

Arch Development and Facial Esthetics

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Orthodontists and patients are becoming more concerned about undesirable effects of bicuspid extractions on the facial profile. Several authors have shown that the lips may become more retrusive, the nasolabial angle may become more obtuse, and less vermilion may be shown in bicuspid extraction cases than in nonextraction cases.¹⁻⁴ In contrast, arch-development techniques can help clinicians achieve a balance between facial and dental esthetics and optimal function.

Little has demonstrated a high rate of relapse when a dental arch is actively expanded in the mixed dentition.⁵ Moawad and colleagues suggest that passive expansion, as achieved with a lip bumper, may be more stable.⁶ Soo and Moore have described how the musculature adapts to a lip bumper: after about eight weeks, the lip and cheek pressure against the bumper decreases to normal levels or even less.⁷ This alteration in muscle balance should help avoid relapse.

When a lip bumper is used, the leeway space can be employed to relieve crowding.⁸⁻¹² Dugoni and colleagues have shown that such treatment is more stable than bicuspid extraction.¹³ If treatment is timed correctly, as much as 2mm of leeway space can be captured on each side. A palatal bar, according to Ten Hoeve, can correct molar rotations and produce another 2mm of space per side.¹⁴ It is also easier to insert a headgear bow after mesial molar rotations have been corrected.

Timing of headgear wear is extremely important. The maxillary first molars can be distalized more rapidly before the second molars erupt into occlusion. A removable plate used in combination with the headgear will provide a continuous distalizing force, and thus more efficient tooth movement. In addition, more spontaneous drift occurs in the mixed dentition than in the established permanent dentition.

Functional appliances can have a positive effect on arch development and facial esthetics. The Fränkel FR-2 appliance, which positions a Class II dentition into a protrusive bite, has a passive effect similar to that of a lip bumper.^{15,16} Another arch-developing appliance, the twin block, has gained popularity in recent years because of its ease of use.¹⁷ Functional appliances are most effective when worn nearly 24 hours per day.

Treatment timing is also important from a psychological standpoint. Younger children are more likely to wear removable appliances as prescribed. They spend more time at home and in bed than older children do, and therefore can wear headgear for longer periods.

The following four cases demonstrate how arch development and treatment timing can have a positive effect on facial esthetics.

Case 1

A 10-year-old female presented with a Class II, division 1 malocclusion, a broad middle face, a long lower face, a retrusive chin, and a high mandibular plane angle (Fig. 1). She had a 6mm overjet, partly because of severe mesiolabial rotations of the maxillary incisors. The mandibular buccal segments were lingually inclined, and both dental arches were narrow.

Because of the patient's broad middle face, I felt a nonextraction approach would produce the best

smile. I did not consider using a functional appliance, because the true overjet was minimal.

Mesial maxillary molar rotations were corrected in four months of treatment with a palatal bar. A high-pull headgear and a removable plate were used to move the first molars distally into a Class I relationship over the following 17 months (Fig. 2). The headgear controlled the vertical dimension and promoted autorotation of the mandible, thus reducing the overjet and improving chin position.

Meanwhile, a lip bumper was used in the narrow mandibular arch to correct mesial rotations of the first molars, upright the first molars, and allow passive physiological uprighting of the buccal segments. This was achieved in 16 months of lip-bumper wear (Fig. 3).

The palatal bar was reinserted for anchorage, and the patient was instructed to continue wearing the headgear 12 hours a day. With the removable appliance discontinued, spontaneous drift was allowed to occur for six months in the maxillary arch (Fig. 4).

The mandibular arch was bonded and aligned with archwires progressing to .019" X .025" (Fig. 5), while the lip bumper was kept in place for anchorage. The maxillary arch was aligned with a similar archwire sequence, with a Class II elastic used on the left side for two months to promote settling (Fig. 6).

Active appliances were removed after a total of 35 months of treatment (Fig. 7). A lingual retainer was bonded to the maxillary incisors, and a Hawley retainer was also prescribed. A cuspid-to-cuspid Essix retainer was placed in the mandibular arch.

Comparison of pre- and post-treatment cephalometric tracings shows little change (Fig. 8). This is not surprising, because most of the treatment effects occurred in the transverse dimension.

Case 2

An 11-year-old male presented with a Class II, division 2 malocclusion on a skeletal Class I base (Fig. 9). He had a flat profile with a retrusive dentition and lips. The incisors were irregular and retroclined. The overjet was normal, but the overbite was severe. The mandibular right first molar and both cuspids were in crossbite. Both arches were narrow, and the maxillary first molars were mesially rotated.

Extractions were contraindicated because of the flat profile and retroclined incisors. Functional appliance therapy was not needed, since there was no skeletal discrepancy.

Treatment was begun with a palatal bar to correct the maxillary molar rotations. A lip bumper was placed in the mandibular arch to encourage passive uprighting. After five months, a removable plate was used to distalize the maxillary molars (Fig. 10), and a headgear was prescribed to be worn 12 hours each night. Lip bumpers were adjusted in both arches to remove the restraining action of the lips and encourage labial movement of the anterior and buccal segments (Fig. 11).

After six months of maxillary lip-bumper wear, the six maxillary anterior teeth were bonded. The mandibular first molars were built up with glass ionomer cement to unlock the anterior crossbite and allow proclination of the maxillary incisors and spontaneous drift of the bicuspid (Fig. 12).

After 16 months of mandibular lip-bumper wear, the mandibular arch and maxillary bicuspid were bonded. Archwires from nickel titanium to .021" X .025" stainless steel were used in both arches,

with labial root torque placed at the lateral incisors. The palatal bar and lip bumper were kept in place for anchorage (Fig. 13).

Fixed appliances were removed after 31 months of active treatment (Fig. 14). Maxillary wraparound and mandibular Essix retainers were placed.

Because of proclination of the incisors during treatment, the interincisal angle improved from 169° to 126°.

Case 3

A 10-year-old male presented with a long lower face, a retrusive mandible, and lip incompetence (Fig. 15). The buccal segments were in a Class II relationship on both sides. The overjet was 12mm, the overbite was complete to the palate, the mandibular arch was narrow, and the mandibular buccal segments were lingually inclined.

Fränkel appliances work in both the anteroposterior and transverse dimensions, but they are bulky, easily broken, and virtually impossible to repair. Nevertheless, I felt a Fränkel would address this patient's problems quite well—protruding the mandible, eliminating lip interference, and encouraging uprighting of the mandibular premolars by removing the unfavorable soft-tissue influence. I had previously treated the patient's sister and found the family's attitude unusually positive. Therefore, I was confident that this young boy would cope well with a Fränkel appliance.

The appliance was worn for 10 months (Fig. 16). The overjet was reduced to 5mm, and the buccal segments were corrected to Class I (Fig. 17). Mandibular arch width increased by 3mm from second premolar to second premolar (Fig. 18).

A palatal bar and lip bumper were then placed, and headgear was added a month later. After another two months, .022" preadjusted edgewise appliances were bonded to both arches.

Fixed appliances were removed 16 months later (Fig. 19), and maxillary wraparound and mandibular Essix retainers were delivered. Active treatment took 29 months.

Case 4

A 12-year-old female was concerned about her traumatic overbite and irregular, retroclined maxillary anterior teeth (Fig. 20). She had a broad face, a short lower face, and a deep labiomental fold with a pronounced chin. The buccal segments were in a Class II relationship, and the dentition was retrusive compared to the nose and chin.

A maxillary removable plate was worn for five months, with an anterior biteplane to allow eruption of the buccal segments and a Z-spring to procline the maxillary incisors (Fig. 21). A Clark twin-block appliance was then placed. The maxillary arch was expanded with a midline jackscrew, and the acrylic was progressively trimmed to allow eruption of the mandibular molars (Fig. 22).

The twin block is robust and is well retained by its upper and lower clasps. It produces an immediate improvement in facial appearance, and with no wire over the maxillary incisors, it is more esthetic than other functional appliances. Speech generally improves after three or four days of wear. I have generally found compliance to be excellent when the patient has a positive attitude.

In this case, with no transverse correction needed in the mandibular arch, I felt the twin block was well suited to correcting both the facial and dental aspects of the malocclusion.

The patient was nearly 13, but her attitude toward treatment was still good. After the removable plate improved the Class II, division 2 to a division 1, the twin block promoted mandibular growth and allowed further eruption of the mandibular buccal segments.

Following 10 months of twin-block wear, .022" preadjusted edgewise appliances were bonded to both arches, and a cervical headgear was delivered. The archwire sequence progressed from light, round nickel titanium to .019" X .025" stainless steel in the maxillary arch and .021" X .025" in the mandibular arch. Class II elastics were worn for 10 months to maintain the Class II correction.

The fixed appliances were removed after a total treatment time of 28 months (Fig. 23). Maxillary Hawley and mandibular Essix retainers were prescribed.

Cephalometric evaluation showed improvement in lower facial height, mandibular plane angle, pogonion, maxillary incisor angulation, and interincisal angle. □

FIGURES

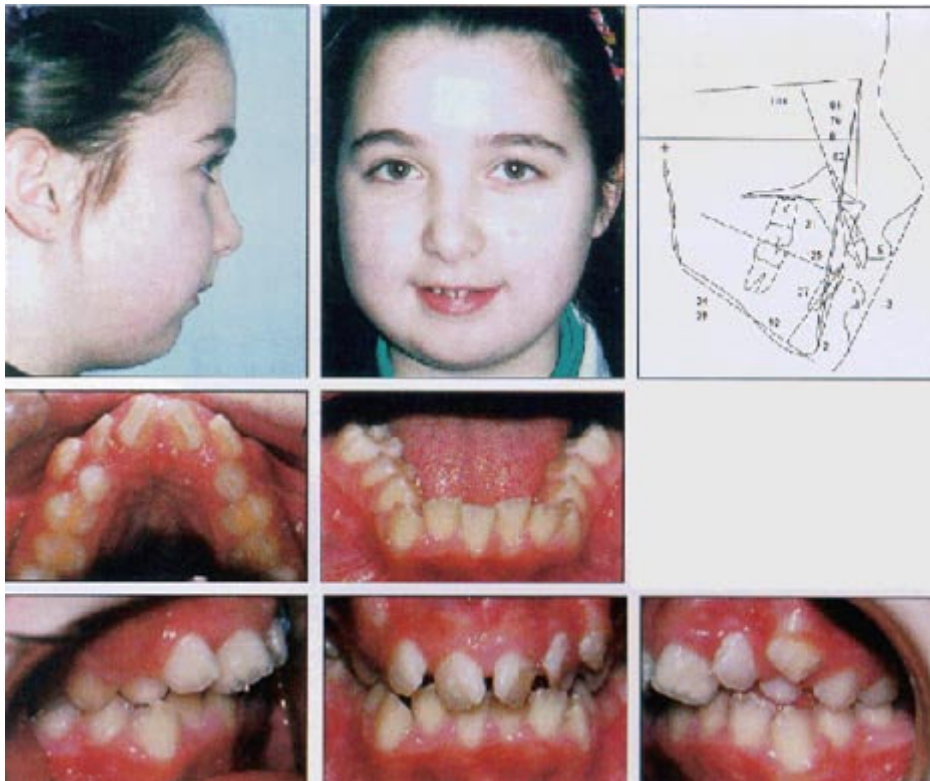


Fig. 1 Case 1. 10-year-old female before treatment.

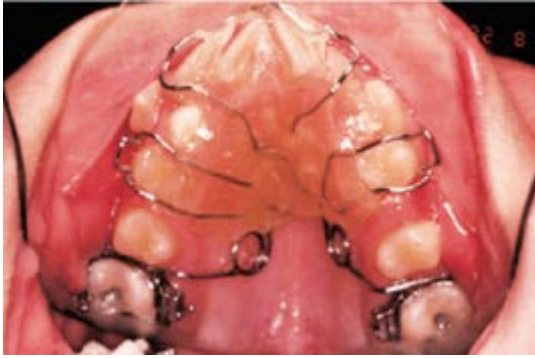


Fig. 2 Case 1. Maxillary removable plate used with high-pull headgear to distalize first molars.



Fig. 3 Case 1. Mandibular lip bumper used to derotate and upright first molars and allow passive uprighing of buccal segments.

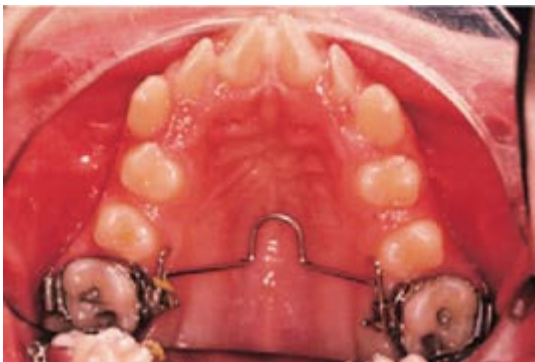


Fig. 4 Case 1. Palatal bar reinserted for anchorage, allowing spontaneous drift.



Fig. 5 Case 1. Bonded mandibular arch, with lip bumper kept for anchorage.



Fig. 6 Case 1. Bonded maxillary arch, with Class II elastic on left side to promote settling.



Fig. 7 Case 1. After removal of fixed appliances.

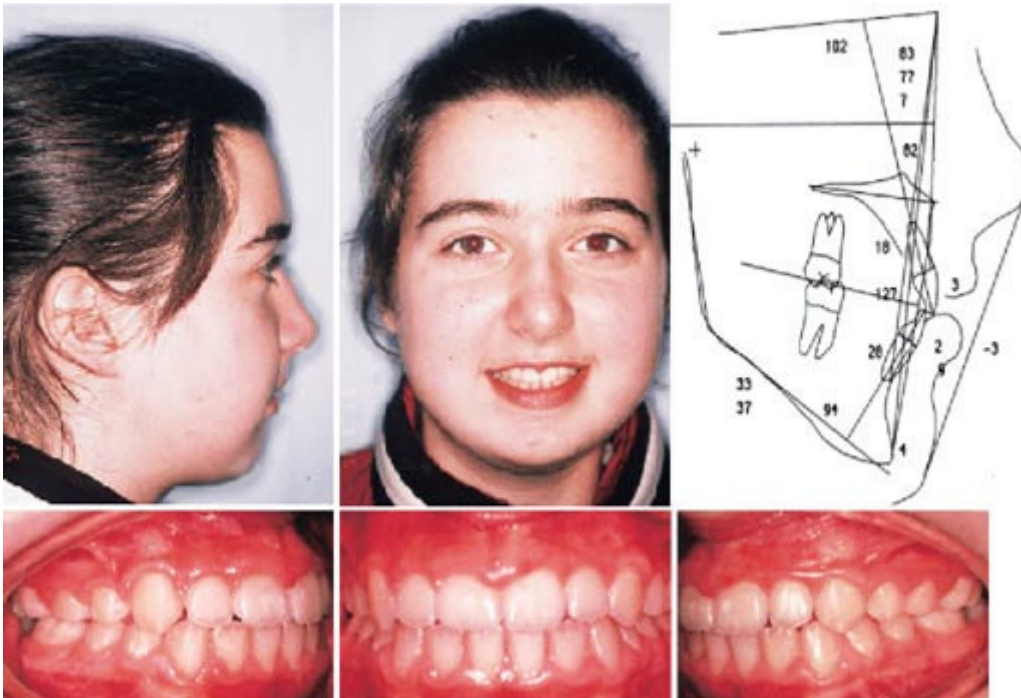


Fig. 8 Case 1. Patient after 35 months of active treatment.

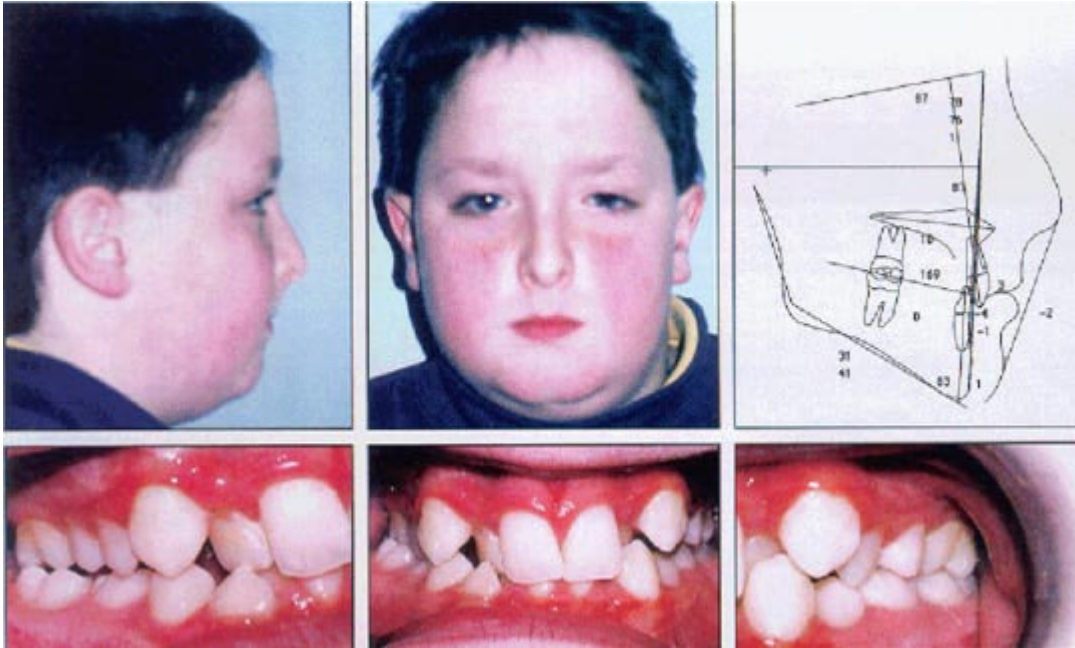


Fig. 9 Case 2. 11-year-old male before treatment.

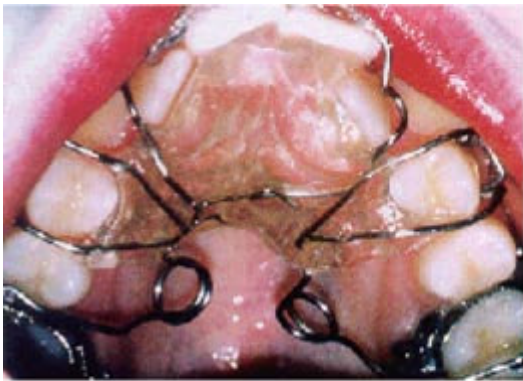


Fig. 10 Case 2. Maxillary removable plate used with headgear to distalize molars.

Fig. 10 Case 2. Maxillary removable plate used with headgear to distalize molars.

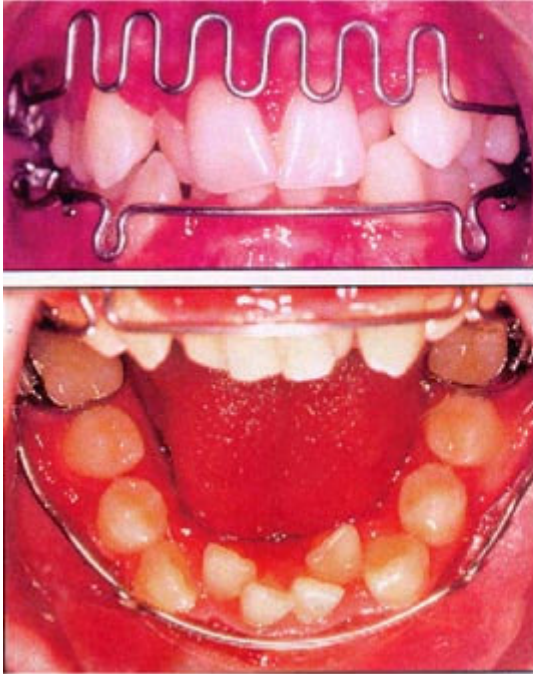


Fig. 11 Case 2. Lip bumpers used in both arches to remove lip restraint and encourage labial movement of anterior and buccal segments.

Fig. 11 Case 2. Lip bumpers used in both arches to remove lip restraint and encourage labial movement of anterior and buccal segments.



Fig. 12 Case 2. Maxillary anterior teeth bonded, and mandibular first molars built up with glass ionomer cement to unlock anterior crossbite.

Fig. 12 Case 2. Maxillary anterior teeth bonded, and mandibular first molars built up with glass ionomer cement to unlock anterior crossbite.

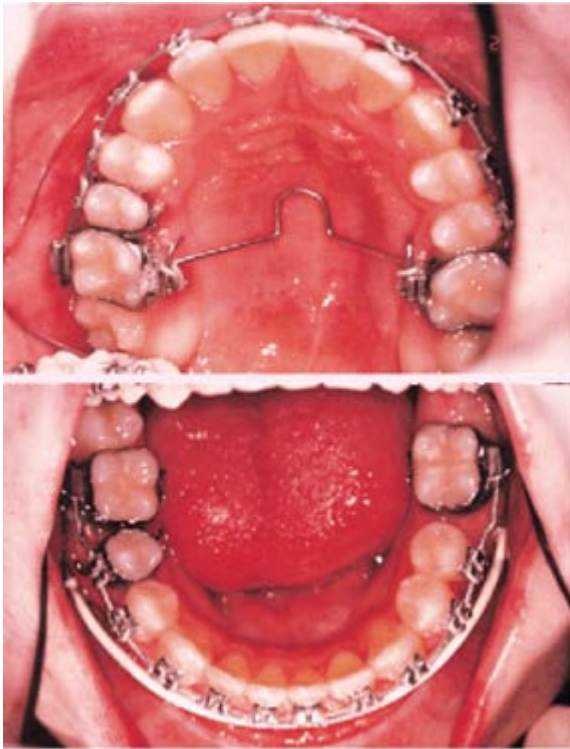


Fig. 13 Case 2. With fixed appliances in place, palatal bar and lip bumper kept for anchorage.

Fig. 13 Case 2. With fixed appliances in place, palatal bar and lip bumper kept for anchorage.



Fig. 14 Case 2. Patient after 31 months of active treatment.

Fig. 14 Case 2. Patient after 31 months of active treatment.

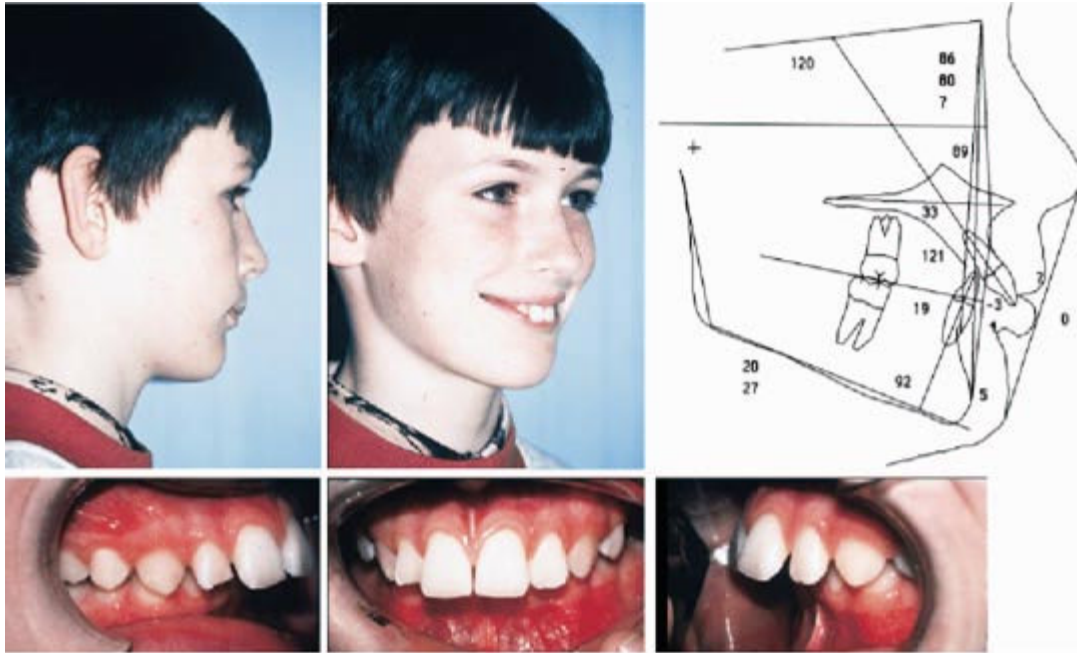


Fig. 15 Case 3. 10-year-old male before treatment.

Fig. 15 Case 3. 10-year-old male before treatment.



Fig. 16 Case 3. Fränkel FR-2 appliance in place.

Fig. 16 Case 3. Fränkel FR-2 appliance in place.



Fig. 17 Case 3. Reduction in overjet and correction of buccal segments after 10 months.

Fig. 17 Case 3. Reduction in overjet and correction of buccal segments after 10 months.

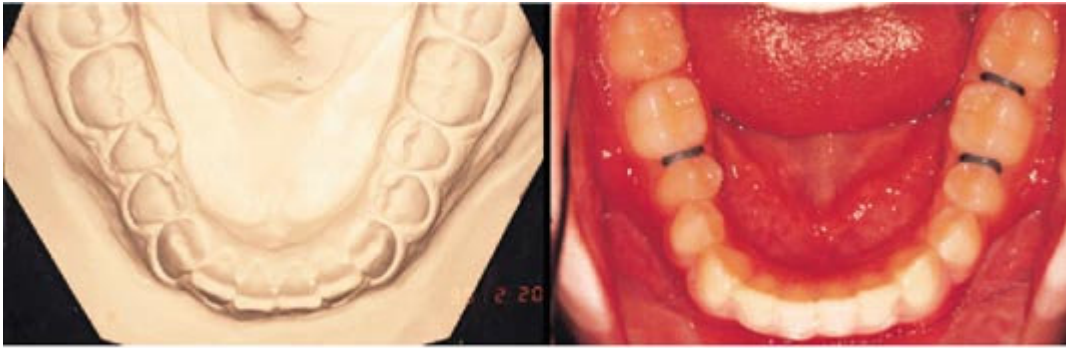


Fig. 18 Case 3. Increase of 3mm in mandibular second-premolar width.

Fig. 18 Case 3. Increase of 3mm in mandibular second-premolar width.

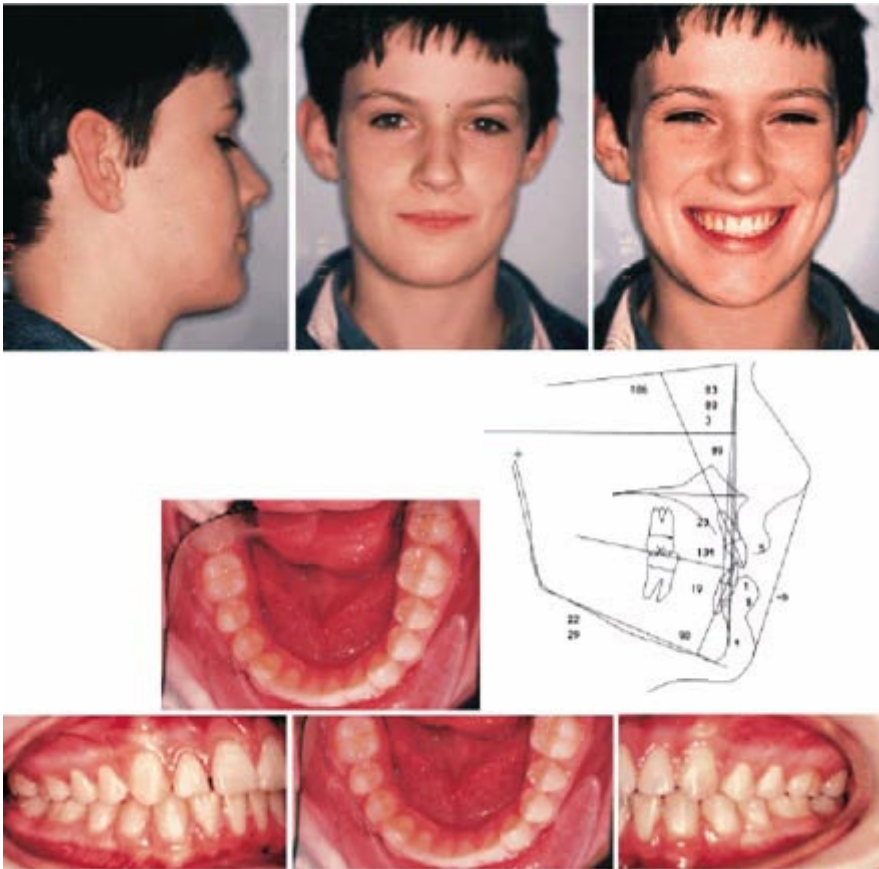


Fig. 19 Case 3. Patient after 29 months of active treatment.

Fig. 19 Case 3. Patient after 29 months of active treatment.

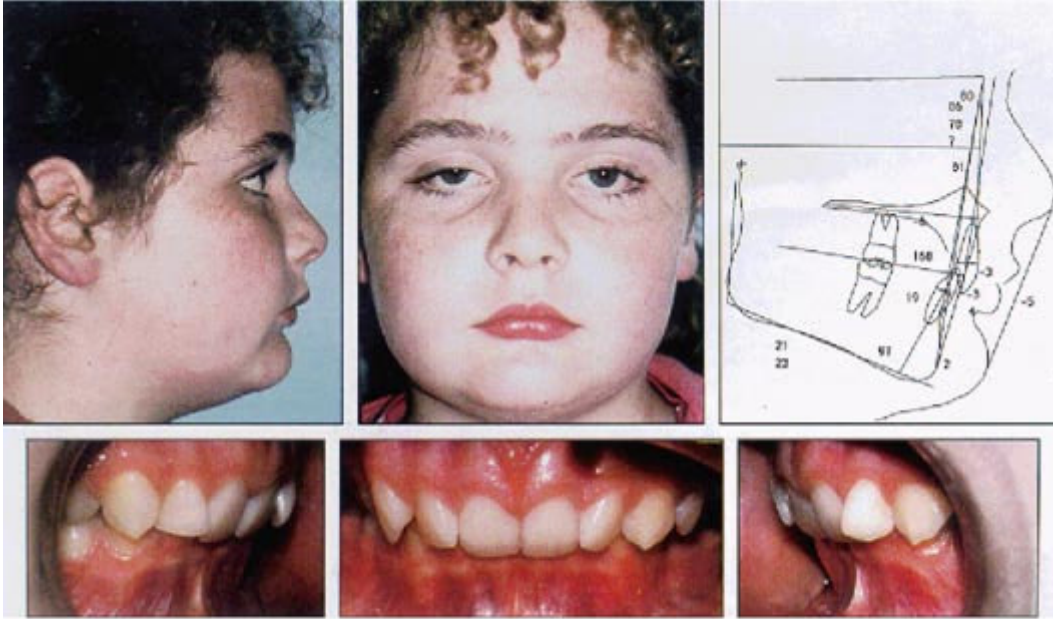


Fig. 20 Case 4. 12-year-old female before treatment.

Fig. 20 Case 4. 12-year-old female before treatment.



Fig. 21 Case 4. Maxillary removable plate with anterior biteplane to allow eruption of buccal segments and Z-spring to procline maxillary incisors.

Fig. 21 Case 4. Maxillary removable plate with anterior biteplane to allow eruption of buccal segments and Z-spring to procline maxillary incisors.

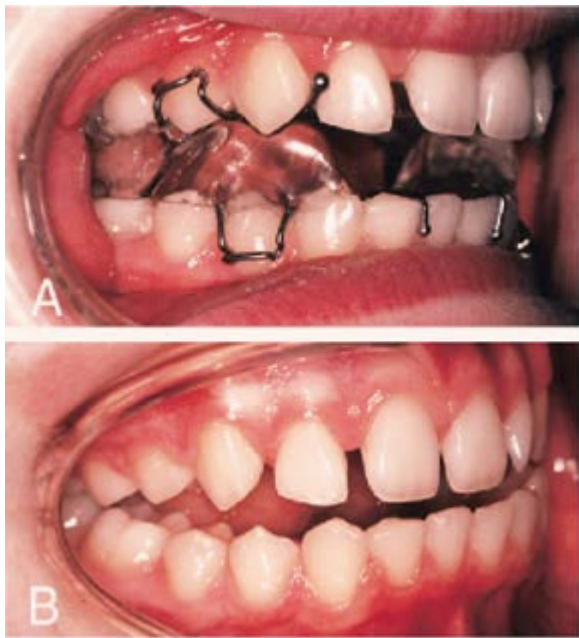


Fig. 22 Case 4. A. Clark twin-block appliance. B. Acrylic progressively trimmed to allow eruption of mandibular molars.

Fig. 22 Case 4. A. Clark twin-block appliance. B. Acrylic progressively trimmed to allow eruption of mandibular molars.



Fig. 23 Case 4. Patient after 28 months of active treatment.

Fig. 23 Case 4. Patient after 28 months of active treatment.

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FOOTNOTES

1 Raintree Essix, Inc., 1069 S. Jeff Davis Parkway, New Orleans, LA 70125.