



# Macroesthetics: Facial and Dentofacial Analysis

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## ABSTRACT

Successful esthetic and prosthodontic treatment are inseparable. In esthetic treatment, the goal is an enhanced but natural-looking appearance in which all prosthodontic principles have been taken into account. By the same token, prosthodontic treatment is as much about esthetics as mechanical and biologic requirements. Using all disciplines of dentistry to create a functional and pleasing esthetic impression creates the most successful outcomes. This article reviews pertinent literature and discusses esthetic analysis from a macroesthetic perspective; i.e., taking into consideration the interrelationships of the face, lips, gingiva, and teeth.

Increasingly, patients who seek prosthodontic treatment are primarily concerned with enhancing their oral esthetics. The word "esthetic" implies beauty, naturalness, and a youthful appearance relative to one's age. The goal for esthetic treatment should be an enhanced but natural-looking appearance. It has been said that esthetic dentistry is the "art of the imperceptible;" thus, the result should be indistinguishable from nature. Esthetic dentistry should be viewed with a gestalt philosophy; i.e., using all disciplines of dentistry to create a single pleasing impression. This may entail the use of a cosmetic covering of some malshaped or discolored tooth; but, just as importantly, it blends the functional and biologic requirements of the patient into a durable and long-lasting result. The treatment should be as conservative as possible to allow the patient future options as new technologies are developed. Successful es-

thetic treatment thus implies that all prosthodontic principles be considered and followed in the course of treatment. By the same token, prosthodontic treatment is as much about esthetics as mechanical and biologic requirements. Successful esthetic and prosthodontic treatment are, in fact, inseparable.

## Dental Esthetic Evaluation

The dental esthetic evaluation begins with the observation of the facial elements.<sup>1-6</sup> Regardless of how attractive the teeth appear in isolation, if spatially they don't relate to the rest of the facial structures, then the overall impression will not be esthetic. Esthetic dentistry can only be achieved if dentists understand the form, texture, and color of natural teeth and how the teeth relate to other facial structures and then translate this information into the fabrication of restorations. The authors have used the term "microesthetics" to describe the es-

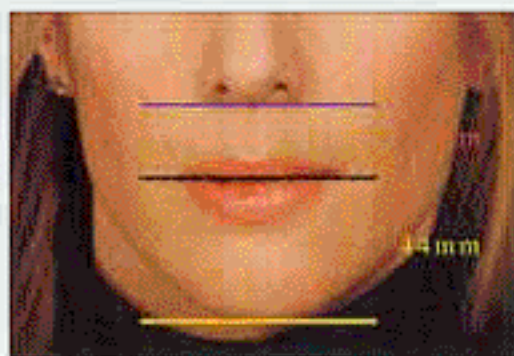
thetics of the individual tooth. The term "macroesthetics" has been used to describe the interrelationships of the face, lips, gingiva, and teeth in obtaining an overall esthetic result. Both micro- and macroesthetic elements need to be satisfied to obtain a truly esthetic result. Only after the facial and dental analysis is performed and the desired outcome is previsualized are the specific treatment modalities considered. Material and technique selection are based on structural and biologic considerations, which vary based on the esthetic positioning of the teeth. Therefore, in the sequence of treatment, esthetics is planned first, biologic aspects second, tooth position third, structure forth, and the material selection last. Most often, treatment is planned in completely the opposite order: The material or technique is chosen first, and every other aspect is adjusted to conform to the chosen material. Treatment sequence may change and follow an entirely different course. If a practitioner treatment plans in a proper sequence, he or she would not plan a restoration for a tooth that is malposed to the point that it would require mutilation to reposition it restoratively. The dentist would plan to reposition it initially so as not to structurally compromise the tooth with excessive preparation. This article reviews pertinent literature and discusses esthetic analysis from a macroesthetic perspective; i.e., taking

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**Figure 1.** Ideal face: frontal view, facial thirds.



**Figure 2.** Ideal face: frontal view, lower facial third, 1:2 relationship



**Figure 3.** Long lower facial third due to vertical maxillary excess.



**Figure 4.** Surgical solution via Le Fort I maxillary impaction.



**Figure 5.** Restorative solution. Left half demonstrates a decreased height to the lower facial third due to a loss of vertical dimension. Right half demonstrates restoration of vertical facial height via full mouth rehabilitation. Figure at right shows excessive wear.



into consideration the interrelationships of the face, lips, gingiva, and teeth.

### Facial Analysis

The analysis of the patient begins at the initial interview, ideally in a non-dental environment. The patient is evaluated from a frontal and sagittal view. Previously published esthetic norms are evaluated.<sup>7-10</sup> Attractive faces generally follow the facial thirds concept (Figures 1 and 2). Artists and facial analysts generally agree upon the concept of using facial thirds to evaluate beauty. More-attractive faces display optimal balance when these proportions are present.<sup>7,9</sup>

Should there be perceptible abnormalities, such as skeletal asymmetries, that bother the patient, a referral may be made to an oral and maxillofacial specialist. Little can be done dentally to affect structural changes to the upper two-thirds of the face. If, in the evaluation of the lower third of the face, it is determined that it be increased in facial height relative to the upper two-thirds (Figure 3), it may be possible to restore an esthetic proportion to the overall face by surgical alteration of the patient's alveolar height and/or vertical dimension<sup>11</sup> (Figure 4).

Patients often have decreased lower facial height.<sup>12</sup> Causes for this decreased height include wear of the teeth resulting in a loss of vertical dimension (Figure 5) or the undereruption of the posterior teeth (Figures 6a through e).

Wear can sometime be treated with restoration of vertical dimension with very conservative preparations and bonded porcelain restorations.<sup>13</sup> Restoration of vertical face height through raising the vertical dimension of occlusion will sometimes dramatically improve facial beauty.<sup>14,17</sup> (Figures 7a and b).

Cases of undererupted posterior teeth should be referred for orthodontic treatment because these teeth generally have minimal wear and raising the vertical dimension for this kind of case creates an unfavorable crown-to-root ratio and prepares teeth unnecessarily.

One of the simplest ways to evalu-



**Figure 6a.** Frontal view demonstrates decreased lower facial height due to undereruption of posterior teeth.



**Figure 6b.** Frontal view shows a more ideal facial proportion due to an increase of vertical facial height by combination orthodontic and restorative dentistry.



**Figure 6c.** Frontal view demonstrates extrusion of lower posterior teeth to restore vertical dimension and maxillary provisional restorations.



**Figure 6d.** Note decreased nasal/labial angle and protruding upper lip.



**Figure 6e.** After restoration of vertical dimension, a relaxed upper and lower lip.



**Figure 7a.** Collapsed appearance to the lower facial third with concomitant acute nasolabial angle and deep lower lip concavity.



**Figure 7b.** More pleasing facial profile.



**Figure 8a.** Ideal face; lips in repose.



**Figure 8b.** Demonstrates slight decrease in vertical dimension with teeth in maximum inter-cuspalion.

ate facial esthetics relative to occlusal vertical dimension is to first view the patient frontally with the lips in repose and the teeth at the acquired vertical dimension of rest (Figure 8a).

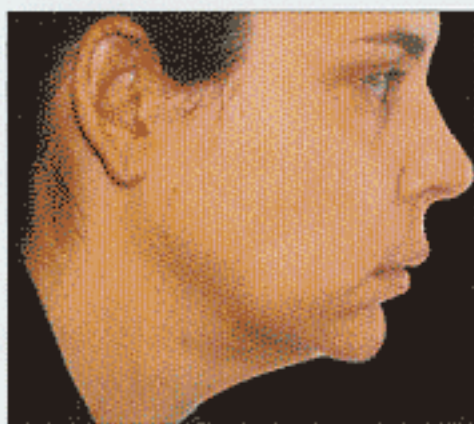
For an individual patient, this position generates optimal facial beauty.<sup>2</sup> If closure from this position to maximum intercuspation reveals a significant decrease in facial height and is esthetically unpleasing, this generally indicates an inadequate vertical position of either the maxillary or mandibular occlusal planes.

Ideally, there should be minimal effect on facial height and thus facial esthetics when the patient closes from the vertical dimension of rest to maximum intercuspation (Figure 8b).

Dentally, these patients appear with one of two conditions: excessive vertical overlap of the incisors with severe cants to the occlusal plane and decreased vertical dimension of occlusion, or significant wear or loss of posterior support due to tooth loss. To evaluate the effect of a change in vertical dimension of occlusion, composite or an acrylic overlay can be placed on the mandibular posterior teeth (nonnotched) so the patient occludes at a position slightly closed from the vertical dimension of rest as a quick evaluation to determine a more favorable position of the mandible for facial esthetics. The composite overlay can be used to mount diagnostic casts for evaluation on an articulator and for treatment waxing of the proposed changes. If it is determined from the diagnostic mounting that the alteration of the teeth to benefit either facial or dental es-



**Figure 9.** Vertical line connecting glabella and pogonion.



**Figure 10.** Profile demonstrating recessed chin and distal placement of pogonion to vertical line from glabella.



**Figure 11.** Note pogonion ahead of glabella.



**Figure 12.** Nasolabial angle of 95 percent.



**Figure 13.** Inferior border of the nose is canted slightly above horizontal.



**Figure 14.** Ideal face with reference lines.

thetics would cause structural or biologic compromise to the patient's dentition, then a multidisciplinary treatment approach is indicated (i.e., this case should not be treated with restorations only and would require orthodontics and possibly orthognathic surgery).

Patients who demonstrate decreased facial height at the vertical dimension of occlusion can often be restored at an increased vertical dimension to improve facial esthetics.<sup>2,13,14</sup> Care must be taken with removable and then fully functioning prototype (trial) restorations to determine if the patient adapts to the new vertical dimension of occlusion prior to final restoration. It is critical to use some trial method to determine a treatment vertical dimension of occlusion, so as not to violate the adaptive ability of the patient to re-establish a freeway space (vertical dimension of rest slightly greater than vertical dimension of occlusion). Once it is determined that teeth

are to be altered either for facial or dental esthetics, it needs to be determined which teeth and to what extent the changes are to be made. It is important to note that most patients do not require alteration of vertical dimension for improvement in dental esthetics.

The patient is then evaluated from a sagittal view. Patients with a Class I dental and skeletal relationship will exhibit a slightly convex facial plane where a vertical line connects the glabella and pogonion anatomical points (Figure 9), and the subnasale point is slightly ahead of the glabella and pogonion point.

Facial arrangement of these three points in which there is a greater convex appearance and the pogonion point is distally placed relative to the glabella generally appears as a Class II skeletal relationship (Figure 10).

When there is a concave relationship of these three points and the pogo-

nion is placed anterior to the glabella point, this generally appears as a Class III skeletal relationship. (Figure 11).<sup>7</sup>

Facial profiles with excessive convex or concave appearance cannot be effectively altered with restorative dentistry only. If the patient desires esthetic alterations for this condition, the patient should be referred for cephalometric analysis to confirm the skeletal diagnosis; and the more appropriate orthodontic and potential orthognathic treatment should be instituted. Some patients who have had moderate to excessive wear will appear to have a Class III tendency from a profile view. This is due to an autorotation of the mandible up and forward into maximum intercuspation as the teeth have worn.

Restoration of vertical dimension of occlusion will decrease the Class III appearance as the mandible rotates down and back when separated from the maxilla to create space to lengthen the

teeth. This effect can be visualized prior to treatment using the same composite technique to evaluate changes in facial height viewed frontally.

Lip position is also evaluated from a sagittal view. This will also give an indication of skeletal and dental relationships. Measured ideal soft tissue norms for the nasolabial angle for Caucasians are 90 degrees to 100 degrees for men and about 95 degrees to 105 degrees for women<sup>7,9</sup> (Figure 12).

Restorative dentistry alone may have a slight effect on the lip position, by positioning the teeth in a more lingual or labial location. This will have a minimal effect on upper lip position because the position of the lip is most affected by the maxilla and gingival third of the maxillary incisors. Major lip repositioning can only be accomplished with orthodontic and orthognathic treatment. Plastic surgery can be used to fill out lip contour, which would decrease the nasolabial angle. The inferior border of the nose may be the esthetic problem giving an abnormal nasolabial angle; the inferior border of the nose in an esthetic face, from the base of the nose to the tip, is canted slightly above horizontal (Figure 13).

If changes to the nasolabial angle are desired in circumstances where the nose tip cant downward below the horizontal, plastic surgery is the appropriate treatment.

The relationship of the nose, lips, and chin can be evaluated by using one or all three of the published reference lines (Ricketts, Steiner, and Burstone)<sup>1</sup> (Figure 14) and is used as a guide to the lower one-third profile.

The relationship of the lips relative to these lines can be helpful in diagnosis and treatment planning of the position of anterior teeth and alveolus. The use of these lines will demonstrate if the lips are anterior or posterior to the ideal, giving an indication as to the positioning of the underlying teeth and alveolus. Lips that appear anterior to the reference lines generally require retraction of the teeth and/or alveolus. Lips that seem excessively posterior to



Figure 15. Tooth structure with lips at rest.

these lines may require advancement of the maxilla and/or mandible. If any of these conditions appear abnormal, then a referral to the specialist for cephalometric evaluation is indicated.

Esthetic changes of lip position and lower facial third profile may be accomplished by surgical, orthodontic, and restorative dentistry.

### Visual Tooth Display

The next step in the esthetic analysis is to evaluate the relationship of the lips to the teeth; i.e., visual tooth display both statically and dynamically. Published reports of tooth display when the lips are at rest have shown that the average 30-year-old female displays 3.5 mm of tooth structure<sup>18</sup> (Figure 15).

The prosthodontic literature has generally recommended setting denture teeth so that 2 mm of tooth structure is displayed at rest. In the authors' experience the 2 mm exposed at rest is the minimal display desired by esthetically driven patients. Thus, between 2 mm and 4 mm displayed at rest will be esthetically ideal for most female patients.

Tooth size and position and lip length and mobility greatly affect maxillary tooth display both statically and dynamically. The average length for maxillary central incisors has been measured at between 10 and 11 mm. The average lip length has been measured at between 20 to 22 mm measured from the base of the nose to the edge of the upper lip.<sup>1</sup> Average lip mobility in a normal smile is between 7 and 8 mm. When a person smiles in an esthetic composition, the



Figure 16. Ideal smile.

tips of the maxillary canines come very close or touch the lower lip while the maxillary incisors come about 2 to 4 mm short from touching the lower lip (Figure 16), this is affected by the curvature of the lower lip and the incisal plane.<sup>19,21</sup> Also, all of the maxillary anterior teeth are displayed, cuspid to cuspid, and up to 3 mm of gingiva is exposed. Most of the maxillary premolars and sometimes the first molar are displayed when smiling.

If the patient has inadequate tooth display or excessive tooth display during smiling, then static lip position, dynamic lip position, and tooth length and position are the critical determining factors in the course of treatment. If patients display less than 4 mm of the maxillary central at rest and the teeth need to be lengthened, the length will generally be achieved by adding to the incisal edge. A flowable composite can be quickly added to the incisal edge to view the esthetic changes and obtain acceptance from the patient (Figure 17).

Incisal lengthening procedures should be previewed by the use of temporary composite bonding or a removable acrylic overlay appliance to see if the patient will functionally adapt to the proposed changes. If the incisal display at rest is 3 to 4 mm and it is determined the teeth are too short, then surgical crown lengthening procedures should be considered. Composite can also be added to the teeth extending beyond the current gingival margin to demonstrate the esthetic effect to the patient (Figure 18).

This composite overlay can also be transferred to the surgeon and placed back on the teeth to show the proposed



**Figure 17.** Flowable composite added to the incisal edge.



**Figure 18.** Removable composite stent to demonstrate to the patient and surgeon esthetic gingival placement.

free gingival margin placement. It is important to note that neither of these composite additions, incisally or gingivally, are bonded to the tooth. The composite is merely added to the un-etched tooth and light cured. It is then easily removed with a scaler.

If there is insufficient tooth display at rest, normal lip mobility, correct tooth length, and inadequate tooth display during smiling, this is diagnostic of vertical maxillary insufficiency. This is not a case that should be treated with esthetic tooth lengthening. This is an orthognathic problem and should be referred for proper treatment. Conversely, if there is too much tooth display at rest, normal lip mobility, normal tooth length, and an excessive display of gingival during smiling (more than 3 mm), this is diagnostic of vertical maxillary excess.<sup>22</sup> This should not be treated by restorative dentistry and surgical crown lengthening alone either; this case should be referred for orthognathic surgical correction. In clinical situations where there is normal tooth display at rest, correct tooth length, correct relationship of the teeth

to the lower lip when smiling, and there is excessive gingival display during smiling, this is usually indicative of excessive lip mobility. This is a very difficult situation to treat, as almost any treatment will leave an esthetic compromise in either a static or dynamic lip position. Possible slight maxillary impaction with slight concomitant crown lengthening may be an esthetic improvement, but computer imaging and mock-ups should be used to demonstrate to the patient the potential final outcome before treatment is initiated.

### Smile Line

In an esthetic smile, the edges of the maxillary anterior teeth follow a convex or gull-wing course matching the curvature of the lower lip (Figure 19) and are generally radially parallel to the horizon.

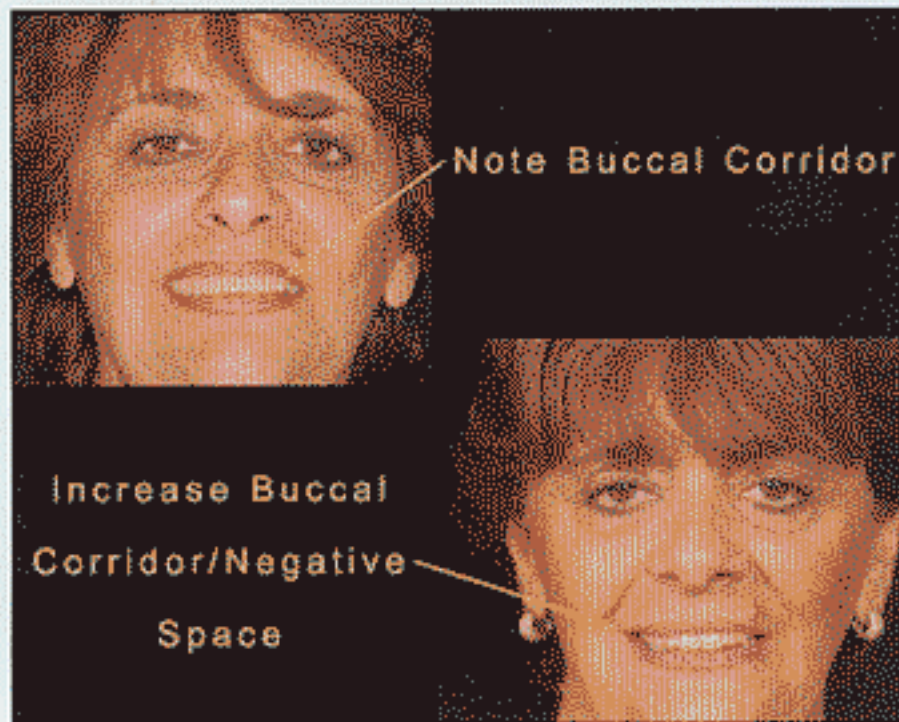
From a frontal view, the maxillary arch from central incisor to molar appears to curve upward, but not always. If it does, this apparent curve may be due to a slight posterior cant to the maxilla or the frequent appearance of

the curve of Spee in the intact dentition. Slight to moderate deviations to this pattern can be effectively treated with esthetic restorative dentistry. In situations where there is ideal tooth form and color, but where there are discrepancies to the smile line or visual tooth display, restorative dentistry is not indicated, as this would cause unnecessary mutilation of otherwise healthy tooth structure. In these clinical situations, and when there is moderate to severe distortion of the smile line, orthodontics may be the more appropriate treatment.

In an esthetic smile, there is what has been termed negative space, which is a small space between the maxillary posterior teeth and the inside of the cheek. If the space appears excessive when the patient is smiling, a small amount of the space can be filled by increasing the buccal contours of the maxillary posterior restorations, assuming restorations need to be placed for restorative reasons. This should only be done judiciously because overcontouring buccally can create an unfavorable cantilever effect on the restoration and potentiate gingival problems. The composite can be placed on the buccal preoperatively to gauge the esthetic effect and to assess any functional disturbances. Conversely, excessive fill of the buccal corridor may also be unaesthetic (Figures 20a and b and 21).

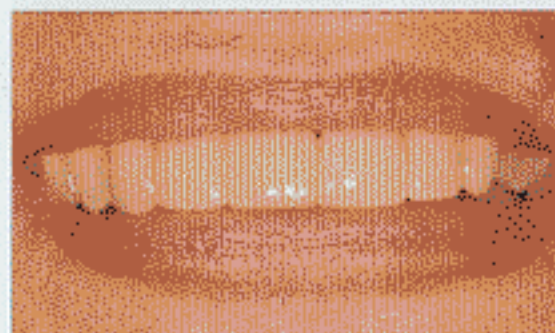
### Midline

Ideally, the dental midline should end up collinear with the facial midline; but this is not usually the case. Fortunately, it has been demonstrated that of all the esthetic parameters, dental midline abnormalities are the least noticed. Kokich showed that the public could not tell that dental midlines were off facial midlines if the discrepancy was less than 4 mm.<sup>23</sup> As long as the midline is parallel with the long axis of the face, midlines discrepancies of up to 4 mm will generally not be perceived as unaesthetic. Midlines can be corrected slightly with restorative dentistry as long as the maxillary centrals are made relatively

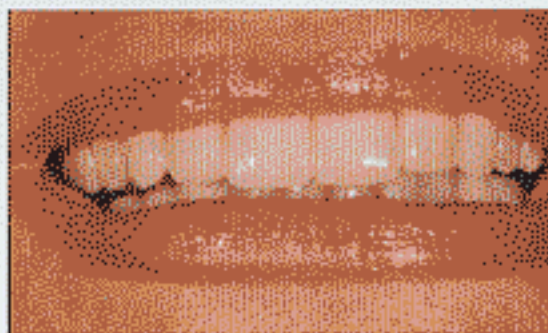


**Figure 20a.**  
The existing restorations overfill the buccal corridor.

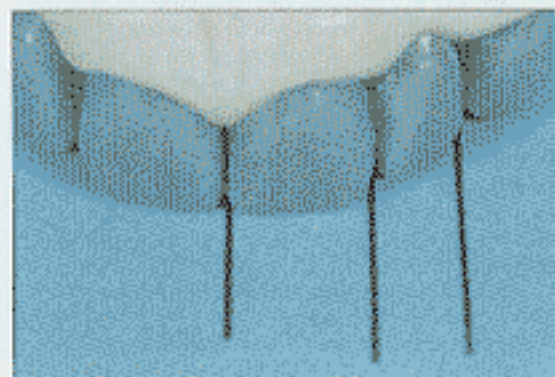
**Figure 20b.**  
A reduction in buccal porcelain creates a more pleasing appearance.



**Figure 21a.** Excessive fill of the buccal corridor.



**Figure 21b.** Over contour of the restorations is eliminated.



**Figure 22.** Lines drawn on paper to represent the optical width of the teeth.

symmetrical and correct intertooth relationships are maintained. If the individual teeth do not require restoration or there is a large midline discrepancy, the ideal treatment is orthodontics.

### Intertooth Relationships

When a person smiles and the teeth are displayed, there is an intertooth re-

lationship that needs to be maintained for the composition to be considered esthetic. The maxillary central incisors should be relatively but not perfectly symmetrical. They should dominate but not overwhelm the smile.<sup>24</sup> This is obviously very subjective, but research has shown that in smiles determined to be esthetic, there was a clear dominance of the maxillary central incisor. Many authors recommend using the golden proportion to define the optical width of the maxillary teeth as they go posteriorly.<sup>25</sup> Recent literature has demonstrated that the actual measurements of most people's anterior teeth do not in fact follow the golden proportion.<sup>24</sup> It has not been determined that optical tooth display in the golden proportion is considered more esthetic than other arrangements. In the authors' experience, the relationship of

the maxillary lateral to central incisor comes very close to the golden proportion in an esthetic smile, and that proportion can be used as a guide in shaping teeth. A good guide is to make the optical width of the lateral incisor about 62 percent to 65 percent of the central incisor. The authors have found that the canine does not follow the golden proportion optically and is generally about 75 percent of the optical width of the lateral incisor. A simple technique can be used during the wax-up or final shaping of the porcelain by placing the cast on paper and drawing lines consistent with the optical width of the teeth (Figure 22).

This is then measured for optimal intertooth proportions, and contour adjustments can be made. The lateral incisors are generally of slightly different shade and size, and the incisal edges are in slightly different horizontal planes. One lateral is usually rotated slightly out and the other slightly in. The canines generally are in slightly different vertical positions and angled differently. This is important to understand because many times when six anterior teeth are prepared, the cast is mounted based on a line drawn through the tips of the canines in an erroneous assumption that this will give the correct incisal plane. Due to the slightly different vertical position of the maxillary canines, mounting casts in this manner will generally end up with the six restorations having an incorrect incisal plane.

### Gingival Relationships

The lips frame the teeth and gingiva. The ratio of tooth structure to the amount of gingival and labial tissue should be harmonized to prevent an overdominance of any one element. In the patient with a high lip line, esthetic gingival contour and symmetry are essential in determining tooth length and proportion. As such, establishing proper gingival relationships relative to lips and teeth are critical elements in an esthetic composition. Gingival line (free gingival margins), gingival scalloping and contour, papillary tip positioning,



**Figure 23.** Symmetry of gingival scallop contributes to tooth proportion.

and gingival color are evaluated next.

There have been several gingival reference line relationships from maxillary bicuspid to the contralateral bicuspid that have been discussed as being esthetic. Other than the dental midline, slight discrepancies in the gingival line are least noticed by the public or by dental professionals. The key esthetic issue is that the gingival line for the anterior teeth be relatively parallel to the horizon and be relatively symmetrical on both sides of the midline. It may radiate up slightly as it goes posterior. It is not critical that the lateral incisor gingival line fall incisal or even slightly apical to the central as this is not obvious when a person is smiling. As long as horizontal symmetry is maintained, within 0.5 mm gingival and 1 mm incisal positioning of the lateral to the central incisor is generally perceived as esthetic (Figure 23).

The contour of the gingiva on the facial surface of the tooth should follow a scalloped appearance, where the measurement from the crest of the gingiva to the tip of the papilla should be between 4 or 5 mm. Ideally, the tip of the papilla should extend 40 percent to 50 percent of the length of the tooth (Figure 24), and the tips of the papillas should have the same radiating symmetry as the incisal edges and the free gingival margins. In situations where this condition does not exist, periodontal and orthodontic procedures are the treatments of choice to create the correct gingival architecture. Orthodontics not only position teeth but also can reposition gingiva and bone. Gingival color should appear pink and healthy or consistent with the healthy color of individual race variations. It is beyond the

scope of this paper to cover the many maladies that contribute to gingival color anomalies.

### Summary and Conclusion

Understanding the importance of facial analysis in dental esthetic treatment planning in order to be able to institute interdisciplinary care when appropriate is paramount to obtaining an optimal esthetic result. Prosthodontic treatment planning must always be performed with the purpose of restoring and maintaining function and health. Despite these historic treatment foundations, dental professionals cannot ignore the essential patient benefits of appealing esthetics. As such, treatment concepts and design must define and tailor the optimal in durability function and esthetics to the patient.

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- References** / 1. Rifkin RG, Facial analysis: a comprehensive approach to treatment planning in aesthetic dentistry. *Pract Periodont Aesthet Dent* 12(9):865-87, 2000.
2. Mack RM, Facially generated occlusal vertical dimension. *Compendium* 18:12, 1997.
3. Bowbeer GRN, The five keys to facial beauty and TMJ health. Reprinted from *Functional Orthodontist* 13:28, 1985.
4. Mack RM, Perspective of facial esthetics in dental treatment planning. *J Prosthet Dent* 75:169-76, 1996.
5. Ahmad I, Geometric considerations in anterior dental aesthetics restorative principles. *Pract Periodont Aesthet Dent* 10:813-22, 1998.
6. Spear F, Facially generated treatment planning: A restorative viewpoint. American Academy of Esthetic Dentistry, 16th annual meeting, Santa Barbara, Calif, Aug 8, 1991.
7. Arnett GW, Bergman RT, Facial keys to orthodontic diagnosis and treatment planning, Part II. *Am J Ortho Dent Facial Orthop* 103(5):295-411, 1993.
8. Peck S, Peck L, Selected aspects of the art and science of facial esthetics. *Semin Orthod* 1(2):105-26, 1995.
9. Powell, Humphreys, *Proportions of the Face*. Thieme-Stratton Inc, New York, 1984, pp 1-9.
10. Peck S, Peck L, Esthetics and the treatment of facial form. In: McNamara J, ed, *Craniofacial Growth Series* Vol. 28. University of Michigan, Ann Arbor, Mich, 1992, p 97.



**Figure 24.** Finished case of maxillary porcelain veneers on teeth Nos. 6-11 that demonstrates ideal gingival integration and esthetics. Note: The tip of the papilla is at about 50 percent of the length of the maxillary centrals, and the dimension of the gingival scallop is between 4 to 5 mm from the apical aspect of the gingival margin to the tip of the papilla.

11. Bell WH, *Modern Practice in Orthognathic and Reconstructive Surgery*. WB Saunders, Philadelphia, 1992.
12. Mack RG, Vertical dimension: A dynamic concept based on facial form and oropharyngeal function. *J Prosthet Dent* 66:478-85, 1991.
13. Rifkin RG, McLaren EA, restoring vertical dimension and facial harmony with the conservative use of fiber-reinforced composite resin. *Pract Periodont Aesthet Dent* 13(3):223-37, 2001.
14. Kois JC, occlusal vertical dimension: alteration concerns. *Compendium* 18(12):1169-77, 1997.
15. Tallgren A, Changes in adult face height due to aging, wear and loss of teeth and prosthetic treatment. *Acta Odontol Scand Suppl* 24:1-24, 1957.
16. Atwood DA, A cephalometric study of rest position of the mandible, part I. *J Prosthet Dent* 6:504-19, 1956.
17. Dahl BL, Krugstad O, Long-term observations of an increased occlusal face height obtained by a combined orthodontic/prosthetic approach. *J Oral Rehabil* 12:173-6, 1985.
18. Vig RG, Brundo GC, The kinetics of anterior tooth display. *J Prosthet Dent* 39:502-4, 1978.
19. Sarver DM, The importance of incisor positioning in the esthetic smile: The smile arc. *Am J Orthod Dentofacial Orthop* 120:98-111, 2001.
20. Frush JO, Fisher RD, The dysesthetic interpretation of the dentogenic concept. *J Prosthet Dent* 8:558, 1958.
21. Ackerman M, The effect of maxillary position on anterior tooth display (thesis). University of Rochester, Rochester, NY, 2000.
22. Robbins JW, Orthognathic differential diagnosis of excessive gingival display. *Pract Periodontics Aesthet Dent* 2:265-72, 1999.
23. Kokich VO, Kiyak HA, Shapiro PA, Comparing the perception of dentists and lay people to altered dental esthetics. *J Esthet Dent* 11:311-24, 1999.
24. Chiche G, Pinault A, Artistic and scientific principals applied to esthetic dentistry. In: Chiche G, Pinault A, *Esthetics of Anterior Fixed Prosthodontics*. Quintessence Publishing, 1994, pp 13-32.
25. Rutenacht CR, *Fundamentals of Esthetics*. Quintessence Publishing, Carol Stream, Ill, 1990.
26. Preston JD, The golden proportion revisited. *J Esthet Dent* 5:247-51, 1993.

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