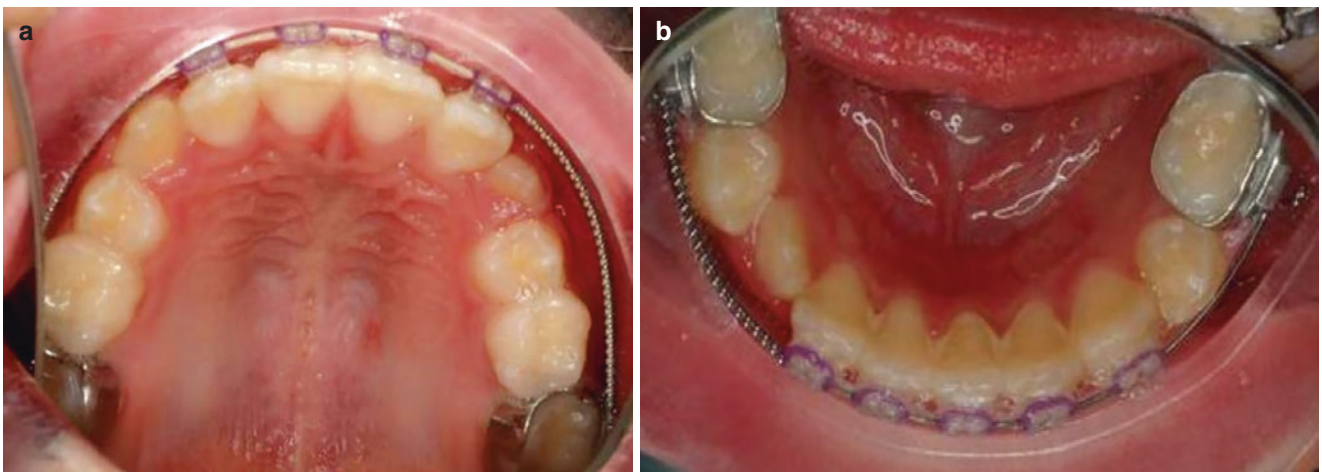


Fig. 8.23 (**a** and **b**) Upper and lower occlusal photographs. The second upper and lower temporary molars are still in place

Fig. 8.24 (**a** and **b**) Frontal photographs at the end of the orthodontic active treatment. Midlines were almost coincident with overjet and overbite within normal ranges

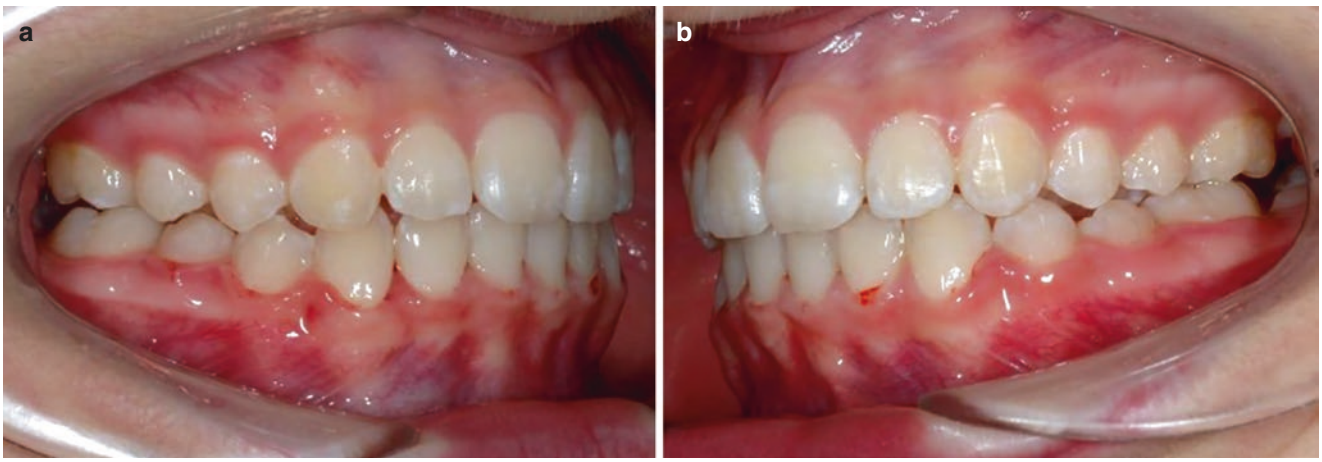


Fig. 8.25 (**a** and **b**) Lateral views at the end of the second phase of treatment

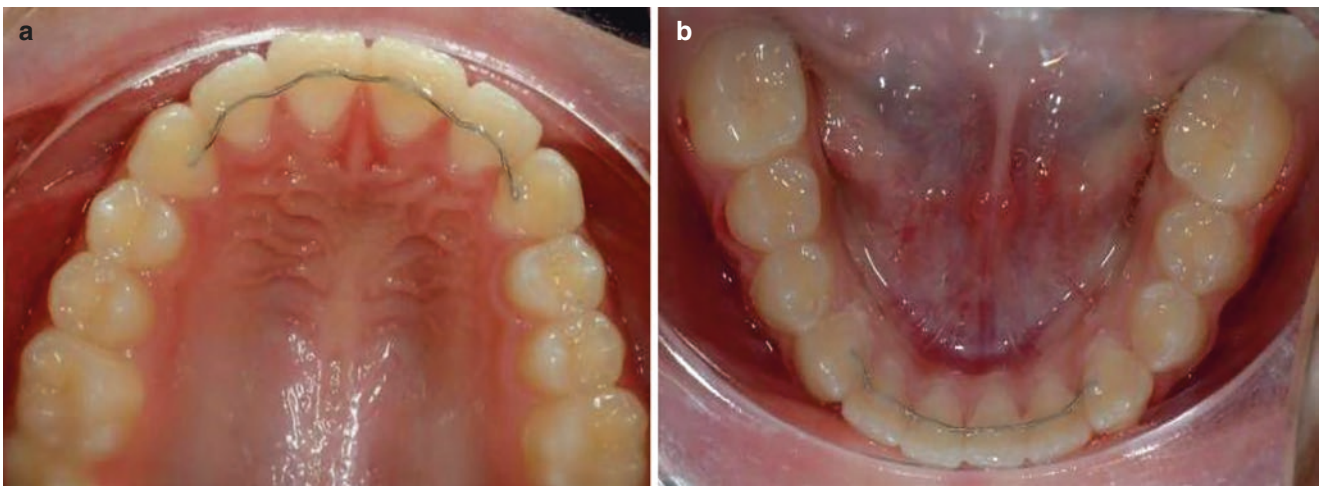
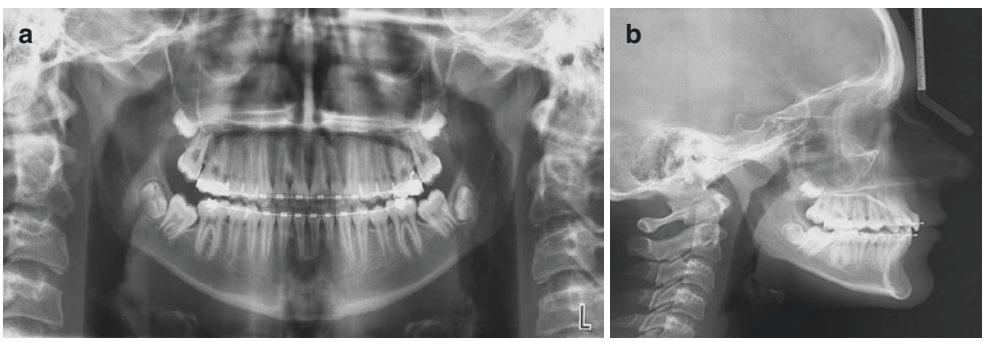


Fig. 8.26 (**a** and **b**) Upper and lower occlusal views with the retention wires bonded between upper and lower right and left canines

Fig. 8.27 (**a** and **b**) Panoramic and lateral radiograph at the end of the treatment



achieved during the second-phase orthodontic treatment (Fig. 8.28a and b).

Similar results were observed from the occlusal point of view. A fixed retention wire was bonded from the right to the left canine to maintain the position of the upper anterior teeth (Fig. 8.29a and b).

Follow-up 30 months after the finalization of the active treatment showed that there was a little relapse in the anterior region, regarding overjet and overbite. A consultation with the speech therapist was recommended to improve the position of the tongue and certain swallowing habits in order to maintain the results in the vertical dimension (Fig. 8.30a and b).

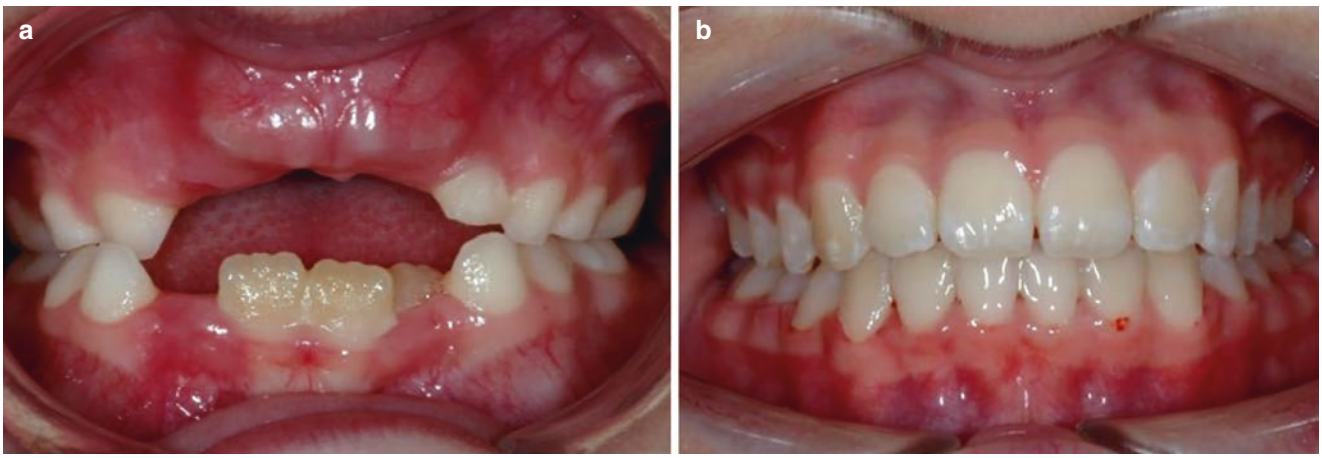


Fig. 8.28 (**a** and **b**) Comparison pre- and posttreatment front photographs. The improvement was noticeable. Overjet and overbite were normal. Occlusal and gingival lines were parallel

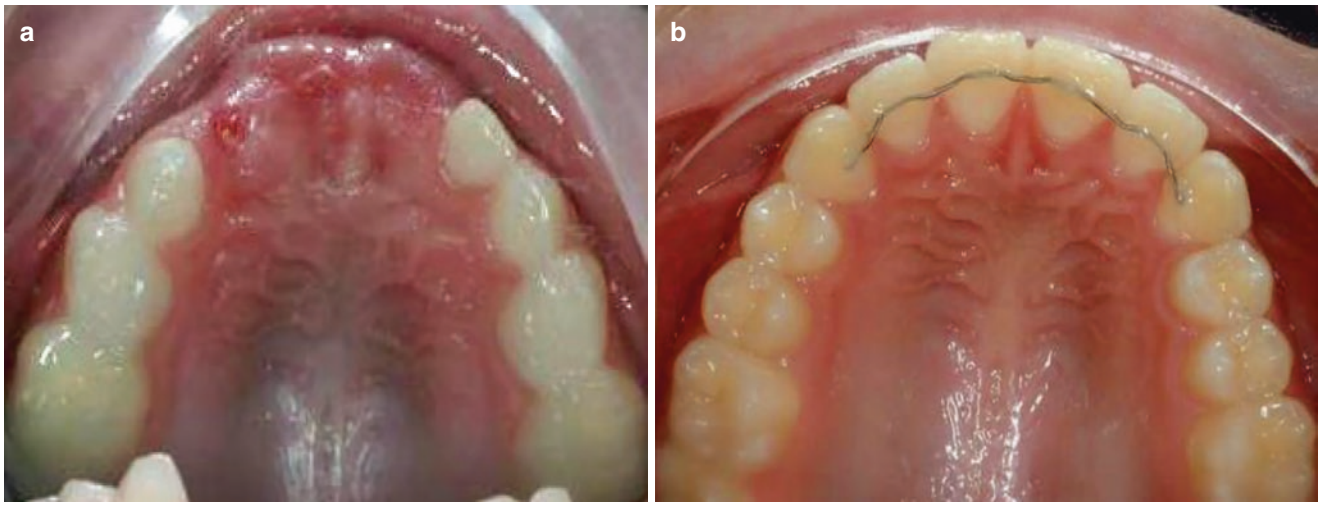


Fig. 8.29 (**a** and **b**) A significant change in the upper arch was evident. The final photograph showed the retention wire bonded between the canines

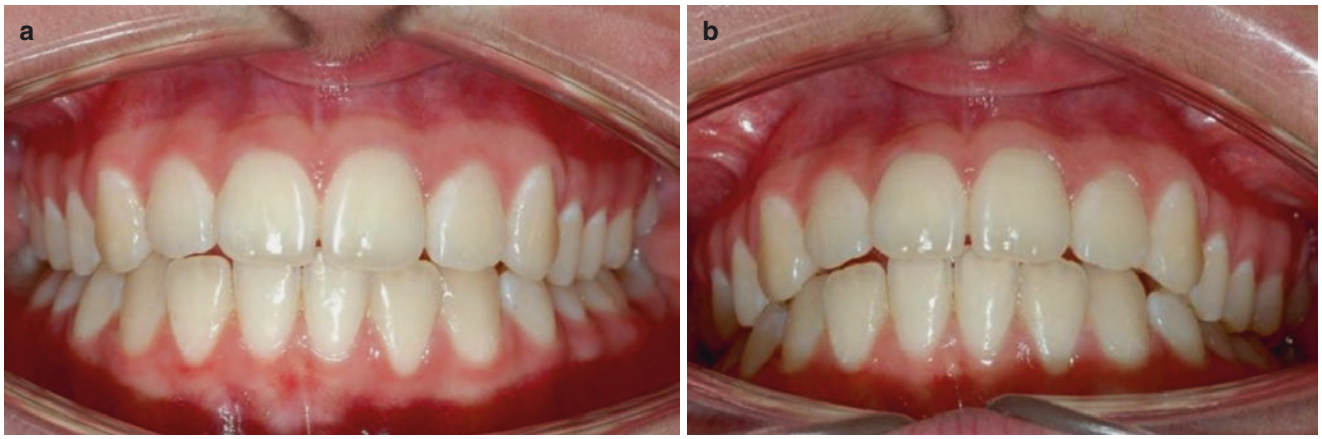


Fig. 8.30 (**a** and **b**) A slight relapse was visible in the anterior region during the 30-month follow-up. It was important that the patient continue going to the speech therapist to control the anterior position of the tongue

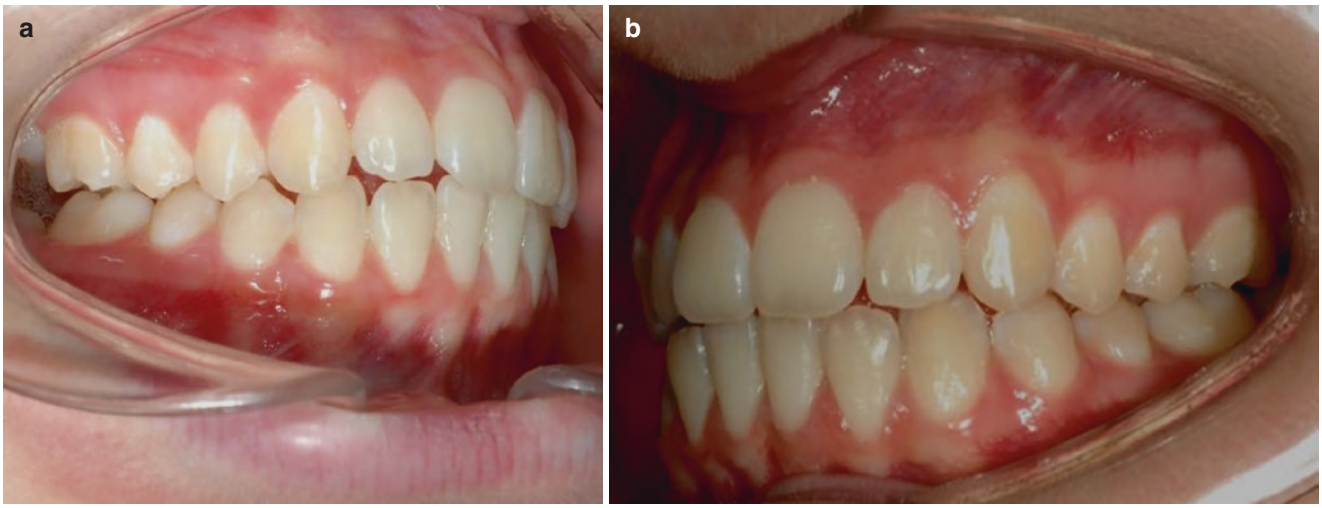


Fig. 8.31 (**a** and **b**) Lateral views confirmed a slight relapse in the anterior region

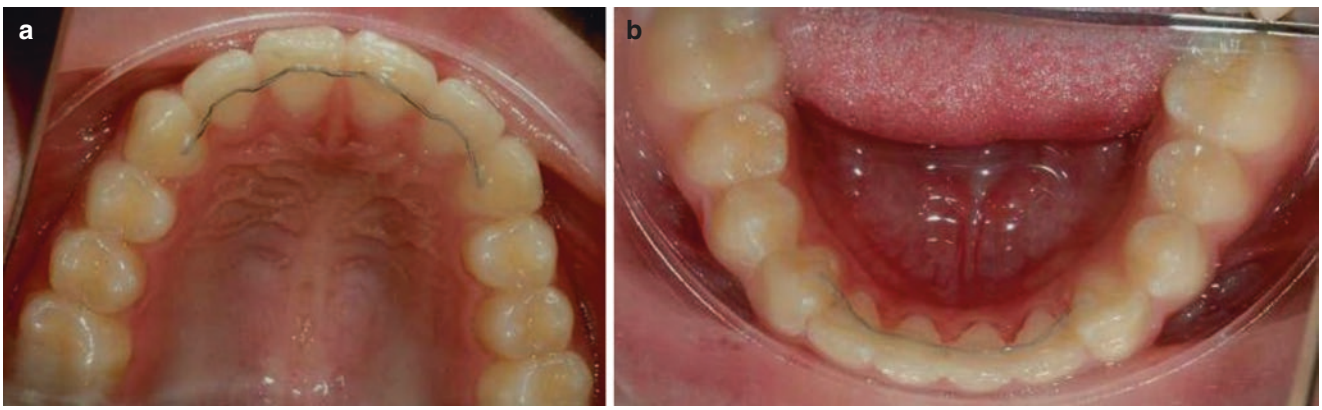


Fig. 8.32 (**a** and **b**) Occlusal photographs 30 months later with the retention wires in place

Similar conclusions were observed after analyzing the right and left side. Class I canine and molar were perfectly maintained but slight changes were observed in the anterior region (Fig. 8.31a and b).

Fixed retention wires were placed and the upper and lower dental arch forms were maintained (Fig. 8.32a and b). The treatment objectives were fulfilled with a very conservative and efficient protocol.

To conclude, the best time to normalize the transverse width of the maxilla is during late primary or early mixed dentition. This procedure provides better and more stable results.

8.1 Conclusions

Slow or rapid maxillary expansion is one of the noninvasive methods of gaining space at any age or facial biotype.

Rapid maxillary expansion performed in temporary or mixed dentition did not produce undesirable root resorption or side effects on the periodontal bone tissues (Garib) when the appliance was bonded on deciduous molars. Also, it protects the first permanent molars from undesirable side effects. The use of an RME appliance is a procedure that was used to split the midpalatal suture and widen the dental arches. Its action has a more skeletal effect with less dental tipping than the removable ones.

Ideally it has to be used prior to the ossification of the midpalatal suture and long-term results are confirmed. Of course there is variability in the amount of changes according the age, facial biotype, and etiology of the problem.

The protocol of activation has to be determined by the orthodontist but during the early or late mixed dentition two turns a day is the most commonly used.

Since there is a considerable correlation between the transverse, anteroposterior, and vertical discrepancies, the

early normalization of the transverse dimension discrepancy is very important. It was widely demonstrated that maxillary arch constriction produces insufficient maxillary arch width causing anterior crowding and lack of the space for the canines (Bahreman).

Rapid maxillary expansion is useful in correcting posterior crossbites, increasing arch length, facilitating Class II and III correction, improving space for canine eruption, improving nasal breathing, and broadening the smile (McNamara).

Different types of RME can be used but to avoid caries or enamel decalcifications it is preferable to use those without acrylic plates not only on the palatal tissues but also cemented on the occlusal surfaces of the molars.

This protocol creates optimal conditions for the normal growth of the craniofacial skeleton and helps to develop a normal stomatognathic system.

In general, no significant secondary effects were observed in patients in either genders.

Suggested Reading

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