



Creating the Perfect Smile: Prosthetic Considerations and Procedures for Optimal Dentofacial Esthetics

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ABSTRACT Creating the perfect smile and individual esthetics is a challenging procedure that requires a multidisciplinary approach and meticulous treatment planning. Since esthetics is subjective and depends upon the patient and the clinician perception, it is difficult to obtain specific guidelines or a systematic approach that will lead to consistent results. This article discusses several guidelines that have been proposed to help clinicians in the process of creating esthetic appearance and their applications in esthetic dentistry.

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Achieving esthetic restorations that are in harmony with the patient's facial contours and appearance is one of the most difficult tasks in prosthodontics.

In the process of providing esthetic treatment for a patient, one relies on one's eyes and personal perception of beauty, as well as guided by the patient's desires, and limited by anatomical and occlusal variables.

What makes a person attractive? Many studies suggest beauty is characterized by balance: The more symmetrical a face, the more appealing it appears. This principle also applies to the body: A symmetrical body is subconsciously perceived by others as a sign of youth, health, and strength.¹

Symmetry is sexy, too. Studies of

hundreds of college-age women and men revealed that men who look more symmetrical started having sex three to four years earlier and had more sex partners than their asymmetrical peers.² A different study found that women prefer the scent of symmetrical men and vice versa.³

Several formulae and geometric proportions have been proposed to help the clinician achieve facial harmony and esthetics. Few of them have been proven to be very useful in detection of esthetic problems when one's eyes cannot:

- The width of the maxillary central incisor has been related through average measurements to the bizygomatic width (1:16) and to the interpupillary distance (1:6.6).^{4,5}
- The interalar width was related to the distance between the canines.

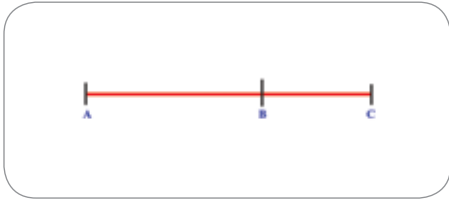


FIGURE 1. Linear golden ratio.



FIGURE 2. Parthenon.

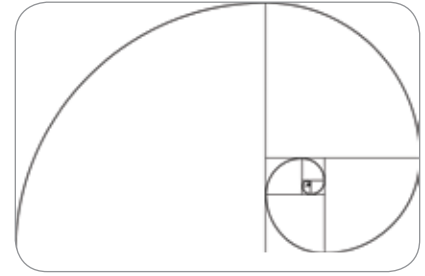


FIGURE 3. Development of seashell.

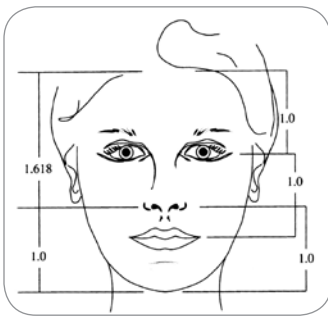


FIGURE 4. Measurements in the vertical aspect.

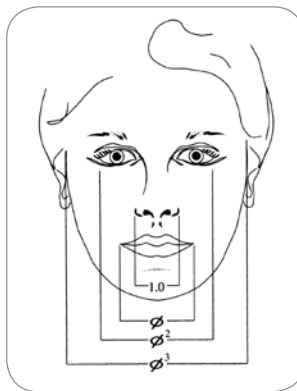


FIGURE 5. Measurements in the horizontal aspect.



FIGURE 6. Golden ruler.

■ Several studies have found that these relationships exist more in women, and change with racial differences.⁶⁷ The large variability of these measurements limits their application in esthetic dentistry and may be used as an initial guide only in the process of smile evaluation.

The golden proportion (1.00:1.618) was first described by Aristotle in ancient Greece and is thought to hold the secret of beauty by many artists, scientists and architects. Leonardo Fibonacci described the mathematical relationship behind the golden proportion in the 12th century. Starting with zero and one, each new number in the series is the sum of the previous two: 0, 1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89 ...

The ratio between each successive number in the series quickly converges on Phi, or as it called: the golden proportion. After the 40th number in the series, the ratio is accurate to the 15th decimal place: 1.618033988749895 ...

FIGURE 1 shows the proportion in its simplest linear form: The line A-C

is divided by B according to the golden proportion, so A-B is 1.618 times larger than B-C. The proportion of the smaller part to the greater is the same as the proportion of the greater to the whole.

The golden proportion appears as a geometric reference in creating perceived esthetics. Artwork and architectural structures throughout history, that incorporate geometrical configurations based on the golden proportion, are often perceived as attractive and beautiful.

FIGURE 2 shows the incorporation of the golden proportions in the constructions of the Parthenon in ancient Greece. It is an integral part in the architecture and drawings of Leonardo da Vinci, Sir Christopher Wren, Le Corbusier, and more.

The proportion is observed throughout nature in animals, plants, and the solar system. FIGURE 3 is an example of golden proportion in the structure of seashells. It is also observed in the human body, in the configuration of the human DNA, and between components of the human face.

FIGURES 4 AND 5 demonstrate craniofacial analysis in the frontal view and the golden proportion between variable parts of the human face.^{8,9}

Applying the rule of the golden proportion to the widths of the anterior teeth as viewed in the frontal plane will help create an esthetic and pleasing smile: The perceived width of a tooth should be approximately 62 percent of the width of the mesial tooth in order to be esthetically pleasing. The width of the central relates to the width of the lateral, the lateral to the canine, and the canine to the first bicuspid. It must be clear that the golden proportion rule does not apply to the actual width measurements of the teeth but to the way they are perceived when viewed from the front.

Several instruments, based on the golden proportion, have been manufactured by different companies as an aid for dentists and other professionals in evaluating facial appearance and designing esthetic restorations:

■ The golden ruler (Panadent Corp.,



FIGURE 7. Diagnostic wax-up with golden ruler.

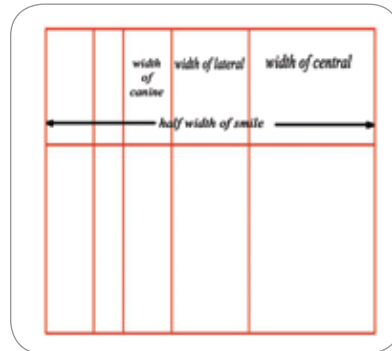


FIGURE 8. Golden grid.



FIGURE 9. Esthetic appearance that does not follow the golden proportion rules.

Grand Terrace, Calif.) and the golden mean gauge (www.goldenmeangauge.co.uk) are three-arm instruments that maintain the spacing of the arms at the golden ratio at any opening (**FIGURE 6**). These instruments allow the dentist to evaluate the patient's facial proportions directly on the patient's face and compare it to the "ideal" measurements represented in **FIGURES 4 AND 5**. They also help in the design of the diagnostic wax-up and the final restorations of the anterior teeth (**FIGURE 7**).

■ The golden proportion waxing guide (Panadent) is a grid of lines spaced by the golden ratio according to the width of the central incisors. The set includes seven guides ranging from 7 – 10 mm in 0.5 mm increments, to correspond to the width of one central incisor. After deciding the width of the central incisor, the clinician or the technician can wax the remaining anterior teeth to achieve an esthetic result that embodies the golden proportionate spacing. A simple grid that can be prepared by the clinician is presented in **FIGURE 8**.

■ Meisner (www.goldennumber.net, www.phimatrix.com, www.phidental.com) developed the PhiMatrix, software that helps in the analysis of tooth size using digital pictures. The software is based on the grids developed by Levin and creates a horizontally and vertically golden proportion grid that can be superimposed on a digital picture.¹⁰

Snow discussed the limitations of the golden proportion and questions its

validity: Applying the golden proportion rules unilaterally (the central to the lateral to the canine) does not analyze symmetry. If the two lateral incisors are different in width, the application of the golden proportion will create different widths for the central incisors. He proposed the "Golden Percentage" as a more useful analysis tool. The golden percentage describes the contribution of each tooth to the overall width between the canines. Each central incisor contributes 25 percent of the width, the lateral incisors contribute 15 percent, and the canines 10 percent each.¹¹ Applying the golden percentage rules on a frontal picture of a smile identifies and quantifies asymmetry of the entire anterior segment, allowing for a more accurate smile design.

Snow also explains the influence of the arch form on the perceived relative width of the anterior teeth. A wider arch form will display more of the canine width in a frontal view and the teeth relative widths will deviate from the golden percentage or the golden proportion rules.¹¹ **FIGURE 9** illustrates this limitation in the application of the golden proportion. Although the width of the canine does not fit the superimposed grid, the appearance of the teeth is pleasing.

The arrangement or sizing of teeth based upon certain facial measurements or set proportions should be used carefully and only as an initial guide for the width and position of the incisors and canines.

Each patient is different, and any decisions based on any instrumentation should be evaluated and tested directly on the patient by means of diagnostic wax-up, temporary restorations, phonetics, and occlusal considerations.

The next important procedures in the process of creating a perfect smile are proper mounting of the patient's models in the articulator and the diagnostic wax-up.

Mounting the Models

The mounted casts should represent the anatomical position of the patient's teeth in relation to reference points. The human eye judges objects and their relationship to the horizontal and vertical or to deviation from these planes. Therefore, it is easy to establish an esthetic baseline by having the esthetic plane of occlusion parallel to the horizon. Traditionally, dentists are taught to record the incisal-canine line parallel to the eyes and use the ear rods of the facebow as the posterior reference points. Since people's facial features are asymmetrical, when the eyes or ears are slanted, the registration would orient the models in the articulator slanted in the same degree. Therefore, it is important to register the position of the teeth in relation to the horizontal plane and transfer the records to the articulator.

Lee created the Bioesthetic Level Gauge and the Adjustable Nasion Relator facebow that are used with the Panadent system.^{12,13} The system uses a magnetic level gauge that can be posi-



FIGURE 10A. Patient's existing teeth.



FIGURE 10B. Mounted casts.



FIGURE 10C. Diagnostic wax-up.

tioned anterior-posterior in the sagittal plane of the facebow, and in the frontal plane along the incisal-canine direction. Transferring the bite fork assembly to the articulator will orient the maxillary arch in correct relation to the horizontal plane.

The Kois Dento-Facial Analyzer System (Panadent) uses the same principles in a simplified facebow that registers the patient's occlusal plane. It is oriented to the patient's midsagittal in the frontal plane, with the bite fork parallel to the horizon from the profile view. The record is then transferred to the articulator and mounted on an adjustable platform. After mounting, the Kois system uses waxing guides that fit over the platform with marked grids based on the golden proportion. As mentioned before, these grids are used for the diagnostic wax-up and help create a proportional, esthetic smile.

The Diagnostic Wax-up

The diagnostic wax-up is next in the planning process. This is the only way one can preview the desired esthetic appearance. The diagnostic wax-up provides guidelines of the needed treatment and a blueprint of the final restorations. A diagnostic wax-up is a necessity for every treatment, from single tooth restoration to full mouth rehabilitation.

It is important to remember, however, that creating the diagnostic wax-up with an idealized configuration dictated by anatomical determinants alone (such as the retromolar pad, commissure of the mouth, Frankfurt horizontal plane, etc.) may lead to suboptimal facial esthetics. It is important to relate the diagnostic wax-up directly onto the patient's teeth



FIGURE 10D. Clear acrylic resin stent.



FIGURE 10E. Acrylic stent on patient's teeth at start of crown lengthening.



FIGURE 10F. Crown lengthening completed.



FIGURE 10G. Final restorations.

in order to evaluate the facial esthetics. This can be done in several ways:

- If restoration of the vertical dimension is needed due to loss of tooth structure, an initial flat stabilization splint can be useful. The splint thickness will restore the patient's VD in the same amount that was created with the diagnostic wax-up. This will help in evaluating the new lower facial height and overall facial appearance before undertaking any irreversible procedures. The bite splint is also useful for evaluating the ability of the patient's musculature to accommodate the new vertical dimension.

- When shortened anterior teeth need augmentation of the incisal aspect, crown lengthening on the gingival aspect, or combination of both, it would be helpful to evaluate the desired teeth length before

the actual procedures are performed.

Spear described three methods for evaluating and placing the incisal edge of the central incisor:¹⁴

1. Evaluation of the central incisal edge relative to the other teeth in the maxillary arch. In a normal class I occlusion the incisal edge of the central will be approximately on the same plane as the tip of the canines and the buccal cusp tips of the premolars and molars.

2. Phonetics — pronouncing of "V" and "F" sounds should create a light contact between the central incisor and the "wet-dry" line of the lower lip. This method is more useful to determine if the patient's teeth are too long. Usually, even with severely worn teeth, the "F" and "V" sounds look correct.

3. Evaluation of the amount of tooth

displayed at rest and lip mobility that occur in a smile. First, evaluate how much of the tooth is exposed when the upper lip is at rest. Then evaluate how many millimeters the lip moves at smile. Knowing the length of an average central (approx. 10.5 mm) and how much tooth the patient would like to show in a smile will help determine the incisal edge position.

These methods provide only a starting point in the diagnosis and guidelines for the optimal diagnostic wax-up. By duplicating the diagnostic wax-up in stone one can obtain a clear matrix of the wax-up made of a clear splint material (Proform 0.08-inch splint material;

Dental Resources, Delano, Minn.) and a vacuum machine (UltraVac Vacuum Former; Ultradent Products). The matrix is then filled with acrylic or composite resin and adapted on the model of the patient's existing teeth. This will create a thin resin shell that will fit over the patient's existing anterior teeth. The shell provides an excellent tool for evaluation of facial appearance, length of the anterior teeth in relation to a full smile and in rest, correlation of the anterior teeth with the lower lip and the midline position.

FIGURES 10A-G demonstrate periodontal and prosthetic procedures for the restoration of severely worn anterior teeth.

FIGURE 10A shows the patient's existing teeth, a 45-year-old male with severe wear of the maxillary anterior teeth. Evaluation of the patient's incisal edge position was made according to the guidelines discussed above and indicated a need for lengthening of the incisal edge in approximately 1.5 mm. High lip line and the display of gingival tissue during smile indicated the need for a crown lengthening procedure of the anterior segment. These procedures will create anterior teeth with normal length and amount of tooth display that would fit the patient's desire.

The patient's models were mounted on a semi-adjustable articulator, ac-



FIGURE 11A. Patient pretreatment.



FIGURE 11B. Mounted diagnostic wax-up.



FIGURE 11C. Final restorations.

ording to the principles discussed earlier (**FIGURE 10B**) and marked for the desired gingival height. The diagnostic wax-up was created (**FIGURE 10C**). The wax-up was duplicated in stone and a vacuum made clear matrix was made as described above. The matrix was filled with cold-cure clear acrylic resin and fitted on a model of the patient's existing teeth. The result, as shown in **FIGURE 10D**, was a thin shell of clear acrylic resin that included the desired additional incisal and gingival lengths and would fit over the patient's existing teeth.

FIGURE 10E shows the application of the acrylic stent during the periodontal procedure. Eight weeks later, the tissue is healthy and esthetically contoured (**FIGURE 10F**) and the patient is ready to continue with the prosthetic phase. Six

porcelain-fused to metal crowns were fabricated and delivered (**FIGURE 10G**).

FIGURE 11A represents a 46-year-old female who presented for esthetic consultation and treatment. After evaluation of the occlusion and the posterior dentition, parafunctional habits, periodontal condition and the patient expectations, a smile evaluation was performed. There was no need for incisal edge lengthening. Although the patient did not show the cervical part of her teeth while smiling, she requested to improve the gingival contour around her anterior teeth. The treatment plan included periodontal procedures to cover the exposed root surfaces and to achieve an esthetic contour of the gingival margins and 16 porcelain veneers on the anterior teeth.

The models were mounted and the

diagnostic wax-up was created (**FIGURE 11B**) with ideal teeth height and gingival contour. A clear acrylic resin matrix was made over a stone duplicate of the diagnostic wax-up. The matrix was carefully trimmed around the gingival margin of the anterior teeth to provide a guide for the periodontist in reshaping the gingival tissue and adding attached tissue over the two laterals for best esthetics. After healing and completion of the prosthetic treatment the final results are presented in **FIGURE 11C**.

Summary

As clinicians, one strives to provide a final result that would fulfill the patient's desires, in harmony with the patient's anatomical structure, and will provide the patients with many years of service.

CONTINUES ON 342

PROVISIONALS, CONTINUED FROM 340

It is a common knowledge that beauty and esthetics are subjective and differ between cultures and geographic locations. This article discussed several methods and techniques that may help the clinician and provide an initial guide for the creation of individual esthetic restorations. ■■■■

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