

FACIAL ANALYSIS: A COMPREHENSIVE APPROACH TO TREATMENT PLANNING IN AESTHETIC DENTISTRY

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Patient aesthetic expectations and smile enhancement can be achieved through the use of facial analysis. This process allows each member of the restorative team (ie, clinician, specialist, dental technician) to diagnose the patient and develop a comprehensive treatment plan for his or her specific needs. Treatment planning according to facial architecture and dental configuration allows function and harmonious aesthetics to be improved. This article demonstrates a predictable means to evaluate the components of an attractive face for use as a guide during aesthetic dental treatment.

Key Words: aesthetics, plane, line, cephalometric

The primary objective of aesthetic dental treatment is to generate a natural, healthy appearance for an otherwise damaged dentition. In order to fulfill this complex task, an interdisciplinary approach is required to synchronize periodontal, orthodontic, restorative, and occasionally plastic surgical treatment modalities, which results in a comprehensive treatment plan. A detailed diagnosis of the given facial architecture and dental configuration with analysis of the individual patient aesthetics are required to initiate the treatment plan.

Historically, attempts to define the essence of beauty were a combination of artistic expression and mathematical proportions. Aesthetics is an element of philosophy, concerning the science of beauty, and is often

associated with circumscriptions such as "good" and "true." Numerous diagnostic techniques are presently used to assist this study and transform the components of a less-than-optimum face into more attractive forms. While dental clinicians utilize full-mouth radiographs and diagnostic models to evaluate the condition of their patients' teeth, analysis of the anterior and lateral facial skeletal relationships and their soft tissue drape is often overlooked in these examinations.

An incomplete diagnosis may occur when one neglects to review cephalometric linear and angular measurements, the facial contours, and the position of the nose, lips, and chin. Since the alteration of cheek support, nasal base and lip support, chin projection, and length of the throat can have dramatic effects on the final outcome, a subtle modification in any of the aforementioned structures will change the harmony of the whole. Although

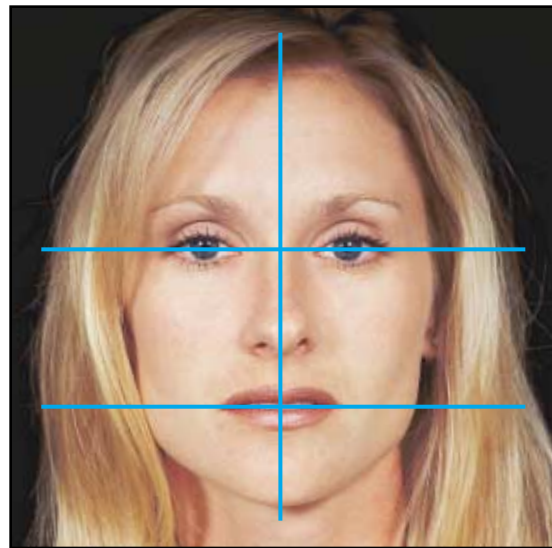


Figure 1. Postural head position (PHP) with relaxed mouth opening displaying facial midline, interpupillary line (IPL), and commissural/incisal line.

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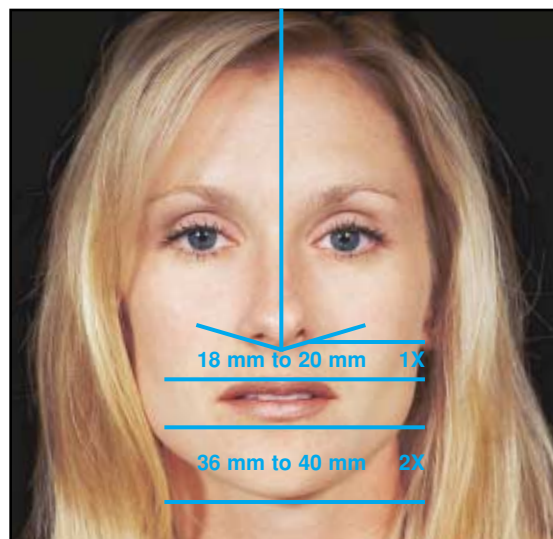


Figure 2. Characteristic facial landmarks: curvature of the dorsum, angulation of the base of the nose, and ratio of upper lip length to lower lip length in PHP.

diversity exists with regard to ethnicity and variations in preference, which ultimately influence the definition of aesthetics,¹ an appearance that is generally considered “aesthetic” can be related to principles of specific symmetries and relationships.²⁻¹²

The purpose of this article is to present a multifactorial analysis of a patient’s functional and aesthetic deficiencies and its transformation into a comprehensive treatment plan. The definitive goal of a preconceived treatment plan is to achieve individually enhanced aesthetics and subsequently increase patient satisfaction.

Diagnosis

Soft Tissue — Frontal View

The natural postural head position,¹³ which allows the patient to sit or stand upright in front of the observer, is the optimal position for an evaluation of the frontal plane. The interpupillary line, facial midline, and commissural line with the lips slightly open are important landmarks for the evaluation of smile harmony (Figure 1).¹⁴ Facial disproportion can be easily ascertained during examination of the frontal plane through the examination of any existing disharmony in the interpupillary line, incisal line, and the facial midline. By observing the exposed teeth during a natural smile and wide smile, the clinician can evaluate a high, medium, or low commissural line, as well as an irregular arch.

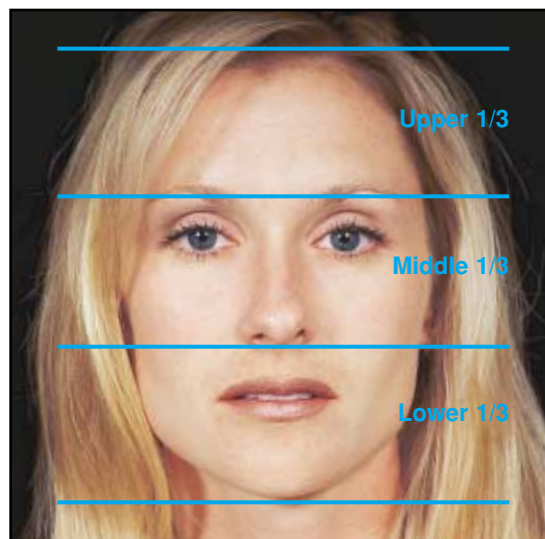


Figure 3. Postural head position with display of facial thirds in an ideal patient. This is useful for evaluating midface and lower face height (eg, open and closed bite [posterior bite collapse] cases).

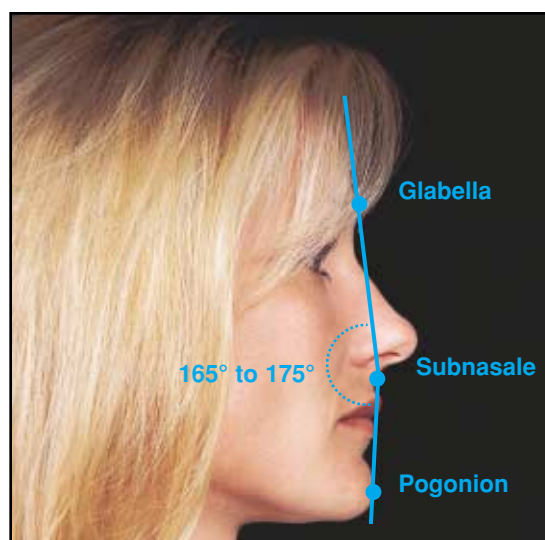


Figure 4. Postural head position for evaluation of the profile using the angle glabella-subnasale-soft tissue pogonion. This permits analysis of eye-cheek relationships, lip position, and lip competence/incompetence.

The symmetry of the face and dental midline is defined by the facial midline. The orientation of the anticipated dental midline can be influenced by the observation of the dorsum of the nose and its curvature as well as Cupid’s Bow and the papilla between the central incisors. The interpupillary line is a reference plane used to determine the incisal plane, the gingival plane, and the occlusal plane.

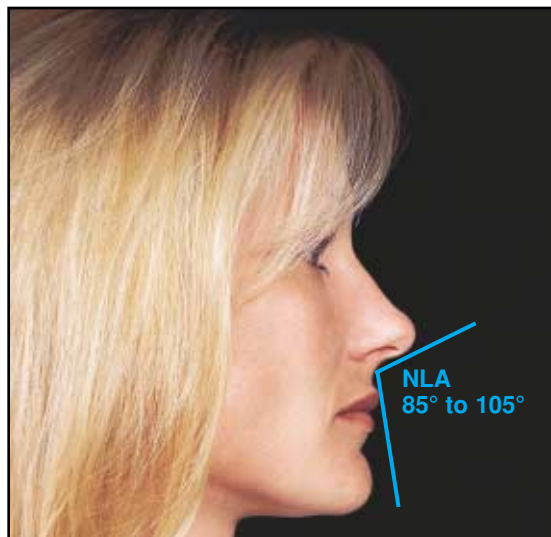


Figure 5. In PHP, the nasiolabial angle (NLA) should range from approximately 85° to 105°.

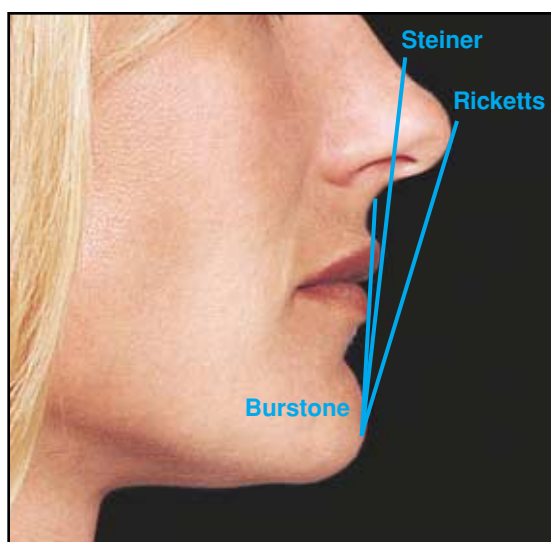


Figure 6. Lip position according to Ricketts, Steiner, and Burstone reference lines.

In optimum facial aesthetics, the distance from subnasale (base of the nose) to the upper lip should be approximately half the length of the lower lip to menton (lowest chin point) (Figure 2). When treatment is performed on advanced cases, an evaluation of the facial thirds — from the hairline to midbrow, midbrow to subnasale, and subnasale to soft tissue menton — is required in order to obtain a more ideal facial proportion (Figure 3).^{10,15}

Soft Tissue — Lateral View

When the patient is observed from a lateral perspective, the natural postural head position^{10,13,16,17} is favored over the Frankfort horizontal plane, which exhibits greater variation. This allows the patient's natural appearance to be displayed for optimum clinical evaluation. The patient's profile angle extends through the glabella, subnasale, and soft tissue pogonion, and should be approximately 165° to 175° for Class I occlusion (Figure 4).¹⁴ The nasolabial angle is constructed from two lines (one tangent to the base of the nose and one to the upper vermilion border of the lip) that intersect at subnasale; the measurement of this angle generally ranges from 85° to 105° (Figure 5).

Aesthetic lip positions can be determined through the use of numerous measurements. Ricketts' E-plane, which describes a line that extends from the tip of the nose to the chin, is one principal reference (Figure 6). In this plane, the maxillary and mandibular lip positions measure −4 mm and −2 mm, respectively. A second alternative is the Steiner line, in which the midpoint of the nose is connected to the chin, and the patient's lips touch this line. The Burstone line, which connects the subnasale point to the pogonion point, can also be used for diagnosis. The maxillary and mandibular lip are compressed by this reference line (ideally +3.5 mm and +2.2 mm, respectively, ahead of this line).¹⁷⁻²⁰ By analyzing the patient's medium and maximum smile in comparison to

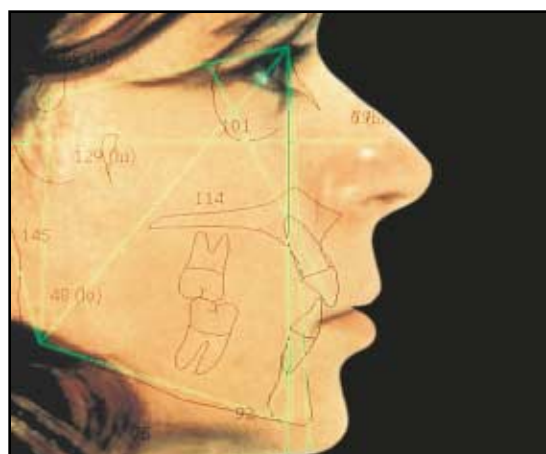


Figure 7. An example of cephalometric reference planes superimposed over soft tissue profile.

its relaxed position, the clinician can determine any necessary variation for the definitive restorative result.

In patients who exhibit significant aesthetic compromise, throat length — the distance from the neck-throat junction to the soft tissue menton — and contour should be evaluated. If asymmetry exists, orthognathic surgery, Le Fort I maxillary osteotomy, or bilateral sagittal split mandibular osteotomy of the mandible with setback or advancement must be considered.²⁰ When skeletal deformities contribute to facial disharmony, the necessity of cheekbone contouring (ie, maxillary Le Fort procedure) should also be addressed.²¹ Since aesthetic restorations can modify the patient's smile, a thorough explanation of the definitive result should be provided for the patient prior to treatment. The use of computer imaging software can be an effective means of communicating the anticipated aesthetic result to the patient. The author, however, prefers the use of flowable composite resins or provisional acrylic veneer templates over the patient's dentition. As with the imaging systems, these methods allow the patient to observe potential enhancement, but the use of resin and veneers also permits phonetic and proprioceptive evaluation. The final guidelines for the definitive restorations are the second set of provisional restorations as completed by the "sandwich technique."¹²

Cephalometry

The anteroposterior and vertical configuration of the facial skeleton can be analyzed with cephalometric radiographs. Cephalometrics also allow the verification of the soft tissue morphology in a profile view without necessitating the removal of the overlaying soft tissue (Figure 7). With the utilization of cephalometrics, the relationship of the axial inclination of incisors and the localization of malocclusions can be assessed to determine Class II, Class III, open bite, or deep bite situations. By establishing reference points in the region of the craniofacial skeleton, reference lines and planes can be constructed and subsequently measured linearly or angularly to determine disparities.^{18,19} Due to the variability of intracranial reference lines and planes (eg, Frankfort Horizontal, Sella-Nasion), these guides can only serve as adjuncts to the natural head position and the true horizontal plane in treatment planning.^{13,16,17}



Figure 8. Preoperative facial view of the patient. Relation of upper to lower lip length is less than the normal 1:2 ratio. Deep mandibular concavity of lower lip due to deep overbite and resultant decreased vertical dimension.



Figure 9. Preoperative lateral view of the patient in centric relation demonstrating compressed upper lip and deep lower lip concavity due to posterior bite collapse. Note abnormal nasolabial angle.



Figure 10. Preoperative view of existing restorations. Note deep overbite and axial inclination.



Figure 11. The existing restorations are removed; patient is at proposed vertical dimension. This new position will restore lost vertical dimension and lingual concavity of maxillary anterior teeth.



Figure 12. View of initial (first set) provisional restorations used for evaluation of aesthetics, phonetics, and function at new vertical opening. Compare to figure 10.



Figure 13. Acrylic resin provisional restorations were seated on the posterior dentition to establish a new vertical opening for the patient.

Dental Analysis

Numerous variables (eg, embrasures, axes, zeniths, shapes) contribute to the appearance of the dentition and consequently the appearance of the patient. While these factors are certainly associated with facial aesthetics and have been the focus of myriad clinical reports, they remain beyond the scope of this article.

Case Presentation

A 27-year-old female patient presented for the replacement of existing laboratory-fabricated resin full-coverage crowns on teeth #6(13) through #11(23) (Figures 8 through 10), which had fractured during function. The patient reported discomfort in the condylar region and was unable to move her mandible without crossarch interferences. Clinical examination and facial analysis revealed the presence of a deep overbite, posterior bite collapse, and a lack of proper foundation restorations beneath the fractured crowns. Lack of proper lingual concavity was also evident for the maxillary anterior dentition; the patient's mandibular teeth extended into the opposing cingulum and palatal tissue (Figure 11). Upon radiographic examination, root resorption from prior orthodontic treatment was noted on teeth #6 through #11. Analysis of the temporomandibular joint and occlusion indicated the patient's inability to perform protrusive or lateral movements without difficulty.

Upon consultation with the laboratory technician and the patient, a comprehensive interdisciplinary treatment plan was developed. Adjunctive orthodontic therapy would be initiated for a period of 8 months and involve a repositioning splint. The posterior dentition would then be extruded to restore the proper vertical dimension, and endodontic treatment would be necessary prior to final rehabilitation of teeth #6 through #11. The patient consented to the proposed therapy, and treatment was initiated.

Clinical Phase

Alginate impressions were made for study models prior to treatment. The shade of the anticipated restorations was subsequently recorded following one month of at-home bleaching, and the maxillary teeth were prepared

and provisionalized at the proposed new vertical position with acrylic resin restorations that were placed over cast-gold posts and cores (Figures 12 and 13). In order to harmonize with the ideal facial drape determined by the preoperative facial analysis, the vertical dimension was opened 4 mm; this would also reduce the excessive maxillary anterior angulation and deep overbite. This was accomplished once the seating of the condyles was confirmed; the resulting open posterior space then required extrusion of both maxillary and mandibular segments. Orthodontic therapy was performed, and the final restorative phase was instituted.

The initial set of provisional restorations were evaluated for phonetics, aesthetics, and function while a second set of acrylic provisional restorations were fabricated with various refinements and characterizations according to the sandwich technique (Figures 14 through 16). The template used to construct the final (second) acrylic provisional restorations was also obtained from alginate impressions of the first set of acrylic restorations; the final impressions of the preparations used to fabricate the definitive metal-ceramic restorations were recorded in polyvinylsiloxane (Take 1, Kerr/Sybron, Orange, CA). The definitive posterior full-coverage crown restorations were seated with a resin ionomer cement, and the endodontically treated anterior teeth were restored with porcelain-fused-to-metal crowns (Figure 17). The final restorations satisfied the expectations of the patient, her family, and the restorative team (Figures 18 and 19). All members of the restorative team were integral to the success of the definitive aesthetic design.

Conclusion

As this article demonstrates, the determination of the proper proportions to achieve an individual's desired facial aesthetics requires a comprehensive facial analysis. In patients that present for complex rehabilitation, it may be advisable to utilize cephalometric radiographs to determine existing disparities. Beyond the soft tissue analysis, a thorough dental analysis should be performed to ascertain dentition deformities that contribute to the facial disharmony. As with all procedures, effective communication between all involved teams is required to arrive at a satisfactory treatment plan.



Figure 14. In the laboratory, a detailed waxup of the anticipated final restorations is used to fabricate the second set of acrylic provisional restorations.



Figure 15. A second set of acrylic resin provisional restorations is fabricated according to the "sandwich technique." Note light-cured resin characterization and tinting.



Figure 16. Facial view of the second set of acrylic resin full-coverage crown restorations upon completion.



Figure 17. The posterior dentition were ultimately restored with full-coverage metal-ceramic crown restorations (Omega 900, Vident, Brea, CA).



Figure 18. Postoperative lateral view of restored vertical dimension. Note axial inclination of anterior dentition as compared to figure 10.



Figure 19. Lateral view of soft tissue drape posttreatment. Note improved nasolabial angle, lip aesthetics, and concavity.

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CONTINUING EDUCATION (CE) EXERCISE No. 31



To submit your CE Exercise answers, please use the answer sheet found within the CE Editorial Section of this issue and complete as follows: 1) Identify the article; 2) Place an X in the appropriate box for each question of each exercise; 3) Clip answer sheet from the page and mail it to the CE Department at Montage Media Corporation. For further instructions, please refer to the CE Editorial Section.

The 10 multiple-choice questions for this Continuing Education (CE) exercise are based on the article "Facial analysis: A comprehensive approach to treatment planning in aesthetic dentistry" by Robert Rifkin, DDS. This article is on Pages 865-871.

Learning Objectives:

This article describes a method of quantifying various measurements of the face in order to create a comprehensive dental plan that satisfies patient aesthetic expectations. Upon reading this article and completing this exercise, the reader should:

- Demonstrate an understanding of the interdisciplinary relationship between all members of the restorative team.
- Be able to construct a comprehensive dental plan based on a patient's functional and aesthetic facial deficiencies.

1. Treatment planning and facial analysis will allow improvements:

- a. With respect to function.
- b. With respect to a proportional and harmonious smile.
- c. With the natural and aesthetic appearance of the final restoration.
- d. All of the above.

2. According to the authors, a multidisciplinary approach of the aesthetic dental treatment may synchronize all of the following EXCEPT:

- a. Periodontics.
- b. Orthodontics.
- c. Endodontics.
- d. Plastic surgery.

3. Harmony of the whole facial appearance is influenced by all of the following conditions EXCEPT:

- a. Ethnicity.
- b. The biologic width.
- c. Variations in preference.
- d. Principles of specific symmetries and relations.

4. The optimal position for an evaluation of the frontal plane is:

- a. Not important.
- b. The natural postural head position.
- c. The natural head position.
- d. The natural postural position.

5. Important landmarks for the evaluation of smile harmony include all of the following EXCEPT:

- a. Sagittal line.
- b. Facial midline.
- c. Commissural line.
- d. Interpupillary line.

6. The low, medium, or high position of the lip line can be observed during:

- a. A neutral smile.
- b. A natural smile.
- c. An inverted smile.
- d. The position of the lip line cannot be observed with the human eye.

7. The orientation of the anticipated dental midline can be influenced by the:

- a. Incisal plane.
- b. Occlusal plane.
- c. Visible length of the maxillary teeth.
- d. Dorsum of the nose and its curvature.

8. A complete diagnosis requires the precise evaluation of which factor?

- a. The facial contours.
- b. The cephalometric linear measurements.
- c. The position of the nose, lips, and chin.
- d. All of the above.

9. An aesthetic lip configuration in a lateral view is related to:

- a. The position relative to a line drawn between the base of the nose and the chin.
- b. Tooth support.
- c. Bone support.
- d. The throat length and contour.

10. "The symmetry of the face and dental midline is defined by the facial midline." This statement is:

- a. True.
- b. False.