JEFFERSON CEPH AND SKELETAL CLASSIFICATION SYSTEM: FACE AND HEALTH FOCUSED

By Yosh Jefferson, DMD

Dr. James McNamara, a renowned figure in orthodontics, stated that most of the cephalometric analyses available today were conceived during the period from 1940 to 1970, when alterations in craniofacial structural relationships were thought impossible. However, clinical orthodontics has seen the advent of orthognathic surgery procedures and functional appliance therapies allowing three-dimensional repositioning of almost every bony structure in the facial region. The development presents new possibilities in the treatment of skeletal discrepancies.

Currently, a method of cephalometric analysis sensitive not only to the position of the teeth within a given bone, but also to the relationship of the jaw elements and cranial base structures to one another is needed. In short, the method of analysis must represent efforts to relate teeth to teeth, teeth to jaws, each jaw to the other, and the jaws to the cranial base.[1]

The cephalometric analysis McNamara alluded to, developed from 1940 to1970, are from Downs, Steiner, Tweed, Jarabak, Coben, Wylie and others, along with the "Wits" appraisal. The analyses are primarily dental focused. Dental-focused analyses work well when treating doctors have no ability to change the size, shape, and position of the maxilla and mandible. However, times have changed. With the advent of functional appliance therapy and orthognathic surgery, where treating doctors can make real and perceivable changes to the maxilla and mandible, we now have an absolute need to develop face- and health-focused cephalometric analyses.

A face- and health-focused cephalometric analysis should aid the treating doctor in enhancing facial esthetics and profiles, improving temporomandibular joint health and upper airway respiration, and alleviating multiple medical problems.

The Jefferson Cephalometric Analysis focuses on the face and health.[2] Treating the face based on this analysis enhances facial beauty and alleviates medical issues, including but not limited to TMD, upper airway obstruction and sleep apnea. The Jefferson Cephalometric Analysis is an abbreviated and modified version of the Sassouni Archial Analysis, developed by Dr. Vikan Sassouni.[3] Whereas the Sassouni Analysis has multiple measurements, including the anterior arc, A-arc, mid-facial arc, posterior arc, vertical arcs and many dental measurements, the Jefferson Analysis measures only the anterior arc and age 4 and age 18 vertical arcs, henceforth known as the Facial Beauty Health (FBH) Anterior Arc and FBH Vertical Arcs. The FBH designation emphasizes the measurements' profound impact on achieving patients' maximum facial beauty and total health and wellness.

The most critical measurements in the Sassouni Archial Analysis are of the anterior and vertical arcs. By concentrating on the anterior and vertical arcs, the analysis is streamlined, efficient and simple. In addition to using only the FBH Anterior Arc, FBH Age 4 Vertical Arc and FBH Age 18 Vertical Arc, the Jefferson Ceph Analysis makes two other modifications, replacing Sassouni's "parallel plane" with the "cranial plane" and the center "O" with the center "T."

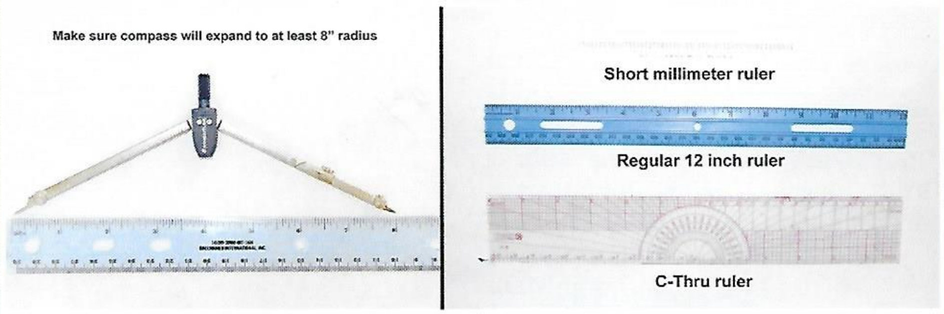

Fig. 1: The figure shows the necessary armamentarium for the Jefferson Ceph Analysis: a compass capable of drawing a radius of 8.5 inches (22 centimeter) and two types of rulers, a short millimeter ruler and a 12 inch ruler or transparent ruler.

Performing the Jefferson Analysis

To perform the Jefferson Cephalometric Analysis, the following armamentarium (Fig. 1) is required:

1. A compass capable of drawing a radius of 8.5 inches (22 centimeters).
2. A short, millimeter ruler and a 12-inch or transparent ruler.

Most of the landmarks for this

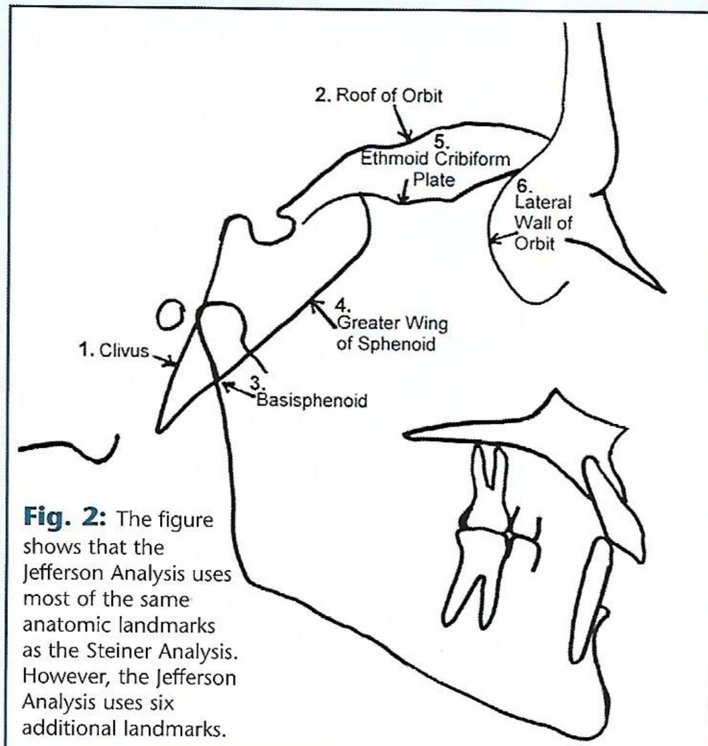

Fig. 2: The figure shows that the Jefferson Analysis uses most of the same anatomic landmarks as the Steiner Analysis. However, the Jefferson Analysis uses six additional landmarks.

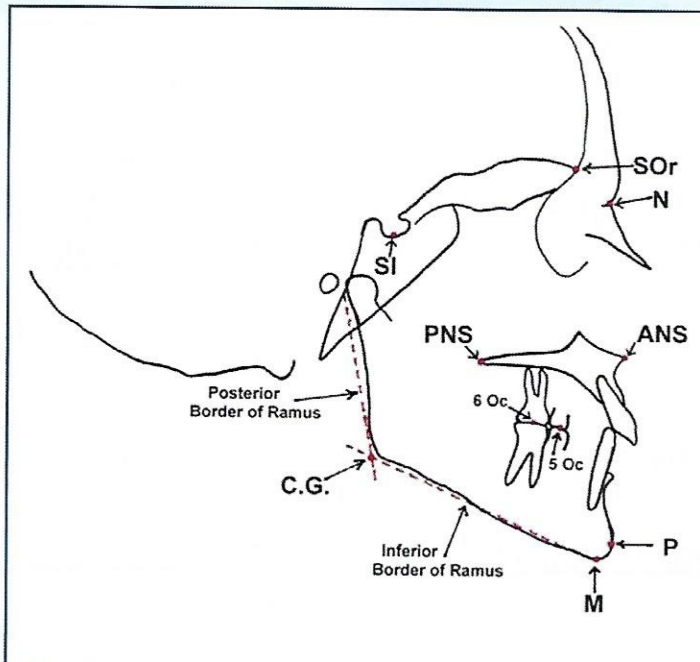

Fig. 3: Shown as the Sassouni points necessary to plot the four major planes of the face.

analysis are the same as those used in the Steiner Analysis. However, six additional landmarks apply (Fig. 2):

1. Clivus.
2. Roof of Orbit.
3. Basisphenoid.
4. Greater Wing of Sphenoid.
5. Ethmoid Cribiform Plate.
6. Lateral Wall of Orbit.

Once all the anatomic landmarks are drawn, Sassouni points should be plotted. The points (Fig. 3) are defined as:

1. *SOr (supraorbitale).* The most anterior point of the intersection of the shadow of the roof of orbit and its lateral contour.
2. *SI (sella inferior).* The lowermost point on the internal contour of the sella tursica.
3. *ANS (anterior nasal spine).* The anterior tip of the premaxilla on the midsagittal plane.
4. *PNS (posterior nasal spine).* The most posterior point on the contour of the maxillary bony plate.
5. *CG (constructed gonion).* The intersection of two lines, one of which is drawn from the articulare and running tangent to the posterior border of the ramus, and the other drawn from the menton and running tangent to the lower border of the corpus. The intersection point is usually a few millimeters distal and inferior to the actual gonion.
6. *Oc (5 occlusal).* The mid-occlusal point of the upper and lower second bicuspids or the mid-occlusal point of the upper and lower second deciduous molars.
7. *Oc (6 occlusal).* The mid-occlusal point of the upper and lower 6-year molars.
8. *N (nasion).* The most posterior point on the curve of the juncture of the frontal and nasal bones.
9. *P (pogonion).* The most anterior point of the profile of the bony chin.
10. *M (menton).* The lowest point on the inferior border of the outline of the symphysis of the mandible.

Once the Sassouni points are determined, the four major planes of the face should be established. Each of the four planes are connected by two points (Fig. 4).

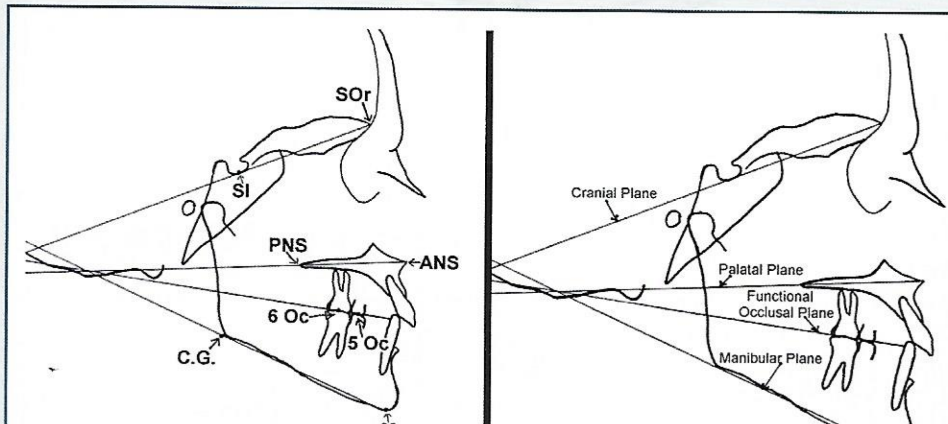

Fig. 4: The left image shows the points where the facial planes are derived; the right image shows the four major planes labeled.

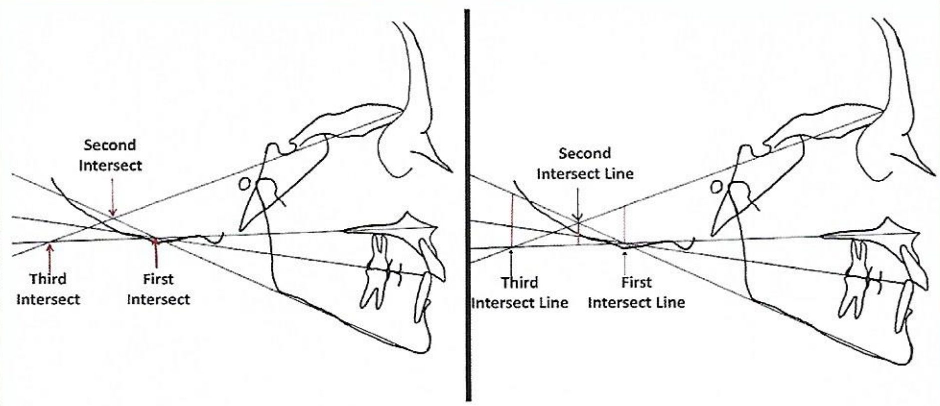

Fig. 5: The left image shows the superior and inferior planes where there are two or more planes intersecting; they are labeled the first, second and third intersect. At right, vertical lines are drawn from intersect one, two and three.

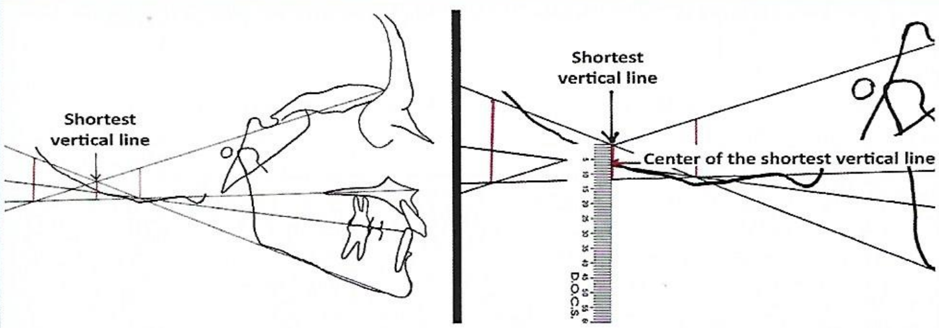

Fig. 6: The left image shows three vertical lines from intersects 1, 2 and 3. In the right image, the practitioner can find the midpoint of the shortest of the 3 vertical lines.

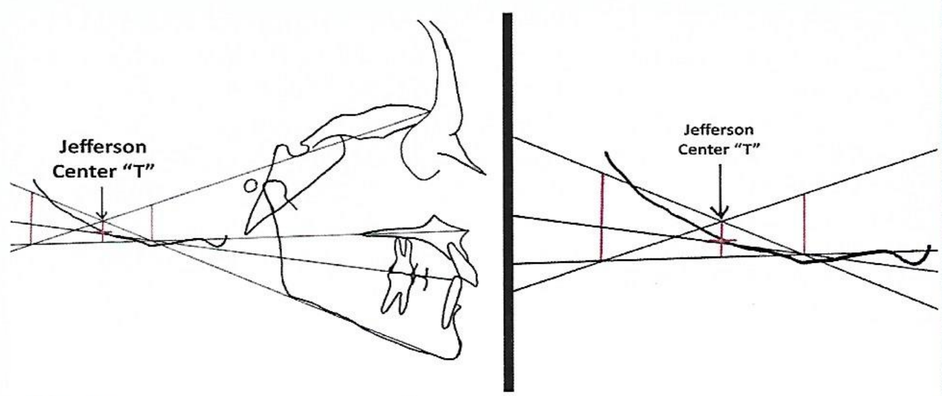

Fig. 7: The image shows a horizontal line going through midpoint of the shortest vertical line.

In the Jefferson Cephalometric Analysis, Sassouni's parallel plane is replaced by the cranial plane. The cranial plane was discovered by the author, who found it to be almost identical to Sassouni's parallel plane but easier to extrapolate and trace.

Fig. 4 shows how the four major facial planes are derived. The critical planes are the:

1. Cranial plane, drawn from SOr to SI and extended posteriorly.
2. Palatal plane, drawn from ANS to PNS and extended posteriorly.
3. Functional occlusal plane, drawn from the mid-occlusal point of the second bicuspids (or the second deciduous molars) to the mid-occlusal point of the 6-year molar. If the teeth are not fully erupted and in occlusal contact, then bisect the distance. Do not bisect the upper and lower incisors, the method used to find the occlusal plane, to determine the functional occlusal plane.
4. Mandibular plane, drawn from the menton running tangent to the lower border of corpus and passing through the constructed gonion. Again, the plane goes through the constructed gonion and not the actual gonion.

The Jefferson Cephalometric Analysis uses the center T instead of Sassouni's center O. The author believes locating the center T is easier to explain and extrapolate than doing so for the center O; however, the center T and O are one and the same.

To find the center T, locate any superior and inferior planes where there are two or more planes intersecting (Fig. 5). Note, the superior planes only have one intersecting plane (designated as the second intersect line), while the inferior planes have two intersecting planes (designated as the first intersect line and third intersect line). The intersecting planes are labeled the first, second and third intersect line. The intersects are numbered from mesial to the face to distal to the face.

Referring to the right image in Fig. 5, draw a vertical line perpendicular to the Frankfort Horizontal from the superior intersect line (labeled as the second intersect line in the figure) down until it hits the most inferior plane. Next, draw a vertical line perpendicular to the Frankfort Horizontal from the inferior intersect line (labeled as first and third intersect line in the figure) until it hits the most superior plane.

Referring to the left image in Fig. 6, locate the shortest vertical line out of the three shown. The shortest vertical line is the one dropped inferiorly from the second intersect line. In Fig. 6, the shortest vertical line is labeled. Referring to the right image in Fig. 6, use a millimeter ruler to measure the shortest vertical line and find its midpoint.

Once the mid-point of the shortest vertical line is located, a horizontal line is drawn across it (Fig. 7). Where the shortest vertical line and the horizontal line intersect is the center T, a critical landmark in the Jefferson Cephalometric Analysis.

The Three Reference Arcs

The FBH Anterior Arc is a reference arc in front of the facial bones. It helps to determine the esthetic and physiologic anterior-posterior position of the maxilla and mandible. To establish the FHB anterior arc, place the metal point of the compass on the center T and pencil point on the boney nasion (N), as shown in Fig. 8. Next, draw an arc from just above the nasion down past the soft tissue of the chin (Fig. 9). This arc, located in front of the facial bones, is the FBH Anterior Arc.

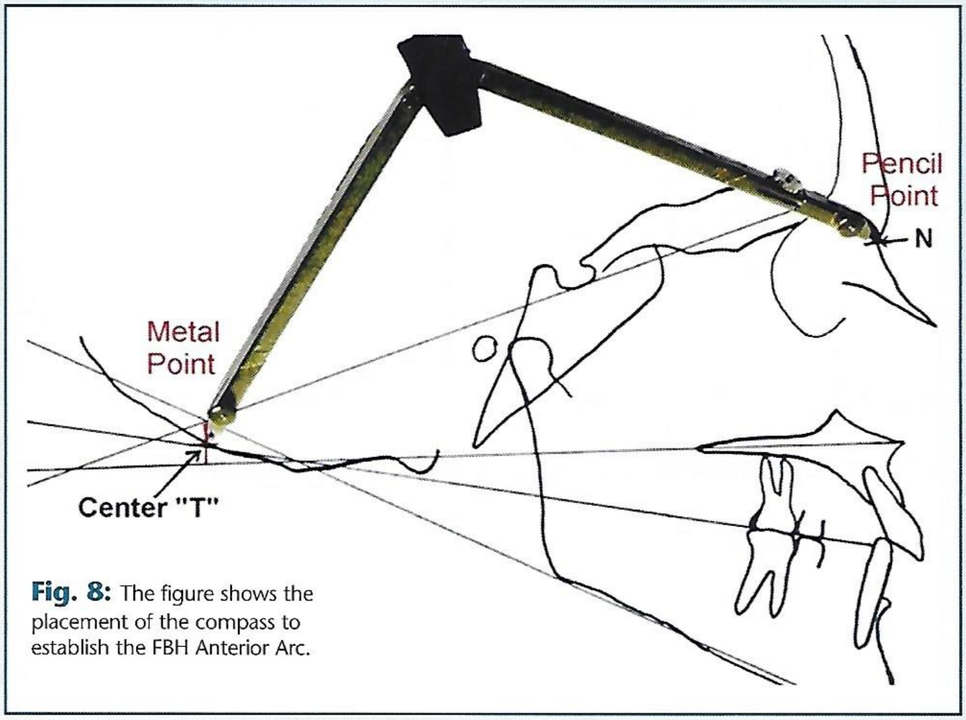

Fig. 8: The figure shows the placement of the compass to establish the FBH Anterior Arc.

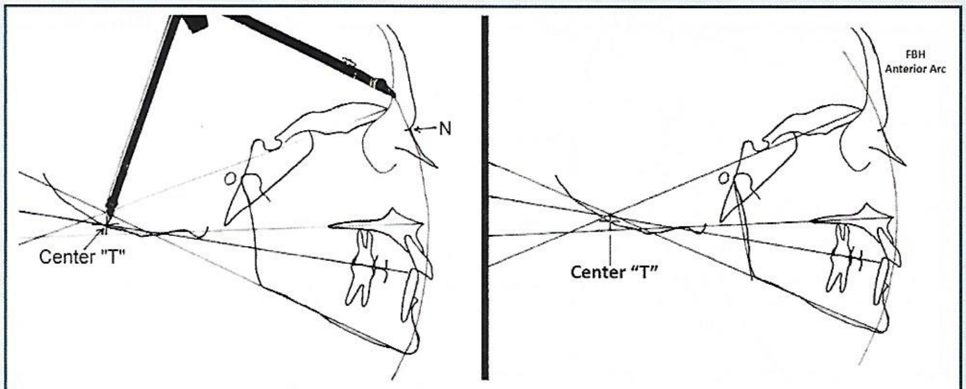

Fig. 9: The figure shows the anterior arc going through the nasion (N) and being drawn just above the nasion and past the menton.

Two short vertical arcs are located around the menton area. The upper, short vertical arc is the FBH Age 4 Vertical Arc. The lower, short vertical arc is the FBH Age 18 Vertical Arc. To establish the vertical arcs, place the metal point of the compass on the ANS and pencil point on the SOr (Fig. 10). Then, rotate the compass down toward the menton area and strike a small arc. This is the FBH Age 4 Vertical Arc.

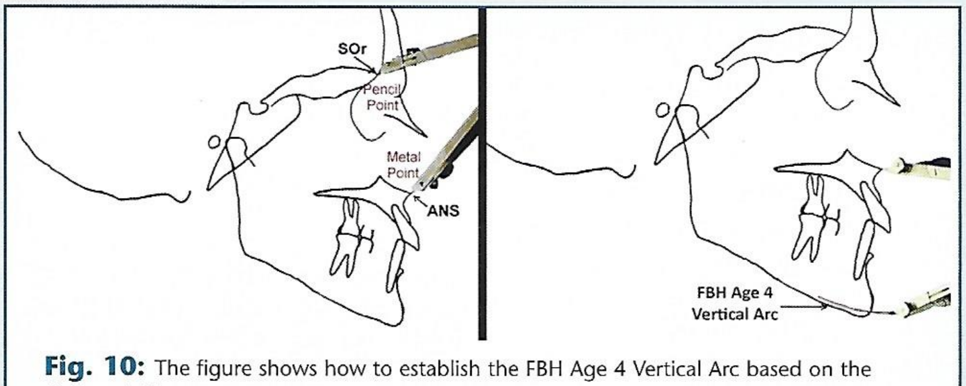

Fig. 10: The figure shows how to establish the FBH Age 4 Vertical Arc based on the ANS and SOr.

To establish the FBH Age 18 Vertical Arc, use a millimeter ruler to measure exactly 10 mm down from the FBH Age 4 Vertical Arc (Fig. 11). Then, strike a short vertical arc exactly 10 mm inferior and parallel to the FBH Age 4 Vertical Arc. This is the FBH Age 18 Vertical Arc.

The completed tracing is shown in Fig. 12. The three arcs thus extrapolated are the:

1. FBH Anterior Arc.
2. FBH Age 4 Vertical Arc.
3. FBH Age 18 and over Vertical Arc.

Interpreting the Jefferson Cephalometric Analysis

The Jefferson Ceph Analysis is universal. It does not require different standards based on race, age, sex, ethnicity or other factors, as is the case with most other cephalometric analyses.

To interpret abnormalities, several cephalometric tracings of patients at age 4, 12 and 21, showing normal or ideal conditions, are first presented. Fig. 13 shows an ideal ceph tracing for all adult patients 18 years old and older.

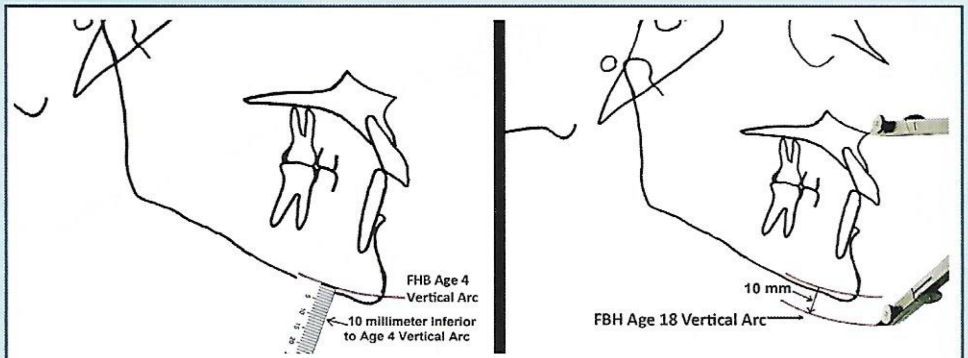

Fig. 11: The figure shows how to establish the FBH Age 18 Vertical Arc, which is 10 mm inferior to the Age 4 Vertical Arc.

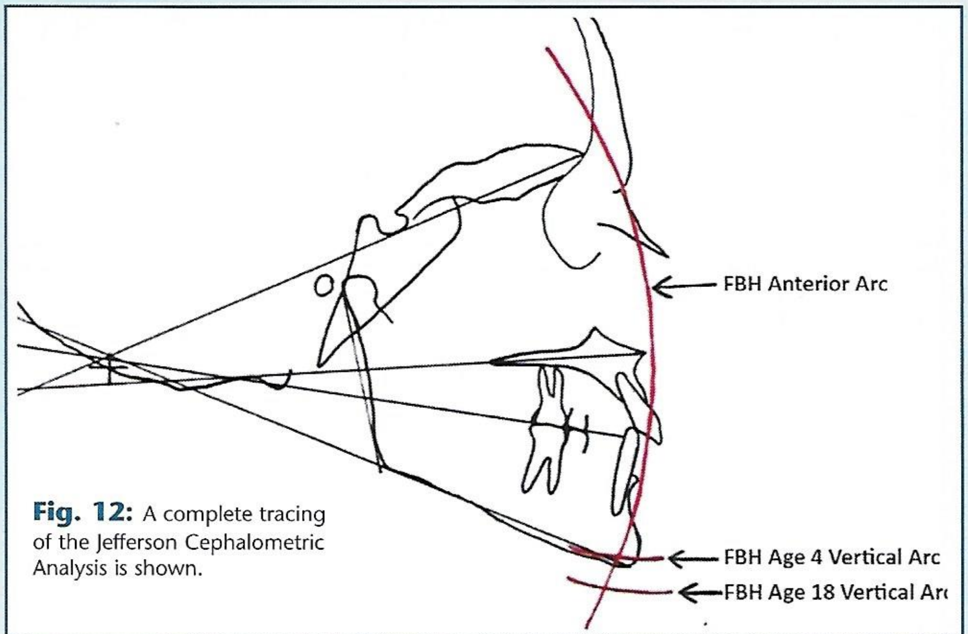

Fig. 12: A complete tracing of the Jefferson Cephalometric Analysis is shown.

Figure 13 shows an ideal cephalometric tracing of adults 18 years old and older. The ideal position of the maxilla and the mandible is when:

1. ANS is within 2 mm of the FBH Anterior Arc.
2. P is within 2 mm of the FBH Anterior Arc.
3. M is within 2 mm of the FBH Age 18 Vertical Arc.

It must be emphasized that the Jefferson Cephalometric Analysis should be used as an adjunct to the treating doctors' ultimate and final diagnoses. This analysis provides a road map as to what direction the maxilla and mandible should be moved to achieve ideal facial esthetics, healthy TM joints, efficient upper airways and other physiologic health. However, in some adults with facial disharmony, years of chronic abnormal facial growth and occlusal wear can cause permanent skeletal deformation. In some patients, it may not be possible to treat them to the ideal position based on the Jefferson Cephalometric Analysis. In such cases, the maxilla and mandible should only be moved as far as their physiologic limitations allow. Moving the skeletal structures beyond their physiologic limitation may do more harm than good.

Fig. 14 shows an ideal cephalometric tracing of a 4-year-old patient. In all children at age 4, ideal position of the maxilla and mandible is when:

1. ANS is within 2 mm of the FBH Anterior Arc.
2. P is within 2 mm of the FBH Anterior Arc.
3. M is within 2 mm of the FBH Age 4 Vertical Arc.

In young children before puberty, it is easier to attempt to treat the maxilla and mandible to their ideal position based on the Jefferson Cephalometric Analysis than it is at later ages. Functional appliances can help guide the growing face to develop toward the ideal maxillary and mandibular position. Exceptions occur in children having experienced trauma to the face and TM joints and with certain genetic conditions. Teenagers and older adults are not precluded from treatment based on the analysis, but it may take longer to treat them.

Fig. 15 shows an ideal cephalometric tracing of a 12-year-old patient. In all children at age 12, ideal position of the maxilla and mandible is when:

1. ANS is within 2 mm of the FBH Anterior Arc.
2. P is within 2 mm of the FBH Anterior Arc.
3. M is within 2 mm of the FBH Age 12 Vertical Arc.

The antero-posterior position of the maxilla and mandible should be within 2 mm of the FBH Anterior Arc, no matter the age, sex or race of the patient. However, the lower facial height varies according to age. From age 4 to 18, the mandible grows vertically down at the rate of .75 mm per year. Using this formula, the ideal vertical height for every patient can be derived to the millimeter. The patient in Fig. 15 is 12 years old and has experienced 8 years of growth. Therefore, the mandible grew vertically downward .75 mm for 8 years, a total of 6 mm, and the FBH age 12 vertical height is calculated as follows:

$$12 - 4 = 8 \times .75 = 6 \text{ mm}$$

The FBH Vertical Arc Assessment is universal. Additionally, the Lower Facial Height assessment is diagnosed as normal, long or short, not normal, open bite or deep bite. Open bite and deep bite are dental assessments. Long and short are

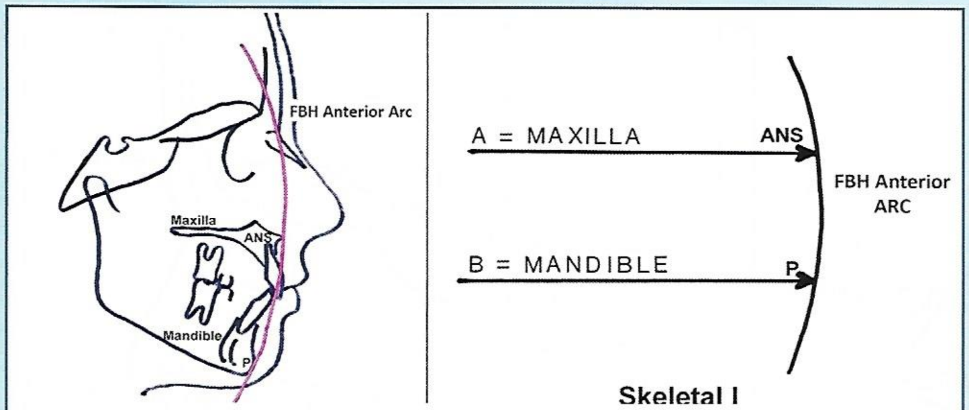

Fig. 16: The figure shows the skeletal diagram representing the different parts of the ceph analysis.

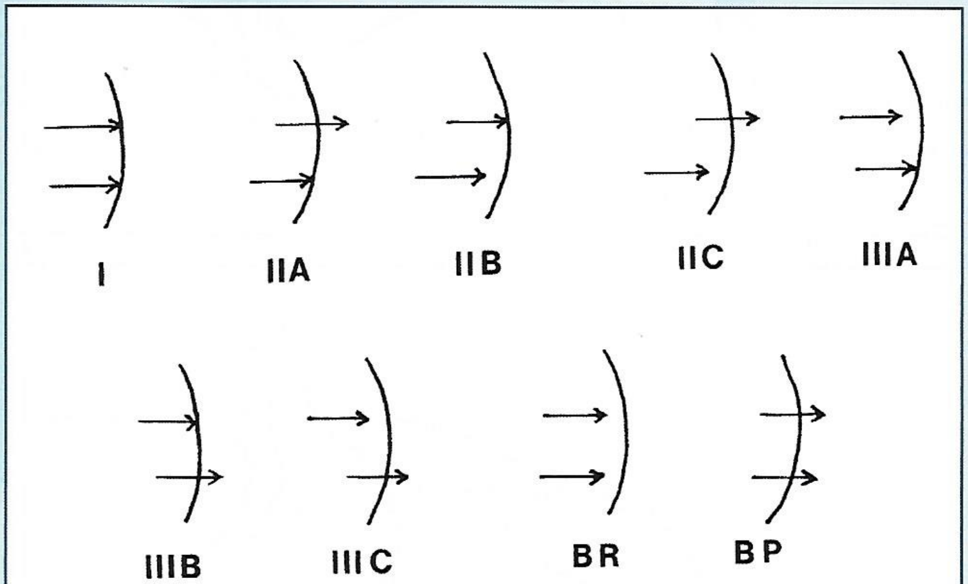

Fig. 17: Shown are various types of skeletal malposition found using the Jefferson Analysis.

malposition. For example, researchers M. Malacic and M. Markovic find that dental Class I malocclusion does not always correspond to ideal antero-posterior position of the maxilla and mandible. In fact, individuals may have a dental Class I with a skeletal Class II or skeletal Class III.[5] It is, therefore, important in making an orthodontic diagnosis that dental and skeletal problems are kept separate and distinct.

In more than 30 years of performing the Jefferson Cephalometric Analysis, the author has found various types of maxillary-mandibular skeletal malposition. The Jefferson Skeletal Classification of Malposition was developed based on the findings. The classification has proven to be fast, easy and accurate. The skeletal diagram in Fig. 16 illustrates the different components of the Jefferson Cephalometric Analysis.

In Fig. 16, the left illustration is the ceph tracing of an adult patient, and the right illustration is the Jefferson Skeletal diagram. In the skeletal diagram, "A" represents the maxilla and "B" represents the mandible. Note that in cephalometric tracings, the A-point is also located in the maxilla and the B-point in the mandible. In the diagram, the tip of the A arrow is at the ANS and the tip of the B arrow is at P. In both the cephalometric tracing and skeletal diagram, the ANS and P are touching the FBH Anterior Arc. Therefore, both A (maxilla) and B (mandible) are in proper A-P position. The skeletal classification for the patient in Fig. 16 is Skeletal I.

Fig. 17 shows the full Jefferson Skeletal Classification system of the types of skeletal malposition found in the patient population. The term "prognathic" refers to skeletal structure that is too far forward past the FBH Anterior Arc. The term "retrognathic" refers to skeletal structure that is too far back behind the FBH Anterior Arc. The terms "retrusive" and "protrusive" apply to dentitions, whereas retrognathic and prognathic in the Jefferson Cephalometric Analysis apply to skeletal structures like the maxilla and mandible's A-P position.

Interpretation of the Jefferson Skeletal Classification should proceed as follows:

- Skeletal I—Both maxilla and mandible in normal A-P position.
- Skeletal IIA—Maxilla prognathic and mandible in normal A-P position.
- Skeletal IIB—Maxilla in normal A-P position and mandible retrognathic.
- Skeletal IIC—Maxilla prognathic and mandible retrognathic.
- Skeletal IIIA—Maxilla retrognathic and mandible in normal A-P position.
- Skeletal IIIB—Maxilla in normal A-P position and mandible prognathic.
- Skeletal IIIC—Maxilla retrognathic and mandible prognathic.
- Skeletal BR—Bi-skeletal retrognathic.
- Skeletal BP—Bi-skeletal prognathic.

Additional Information & Facial Profiles

Fig. 18 shows important additional information that can be obtained from the Jefferson Cephalometric Analysis. The palatal plane, as it is drawn beyond the ANS and PNS, should pass between the basion and odontoid process. In functional orthodontic therapy, practitioners should avoid tipping the palatal plane above the basion or below the odontoid process. The ideal position of the upper central can also be assessed using the analysis. Ideally, the incisal tip of the upper centrals should be 1 mm in front of the anterior arc.

Fig. 19 shows various types of facial profiles from the general population. In an informal survey of orthodontic seminar attendees in the United States and around the world, respondents almost unanimously select Profile F as the most beautiful. Profile F, which conforms to the divine proportion, is also physiologically healthy. Dr. Robert M. Ricketts stated that when the face and body are in divine proportion, all the cells are used to maximum efficiency.[6] In addition to achieving facial profile beauty, treating patients to Profile F has also been found to alleviate medical issues like TMD and sleep apnea.[7]

In more than 30 years of practice, treating to the FBH Anterior Arc and age-appropriate FBH Vertical Arc has been shown to move patients to Profile F, which in addition to the divine proportion also conforms to the facial beauty mask in profile view proposed by Dr. Stephen Marquardt.[8] By using Jefferson Ceph as a guide to ideal maxillary and mandibular position, all patients, regardless of race, age or sex should be treated to facial Profile F.

Alleviating TMD & Upper Airway Obstruction

Patients with short faces and/or retrognathic mandibles (characterized by small, weak chins) usually have compressed TM joints and TMD symptoms (see Fig. 20). Conversely, patients with ideal facial profiles tend to have minimal or no TMD symptoms. By using the Jefferson Cephalometric Analysis to treat to Skeletal I, Normal, patients often achieve the neuromuscular position and healthy TM joints. The

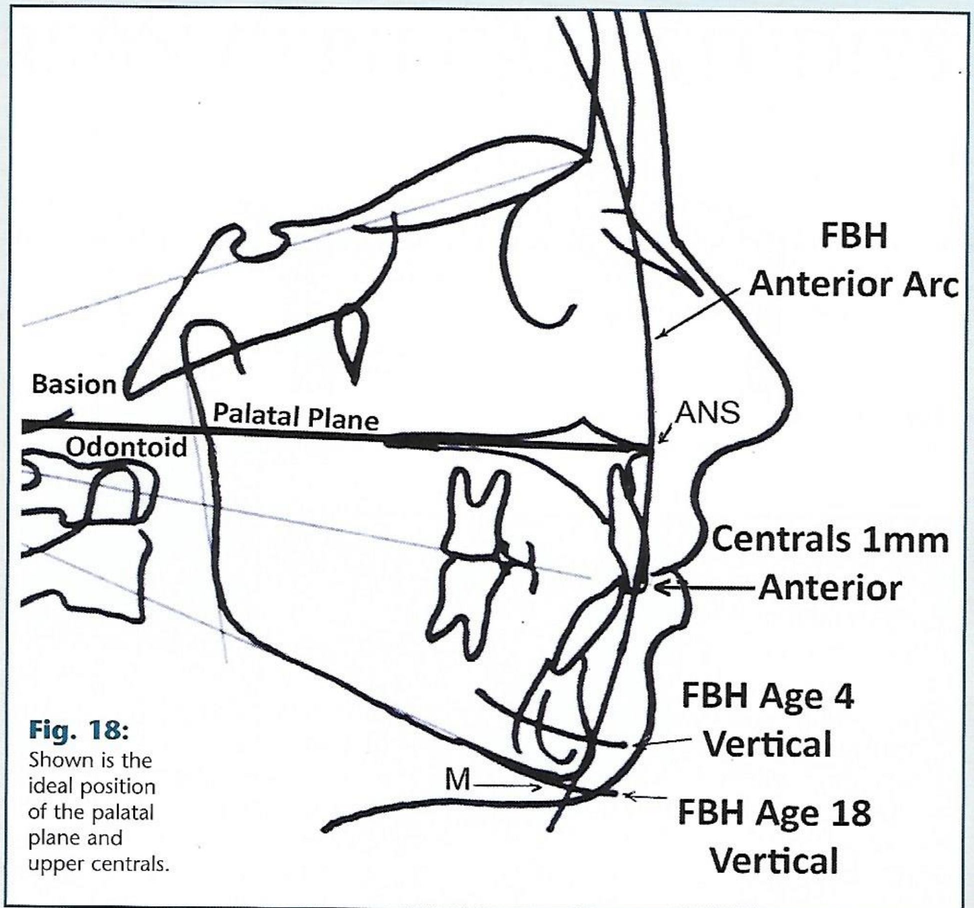

Fig. 18: Shown is the ideal position of the palatal plane and upper centrals.

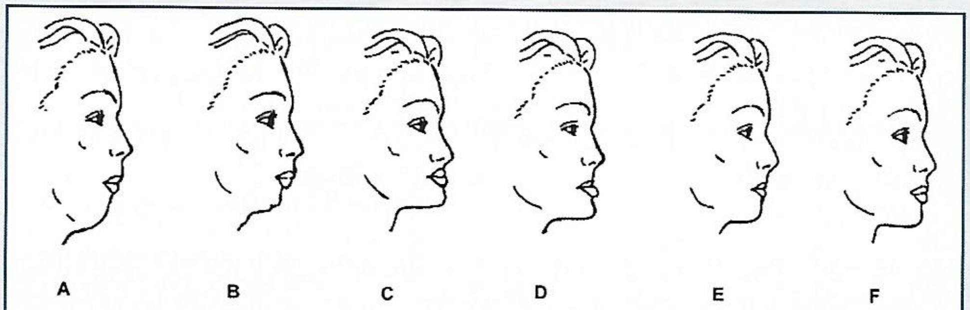

Fig. 19: Shown are the various types of facial profiles seen in the general population. Profile F represents a clinically beautiful face.

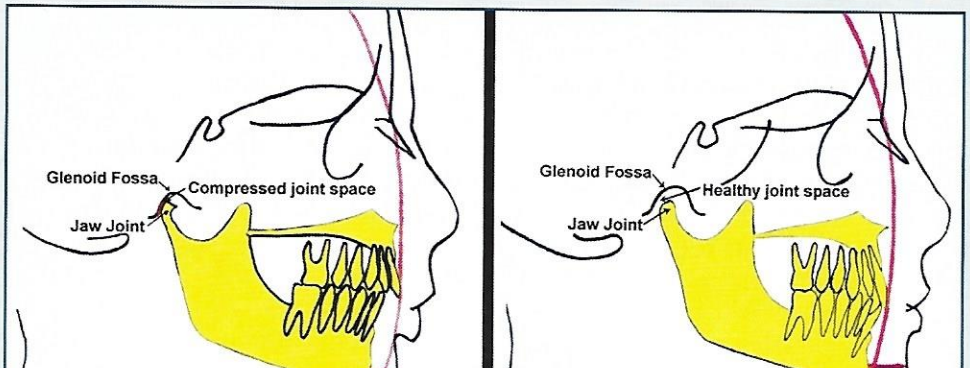

Fig. 20: At left, a small, weak chin and/or short vertical in an adult indicates possible TMD. At right, the ideal profile suggests less incidence of TMD.

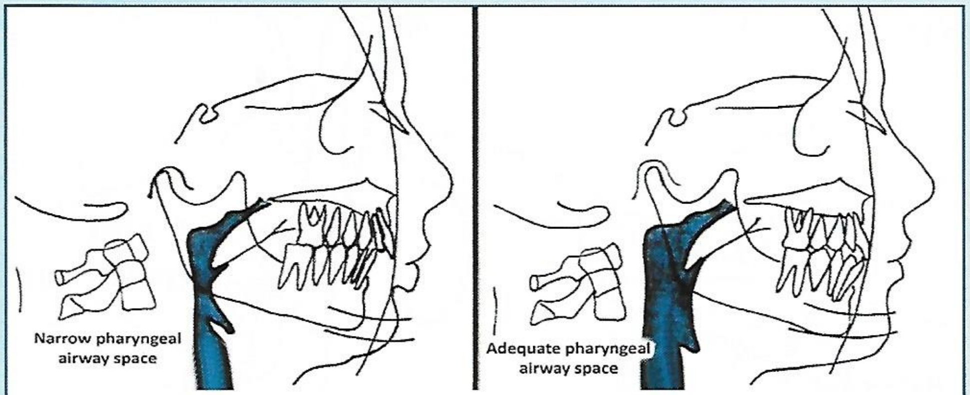

Fig. 21: At left, the poor profile likely causes a compressed pharyngeal airway and poor respiration. At right, the clinically beautiful profile allows for a larger pharyngeal airway and efficient respiration.

process entails bringing the mandible down and forward, which decompresses the TM joints and alleviates TMD symptoms.[9] The exception to this rule is that, in rare cases, the patient's mandible is smaller and/or shorter than normal, possibly due to a genetic disorder or trauma to the TM joints. To bring short mandibles into accordance with the Jefferson Ceph prescription may cause a "dual" bite.

How does the Jefferson Cephalometric Analysis assess and aid in alleviating upper airway obstruction? Upper airway obstruction can be caused by compressed nasal passages, compressed pharyngeal airways, or swollen tonsils and/or adenoids. Although the Jefferson Ceph Analysis does not assess frontal ceph views, patients with narrow faces and narrow, high palatal vaults tend to have transverse narrow and compressed maxillary sinuses, which inhibit efficient nasal respiration.[10] Increased nasal respiration can be achieved by expanding the palate with palatal expansion appliances. Expanding the palate expands the nasal sinuses transversely, lowers the floor of the palate and straightens deviated septums, thus significantly increasing the respiratory efficiency of the nasal airway passages.[11]

The Jefferson Cephalometric Analysis can aid in the assessment of pharyngeal airway compression causing upper airway obstruction. Just as poor facial profiles can indicate TMD, they can also point to pharyngeal airway compression. And just as retrognathic mandibles and/or short verticals can cause TM joint compression, patients with retrognathic mandibles and/or short verticals tend to have compressed pharyngeal airways, which can cause upper airway obstruction and sleep apnea.

Fig. 21 shows a simulated ceph tracing with a poor facial profile due to a retrognathic mandible and/or short vertical. Note how the retrognathic mandible pushes back into the tracheal area and compresses the pharyngeal airway, causing inefficient respiration. At right, the figure shows a simulated ceph tracing with a beautiful facial profile where the mandible is in a more forward position. The pharyngeal airway is decompressed, allowing for efficient respiration. By repositioning the mandible in a forward position using appliances like the Herbst, D.L. Grim found that lateral cephalometric airways increased in more than 90 percent of the cases.[12] Other removable appliances, such as Bionators and Twin-Blocks, can help open the pharyngeal airways. Fixed appliances, including the Ortho Organizers Twin Force and Jefferson's Fix-A-Nator Technique in addition to the Herbst, can help to permanently open pharyngeal airways.[13]

Many other studies have shown that sleep apnea due to collapsed pharyngeal airways can be alleviated with the use of mandibular advancement appliances by increasing pharyngeal airway space. All sleep apnea appliances work by bringing the mandible down and forward and opening the pharyngeal airway.[14]

Using the Jefferson Skeletal Classification in screening for pharyngeal airway compression, patients assessed as Skeletal IIB, Short, would most likely have the condition. Patients classified as Skeletal I, Normal, would have significantly less incidence of pharyngeal compression. Moving the mandible from Skeletal IIB, Short, to Skeletal I, Normal, greatly improves pharyngeal airway respiration and helps maximize patients' quality of life.

Conclusion

Some orthodontic practitioners still use outdated treatment techniques and treat only the teeth, disregarding the face and health of their patients. They cling to cephalometric analyses that primarily assess the dental component and avoid cephalometric analyses that are face- and health-focused. By not assessing the face and health, the practitioners can induce treatment outcomes that may negatively impact their patients' facial esthetics and total health and wellness. On the other hand, placing the maxilla and mandible into their proper and ideal position significantly simplifies straightening and aligning the dentition.

The Jefferson Cephalometric Analysis and Jefferson Skeletal Classification System were developed to address these shortcomings. The analysis and classification system are simple and universal, regardless of race, age, sex, ethnicity and other variables, and are taught by instructors and lecturers around the world.

Treating only the teeth is outdated. The future of our profession is to enhance facial and dental esthetics and alleviate a multitude of medical problems. All healthcare providers must strive to increase their patients' confidence and personal self-image in addition to maximizing their total health and wellness.

THREE JEFFERSON CEPH CASE STUDIES

To illustrate how the Jefferson Cephalometric Analysis can be used to assess various skeletal abnormalities, consider the three following patient cases. Note that some physiologic limitations exist. For example, the lower mandible cannot be brought to the ideal A-P position in some cases because the patient cannot tolerate it. In other cases, the vertical cannot be opened further because doing so would create an anterior open bite. However, the condition does not preclude the practitioner from using the approach if the anterior teeth can be extruded to their proper position.

Case 1. Fig. A shows a patient with a Skeletal II profile. The practitioner must determine whether the problem is due to the maxilla being prognathic and the mandible being in the correct A-P position, the maxilla being in the correct A-P position and the mandible being retrognathic, or the maxilla being prognathic and the mandible being retrognathic. The Jefferson Cephalometric Analysis shows that the maxilla is in correct A-P position and the mandible is retrognathic. Also, the patient is vertically short. His skeletal and dental classification is Skeletal IIB, Short; Dental Class II division 1. Patients with this skeletal classification usually have temporomandibular disorders.

Fig. B shows the patient's post-treatment facial profile and ceph tracing. Although the mandible was repositioned forward, it was not fully repositioned according to the FBH Anterior Arc. Still, the patient's vertical was repositioned to normal, improving the facial profile. His post-treatment skeletal and dental classification is: Skeletal IIB, Normal; Dental Class I.

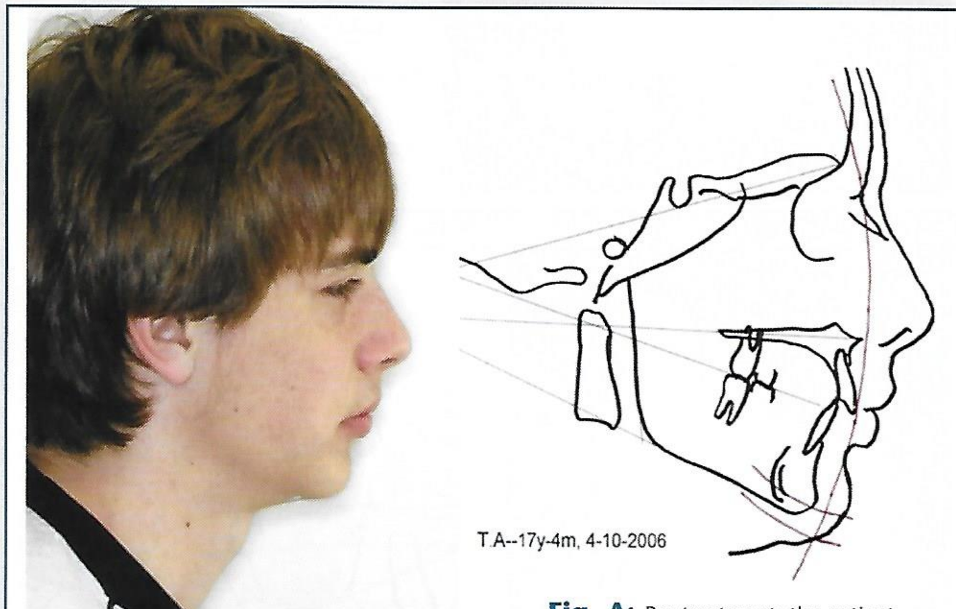

Fig. A: Pre-treatment, the patient is Skeletal IIB, Short.

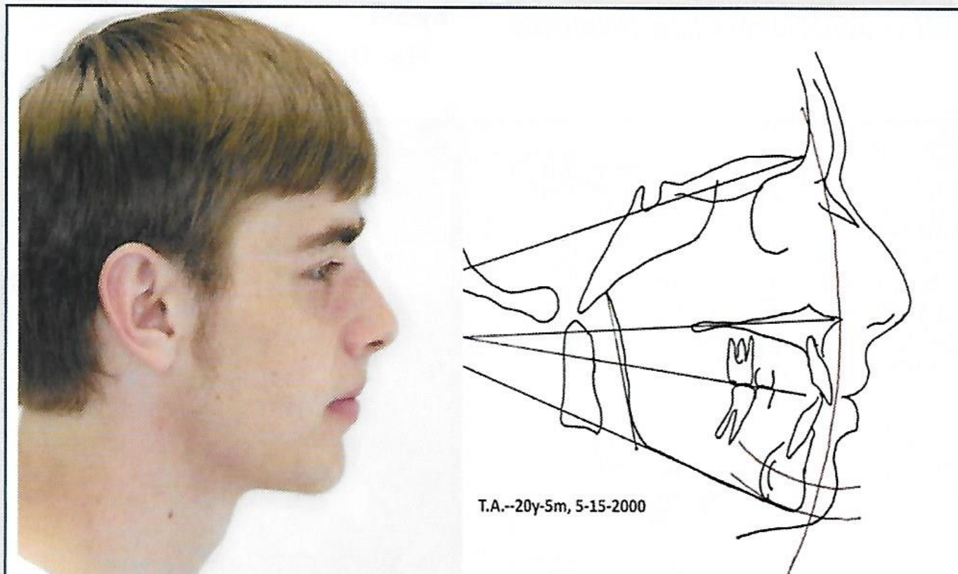

Fig. B: Post-treatment, the patient is Skeletal IIB, Normal.

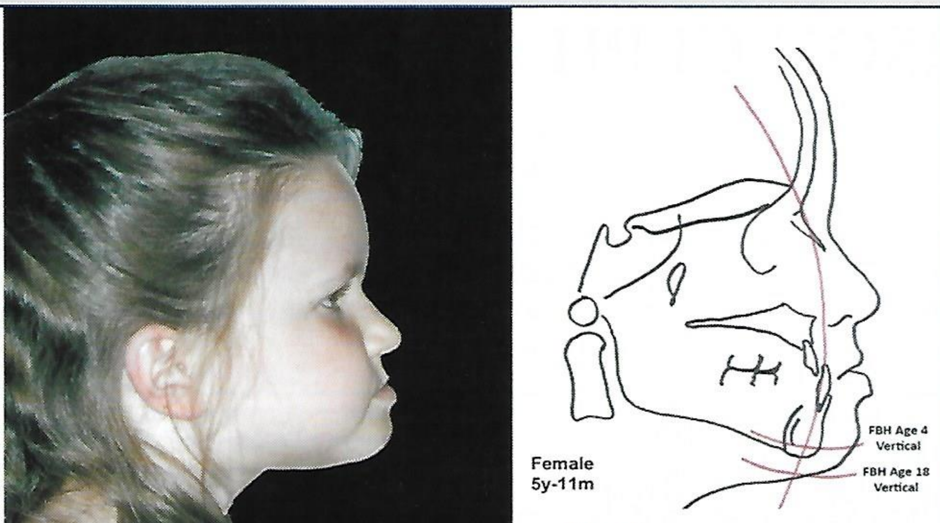

Fig. C: Pre-treatment, the patient is Skeletal IIIC, Normal.

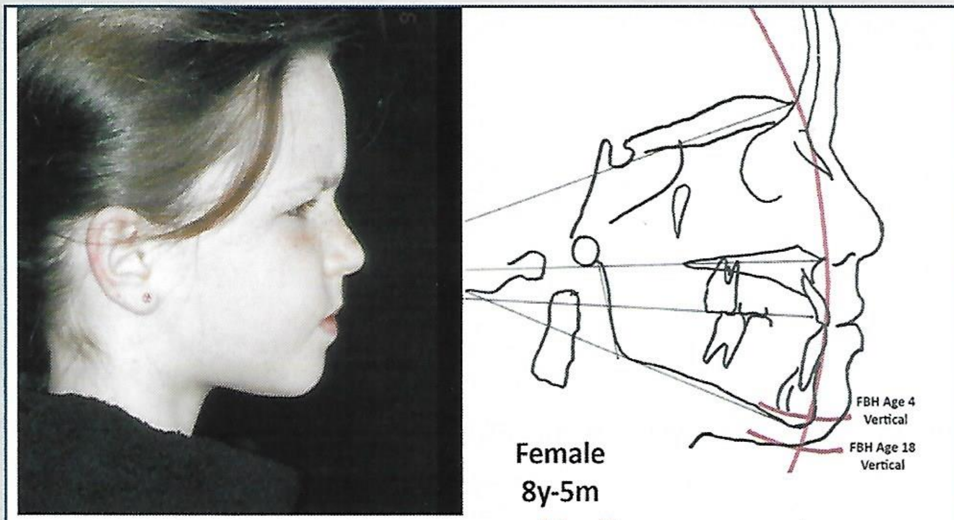

Fig. D: Post-treatment, the patient is Skeletal I, Normal.

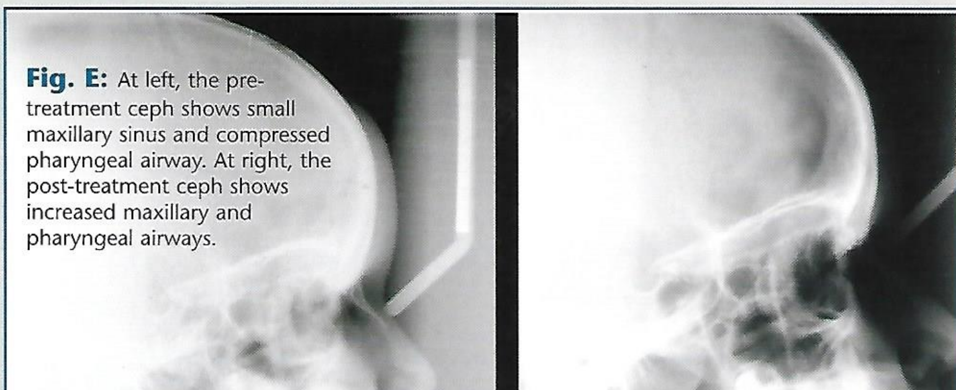

Fig. E: At left, the pre-treatment ceph shows small maxillary sinus and compressed pharyngeal airway. At right, the post-treatment ceph shows increased maxillary and pharyngeal airways.

Case 2. Fig. C shows a child with a Skeletal III profile. Is the problem due to a normal maxillary A-P and prognathic mandible, a retrognathic maxilla and normal mandibular A-P, or a retrognathic maxilla and prognathic mandible? The Jefferson Cephalometric Analysis shows that it is due to a retrognathic maxilla and prognathic mandible. The vertical is normal. The skeletal classification is Skeletal IIIC, Normal, where IIIC indicates a combination Skeletal III problem where the maxilla is retrognathic and the mandible prognathic.

Fig. D shows the patient's post-treatment facial profile and a post-treatment ceph tracing showing the maxilla and mandible repositioned to ideal: Skeletal I, Normal. The child was treated with a Frankel III appliance.

Note that the patient's pre-treatment facial disharmony was caused by an underdeveloped maxilla and protrusive mandible. Her underdeveloped maxilla caused her maxillary sinus to be compressed anterior-posteriorly. The Frankel III appliance developed her maxilla and, in turn, enlarged her maxillary sinuses, increasing her capacity to breathe nasally. Additionally, her pharyngeal airway increased after treatment. Fig. E shows the patient's narrow A-P maxillary sinus radiographically before treatment, as well as her narrow pharyngeal airway.

Her post treatment ceph clearly shows that both her maxillary sinuses and pharyngeal airways enlarged to allow more efficient respiration, critical for her total health and wellness.

Case 3. The final case illustrates how pharyngeal airway space can be increased by moving the mandible down and/or forward. Fig. F shows the patient's pre-treatment facial profile and Jefferson Cephalometric Analysis. The skeletal classification is Skeletal IIB, Short. Fig. G shows the patient's post-treatment facial profile and Jefferson Cephalometric analysis. The post treatment skeletal classification is Skeletal IIIB, Short. Note that the post-treatment results show that the patient was not fully treat to the ideal Skeletal I, Normal. Although his vertical is closer to normal than at pre-treatment but still somewhat short, the mandible was brought forward, improving the patient's post-treatment profile.

The left side of Fig. H shows the patient's pre-treatment cephalometric x-ray; the right side shows the post-treatment cephalometric x-ray. Note how narrow the pharyngeal airway space is in the pre-treatment image compared to the post-treatment image. The airway's post-treatment width is nearly 3 times that of the pre-treatment airway, allowing for more efficient respiration.

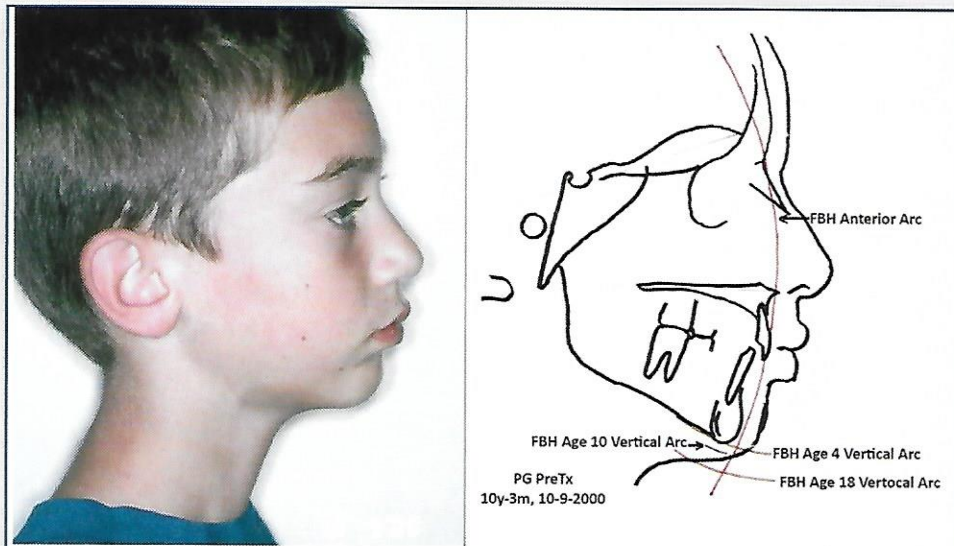

Fig. F: Pre-treatment, the patient is Skeletal IIB, Short.

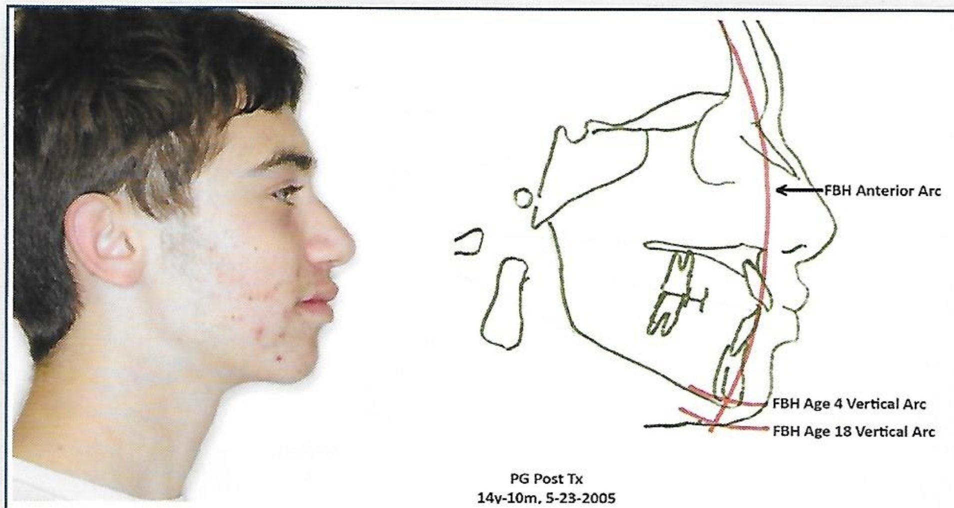

Fig. G: Post-treatment, the patient is Skeletal IIIB, Short.

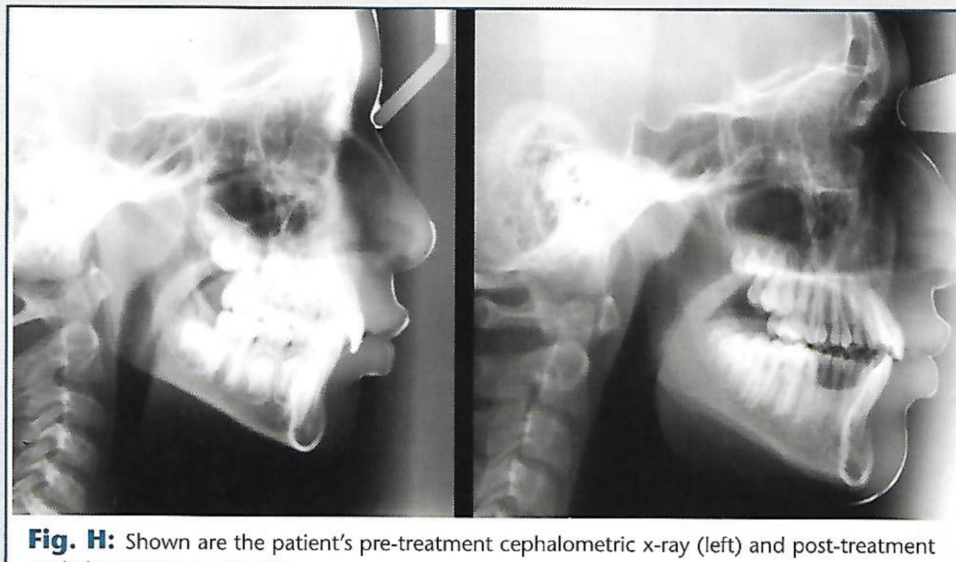

Fig. H: Shown are the patient's pre-treatment cephalometric x-ray (left) and post-treatment cephalometric x-ray (right).

Whenever using the Jefferson Cephalometric Analysis to evaluate a patient's maxillary and mandibular position, it is important to note that a retrognathic mandible and/or short vertical indicates a high probability that the patient's TM joints and/or pharyngeal airway may be compressed. Compressed TM joints and pharyngeal airways have a negative impact on a patient's total health and wellness. The Jefferson Cephalometric Analysis gives the treating doctor direction about where to move the maxilla and mandible to decompress the joints and airway, ultimately enhancing facial esthetics and alleviating multiple medical problems.

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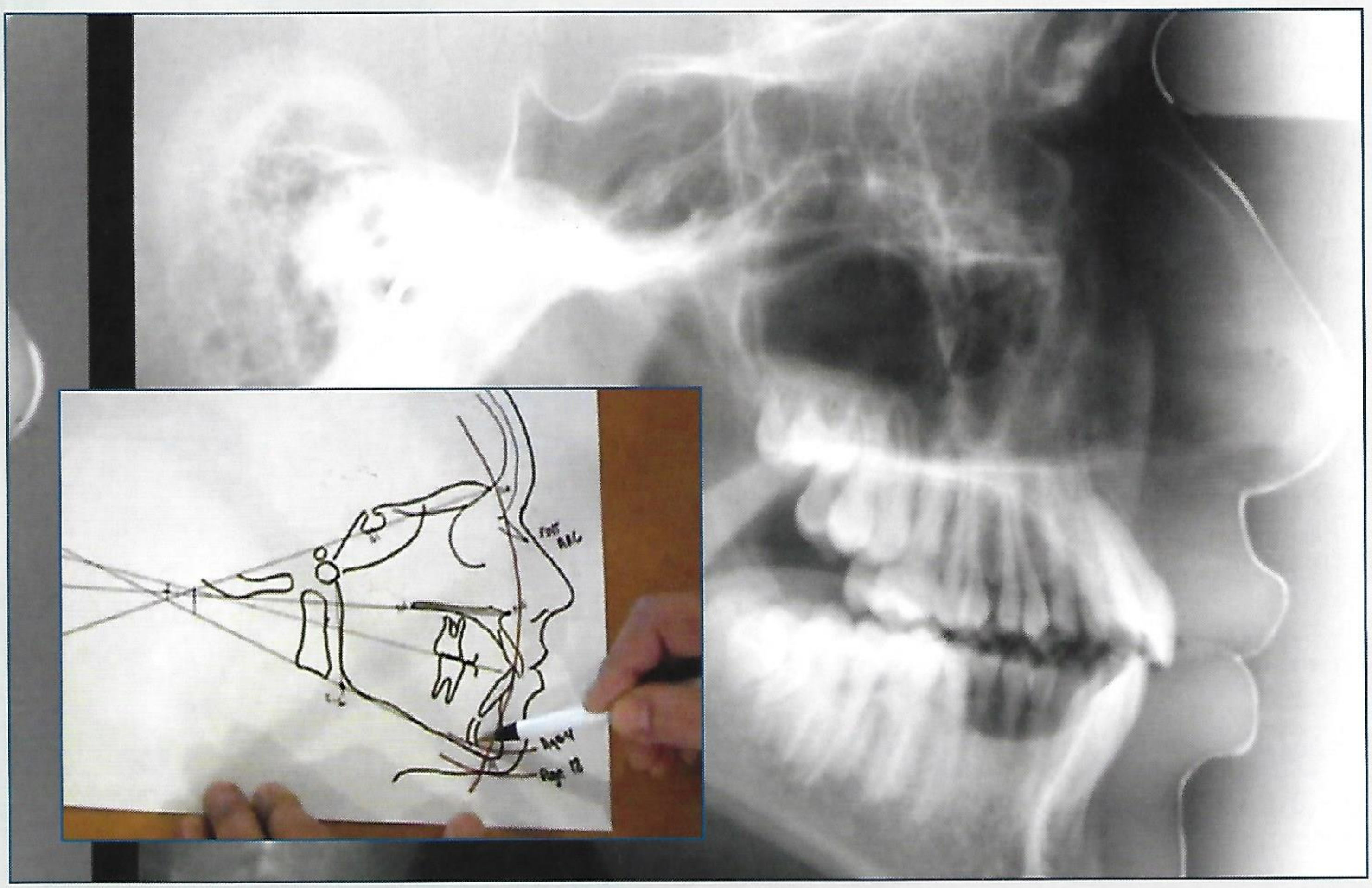

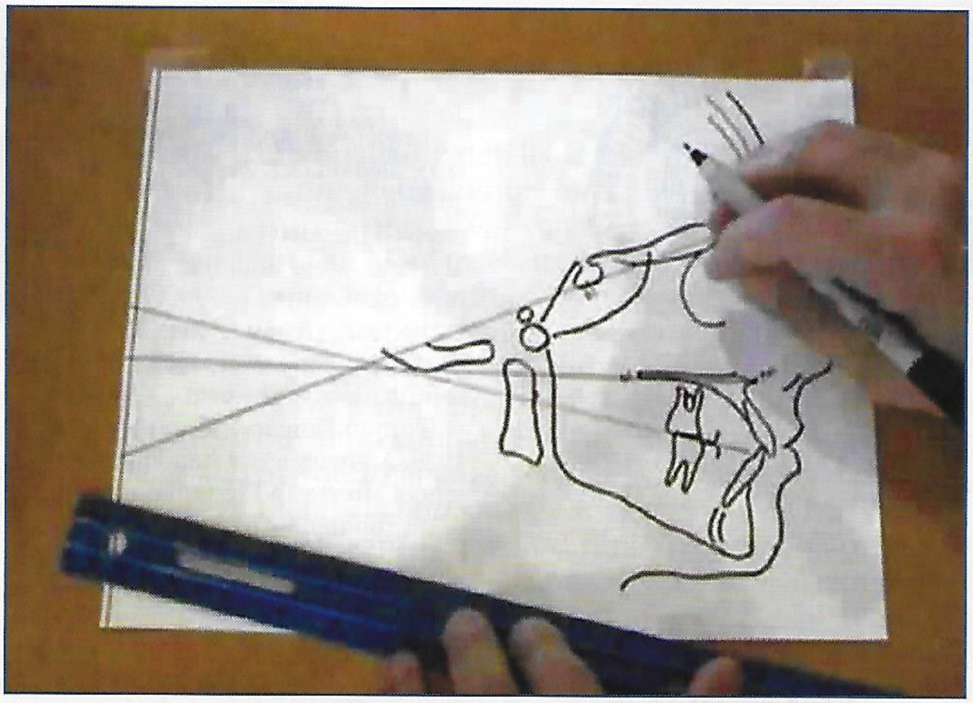

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