THE VERTICAL DIMENSION: THE HIGH-ANGLE PROBLEM

When the patient who has excessive anterior facial height desires treatment for the correction of a malocclusion, the dimension of the dentition should be respected. The clinician must adhere to the anterior, posterior, vertical, and lateral limits of each patient’s dentition—providing the musculature is normal—when the treatment plan is formulated. The goals of esthetics, health and function, stability, and treatment in harmony with growth are as valid for the high-angle patient as they are for a patient with a more normal vertical dimension. The diagnostic decisions made for the high-angle patient should be predicated on nonexpansion of the mandibular arch. Mandibular incisors must be overly upright. In addition, a decision on the mandibular third molars must be made prior to anchorage preparation—because their relationship to the mandibular second molars is critical if anchorage is to be properly prepared. A discussion of these topics as well as an illustrative case report are presented in this article. World J Orthod 2006;7:336–344.

The treatment goals of esthetics, health, function, and stability, which are universally accepted by the orthodontic specialty, are also the goals the clinician must subscribe to when treating the patient with a compromised vertical dimension—either excessive anterior facial height or decreased anterior facial height. The diagnosis and treatment plan for these patients must be based on the dimensions of the dentition. This concept requires the clinician to adhere to the anterior, posterior, lateral, and vertical limits of the dentition during diagnosis and treatment. If these dimensions are violated, facial esthetics, as well as the stability of the treatment results, will be compromised.

When a differential diagnosis is made for the patient with excess vertical dimension, the face, the skeletal pattern, and the teeth must be considered—in that order. The goal of orthodontic treatment for these patients is to either improve or maintain facial balance, harmony, and proportion. Patients with excessive vertical dimension require strict attention to detail if their facial esthetics and smile are to be enhanced (Fig 1).

The hyperdivergent face (Fig 2) is characterized by a lower facial third that is out of proportion with the other divisions of the face. Another characteristic of the high-angle patient’s face is that the lower lip always seems to be

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procumbent (Fig 3). High-angle patients have to be diagnosed and treated carefully. The mandibular incisors of these patients have to be overly upright, and posterior teeth must not be extruded during active treatment. For these goals to be accomplished, teeth generally have to be removed. To change the unbalanced high-angle face (see Fig 3) to one of balance and proportion (Fig 4), the diagnosis and treatment concepts must be fundamentally sound.

Orthodontic mechanotherapy must be carefully monitored, even if the diagnosis is correct, or facial balance will be compromised. The patient shown in Fig 5 lacks facial balance. The pretreatment/posttreatment cephalograms (Fig 5b) provide a hint of a problem during mechanotherapy. The pretreatment/posttreatment tracings (Fig 5c) confirm the suspicion that the vertical dimension was violated. The Frankfort-mandibular plane angle (FMA) increased from 37 degrees to 44 degrees; anterior facial height increased from 60 mm to 66 mm. The superimposition (Fig 5d) shows extrusion of the molars and a downward and backward rotation of the mandible. The pretreatment/posttreatment face (Fig 5a) confirms poor facial esthetics due to poor mechanotherapy—not poor diagnosis.

On the other side of the coin, the patient shown in Fig 6 has a typical high-angle face. The pretreatment/posttreat-
Fig 5  Patient lacking facial balance whose orthodontic treatment was poor. Pretreatment and posttreatment (a) photographs, (b) cephalograms, (c) tracings, and (d) superimpositions.
Fig 6  Patient with a typical high-angle face whose treatment was successful. Pretreatment and posttreatment (a) photographs, (b) cephalograms, (c) tracings, and (d) superimpositions.
Cephalometric tracings (Fig 6c) confirm control of the vertical dimension. The FMA remained constant, while anterior facial height was controlled. The superimpositions (Fig 6d) illustrate molar control and a downward and forward movement of the mandible, not downward and backward. The pretreatment/recall facial photographs (Fig 6a) confirm improvement in facial balance and harmony due to a correct diagnosis and appropriate control of mechanotherapy. When the posttreatment face of the patient whose mechanotherapy was not controlled is compared to the posttreatment face of patient whose treatment was controlled (Figs 5a and 6), the difference is marked. The improvement in facial esthetics for the high-angle situation, therefore, is dictated by a good differential diagnosis, as well as excellent and controlled mechanotherapy.

The skeletal pattern of the high-angle patient (Fig 7) is generally a result of a multifactorial problem. Björk states that people who have long anterior facial heights are “backward” rotators (Fig 8). Björk’s indicators for backward rotators are: (1) straight condylar head; (2) straight mandibular canal; (3) notched inferior border of the mandible; and (4) forward-sloping mandibular symphysis.

Another anatomic finding that impacts the skeletal pattern of the long anterior facial height patient is dentoalveolar development. The classic study on dentoalveolar development was conducted by Isaacson et al. These investigators found that patients with long anterior facial height had 5.1 mm more dentoalveolar development in the maxilla than did patients who had short anterior facial height and 3 mm more than patients with normal facial height.

Environmental factors such as airway problems, mouth breathing, swallowing, and forward tongue posture also contribute to the skeletal problem. These etiologic factors always compound the high-angle problem. However, the amount they contribute...
is subject to debate. All of these factors together—backward rotation, alveolar development, and environmental issues—contribute to the skeletal pattern of the patient who has long anterior facial height.

The teeth and their alignment, or lack thereof, form the third component of the diagnostic dilemma for the high-angle patient. Particular emphasis must be placed on the tooth-arch discrepancy and on the cephalometric discrepancy. An anterior tooth-arch discrepancy must be treated with extraction because the mandibular anterior teeth will need to be overly upright, and not proclined, or the facial balance is compromised. In addition, the posterior discrepancy has to be considered. Often, patients who have high mandibular plane angles should have the mandibular third molars removed prior to the anchorage preparation step of treatment. If these teeth are not removed, the second molar “rolls up over” the impacted third molar and increases the vertical dimension.

**CASE REPORT**

The records of this patient illustrate the diagnosis, treatment planning, and treatment of a patient with a steep mandibular plane angle and long anterior facial height. The pretreatment facial photographs (Fig 9) show a patient with long anterior facial height, a significant outward curl of the lower lip, a rather pronounced mentolabial sulcus, and some mentalis strain when the patient’s lips are closed and at rest. The casts (Fig 10) reveal maxillary and mandibular crowding, a midline deviation, and a significant Angle Class II dental relationship on the patient’s right side. The pretreatment panoramic radiograph (Fig 11) confirms that all teeth, including maxillary and mandibular third molars, are present. The pretreatment cephalograms and its tracing (Fig 12) confirm the skeletal problem. The patient’s FMA is 36 degrees, the occlusal plane angle is 17 degrees, and the facial height index is 0.63. These values confirm a hyperdivergent skeletal pattern. The facial imbalance is quantified by a Z angle of 58 degrees and profile line that lies outside the tip of the nose. The anterior problem is reflected by an ANB of 6 degrees. After a careful total dentition space analysis, it was found that the patient had a space deficit of 24.4 mm. Coupled with the excess vertical height, this space deficit made it necessary to remove the maxillary and mandibular first premolars, as well as the mandibular third molars, prior to the start of orthodontic treatment. The space for the crowding amelioration was created by first premolar removal. Mandibular incisors also had to be overly upright for this particular patient, even though they were at 92 degrees pretreatment, if facial esthetic improvement was to be realized. Therefore, the extraction space had to be used to upright the mandibular incisors, as well as to correct the crowding. The Class II relationship had to be achieved by distalizing the maxillary posterior teeth on the patient’s right side because there would be no space in the mandibular arch to move the mandibular right posterior segment mesially.

The patient’s retention facial photographs (Fig 13) exhibit a pleasing and balanced face. Note that the lower lip is not nearly as procumbent. There is no deep mentolabial sulcus and no mentalis strain. The patient’s smile is correct and also pleasing. The recall casts (Fig 14) reveal proper occlusion of the teeth and maintenance of the arch form. The intraoral photographs (Fig 15) confirm the proper occlusal relationships, as well as a lack of balancing and working prematurities. The 5-year posttreatment tracing (Fig 16) confirms that the mandibular incisors were uprighted significantly—from 92 degrees to 82 degrees. This mandibular incisor uprighting was necessary to achieve improvement in the facial profile. Note that the Z angle is now a normal 74 degrees and the profile line bisects the anterior portion of the nose—exactly as it should. The ANB has been reduced from 6 degrees to 2.5 degrees. This mandibular incisor uprighting was necessary to achieve improvement in the facial profile. Note that the Z angle is now a normal 74 degrees and the profile line bisects the anterior portion of the nose—exactly as it should. The ANB has been reduced from 6 degrees to 2.5 degrees. This mandibular incisor uprighting was necessary to achieve improvement in the facial profile. Note that the Z angle is now a normal 74 degrees and the profile line bisects the anterior portion of the nose—exactly as it should. The ANB has been reduced from 6 degrees to 2.5 degrees. This mandibular incisor uprighting was necessary to achieve improvement in the facial profile. Note that the Z angle is now a normal 74 degrees and the profile line bisects the anterior portion of the nose—exactly as it should. The ANB has been reduced from 6 degrees to 2.5 degrees. This mandibular incisor uprighting was necessary to achieve improvement in the facial profile. Note that the Z angle is now a normal 74 degrees and the profile line bisects the anterior portion of the nose—exactly as it should. The ANB has been reduced from 6 degrees to 2.5 degrees. This mandibular incisor uprighting was necessary to achieve improvement in the facial profile.
Fig 9  Pretreatment facial photographs.

Fig 10  Pretreatment casts.

Fig 11  Pretreatment panoramic radiograph.

Fig 12  Pretreatment cephalograms and tracing.

Fig 13  Recall facial photographs.
Fig 14 (left) Recall casts.

Fig 15 (above) Recall intraoral photographs.

Fig 16 Cephalometric tracing and superimposition.

Fig 17 Profile views of patient pretreatment, post-treatment, and at recall.
positive impact on her facial esthetics. The pretreatment, posttreatment, and recall facial profiles (Fig 17) illustrate that the patient who has a high-angle Class II malocclusion can be successfully treated with orthodontics if the diagnosis and treatment plan are properly determined and executed, and if the force systems applied to correct the malocclusion are delivered with precision.

**CONCLUSION**

The high-angle patient must be treated with care. The universal goals of orthodontic treatment can be achieved for these patients, with a careful and discerning diagnosis and appropriate force system. The high-angle patient must have, first and foremost, balanced facial proportions (Fig 18). The dentition must be healthy and functional. Finally, stability of the dentition must be achieved. For the teeth to be stable, they must be in a state of equilibrium with their muscular environment. Long-term retention records should show a dentition that exhibits proper alignment and interdigitation of the teeth in a pleasing smile.

**REFERENCES**