

Skeletal Changes in Non-invasive Orthodontic Treatment in Growing Patients

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ABSTRACT

General and pediatric dentists often refer teenage patients to the orthodontist around the time of exfoliation of the last remaining primary tooth in the dentition. Unfortunately, many times, that timing tends to be past the peak of growth of the patient, which hinders the orthodontist's ability to successfully treat the occlusion without using more invasive supplemental procedures, such as extraction of teeth, placement of mini-implants or surgery. This case report describes three situations where the referral to the orthodontist was made well in advance of tooth exfoliation and the patient's growth was able to be manipulated using non-invasive orthodontic techniques.

The American Association of Orthodontists (AAO) recommends referral to the orthodontist by age 7.^[1] Many parents and dentists disregard this guideline, probably feeling it unwarranted with so many primary teeth in the mouth that do not need to be aligned since they will soon exfoliate. In a high percentage of cases they are correct. The orthodontist will take a panoramic radiograph to ensure a proper eruption pathway of the remaining unerupted permanent teeth and recommend a follow-up visit in one to two years.^[2] However, in those instances where the orthodontist can use the patient's growth to their advantage, those months can be invaluable.

Peak growth in children usually occurs in the 10-to-12-age range in girls and 12-to-14-age range in boys. It can be timed

fairly accurately using the cervical vertebral maturation (CVM) index from a standard 2-D cephalometric radiograph taken at the orthodontic office.^[2,3] The orthodontist will use this information as a guide when certain appliances, particularly mandibular functional appliances, should be inserted. Certain skeletal malocclusions, such as a negative overjet from a hypoplastic maxilla, should be treated well before peak growth.^[2]

Described here are three malocclusions that were treated using only fixed appliances (braces) and other non-invasive orthodontic appliances, all of which were removed upon completion of the case. It is hoped that this information will assist general and pediatric dentists diagnose those skeletal conditions when an early referral to an orthodontist should be made.

Skeletal Class II from Retruded Mandible

Many skeletal Class II patients can be easily spotted by dentists and parents presenting as a large overjet ("buck teeth" or "weak chin" in layman's terms). Sometimes, however, as in this case, retruded maxillary incisors can mask a retruded mandible. Only when the maxillary incisors are uprighted into a normal position is the extent of the underlying skeletal issue uncovered (Figure 1).

In such situations, my favorite appliance is the Herbst (Figure 2). It consists of a cemented palatal expander, with telescoping rods connected to a cantilever off of the mandibular first molars to hold the lower jaw forward at all times. The Herbst has been well studied for decades and has been shown to increase mandibular length, protract the mandibular basal bone, distalize maxillary posterior teeth, remodel the condylar area and increase pharyngeal airway width.^[4,5,6] The classic criticism of the Herbst, as well as other functional appliances, has been that long-term studies have shown that, on average, the length of the mandible (measured from con-

dylion to pogonion) was not affected by the appliance. However, these studies did not consider the other benefits of the Herbst appliance, including mesial movement of the mandibular basal bone and distalization of the maxillary dentition.^[5]

My philosophy is to always give the patient a chance to attempt to fix the occlusion non-invasively. Other techniques, such as extraction of permanent teeth to mask the skeletal problem, placement of mini-implants for anchorage to move entire dentitions, and corticotomy and orthognathic surgical procedures are always available later should the Herbst appliance fail, but there is little chance a functional appliance will succeed once the patient is well past peak growth.^[5] There are many functional appliances used by orthodontists, with differing levels of clinical research performed on them, so please discuss this with your referring orthodontist.

In this case, once the maxillary teeth were uprighted, the Herbst was inserted and left in the mouth for a year and a half. The appliance was then removed, and standard metal brackets and bands were bonded on the remaining teeth. Bite turbos (ramps) were placed on the lingual of the maxillary central incisors to allow for eruption of the posterior teeth to increase the lower vertical facial height. Final records and superimposition show good downward and forward growth of the mandible, an increase in the mandibular plane angle and maintenance of the incisor angulation after initial uprighting, significantly increasing the incisor show upon smile.

The final CBCT scan shows the condyles normally positioned in the glenoid fossa and ample cross-sectional airway (Figure 3). Although there is as yet no published data on the effects of the Herbst appliance on sleep apnea patients, this is an avenue of treatment our office is pursuing. Standard braces and elastic wear in cases like this tend to procline the mandibular dentition, masking the overjet, but often leaving the patient with a retruded chin and unstable mandibular anterior teeth that have less bone and gingival support.^[7,8]

Skeletal Class III from Hypoplastic Maxilla

Due to the late growth of the mandible, many skeletal Class III cases will evolve into surgical cases no matter what the orthodontist does. But using a protraction facemask off of a palatal expander is a powerful appliance has been shown to greatly reduce the need for surgery later.^[9,10,11] Because the orthodontist is distracting the maxillary sutures in order to bring the maxilla forward, and the younger the patient the more malleable the sutures,^[2] the general rule we use is to get these patients into the appliance as soon as they can tolerate it. The expander is cemented to the maxillary first molars or in some cases, primary second molars, the maxilla is expanded as much as is required for transverse correction, and the facemask is attached to hooks coming off of the expander with elastics (Figure 4). It needs to be worn 10 to 12 hours a day to be effective, so the patient can wear it while sleeping and at home only.^[2,9]



Figure 1. Pre-treatment records and pre-Herbst cephalometric radiograph for Case One.



Figure 2. Herbst appliance.

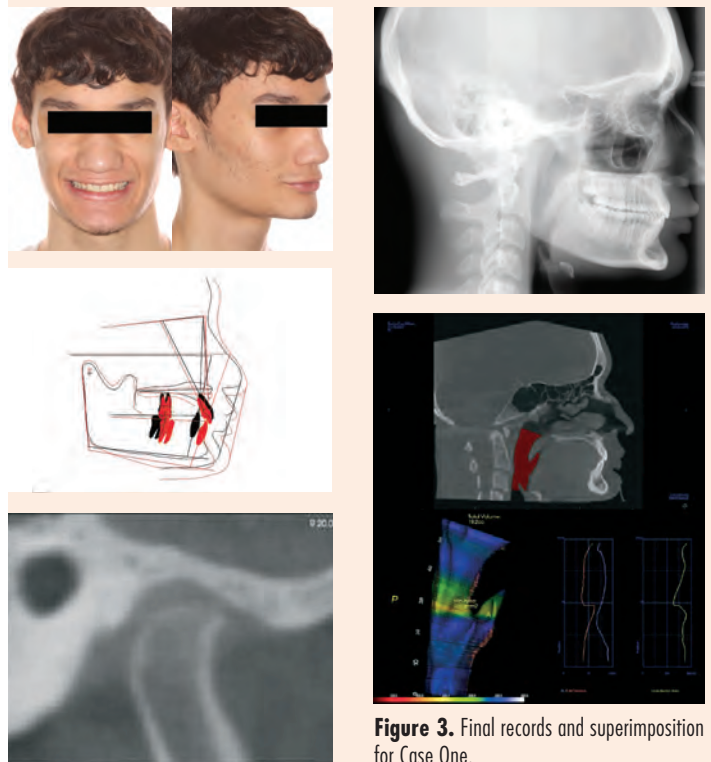


Figure 3. Final records and superimposition for Case One.

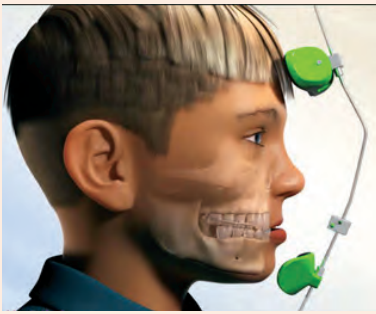


Figure 4. Protraction facemask appliance (Dolphin Imaging®).



Figure 5. Pre-treatment records for Case Two.



Figure 6. Final records and superimposition for Case Two.

This patient presented with an obvious hypoplastic maxilla, as evidenced by the negative overjet and lack of malar support in the midface (Figure 5). She wore her facemask well for one year, and was then bonded into full fixed appliances and Class III elastics. The superimposition shows the dramatic forward movement of the maxilla (which needed to keep up with the natural mandibular growth) and relatively subtle changes to the incisor angulation (Figure 6). There are exceptions, but as a general guideline in orthodontics, minimal anterior-posterior movement of the mandibular incisors is preferred for case stability.^[2] This patient was almost certainly destined for orthognathic surgery had the dentist not referred her to our practice at age 6 and a half.

Open Bite from Vertical Maxillary Excess

These cases are very challenging for the orthodontist, especially when the parent declines the use of mini-implants to intrude maxillary posterior teeth. But if the dentist is keen to recognize the open bite early enough, a classic high-pull headgear can many times do the job (Figure 7).^[12,13] Vertical skeletal malformation cases often require different treatment plans from open bites arising from a finger sucking or tongue thrust habit, but regardless of the etiology, these patients should be referred to the orthodontist as soon as it is evident that the permanent anterior teeth are almost fully erupted out of the gingival and there is no overbite.^[14]

This patient presented a little older than we would have liked (CVM is IV, indicating peak growth was at least two years prior).^[3] But, fortunately, there was enough growth left to treat the case nonsurgically (Figure 8). She had a posterior crossbite that needed to be corrected with a palatal expander first, followed by the high-

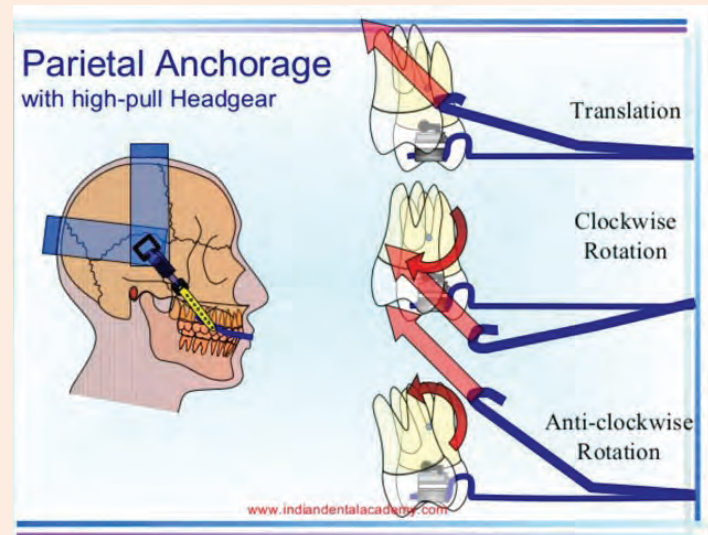


Figure 7. High-pull headgear (www.indiandentalacademy.com).

pull headgear to be worn 10 to 12 hours a day. The patient was motivated by the fear of surgery and wore the appliance well for over a year, followed by full fixed appliances and vertical elastics.

The superimposition shows about 1 mm of maxillary posterior intrusion, which is all it takes to close the wedge on a 3 mm anterior open bite (Figure 9). Some uprighting and extrusion of the anterior teeth are also evident. We saw this patient recently after several years in retention and the overbite is holding stable. Recently, we have been treating many cases requiring posterior intrusion using Invisalign, but that would have been difficult in this case given the skeletal posterior crossbite, as well as the required extrusion of anterior teeth to improve the incisor shown.^[15] //

Queries about this article can be sent to Dr. Kuncio at dr@kuncioorthodontics.com.

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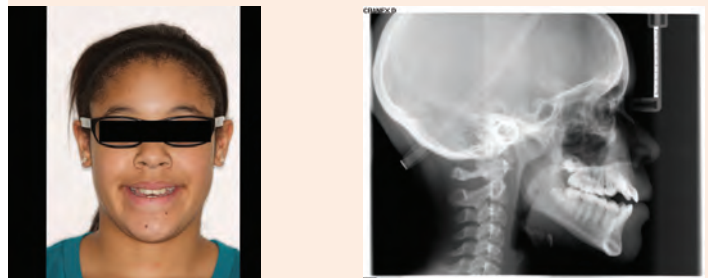


Figure 8. Pre-treatment records for Case Three.

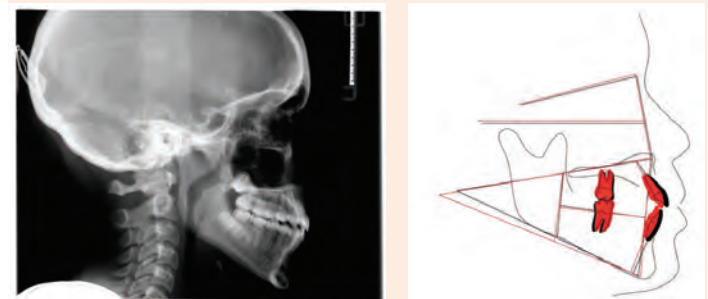


Figure 9. Final records and superimposition for Case Three.

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