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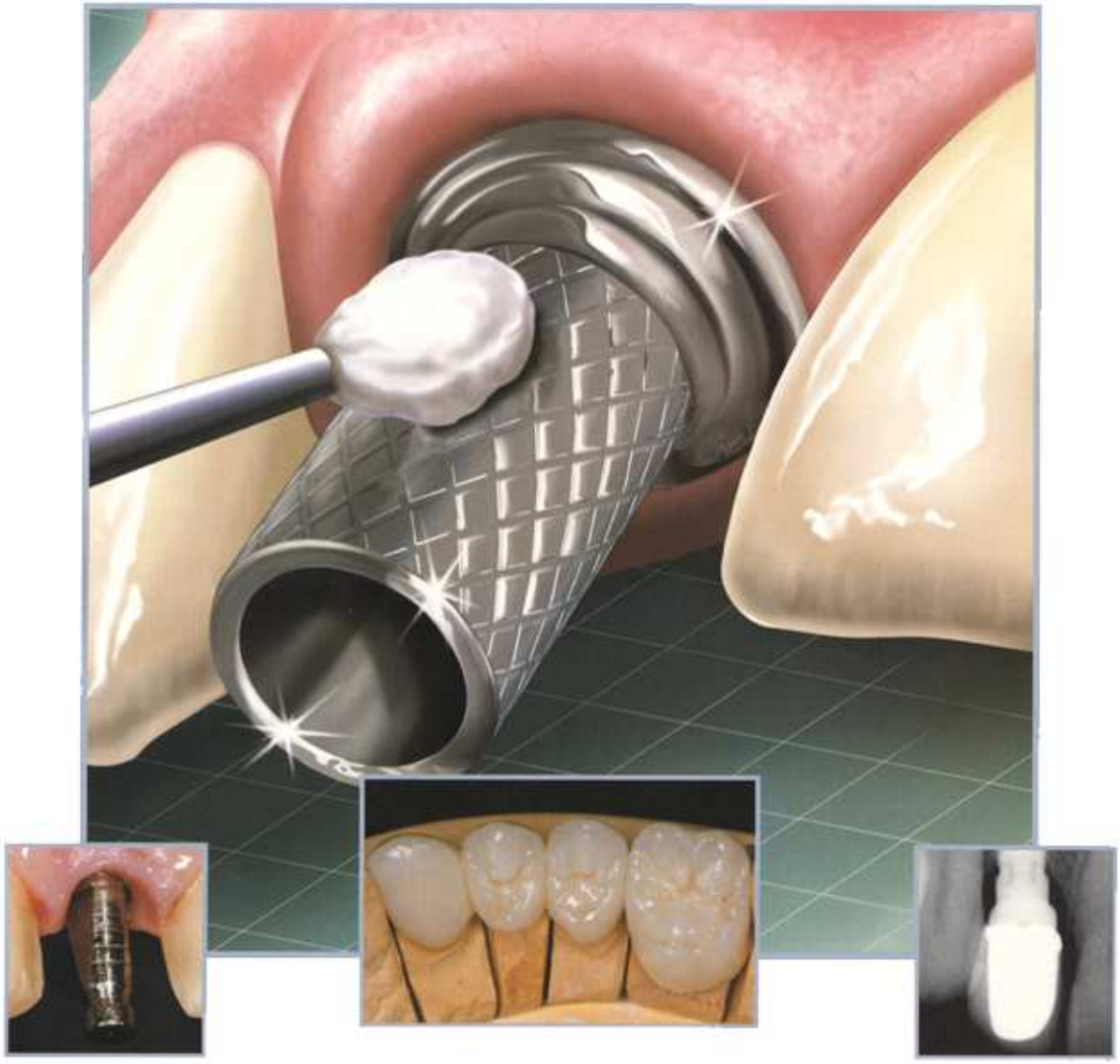

AESTHETIC CHRONICLE II

- Treatment Selection for Anterior Endodontically Involved Teeth
- Placement of an Implant-Stabilized Complete Denture
- Functional and Aesthetic Solutions for Edentulous Sites
- The Diagnostic Tracing Analysis — Visualization by the Numbers

A Montage Media Publication

THE DIAGNOSTIC TRACING ANALYSIS — VISUALIZATION BY THE NUMBERS

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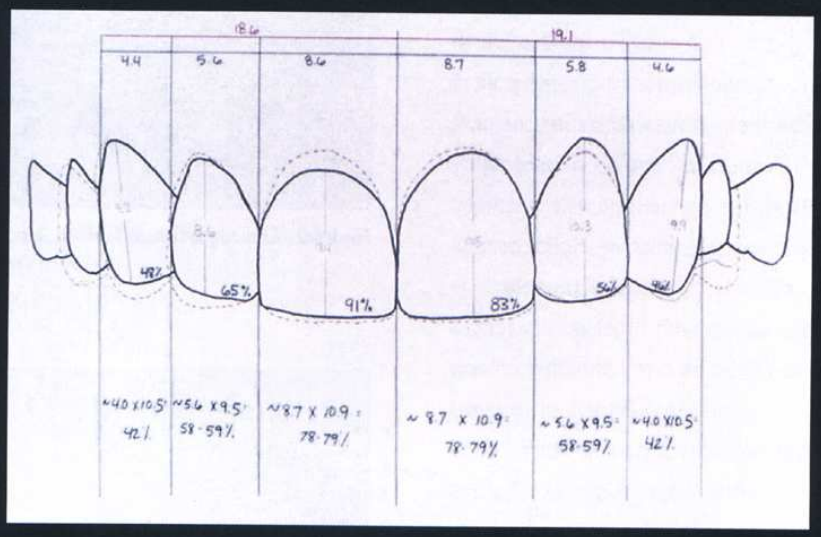

Aesthetic treatment planning for dentistry often involves nontraditional methods of extracting information from clinical data. Being able to visualize the final treatment solution accurately in the initial diagnostic stages of treatment planning benefits both the clinician and patient. For the dentist it helps define the final treatment plan, allows for identification of unique nuances of the particular case, and contributes to the ease of fabrication of three-dimensional treatment aids. It is also important for the dentist to verify that the patient's expectations of treatment are consistent with clinical reality. This article will describe the diagnostic tracing analysis, a tool that can help the visualization process.

Learning Objectives:

This article describes a novel approach to preoperative treatment planning to ensure restorative success. Upon reading this article, the reader:

- Will be able to construct a diagnostic tracing from a projected image.
- Should be able to apply smile design mathematical calculations to help visualize the best potential outcome for a smile design case.
- Will recognize how the diagnostic tracing analysis can help in treatment planning, patient education, and fabrication of the diagnostic waxup.

Key Words: tracing, smile design, treatment planning, diagnostic aid

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As the diagnostic process for comprehensive treatment planning unfolds, there comes a time when visualization of the finished case is not only beneficial, but also necessary to identify what is needed to achieve treatment objectives. During the examination, a great deal of information is gathered, including radiographs and clinical data that allow a formulation of treatment planning for functional dentistry. If the patient wishes to address aesthetic issues, a variety of nontraditional tools can be used to develop a satisfactory treatment plan that addresses the patient's aesthetic desires. Photographic images, whether digital or analog, are extremely helpful in guiding the process.

In a landscape replete with high technology, it becomes very easy to gather an array of high-cost tools to gain an idea of the patient's aesthetic objectives. Digital imagery allows the patient's photographic image to be modified in numerous ways to clarify what the patient is expecting to see when the case is finished. Problems can arise, however, when the proposed pretreatment image simulation cannot be realized in the final outcome. Often the problem has its origin in the digital creative license being extended too far and offering only a two-dimensional rendition of a three-dimensional treatment solution. The difference can create an unhappy patient and a damaged patient/clinician relationship.

Figure 1. Preoperative retracted view of patient used to fabricate initial tracing for the diagnostic tracing analysis (DTA).

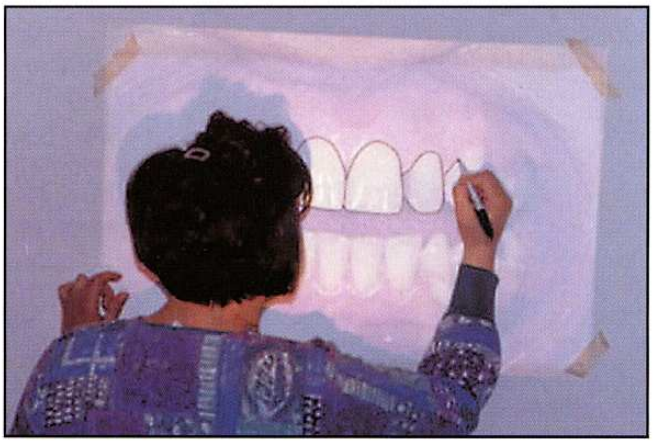

Figure 2. Clinical assistant tracing image magnified exactly 10×.

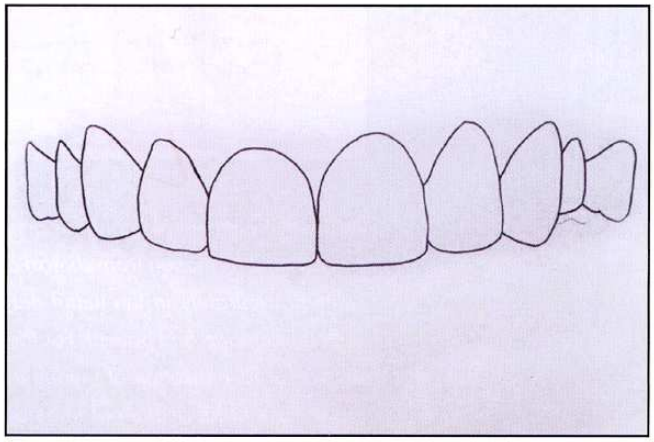

Figure 3. Illustration demonstrates the completed maxillary arch tracing performed by the staff.

Intraoral mock-ups with composite resin can be very helpful in allowing the patient to visualize some of the changes that can be achieved. While areas of clinical difficulty can be identified and communicated so that expectations are more closely linked to reality, there is great difficulty in creating a precise prototype of the possible final result intraorally. In cases with protrusive situations or severe crowding, this method can be impossible to utilize.

The validity of accurate communication with the patient to verify the patient's expectations and to compare them to the realities of clinical possibilities have been documented in the literature. The teachings of Dawson have long espoused the benefits of

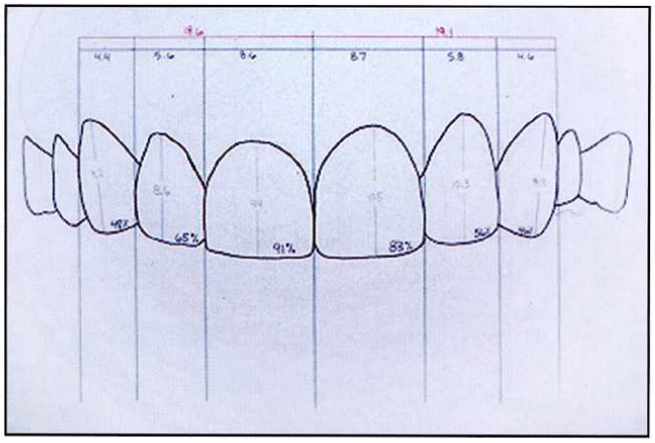

Figure 4. Once the image is traced, the width-to-height ratios of the incisors are determined as percentages.

Figure 5. Visual determinations can be made regarding the harmony of the patient's face and smile presentation.

doing dentistry in a minimum of three phases: first in wax, second in acrylic as provisional restorations, and lastly in the desired, permanent dental restorative material.[1] The diagnostic waxup can be used as a three-dimensional visual aid for the patient and clinician, as well as serving as the prototype for the acrylic provisional restorations.[2] Having a diagnostic waxup completed for treatment planning and consultation can be time consuming and/or costly depending on whether the dentist performs the waxup or has it created by the laboratory technician. Unless the patient requests the diagnostic waxup for visualization, having the diagnostic waxup completed after the patient has agreed upon treatment would be preferred.

This article introduces the diagnostic tracing analysis (DTA) as a method of providing important treatment information. When completed, the DTA can be a very helpful aid in definitive treatment planning, laboratory communication, and patient education.

The Tracing

For consistency in photographic composition, this author has long utilized the photographic series set forth by the American Academy of Cosmetic Dentistry Guide to Accreditation Photography.[3] For the purpose of fabricating the initial tracing, a 1:2 magnification view is captured directly in front of the patient with cheek retractors (Figure 1). The photograph is taken to evaluate the horizontal and vertical planes of reference. The patient maintains a slightly open mouth so the photograph can capture the incisal edges of the teeth in detail. The objective is to project an image of the dentition onto a plain piece of easel paper. For the purpose of this article, a projected slide image will be utilized. If the shot was taken as a digital image, a slide would have to be fabricated from the digital image or a liquid crystal display (LCD) projector utilized.

The image is projected onto the easel paper by a magnification factor of ten (eg, if the maxillary right central incisor is 10 mm in length, the projected image

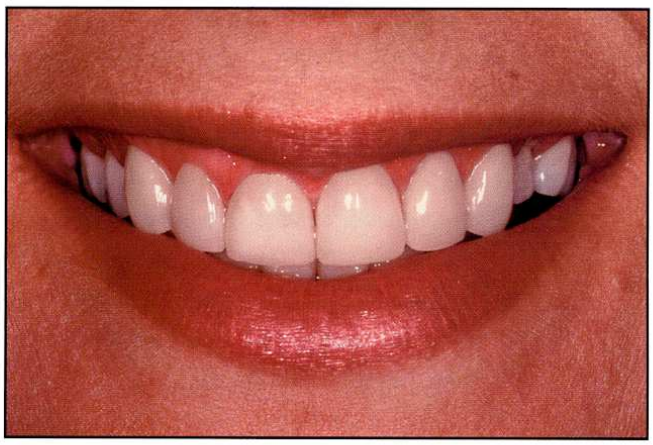

Figure 6. Preoperative maxillary view of the patient's smile. Note the lack of harmony among the hard and soft tissues.

will make this incisor exactly 10 cm when measured on the paper) (Figure 2). Once the assistant has calibrated the image size, a complete tracing of the outlines of each tooth of the maxillary arch in the smile is accomplished (Figure 3). After completing the tracing, the assistant then measures the following distances:

1) The length and width of each anterior tooth.
2) The distance from the midline to the distal of the cuspid, bilaterally.
3) The width-to-height ratios of the incisors, as a percentage (Figure 4).

The Analysis

From this tracing, the dentist can study its presentation to determine various visual data. Smile design principles may be employed to construct a corrected illustration of how the patient's smile can be improved.[4,5] While studying the 1:10 magnification frontal view, visual determinations can be made regarding the harmony of the patient's face and smile presentation (Figure 5). Questions to be asked include:

1) Is the dental smile midline correct in placement and angulation, and in harmony with the face?[6]
2) Is the distance from the midline to the distal visual extent of the cuspids bilaterally symmetrical?
3) Do teeth positions allow restorative changes if warranted or is pre-restorative orthodontic treatment necessary?

Following facial analysis, smile design principles can be taken into consideration by studying the 1:2 magnification frontal view of the patient's smile (Figure 6). Presentation characteristics to be appraised include:

1) Are incisal edges in harmony with the smile line?[7]
2) Are there any facial dissymmetries that need to be considered (eg, muscle hypercontraction)?
3) In assessing the relationship of the periodontium to the lips, are there any visual disharmonies (eg, excessive gingival display)?

The dental smile design elements can then be accomplished by viewing an unimpeded image of the patient's anterior teeth (Figure 1). Remember, this is the

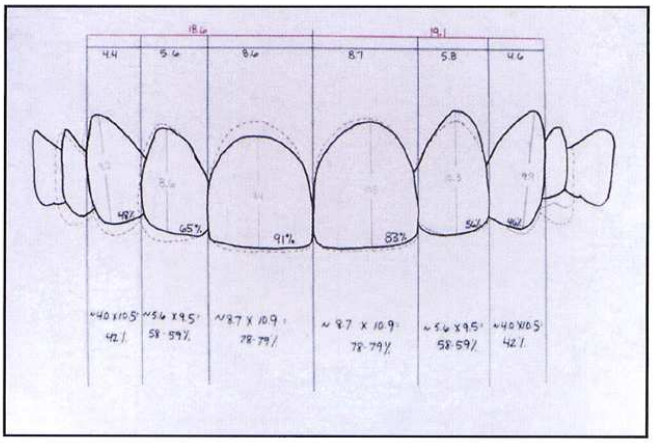

Figure 7. Illustration represents the projected aesthetic correction of the restored smile.

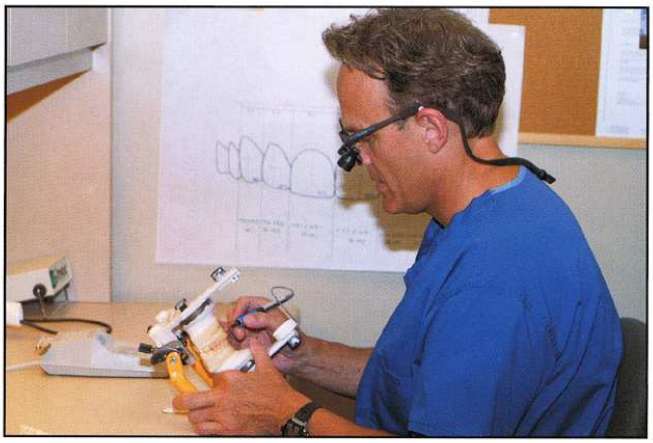

Figure 8. With the DTA as reference, the diagnostic waxup was fabricated by the clinician.

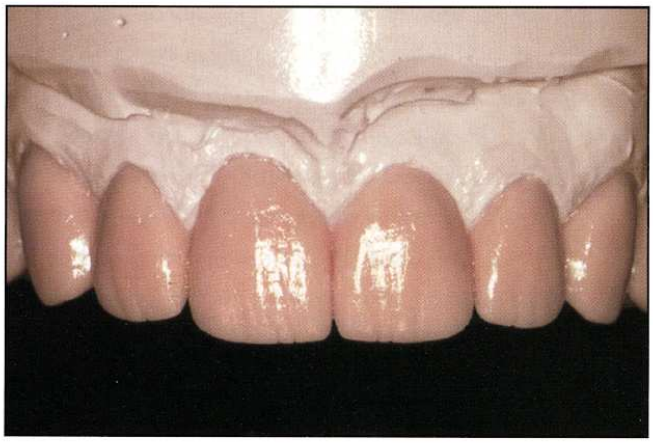

Figure 9. Diagnostic waxup of the anticipated restorative result. Note the improved gingival architecture and aesthetics.

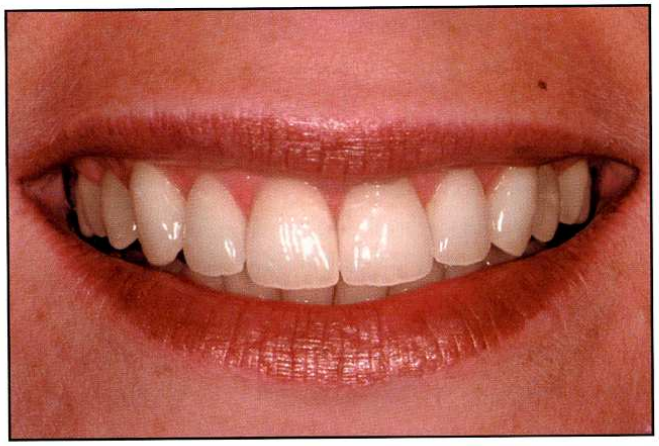

Figure 10. Postoperative appearance of the definitive restoration following concise diagnostic analysis.

Figure 11. Postoperative retracted view reflects the aesthetic enhancement achieved using the DTA process.

Figure 12. The patient was satisfied with the postoperative results following DTA analysis and subsequent restoration.

image from which the tracing is fabricated. Questions to be answered include addressing issues of central dominance and proportionality:

1) Is the width-to-height ratio of the central incisors 75% to 78%, and if not, what needs to be changed to achieve that ideal?[8]
2) Do the lateral incisors allow their height to be 1 mm to 2 mm less than the central incisors, and is the gingival architecture appropriate for a lower gingival crest height than the central incisors and the canine?
3) Are the canines positioned to accommodate proper aesthetic ideals and/or can they be made to be ideal?
4) Is the cervical-incisal tooth height bilaterally symmetrical intraorally?
5) Are the maxillary teeth proportionately balanced to one another and can central incisor dominance be established?[8,9]

When determining proportionate balance, one may use the Golden Proportions Rule (GPR) as an estimate.[10] Strict adherence to the mathematics of the GPR not only limits creativity, however, but also leads to failure in considering individual and cultural differences. Therefore the GPR should be used as an approximation, not a firm rule.

In dentistry, the number that is utilized is 1.618 and is applied as a numeric relationship to the maxillary central incisor (1.618), the lateral incisor (1.0), and the canine (.618) as viewed from a frontal perspective. It would follow that, when these relationships are presented as ratios, if three values are known, the fourth unknown factor could be calculated.

(x) Width of Central/1.618 = (y) Width of Lateral/1.0

(y) Width of Lateral/1.0 = (z) Width of Canine/.618

Therefore, one can calculate that if the width of the central incisor is known, he or she may find the width of the lateral incisor by *dividing* the width of the central by 1.618. And it follows that, if one knows the width of the lateral incisor, he or she can find the width of the canine by *multiplying* by .618. These values of width relate to the frontal view only.

To gain an estimate for tracing possible new clinical crown sizes, one need only find the potential dimensions of the central incisor (CI) and see how the calculated widths for the lateral incisor (LI) and canine (C) fit into the patient's arch dimensions. For this patient, a central incisor width of 8.5 mm yields a midline to distal of canine distance that is far too short at 16.6 mm (CI=8.5, LI=5.05, C=3.13). When a value of 9.0 mm is used for the central incisor width, the combined widths of the central, lateral, and canine are very close to the patient's midline-distal of canine presentation at 17.7 mm (CI=9.0, LI=5.4, C=3.3). For the sake of this patient's individual needs (width-to-height %), it was determined to slightly decrease the central incisor width. Due to the overcontours of the patient's presenting canine veneers, a decrease in contour was advantageous for the aesthetics of the patient's smile as well, in effect reducing the canine's hypercontours and establishing a more evenly developed buccal corridor. It was found that a central width of 8.7 mm would work well for the central if the incisor height could be 10.9 mm, making a perfect width-to-height ratio of 78%. The values for the lateral incisor and canine were calculated and traced in as the patient's individual arch size and tooth position allowed. This provided the dentist with a potential two-dimensional blueprint for the new smile (Figures 7 through 12).

Conclusion

The completed DTA can be utilized in many ways. It can help determine what treatment is necessary aesthetically to construct a treatment plan that can be further defined in terms of smile enhancement. This technique was developed to enhance definitive visualization of the contemplated treatment. This author utilized this technique to search for cases that could be completed to the ideal, thereby identifying a potential case to use for Accreditation with the American Academy of Cosmetic Dentistry. It worked well for this process because cases that were not appropriate could also be identified before the investment of considerable time and expense.

The knowledge that the dentist can obtain from visualizing the case helps identify potential problem areas and stimulates thorough communication with the dental laboratory in the diagnostic phase. As a "blueprint," the DTA can be used by the dentist and/or laboratory technician as a guide for determining potential clinical crown sizes while fabricating the diagnostic waxup. After locating a defining landmark such as the contemplated midline, the waxup can proceed simply by "waxing by the numbers."

As a patient education tool, the DTA can be utilized to help patients identify disharmonies in their smile before viewing their own images. It can help them understand why they are unhappy with their smile and how it can be changed to fulfill their treatment objectives. With this understanding comes a greater acceptance of needed treatment when considering a treatment plan solution.

A side-by-side comparison of the DTA, the diagnostic waxup, and the patient's completed dentistry demonstrate a strong level of consistency throughout the procedure. Because of this continuity, the dentist and patient can be virtually assured that the final treatment is consistent with the preoperative vision.

Acknowledgment

Portions of this presentation were adapted with permission from Sesemann MR. Utilizing diagnostic tracing analysis for smile design. The New Face of Aesthetics: The AACD Monograph. ©2004. Montage Media Corporation.

References

1. Dawson P. Evaluation, Diagnosis and Treatment of Occlusal Problems. 2nd ed. St. Louis, MO: C.V. Mosby, 1989.
2. Dawson P. The Concept of Complete Dentistry Lecture Series, 1994, The Dawson Center for Advanced Dental Study, St. Petersburg, FL.
3. Steel C, Behle C, Bellerino M, et al. A Guide to Accreditation Photography. Madison, WI, American Academy of Cosmetic Dentistry, 2002.
4. Rufenacht C. Principles of Esthetic Integration. Chicago, IL: Quintessence, 2000.
5. Blitz N, Steel C, Willhite C. Diagnosis and Treatment Evaluation in Cosmetic Dentistry — A Guide to Accreditation Criteria. Madison, WI: American Academy of Cosmetic Dentistry, 2001.
6. Kokich V, Kiyak A, Shapiro P. Comparing the perception of dentists and lay people to altered dental esthetics. J Esthet Dent 1999;11(6):311-324.
7. Rufenacht C. Fundamentals of Esthetics. Chicago, IL: Quintessence, 1990.
8. Miara P, Nathanson D, Touati B. Esthetic Dentistry and Ceramic Restorations. New York, NY: Thieme Medical Publishers, 1999.
9. Chiche G, Pinault A. Esthetics of Anterior Fixed Prosthodontics. Chicago, IL: Quintessence, 1994.
10. Levin EI. Dental esthetics and the golden proportion. J Prosthet Dent 1978;40(3):244-252.