doi:10.5937/sejodr3-1278

Case report

SEJODR

Diagnosis and treatment of an excess vertical dimension malocclusion

Vaden, James L. [1]***; Williams, Richard A.*** [2]

1 Private Practice, Cookeville, TN, USA

2 The University of Tennessee, TN, USA

ABSTRACT

The orthodontic clinician must use a careful differential diagnosis protocol for each patient who seeks his or her care. The diagnosis must analyze all three components of a malocclusion—facial, dental, and skeletal. Each component must be carefully studied and understood so that (1) the proper questions are asked and (2) the correct diagnostic decisions are made so that an effective treatment plan can be developed. Once the treatment plan is finalized, proper forces at appropriate treatment intervals must be utilized. If these concepts are used, most vertically compromised patients can be successfully treated with conventional orthodontics.

Vaden JL, Williams RA. Diagnosis and treatment of an excexx vertical dimension malocclusion. South Eur J Orthod Dentofac Res. 2016;3(2):52-58.

Submitted: February 09, 2016; Revised: June 06, 2016; Published: September 22, 2016

INTRODUCTION

Conventional treatment of a patient whose vertical dimension must be respected and preserved requires essentially two components: a proper treatment plan and a proper force system. [1-4] Both of these areas must be carefully considered prior to the initiation of treatment. Either area, if neglected, will make successful treatment of the patient with a vertical dimension problem virtually mpossible. The patient who has excessive vertical dimension must have a treatment plan that allows the clinician to control every facet of the malocclusion. The clinician must determine where the teeth should be positioned. For the long anterior facial height patient, the mandibular anterior teeth must be positioned in a more upright posture over basal bone. Space must be available to eliminate crowding because proclination of teeth is disastrous to the facial esthetics of patients who are vertically compromised. Lip procumbancy can be best resolved if the mandibular anterior teeth are upright. The amount of uprighting that must be achieved is a matter of (1) preference for facial esthetics and must be determined during the treatment planning phase of the treatment protocol and/or (2) the dictates of the malocclusion. It is fundamental for the clinician to be able to visualize the posttreatment positions of the mandibular anterior teeth during the formulation of the treatment plan. One must ask - will extractions be necessary? Normally, space for correction of a vertically excessive malocclusion must be made available with the extraction of teeth. Space is required because mandibular incisors must be overly upright if the patient is going to have good facial esthetics at the end of treatment. [2] Space must also be available for correction of a Class II dental relationship because one cannot distalize maxillary teeth without having some sort of adverse affect on the vertical dimension unless maxillary posterior space is available. A careful treatment plan for these types of patients must consider the dimensions of the dentition. [5] This concept, originally promulgated by Merrifield, postulates that there is an anterior, posterior, lateral and vertical limit of the dentition. The dimensions of the dentition must be respected – more so for the patient who has excessive vertical dimension. Vertical extrusion of the molars, flaring of anterior teeth, maxillary arch distalization that encroaches upon the posterior limit of the dentition, and lateral expansion - all have adverse affects on facial esthetics and long term stability of the finished treatment result.

The easiest area of the dentition to violate is the anterior limit. Proclination of anterior teeth for a patient who has a high mandibular plane angle is not conducive to good facial esthetics. A violation of the posterior limit can result in second molars that have no room to erupt and/or an opening of the mandibular plane angle if maxillary molars are extruded as they are distalized. Lateral expansion can rarely be done without some sort of vertical or anterior expansion. The other problem with lateral expansion,

Corresponding Author
James L. Vaden
Private Practice,
Cookeville, TN, USA
e-mail: jlvaden@frontiernet.net

particularly in the mandibular canine area, is that it will not be stable. Mandibular canine expansion is the most predictable of all orthodontic relapse. The literature is replete with arguments against mandibular canine expansion because no one has reported its stability. [6-10] It goes without saying that vertical extrusion or expansion in a patient who already has a vertically excessive skeletal and facial pattern can be disastrous. Vertical expansion leads to a longer anterior facial height and a very stretched appearance of the face.

In summary, the high angle, vertically compromised patient's treatment plan must be carefully formulated. A treatment plan that facilitates intrusive and contractive forces seems to be what these patients must have. If a treatment plan incorporates expansion, the clinician does not normally have an opportunity to successfully correct the patient's malocclusion and improve the patient's facial esthetics at the same time.

Main findings and clinical implications

Any conventional force system that is used to successfully correct the vertically compromised patient's malocclusion must control the horizontal planes – the palatal plane, the occlusal plane, and the mandibular plane. Without careful attention to the types of forces that are being delivered, the high angle patient will get a very compromised treatment result.

Leveling

During leveling of the dentition, rotations must be corrected, canines must be retracted for the extraction patient, and the mandibular arch is initially prepared for the Class II correction stage of treatment – if the patient has a Class II malocclusion. Leveling can be done in many different ways, but it should not be done with a simple alignment archwire that flares the anterior teeth and extrudes the molars. Molar and incisor control during leveling is critical.[11] Various mechanical techniques can be used to accomplish these goals. One way of doing it is to use edgewire arch wires from the outset. [12] If this is done, first molars might not be banded at the initial banding appointment – only second molars and premolars are banded. Canines are gradually retracted into a premolar extraction space and malaligned anterior teeth are not ligated to the wire. They are tied into the wire for alignment only after there is space for them. Leveling requires proper and careful archwire manipulation and a force system that is designed to control anterior flaring and molar extrusion. Helpful adjunctive therapy during leveling can be applied with a J-hook headgear force to the maxillary and mandibular canines (Figure 1). This J-hook headgear force has the effect of helping to retract the canines into an extraction space. It also places an intrusive force on the posterior part of the mandibular arch. If attached to the canines, the anterior J-hook headgear can be an important adjunct to mechanotherapy that helps to preserve the vertical dimension during the leveling process.

Space Closure

After the patient's dentition is leveled and the canines have been retracted, spaces that remain anterior to the canines must be closed. Space closure needs to be accomplished with no extrusion of the posterior teeth. This goal can be facilitated by placing a curve of occlusion in a relatively heavy edgewise maxillary closing loop archwire. If an .022 slot is used, an .020 x .0215 archwire is ideal for space closure and vertical maxillary molar control. A curve of occlusion incorporated into this dimension of wire as well as the application of a J-hook headgear to the anterior segment helps control vertical extrusion of the maxillary molars. Closing loops in the mandibular arch should be made with an .019 x .025 archwire if an .022 slot is used. An adjunct to space closure is an anterior vertical elastic. If the patient wears a high pull J-hook headgear to the anterior segment of the maxillary arch wire and vertical elastics from the maxillary arch to the mandibular arch, the vertical elastics have the effect of "pulling up" on the front of the mandibular arch and "pushing down" on the posterior teeth in the mandibular arch (Figure 2). This downward force helps control mandibular molar extrusion and, in the edgewise archwire, anterior teeth do not extrude.

Figure 1.

If maxillary molar distalization for Class II correction is necessary, the clinician has to be even more careful. Mandibular arch anchorage must be prepared to offset the vertical component of the Class II elastic pull. Tweed prepared en masse mandibular anchorage. [13] His technique, though effective, was extremely sensitive to patient cooperation. In 1978 Merrifield proposed sequential mandibular anchorage preparation. [14] His sequential anchorage preparation prepares mandibular anchorage by moving two teeth at a time into an anchorage prepared position versus Tweed's concept of attempting to move all of the teeth at one time. Merrifield's "ten two system" utilizes ten teeth in the arch to help move two teeth. The ten teeth are anchorage units for the two teeth that are being tipped to a distal inclination. The first teeth that are uprighted and tipped are mesially tipped mandibular second molars. After these teeth are in their proper distally tipped positions, the first molars are tipped distally. Because anchorage preparation can be vertically extrusive if not done properly, the patient is instructed to wear an extra-oral force (headgear) or an intra-oral elastic that has an upward force on the mandibular anterior teeth. This force has a contralateral downward force effect on the posterior teeth. It can be applied

with a J-hook headgear during sleeping or with vertical elastics if a headgear is being worn on the maxillary arch (Figure 3). It must be remembered that anchorage preparation requires diligence and an acceptable degree of patient cooperation. Careful control of the vertical dimension is so vitally important during this stage of treatment. After the mandibular arch has been prepared to withstand the extrusive effects of Class II elastics, maxillary dentition distalization can be accomplished if the distalization is done sequentially and carefully. Again, the maxillary second molars are moved distally, then the first molars, then the premolars, etc. (Figures 4 and 5). As has been described for space closure, the maxillary archwire utilized for distalization has to be of significant size and it must have a curve of occlusion built into it so that the maxillary molars are not allowed to extrude. If maxillary distalization mechanics are to be utilized and Class II elastics are used to accomplish it, vertical elastics can be used to preserve the position of the mandibular anterior teeth. The whole system must be supported with a high pull J-hook headgear that is attached to the anterior segment of the maxillary arch. The force system that has been described and illustrated is very effective when vertical dimension control is a goal.

Figure 2.

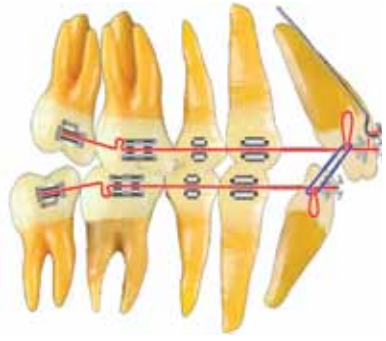


Figure 3.

Figure 4.

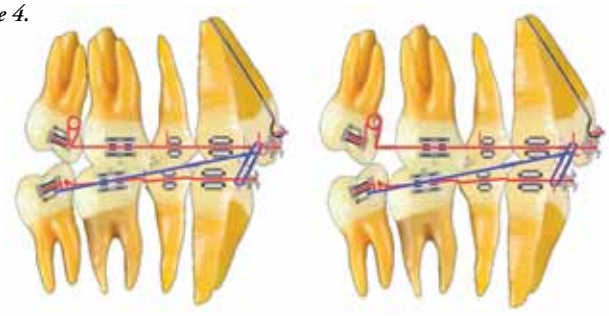


Figure 5.

CASE REPORTS

The five essential goals of orthodontic treatment are: esthetics, health, function, stability, and treatment in harmony with growth. For these five goals of treatment to be realized, the malocclusion must be corrected with a good treatment plan and with a proper force system. The concepts that have been described require the clinician to treatment plan properly and to deliver a force system that will correct the malocclusion with minimal effects on the vertical dimension. The records of the following two patients will, hopefully, illustrate the concepts that have been described. One of these patients was treated two years ago and the other was treated in the late 1970's. The records of both are being shown to illustrate the treatment planning and force systems concepts that have been described. The thirty-two year posttreatment records of patient #2 attest to the stability of the treatment result. Stability should be an overriding concern during the treatment planning and treatment phases of orthodonticss.

CASE REPORT 1

The facial photographs (Figure 6) reflect a mild retrognathia and reasonable balance of the face. The casts (Figure 7) illustrate an Angle's Class I molar relationship, a deep curve of Spee, and canines that have an end to end relationship. There is mild crowding of the maxillary and mandibular anterior teeth. The panoramic radiograph (Figure 8) confirms that all teeth are present. The cephalogram and its tracing (Figure 9) confirm that the patient has a high mandibular plane angle of 35°. The retrognathic mandible is reflected with an SNB of 74°. The ANB is 7°.

Treatment Plan

As has been previously described, it is very important for mandibular incisors to be very upright if the patient has a long anterior facial height. This patient, because of the high FMA, has increased anterior facial height. For this reason, maxillary and mandibular second premolars were removed so that the mandibular incisors could be placed properly in the face.

Figure 6.

Figure 7.

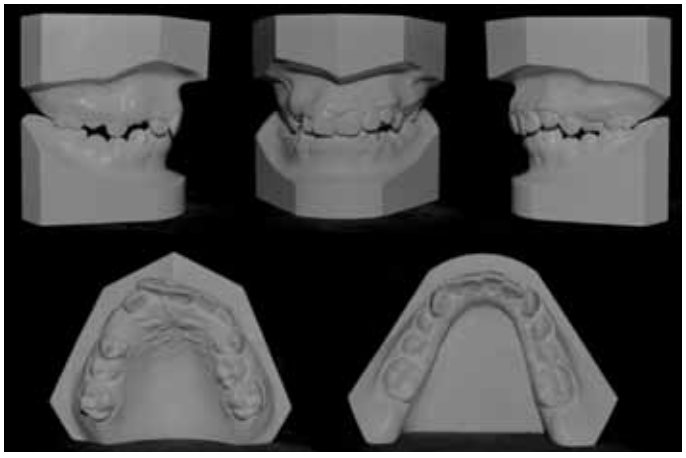


Figure 8.

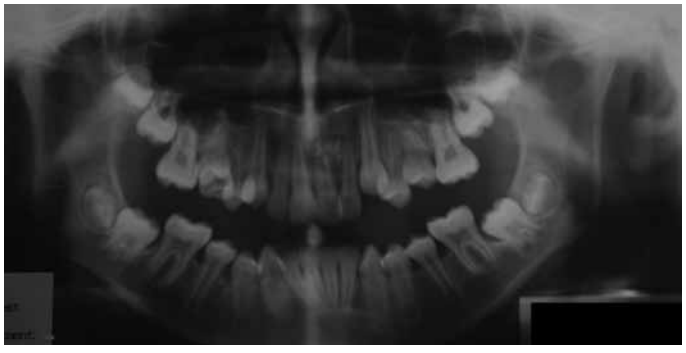


Figure 9.

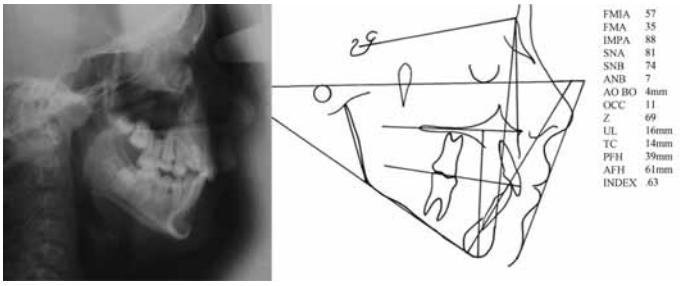
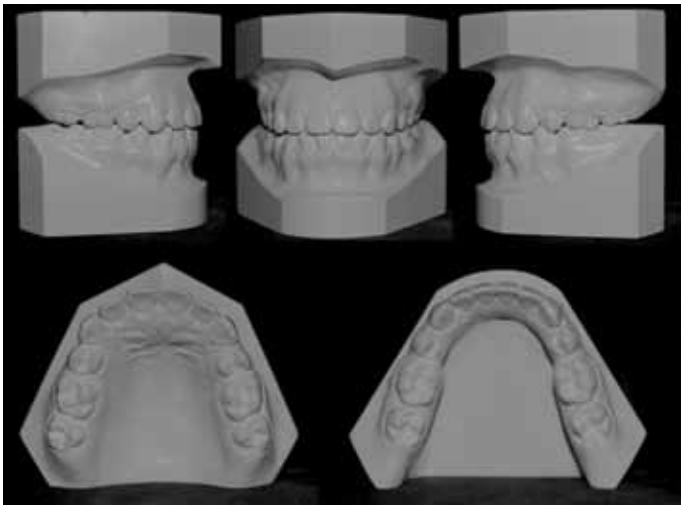


Figure 10.

Figure 11.



Treatment Results

The facial photographs (Figure 10) reflect a very balanced face. Note that there is nice upper lip curl, and the position of the chin is more harmonious with the rest of the face. The casts (Figure 11) reflect a good interdigitation of the teeth, a level curve of Spee and mild anchorage preparation. Arch form and arch width have been maintained. The posttreatment panoramic radiograph (Figure 12) illustrates mandibular anchorage preparation and uprighting of the teeth into the extraction spaces. The posttreatment cephalogram and its tracing (Figure 13) confirms that mandibular incisor position was protected, and in fact, incisors were uprighted another 5°. ANB has been reduced from 7° to 2°. The pretreatment/posttreatment superimpositions (Figure 14) exhibit a favorable change in the spatial relationship of the mandible to the maxilla. The superimpositions confirm control of the vertical dimension in both maxillary and mandibular molar areas. Mandibular molars extruded only about two millimeters even though there was significant mandibular growth. The pretreatment/posttreatment composite facial photographs (Figure 15) reflect a favorable change in facial esthetics due to control of the vertical dimension during treatment.

CASE REPORT 2

The pretreatment facial photos (Figure 16) illustrate a protrusive face. There is excessive proclination of the mandibular lip and a retrognathic chin. Photos of the casts (Figure 17) exhibit and "end on" Class II occlusion on the right side, an Angle's Class I occlusion on the left side, a relatively deep curve of Spee and minor anterior crowding. The mandibular left second premolar is blocked out of the arch. The panoramic radiograph

Figure 12.

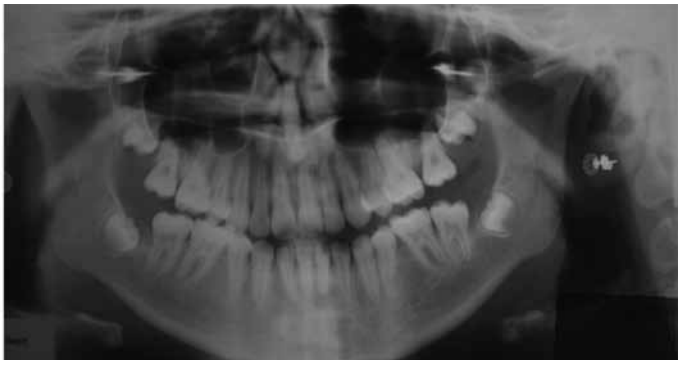
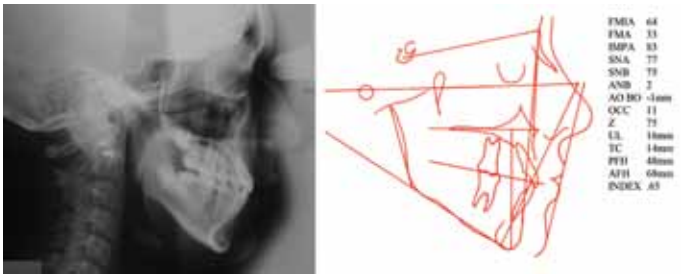


Figure 13.



(Figure 18) reveals the presence of 32 permanent teeth. The cephalogram and its tracing (Figure 19) confirm a vertical dimension problem as well as a protrusion of the maxillary and mandibular anterior teeth. The FMA is 32° and the ANB is 9°.

Treatment Plan

In order to ameloriate the crowding and reduce the protrusion, maxillary and mandibular first premolars were removed. The patient was treated with the force system and mechnotherapy that have been previously described. The arches were leveled. The patient wore a J-hook high pull headgear to both the maxillary and mandibular canines during the leveling process. During space closure in the maxillary and mandibular arches, a J-hook headgear was attached to hooks that were soldered between the maxillary laterals and centrals. The patient wore vertical elastics to protect the vertical dimension while spaces were being closed. After space closure, very moderate anchorage was prepared in the previously described manner. The malocclusion was then finished with Class II elastic force, anterior vertical elastics and a J-hook headgear that was attached to hooks that were soldered between the maxillary laterals and centrals.

The posttreatment facial photographs (Figure 20) exhibit a more balanced face. There is no lower lip strain. The casts (Figure 21) exhibit a Class I dentition with well interdigitated teeth. The posttreatment panoramic radiograph (Figure 22) reveals some distal tipping of the mandibular second molars, uprighting of the mandibular first molars, and proper root angulation. The posttreatment cephalogram and its tracing (Figure 23) exhibit control of the vertical dimension, uprighting of the mandibular incisors from a 97° to 85°, and a reduction of the ANB from

Figure 14.

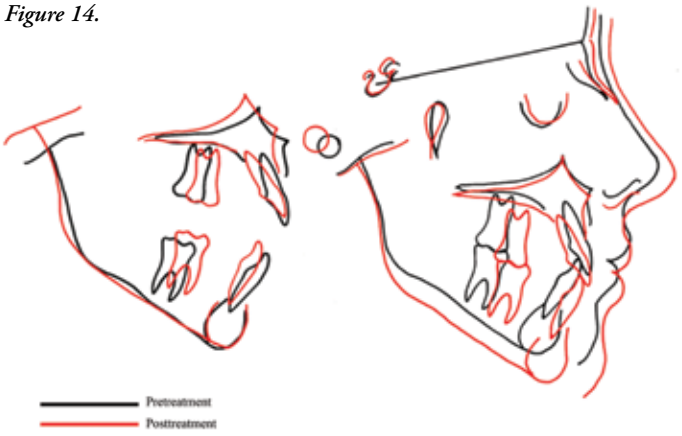


Figure 15.

9° to 2°. The superimpositions (Figure 24) confirm that the patient had an excellent growth pattern even though she had a high mandibular plane angle. The "favorable" growth was due in large part to the fact that there was no extrusion of the maxillary molars and very minimal extrusion with uprighting of the mandibular first molars. Mandibular incisors were uprighted and maxillary incisors were moved lingually with good control of the axial inclination. The superimpositions show an excellent change in the spatial relationship of the mandible to the maxilla with much more chin projection as a result.

The patient was recalled 32 years after treatment. Facial esthetics (Figure 25) at 32 years posttreatment is very balanced and harmonious. The casts (Figure 26) exhibit an excellent interdigitation of the teeth with some very minor mandibular incisor irregularity. The leveling of the curve of Spee and the correction of the posterior occlusion have remained stable. The recall cephalogram and its tracing (Figure 27) confirm stability of the treatment result. The pretreatment/posttreatment/recall superimpositions (Figure 28) reflect a very normal downward and forward development of the dentofacial complex during the posttreatment decades.

Figure 16.

Figure 17.

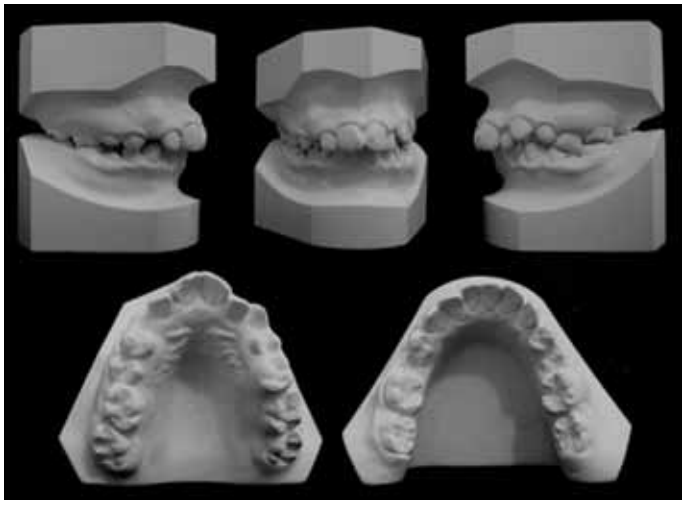


Figure 18.

Figure 19.

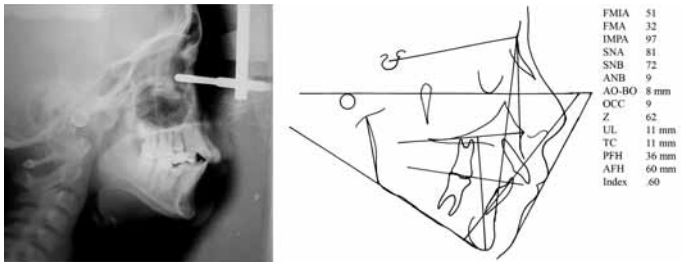


Figure 20.

Figure 21.

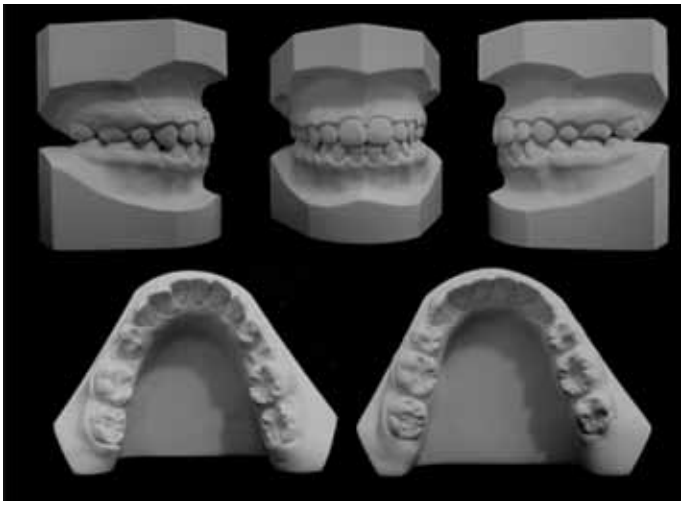


Figure 22.

Figure 23.

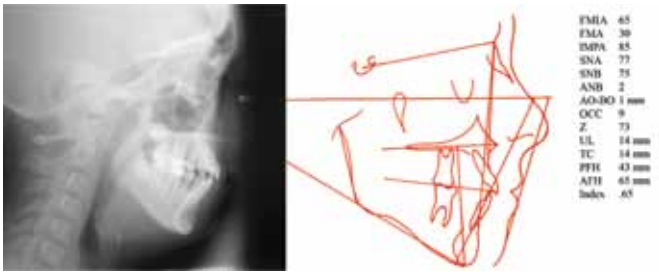


Figure 24.

Figure 25.

Figure 26.

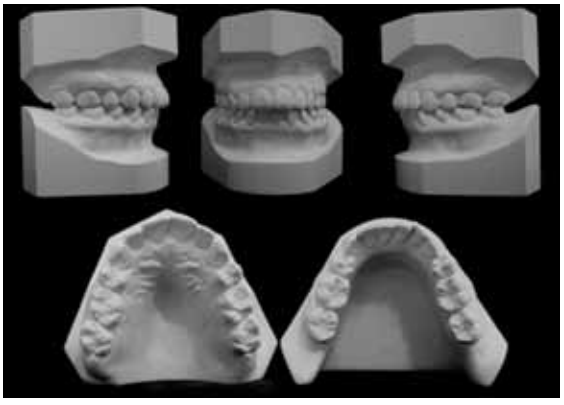


Figure 27.

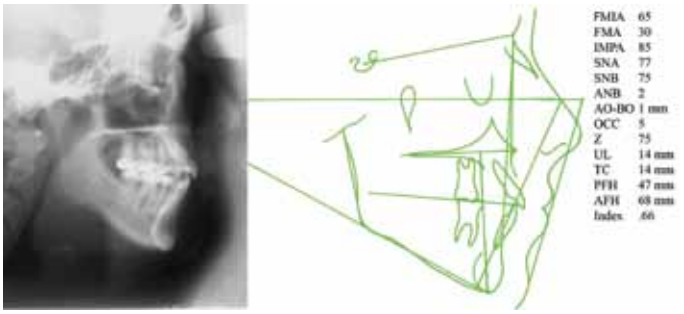
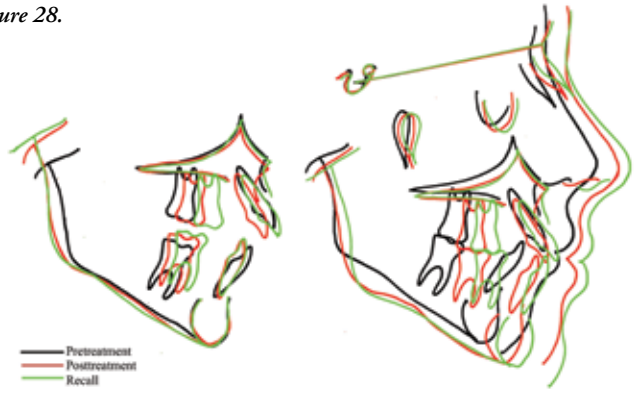


Figure 28.



ACKNOWLEDGMENTS

The author acknowledges that some of the material that was used in the diagnosis section of this chapter was excerpted for the following article Vaden JL, Pearson LE; "Diagnosis of the Vertical Dimension", Seminars in Orthodontics, Vol. 8, Issue 3, 2002, pp. 120-129. The drawings used in this manuscript are from the Tweed Course. The authors gratefully acknowledge the assistance of E. Nakas for editing the manuscript.

REFERENCES

1. Pearson LE, Pearson BL: Rapid maxillary expansion with incisor intrusion: a study of vertical control. Am J Orthod Dentofacial Orthop. 1999;115(5):576-82.
2. Klontz HA: Facial balance and harmony: an attainable objective for the patient with a high mandibular plane angle. Am J Orthod Dentofacial Orthop. 1998;114(2):176-88.
3. Vaden JL: Alternative nonsurgical strategies to treat complex orthodontic problems. Semin Orthod. 1996;2(2):90-113.
4. Pearson LE: The management of vertical dimension problems in growing patients, from the enigma of the vertical dimension. In McNamaraJAJr (ed): Craniofacial Growth Series 36, Center for Human Growth and Development. Ann Arbor, MI, The University of Michigan, 2000.
5. Merrifield LL. Dimensions of the denture: Back to basics. Am J Orthod Dentofacial Orthop. 1994;106(5):535-42.
6. de la Cruz A, Sampson P, Little RM, Artun J, Shapiro PA: Long-term changes in arch form after orthodontic treatment and retention. Am J Orthod Dentofacial Orthop. 1995;107(5):518-30.
7. Strang RHW: The fallacy of denture expansion as a treatment procedure. Angle Orthod. 1949;19(1):12-22.
8. Nance H: The limitations of orthodontic treatment; diagnosis and treatment in the permanent dentition. Am J Orthod. 1947;33(5):253-301.
9. Tweed CH: Indications for the extraction of teeth in orthodontic procedures. Am J Orthod Oral Surg. 1944-1945;42:22-45.
10. El-Mangoury NH: Orthodontic relapse in subjects with varying degrees of anteroposterior and vertical dysplasia. Am J Orthod. 1979; 75(5):548-61
11. Vaden JL, Klontz HK, Dale JG: Standard edgewise: Tweed-Merrifield philosophy, diagnosis, treatment planning and force systems. Orthodontic: Current Principles and Techniques. Chapter 15, p 535.
12. Ibid, p533.
13. Tweed CH. The Frankfort-mandibular plane angle in orthodontic diagnosis, classification, treatment planning, and prognosis. Am J Orthod Oral Surg. 1946;32:175-230.
14. Merrifield LL. The systems of directional force. J Charles H. Tweed Int Found. 1982;10:15-29.