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Asymmetric Application of the Jasper Jumper in the Correction of Midline Discrepancies

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Significant midline discrepancies, often due to anchorage loss, must sometimes be corrected during the last phase of orthodontic treatment. Although asymmetrical intermaxillary elastics are the most popular means of resolving this problem, the vertical force vector and the possibility of inadequate patient compliance can create undesirable side effects with fixed appliance mechanics.1

The Jasper Jumper, a flexible sagittal force module, was designed for the correction of Class II high-angle malocclusions.2 Unlike rigid bite-jumping appliances such as the Herbst ,3 the flexible Jasper Jumper produces a range of force from 1-16oz, depending on its length when the teeth occlude.4

Because of this flexibility, we decided to use the Jasper Jumper asymmetrically–one side with conventional Class II mechanics, the other with Class III mechanics–to correct a midline discrepancy and a possible mandibular shift resulting from maxillary deficiency. This article describes the skeletal and dental effects of such treatment in two cases: one in the early permanent dentition, and the other a young adult.

Case 1

Diagnosis and Treatment Plan

A 10-year-old male showed a moderate facial asymmetry, with a mandibular shift to the right and a normal soft-tissue profile and smile (Fig. 1). A functional crossbite on the right side, resulting from a narrow maxilla and the mandibular deviation to the right in habitual occlusion, was noticed in the intraoral examination and verified with functional analysis. The patient had a full-cusp Class II molar and cuspid relationship on the right side, but a Class I relationship on the left. Other orthodontic problems included a collapsed maxillary arch, upper and lower anterior crowding, and a palatally positioned maxillary right lateral incisor.

Radiographs indicated no abnormalities in condylar growth. The cephalometric analysis revealed a Class II skeletal relation with a mild maxillary excess and a moderate mandibular retrusion. The vertical pattern was within normal limits, and the soft-tissue profile was slightly biprotrusive. The maxillary incisors were slightly flared with respect to the anterior cranial base.

A combination of orthodontic and orthopedic treatment was planned to achieve the following objectives:

- Correction of the maxillary transverse deficiency to allow better mandibular growth.
- Control of sagittal growth to improve dentofacial esthetics.
- Alignment and leveling of the anterior segments with nonextraction mechanics.

Treatment Progress

Treatment was initiated with a bonded Minne-Expander, using a spring force of about 450g, to

correct the transverse discrepancy (Fig. 2). A bonded expander was chosen because it would unlock the unilateral posterior crossbite and immediately free the mandible, allowing us to begin correction of the mandibular anterior crowding and the accentuated curve of Spee.

Once sufficient expansion was achieved, in two months, a unilateral medium-pull headgear was fitted to the molar tubes embedded in the buccal acrylic of the expander. The headgear was intended to improve the skeletal relationship and to help correct the maxillary asymmetry. Leveling of the maxillary incisors and cuspids was initiated with Straight-Edge brackets (.018" slots on the incisors and .022" slots on the other teeth) and an .0175" X .0175" nickel titanium archwire through the same buccal tubes.

After five months of unilateral headgear wear, similar mechanics were continued with a transpalatal bar (also activated unilaterally, with a distolingual rotation bend at the maxillary left first molar), and the headgear attached directly to the maxillary first molars.

Despite the asymmetrical orthodontic mechanics and good dental alignment, the midline discrepancy remained (Fig. 3). The maxillary midline deviation was about 4mm, and there was still a slight mandibular shift of about 1.5mm to the right. The molar and canine relationships were cusp-to-cusp on the right side and Class III on the left. With no overjet, it was impossible to continue the same treatment approach, and conventional asymmetrical elastics seemed necessary.5,6 Instead, we decided to use asymmetrical Jasper Jumpers to obtain a more continuous and intensive force system on the maxillary complex. Theoretically, the Jasper Jumpers would avoid the potentially adverse side effects of elastics (Fig. 4).

During the asymmetrical jumper application, the stiffest possible rectangular stainless steel archwires–.017" X .025" maxillary and .018" X .025" mandibular–were placed (Fig. 3). The transpalatal bar was kept in place to counteract any side effects of the asymmetrical mechanics on the maxillary arch.

After about four months of this treatment, the intrusive effect of the Class III jumper could be observed in the maxillary left anterior region, so a 4.5oz diagonal elastic (Zebra) was added from the maxillary left lateral incisor to the mandibular right lateral incisor. By the end of sixth month, the midline was overcorrected and the posterior occlusion was satisfactory.

Results

Superimpositions of cephalograms taken before and after the Jasper Jumper treatment indicated a mixed effect of this force system, especially in the maxilla (Fig. 5). Since the right and left posterior regions could be easily distinguished on the initial lateral cephalogram, the effects of the jumpers were assessed on both sides. The best fit of anterior cranial base superimposition showed a restricted maxillomandibular sagittal growth, but a vertical increase, whereas the structural maxillary superimposition7,8 of the right side indicated a slight intrusion and distalization of the maxillary posterior regions. The mandibular symphysis superimposition showed slight mesialization and extrusion of the mandibular right posterior teeth and anterior tipping of the mandibular incisors. On the other hand, the left teeth of both arches displayed mesial and extrusive movements–a simple uprighting in the mandibular arch, but a bodily movement in the maxilla. Some resorption was evident in the posterior border of the ramus. The left condyle moved slightly back, while the right condyle increased in vertical height.

The most interesting results could be seen in the anteroposterior and basal headfilms. Frontal

symmetry analysis revealed approximately 2mm of displacement of anterior nasal spine to the right (Fig. 6). On the basal superimposition of radiographs taken with maximum mouth opening, the palatal plane (ANS-PNS) was turned about 2.5° to the right in the transverse dimension, with a center of rotation around posterior nasal spine (Fig. 7). Neither condylar nor gonial changes could be observed in the anteroposterior headfilms, even though the mandibular anterior teeth were moved bodily.

After the Jasper Jumper stage, the case was finished according to traditional esthetic and functional considerations. The entire orthodontic treatment took 35 months. In the final results, the jaw symmetry was good, but the nasal and left orbital regions grew with a slight deviation, and some divergence of the left eye could be noted (Fig. 8). The soft-tissue profile was orthognathic, and the smile was esthetic. Intraoral photographs showed a good occlusion, but also a negligence of oral hygiene in the last phase of treatment, which the patient later corrected.

The upper retainer was a Hawley plate with a circular vestibular bow, and the lower was a 3-3 bonded retainer. One-year follow-up revealed a slight relapse in the labiolingual inclination of the maxillary right lateral incisor, but a reasonably stable correction of the midline and posterior dental relationship (Fig. 9).

Case 2

Diagnosis and Treatment Plan

An 18-year-old female presented with the chief complaint of anterior spacing (Fig. 10). Her right maxillary and both mandibular first permanent molars were lost in childhood due to caries. She had a symmetrical face and a prominent upper lip, with severe flaring of the maxillary incisors, multiple spaces in both arches, an extreme overjet of 11mm, mesially tipped mandibular left second and third molars, and a mesiolingually rotated maxillary right second molar. The molar and canine relationships were cusp-to-cusp on the right side and Class II on the left.

The condyles were normal radiographically, and although there was minor clicking in the left TMJ, the patient reported no history of pain and showed no pain on palpation. Cephalometric analysis indicated a Class I skeletal relation with a decreased ANB angle (-2°) due to the labial position of the incisors.

Since the tongue appeared normal in the functional analysis, the treatment plan called for space closure with sliding mechanics. An .022" preadjusted appliance was used, except that standard edgewise brackets were placed on the four maxillary incisors to provide negative torque.

Treatment Progress

Leveling was begun with .0175" X .0175" nickel titanium archwires. After two months, elastomeric chains were added for continuous space closure. Anchorage was maximized in the maxillary molar region with an active transpalatal bar and minimized in the mandibular posterior region.

The patient could not tolerate the transpalatal bar, and therefore the elastomeric chain was extended lingually over the maxillary right second molar. More rigid .017" X .025" stainless steel archwires were placed, and in two months the correction of the rotated maxillary right second molar was remarkable (Fig. 11). However, there were two side effects of this space closure and derotation of the second molars: posterior anchorage loss, which could not be reinforced because of the patient's lack

of compliance with headgear, transpalatal bar, and intermaxillary elastics; and a tendency for lingual movement of the maxillary second premolars, due to the lingual force component of the elastomeric chain (later counteracted with more rigid archwires).

After the mandibular molars were uprighted, anchorage was reinforced with figure-8 ligatures between the mandibular right second molar and the mandibular left canine, and the residual space between the left canine and first bicuspid was closed with a medium-pull nickel titanium closed-coil spring . During the space-closure sliding mechanics, which lasted about a year, the patient would not wear intermaxillary elastics for anchorage reinforcement. As a result, she entered the finishing stage with a significant 6mm midline shift (2mm to the right in the maxilla and 4mm to the left in the mandible). The right side was in a super-Class I relationship, while the left was cusp-to-cusp.The patient was informed of the situation and was motivated to undergo treatment with asymmetrical Jasper Jumpers. The newly erupted maxillary left third molar was extracted, and the archwires were changed to .018" X .025" stainless steel with anterior negative root-torquing bends (Fig. 12). Because the deviation was more pronounced on the left side, the Class II jumper had to be longer than the Class III jumper to produce the same deflection from the force modules.

After four months of treatment, frontal symmetry analysis revealed a dental correction with bodily movement and no skeletal effect (Fig. 13). The patient had good facial esthetics and a functional Class I occlusion (Fig. 14). Superimpositions of cephalograms taken before and after the Jasper Jumper treatment showed the reciprocal effect of the asymmetrical force system on both sides (Fig. 15).

Superimpositions of the cephalograms taken before and after 26 months of total treatment revealed a slight nasal growth and posterior mandibular rotation resulting from vertical condylar growth (Fig. 16). The entire mandibular arch and the maxillary right posterior region moved mesially, while the maxillary left molar and premolars moved distally. The mandibular incisor was intruded; A point moved forward due to uprighting of the maxillary incisor.

The clicking in the left TMJ was no longer evident. Bonded maxillary 2-2 and mandibular3-3 retainers and upper and lower Hawley plates were delivered, and the patient was instructed to wear the removable retainers for six months.

Discussion

Although a subtle asymmetry of the midlines may be acceptable, significant midline discrepancies can be quite detrimental to dentofacial esthetics.9 Moreover, the basic objectives of orthodontic treatment, such as maximum intercuspation, functional occlusion, stability, and a reduced potential for TMJ dysfunction, can only be achieved with fairly symmetrical dental arches.

Minor facial asymmetry is usually the result of a small difference in size between the two sides.1 Asymmetry becomes more obvious when there is a nasal or mandibular shift. If there are no developmental or traumatic problems in the mandible, the major reason for the deviation will probably be maxillary deficiency. Several authors have observed a tendency for the maxilla to be more asymmetrical than the mandibular and dentoalveolar regions.10,11

Functional posterior crossbite due to a narrow maxilla is common in the early development of the dentofacial complex. The patient moves the mandible to one side to avoid premature contact of the occlusion, and a unilateral posterior crossbite can be observed clinically. Because of condylar spacing in the side opposite the crossbite, the condyle and glenoid fossa can grow abnormally, making the

asymmetry permanent. Therefore, a functional problem caused by maxillary deficiency should be corrected as early as possible. In some cases, however, maxillary expansion and even unilateral orthodontic mechanics may be inadequate, so that a significant midline discrepancy remains.

Asymmetrical intermaxillary elastics may seem to be the solution, but their potentially adverse side effects, especially on the cant of the maxillary occlusal plane, require caution when using fixed appliances. Lack of patient compliance may also delay the achievement of the desired results. In such cases, Jasper Jumpers can be advantageous.

The two cases presented here confirm the ability of the appliance to correct asymmetrical dental arches. In particular, the maxillary rotational effect observed in Case 1, in the early permanent dentition, seems to deserve further research. This result corroborates the recommendations of Jasper and McNamara that the appliance be used in Class III malocclusions with maxillary skeletal retrusion.4

The Class III jumper did not contribute to TMD in either case. In fact, the clicking in the left TMJ noted at the beginning of treatment in Case 2 disappeared after the correction of her malocclusion. These clinical results seem to indicate condyle-fossa remodeling as a normal adaptation to the maxillary skeletal and overall occlusal changes.13-15

The dental effects of this force system are reciprocal—the incisors moved bodily in opposite directions, while the direction and amount of movement were controlled by the sizes of the jumpers. One-year follow-up showed acceptable stability.

The asymmetrical jumpers were well accepted by the patients, and no breakage occurred even though they were placed mesial to the molar tubes. Although such a configuration is contrary to the inventor's instructions, we felt it necessary to obtain equilibrium between the two sides. On the Class III side, rather than risking soft-tissue irritation during functional jaw movements from the friction between the ball pin and the mandibular molar tube, we elected to place the module mesial to the tube along the lower archwire. This would seem less comfortable, but we heard no complaints. The use of narrower single brackets on the posterior teeth would allow freer sliding during mandibular movements as the interbracket span increases. □

FIGURES

Fig. 1 Case 1. 10-year-old male with midline discrepancy before treatment.

Fig. 2 Case 1. A. Maxillary expansion with bonded Minne-Expander. B,C. Leveling of mandibular anterior teeth with .022" Straight-Edge appliance and .0175" x .0175" nickel titanium archwire.

Fig. 3 Case 1. Asymmetrical Jasper Jumpers, Class II on right and Class III on left, placed mesial to molar tubes. Anchorage is reinforced with rectangular stainless steel archwires; mandibular incisor brackets have -5° root torque and figure-8 ligatures.

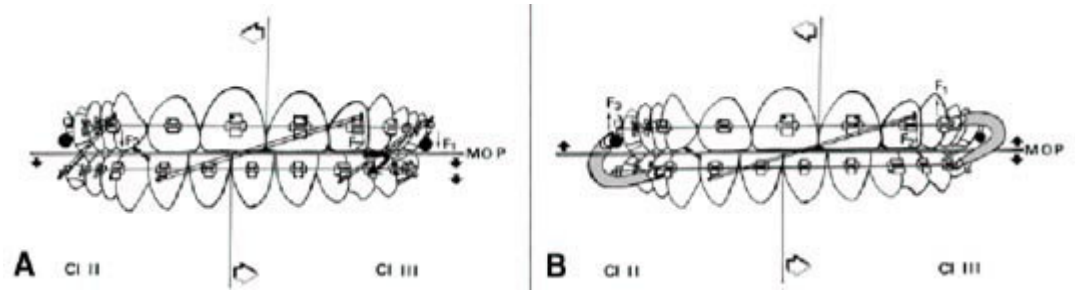

Fig. 4 A. Asymmetrical intermaxillary elastics can correct midline discrepancy of more than 3mm, but extrusive vertical force vectors of Class III (F_1) and diagonal (F_2) elastics will theoretically exceed force vector of Class II side (F_3). Maxillary occlusal plane (MOP) may therefore be lower

on left side, causing difficulties with fixed appliance mechanics. B. With asymmetrical Jasper Jumpers, vertical force vectors of Class III jumper (F_1) and diagonal elastic (F_2) are opposite. Even if forces are unequal, adverse effects will be less likely.

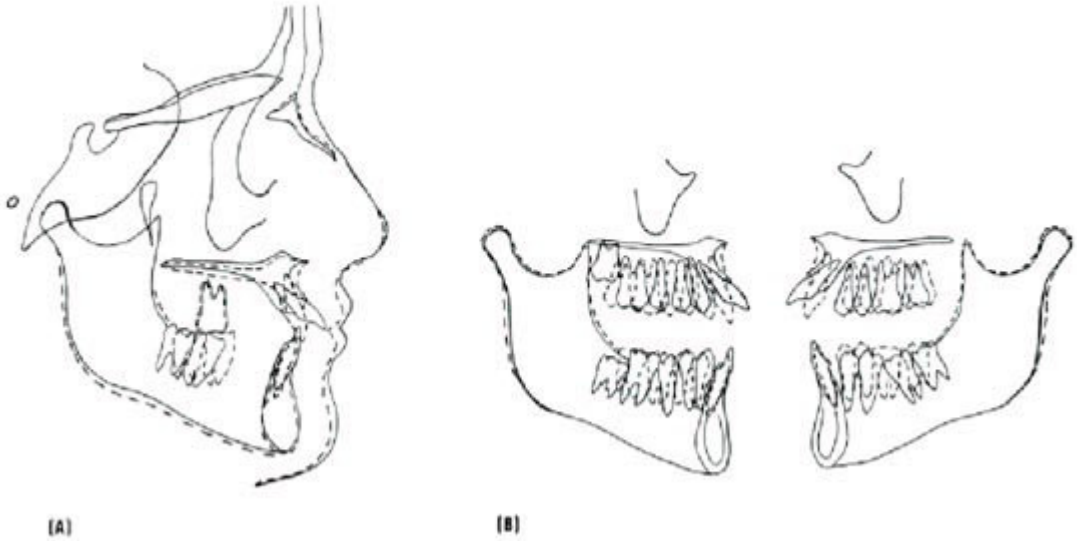

Fig. 5 Case 1. Superimpositions of cephalometric tracings before (solid line) and after (dashed line) asymmetrical jumper application. A. Best fit anterior cranial base superimposition. B. Structural maxillary and mandibular symphysis superimpositions of right and left buccal segments.

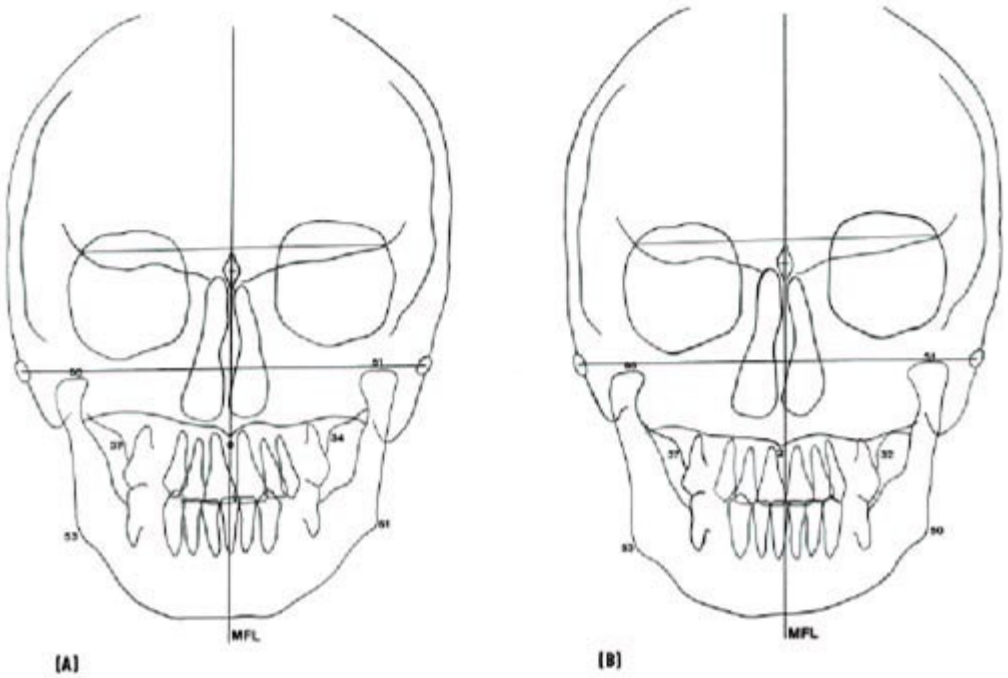

Fig. 6 Case 1. Frontal symmetry analysis before (A) and after (B) asymmetrical jumper application (numbers indicate distances of ANS, Mx, Co, and Go from midfrontal line [MFL] in millimeters).

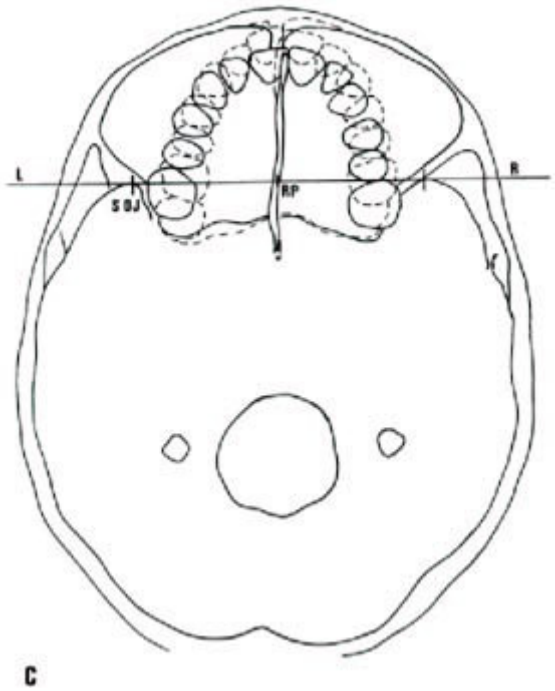

Fig. 7 Case 1. Basal radiograph tracings with maximum mouth opening before (solid line) and after (dashed line) asymmetrical jumper application, superimposed on line through left and right spheno-orbital junctions (SOJ) between lateral wall of orbit and minor wing of sphenoid bone, registered at geometric midpoint.

Fig. 8 Case 1. After 35 months of treatment.

Fig. 9 Case 1. One year after treatment.

Fig. 10 Case 2. 18-year-old female with multiple spacing before treatment.

Fig. 10 Case 2. 18-year-old female with multiple spacing before treatment.

Fig. 11 Case 2. Space-closure sliding mechanics with continuous elastomeric chains.

Fig. 11 Case 2. Space-closure sliding mechanics with continuous elastomeric chains.

Fig. 12 Case 2. Asymmetrical Jasper Jumpers, Class III on right and Class II on left.

Fig. 12 Case 2. Asymmetrical Jasper Jumpers, Class III on right and Class II on left.

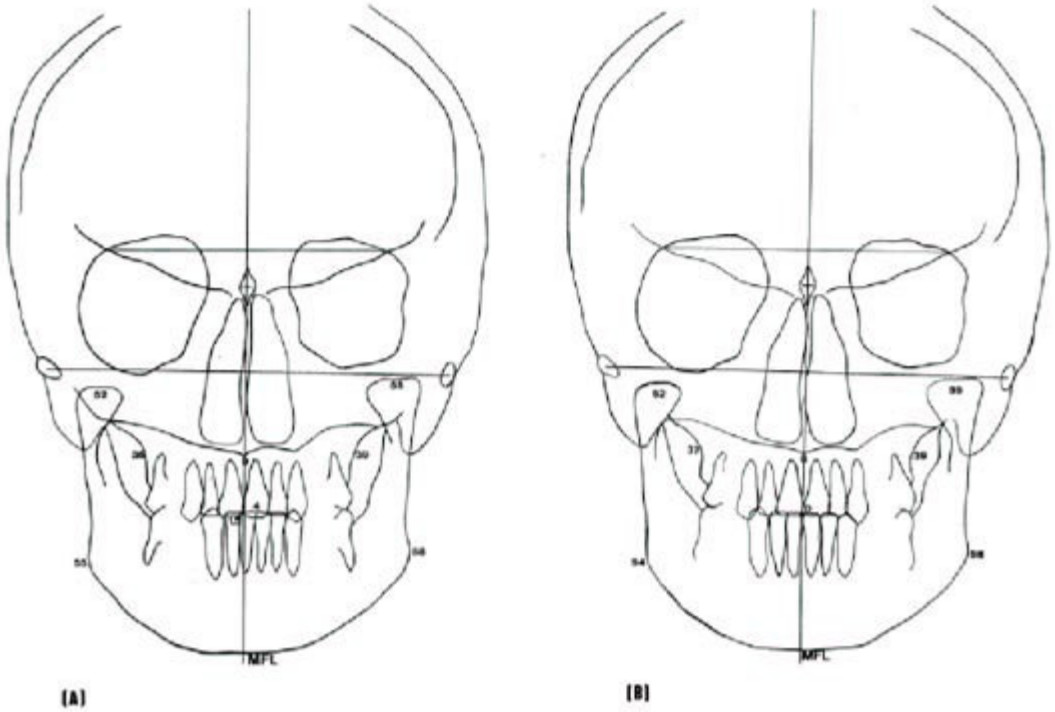

Fig. 13 Case 2. Frontal symmetry analysis before (A) and after (B) asymmetrical jumper application, showing bodily movement of anterior teeth in opposite directions (numbers indicate distances of ANS, Mx, Co, and Go from midfrontal line [MFL] in millimeters).

Fig. 13 Case 2. Frontal symmetry analysis before (A) and after (B) asymmetrical jumper application, showing bodily movement of anterior teeth in opposite directions (numbers indicate distances of ANS, Mx, Co, and Go from midfrontal line [MFL] in millimeters).

Fig. 14 Case 2. After 26 months of treatment.

Fig. 14 Case 2. After 26 months of treatment.

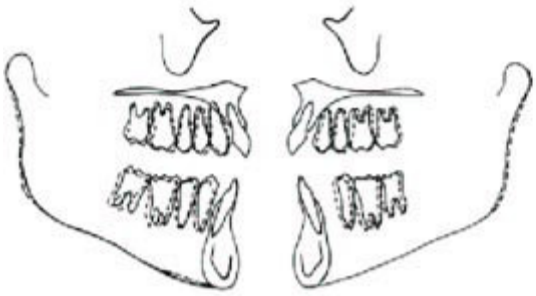

Fig. 15 Case 2. Structural maxillary and mandibular symphysis cephalometric superimpositions before (solid line) and after (dashed line) asymmetrical jumper application, showing dentoalveolar changes on right and left sides.

Fig. 15 Case 2. Structural maxillary and mandibular symphysis cephalometric superimpositions before (solid line) and after (dashed line) asymmetrical jumper application, showing dentoalveolar changes on right and left sides.

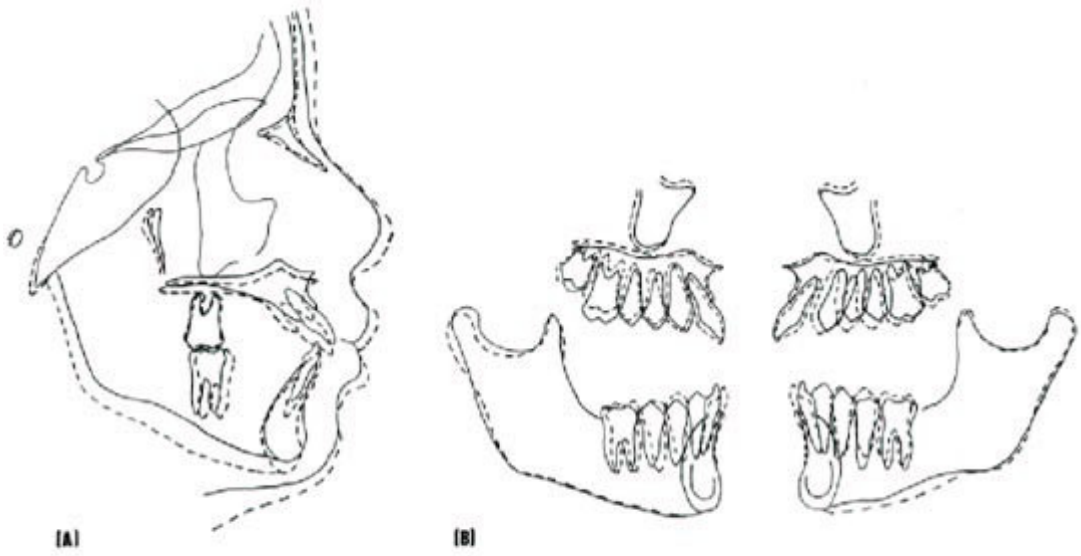

Fig. 16 Case 2. Superimpositions of cephalometric tracings before (solid line) and after (dashed line) entire treatment.

Fig. 16 Case 2. Superimpositions of cephalometric tracings before (solid line) and after (dashed line) entire treatment.

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FOOTNOTES

1 Jasper Jumper: American Orthodontics, 1714 Cambridge Ave., Sheboygan, WI 53082.

2 Herbst: Registered trademark of Dentaurum, Inc., 10 Pheasant Run, Newtown, PA 18940.

3 Straight-Edge brackets: TP Orthodontics, Inc., 100 Center Plaza, LaPorte, IN 46350.

4 Nickel titanium archwire: Ormco, 1717 W. Collins Ave., Orange, CA 92667.

5 Zebra elastics: Ormco, 1717 W. Collins Ave., Orange, CA 92667.

6 Closed-coil spring: GAC International, Inc., 185 Oval Drive, Central Islip, NY 11722.