

Success By Design: Not By Accident

By Hugh Flax, DDS

It has been over sixty years since Dr. Charles Pincus introduced us to the "Hollywood Veneers." Since that time we have been through several revolutions (and revelations) in esthetic/restorative care. Just being able to make tooth colored materials adhere to teeth was our initial goal. Soon we focused on creating a palette of colors to handle many situations for our patients (remember many of the early Rembrandt bonding products?). Eventually, our patients demanded more life like and durable creations. This led Faunce, Simonsen, Calamia, Goldstein & Garber to develop the protocol for feldspathic porcelain veneers. Fortunately, international research in dental bonding and porcelain technology allowed us to not only beautify, but also strengthen teeth. Who would have ever imagined years ago that enhancing someone's appearance could not only elevate their self image but improve their dental health as well?

Esthetic/restorative care is no longer an ethereal, magical endeavor. After years of research very sound principles can be utilized to create a "functionally esthetic" result for our patients to benefit for many years. This article will discuss some of the many techniques that can be utilized to create a predictable result. A case will be presented to lend support to the "smile design" process.

SMILE DESIGN

Historically, beauty has been philosophically debated since the days of ancient Greeks. The literature has often tried to combine artistic expression and mathematical proportions creating subjective/objective diagnostic modalities.^{1,2} Charles Darwin said it best: "Beauty is the association of many complex associations." In order to create a natural, healthy result, a multidisciplinary approach is often needed to blend restorative, periodontal, orthodontic, and occasionally plastic surgical treatment disciplines. Spear's facially generated viewpoint³ gives a framework to design more than just teeth but to take it several steps further — "change someone's life."

Facial Analysis

Of course the frontal view is the area we look at most frequently. Harmony must exist between the incisal line, interpupillary line, and facial midline. Disharmony may be a result of one or more irregularities in the occlusal, incisal, or gingival planes. Naturally by "cause and effect," correcting these underlying problems of tilt and/or wear will optimize esthetics of soft and tissues.⁴

Dividing the face up into the classical upper, middle, and lower thirds is quite useful in dental rehabilitation. Bite collapse and wear cases ("pathologic aging")

tend to show a collapse of the lower division. As suggested by Rufenacht, there should be a 2:1 ratio between the areas of the tip of the lower lip to the menton and the subnasale to the upper lip. Furthermore, "physiologic aging" of muscle and skin tone especially after 35 years of age, tends to worsen both this abnormal facial balance and the exposure of teeth during a smile. Esthetic restorative care can do much to reestablish harmony and youthfulness to someone's face.⁴

The anatomy of the lips, which frame the teeth, can profoundly affect any rehabilitation of a smile. Factors of shape, fullness, competence, symmetry, and commissural position are beyond the scope of this article. However, it must be noted that the lip profile (and function) will be profoundly affected by arch height, tooth position, and labial inclination.⁶ Many orthodontic standards (such as Ricketts, Steiner, and Burstone) are useful diagnostically as well as cephalometric reference planes. In addition, the lateral postural head position reveals the straightness/concavity or convexity of the profile and its relationship with the lip position and how they relate to the rest of the face (chin, nose, and forehead). It is essential to evaluate these landmarks in giving your patients a long term esthetically pleasing result.⁷

Dental Analysis

The pathway to a perfect smile obviously must lead to the myriad of factors involving the teeth.



FIGURE 1 Full face preoperative view shows balanced facial features.

There are many books and lengthy articles that have been devoted to this subject (and many are referenced for the reader^{1,2,3,4}). The most important reference points are:

Dental midline — Try to match to the facial midline while using the incisal papilla as a landmark; it must be perpendicular to interpupillary plane.

Interpupillary/occlusal planes — Should be parallel to each other; if not, there may be a skeletal abnormality.

Smile line — The plane of the incisal edges approximates the curve of the lower lip; convexity creates youthfulness.

Axial inclinations — Should parallel each other and “point to the belly button”⁵; harmony creates a slenderizing effect on the

face and a front-back progression.

Proportionality — Mathematical “Golden Proportions” established by Pythagorus to help create relationships between the centrals, laterals, and canines; Tooth proportion (width to length ratio of the central incisors) is described by Chiche to be pleasing at 75 – 80%.

Buccal corridor (negative space) — The vestibular space between the maxillary posterior teeth and the inner cheek should be minimized to “broaden the smile.”

Dental profile — Contours of labial surfaces should have some parallelism with adjacent structures and will make the smile more pleasing. Dawson’s Esthetic Checklist is valuable at visualizing and communicating this.

Dental morphology — Texture,



FIGURE 2 Appearance compromised by gumminess, diastemas, and poor axial inclinations.



FIGURE 3 Intraoral view shows unnatural occlusal contours on #11, #21 & #28.



FIGURE 4 Preoperative models mounted on Denar Combi articulator.



FIGURE 5 Completed diagnostic wax-up (red mark indicates what patient wanted corrected).



FIGURE 6 Periodontal surgical stent to guide “gum lift.”

outline form, embrasure spaces, contact points, and color give natural character and three dimensionality to the teeth. A progression of increasing size of the incisal embrasure spaces should be seen.

Gingival Analysis

Just like the matting affects the display of a framed picture, the gingiva can make or break the appearance of the teeth. Several factors contribute to a healthy, esthetic result.

Morphology — should have a matte, “orange peel” texture and pink color (depending also on racial pigmentation) that is firm and creates a papilla that fills the embrasure between the teeth.

Symmetry — should be excessively displayed with the upper gingival margins following the

curvature of the upper lip (assuming it is symmetrical). Therefore, the framework or shape and length around the centrals should match each other with the lateral incisalgingival height approximately or slightly shorter than the adjacent teeth.

Labial contour — should approximate the correctly placed labial tooth surfaces; collapse of gingival/alveolar structures by tooth loss or occlusal/bacterial pathology must be corrected to create optimal health and esthetics.¹²

This is where a synergy of knowledge and techniques requires multidisciplinary care with a very high level of communication. Visualizing the final result and then “landscaping” the surrounding soft and hard tissues is needed to optimize this very complex task.

MAKING SMILES BUILT TO LAST

If you were to think about the many “great wonders of the world” (e.g. the Sphinx and its neighboring Pyramids), the common thread is that they not only are magnificent to look at, but they have been enduring as well. Form and function were blended together to create a masterpiece.

Ethically we owe our patients that same approach to rehabilitating their health and appearance. This complete dental focus was well articulated by Dawson¹³:

Optimum oral health: eliminating bacterial and stress related deterioration especially allowing for thorough cleansability.

Anatomic harmony: of the parts of the masticatory system (muscles, TMJ, teeth, periodontium, labio/lingual soft tissue); all fit together.



FIGURE 7 One month post surgical view; note diastema closures have maintained papillae.



FIGURE 9 Luxatemp (Zenith) esthetic mockup to verify wax-up.



FIGURE 8 Siltec putty (Ivoclar) matrix of diagnostic blueprint.

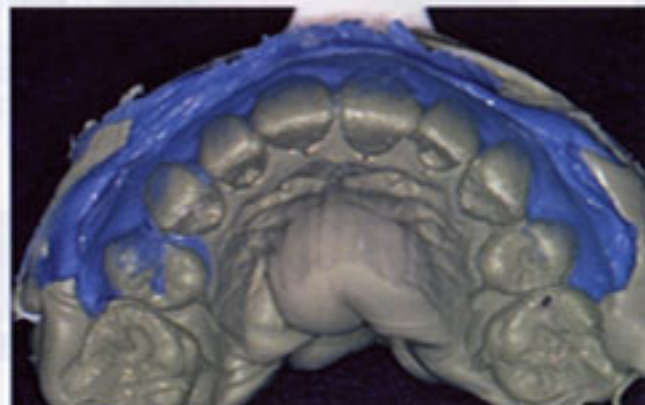


FIGURE 10 Double arch impression to preserve mockup contours.

Functional harmony: multiple uses of the mouth for chewing, speaking, and drinking (among others) requires bioengineering ingenuity to coordinate all of the oral parts.

Occlusal stability: balancing all structures to resist vertical and horizontal forces to maintain comfort and structural integrity/longevity. This requires incredible coordination of proprioception between tissues (hard/soft) and antagonistic muscular harmony.

Taking this a step further, in 1966 Pound described the mandible as an "inverted tripod" whose three legs are the two condyles and the anterior teeth. In addition, Schuyler, stated that these are the same three key fac-

tors in oral rehabilitation. All must be in harmony for the tripod to be stable. Designing this protocol into our esthetic rejuvenations will give us the durability we are looking for. According to Pankey-Mann-Schuyler¹¹ the guidemarks for a healthy, stable occlusion are:

- Comfortable muscles
- Stable, loadable TMJ's in centric relation
- The maximum number of stable, equal vertical contacts between arches when the mandible is in centric relation
- Smooth, comfortable dynamic interplay between the upper/lower anterior teeth that is guiding the lower jaw so that posterior teeth

are discluded in working, balancing, and protrusive movements

- No chipping or movement of teeth

Using this simple road map, most any occlusal problem can be solved in an orderly fashion. Even better, with the introduction of other technologies, these goals can provide a foundation and a standard to compare breakthroughs in care.

COMMUNICATE A BLUEPRINT

In order to solve multidisciplinary or even simple problems for our patients we must take on the attitude that we are the "architects" for their destiny. No responsible architect would design and execute without creating a "blue-



FIGURE 11 Radiosurgical modification of gingival collars enhances esthetics.



FIGURE 12 Stratos (Ivoclar) facebow transfer communicates intraoral/extraoral landmarks.



FIGURE 13 Macro 5 photo (Polaroid) quickly communicates stickbite measurement.

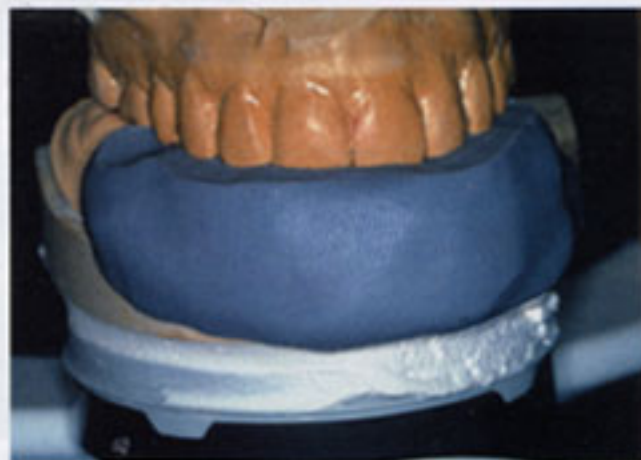


FIGURE 14 Siltec labial-lingual matrix preserves contours of mounted provisional model.

print" of the final result. Furthermore, successful esthetic, restorative rehabilitation requires a team involving the patient, the restorative dentist, designated specialist and the laboratory technician/artist. By thoroughly communicating the patient's desires and expectations through the blueprint and then following the plan exactly, frustration and costly errors can be avoided. Just as important, more excitement and satisfaction will be experienced by all involved.



FIGURE 15 Facial features more comfortable after rehabilitation.

Esthetic dentistry demands more "audience participation" than simple restorative care. Going beyond the radiographs and mounted models is needed to be able to understand and evaluate esthetic beliefs (e.g. Do they want a natural smile or the Hollywood/media style?). Also, determining a patient's understanding of physical and/or restorative limitations is important. "Ultimately the patient is always right." Sometimes if their goals are unrealistic, it is best not to begin treatment.¹²

While interviewing the patient, photographs are the best way to open up the dialogue of what concerns and goals are to be considered. Fortunately, technology has brought us digital imaging and even more simply, the Polaroid Macro 5 images. These can provide quick and easy information for all members of the team. Also, it can create excitement for the patient of what "might be possible."

The communication tool that is most realistic and most accurate (if properly done) has been the three dimensional wax-up on properly mounted diagnostic models. At this point, the lab technician can provide input collaboratively. Furthermore, if incisal edge and buccal corridor positions

are provided (e.g. via a flowable resin mockup and impression), it can be determined how many teeth may need attention or if the vertical dimension will need to be altered. It creates an extraoral method of communicating the "vision" for the final result. This will help get everyone on the team "up to speed." Additionally, it will reinforce implications of needed treatment and reinforce the benefits for each step.

Over the years, we have found the above technique to be useful for most everyone, however some patients find it hard to visualize themselves just by observing the wax-up. Intraorally "mocking up the wax-up" using a Siltec putty matrix of the wax-up and Luxatemp created a whole new understanding for the team.^{10,13} Most importantly, the patient could get a more personal feel for the anticipated result. This allowed them to give us better feedback without anesthetic and keep involved with the design process. As an extra benefit we could immediately fine tune our direction about many aspects of the case. Instead of "prepping and praying" we could now evaluate and modify incisal edge position, incisal plane/smile curvature, gingival position, negative space elimination, and occlusion. This saves time making provisionals



FIGURE 16 Beautiful porcelain restorations and gums add warmth and vitality to smile.



FIGURE 17 Healthy gingival tissues and occlusal contours bring harmony and stability to patients' prognosis.

because we immediately make a double arch impression of the approved mockup. In general, this mockup will work for additive or lengthening procedures. Reductive or straightening treatments only allow for visualizing the wax-up.

Communicating the results of the provisional "prototype" restorations is absolutely essential to the whole process. Giving the patient a chance to "test drive" the esthetics and function allows them to critically evaluate their new appearance and ability to chew, speak, swallow, and kiss, etc. Also, making modifications on lip support and anterior guidance allows us to provide a higher level of predictability and give the lab technician a blueprint for the definitive restorations. There are several ways of confidently communicating this information. Visually, a polyvinylsiloxane impression with accurate bites and facebow will give a three dimensional tool to duplicating exact contours (especially if a labioincisal matrix and anterior guide table are used). In addition, photos (extraoral and intraoral) of frontal and lateral views give the technician extra input beyond the models. A "stickbite" will further verify the interpupillary plane. Lastly, an Esthetic Checklist (developed by Dawson) is an excellent means for communicating additional guidelines to the lab artist as well as verifying instructions have been followed.

Color, of course, is always an important issue in esthetics. Volumes have been written about shade communication and this is certainly beyond the scope of this article. However, using picture books of natural teeth is useful for eliciting patient input before and after provisionalization. Also, sending photos (with shade tabs) of preparation and provisional colors is very helpful.

CASE PRESENTATION

A healthy 41-year-old patient (Figs. 1-3) presented for enhancement of her smile and to get her mouth on the correct path for health. She wanted to create a more uniform and brighter smile as well as close the spaces between her teeth. Her previous dental care had been frustrating due to numerous emergency root canals although she had seen her dentist regularly. Furthermore, her inquiries into cosmetic care had been handled with a sarcastic, non-informative attitude by

in proportion. However, the gum tissues were not balanced with the teeth which had a displeasing width/length ratio far above 80%. Also, the axial inclinations of #12 & #22 were tilting distally instead of towards the midline. Of course, the color and spaces were unesthetic. Solving the "gummy smile" and slenderizing the appearance of #12 - 22 were the esthetic challenges to overcome.

Working with our periodontist we developed a predictable game plan of doing a "gum lift" to create

Giving the patient a chance to "test drive" the esthetics and function allows them (and their significant others) to critically evaluate their new appearance and ability to chew, speak, swallow, and kiss, etc.

the previous practitioner. Lastly, she had recently noticed increasing tenderness in her jaw muscles upon awakening.

A full set of radiographs, photos, mounted diagnostic models and periodontal and occlusal charting were assembled. Furthermore, since the patient was an accountant, (i.e. very interested in knowing the details) she was excited that we could actually blueprint her therapy (Figs. 4 & 5). During her exam, we found generalized periodontal inflammation and localized bone loss (especially at the mesials of teeth #12 & #22) partly due to defective restorations but also due to occlusal trauma associated with parafunction and an unstable occlusal scheme related to no anterior stops.

Esthetically, the patient's facial and lip features were acceptably

a better gingival framework in her upper esthetic zone (teeth #15 - #25). Prior to this we would initiate occlusal therapy and close the anterior diastemas to provide scaffolding for the papillae and avoid any "black holes" at the conclusion to treatment.¹⁴ Prior to surgery and scaling procedures, we would also provide a "surgical guide" to give the periodontist a reference for sculpting the tissue (Fig. 6) Please note that tooth #31 would have a semilunar gingival graft. Lower implant treatment was to be "phased in" when maxillary care was complete.

The patient was allowed to heal for approximately 8 weeks during which equilibration and home whitening care was provided (Fig. 7). Also, a mockup appointment allowed us to fine tune our final wax-up (Figs. 8 - 9) with the patient and determined

FACTORY DIRECT Dental Cabinets



KNOW THE FACTS!

• Direct Savings • Quality Dental Cabinets from LogArt Inc.

WE OFFER:

- High quality commercial grade cabinets
 - Versatile designs for function & aesthetics
- A comprehensive selection of styles & types
 - Direct to you savings with our in-house design & manufacturing
- Priced so competitive we encourage you to compare
 - Financing available

DOCTOR APPROVED:

"Proficient, accurate and a job well done."

Garry Chuback D.D.S.

"I'm very happy with the work LogArt did."

Dr. Avadalla

"Quality work, with great service, follow-up and below market costs, are what has kept me putting LogArt cabinets into my offices."

Dr. Mark Pasternak

Can you afford not to compare?

KNOW THE FACTS!

Call today for a **FREE**
consultation & estimate



CUSTOM DENTAL
CABINETS

300B Supertest Road, Units 4-5
Downsview, Ontario M3J 2M2

Tel: (416) 665-1147

Fax: (416) 665-1688

that some slight gingival sculpting was needed at the time of preparation. A double arch impression was taken for preserving the mockup (Fig. 10).

Electrosurgery was performed at the time of preparation using the Ellman #118 radiosurgery tip (Fig. 11). After the patient tested her provisionals, appearance and occlusion was perfected to patient specifications. A PVS impression, a new facebow record (the Stratos system), and Polaroid photos (including the "stick bite" registration) were gathered for the lab technician (Figs. 12 & 13). An Esthetic Checklist and shade map were also sent to the lab. The patient was given detailed home-care instructions.

All porcelain Empress I restorations were made in the lab using an labioincisal matrix (Fig. 14) of the mounted provisionals. This type of quality control is the difference between having ordinary and extraordinary results. All restorations fit beautifully and were cemented with Syntac and Variolink II translucent cement while using the "two by two method" under rubber dam isolation.¹⁶ The tissues were cleansed and the patient has healed well and is now wearing an upper Bruxese appliance to protect her new smile. She is ecstatic and grateful about her new appearance and receives compliments about her natural smile (Figs. 15-17). She is looking forward to beginning implant care next year.

CONCLUSION

As this article demonstrates, esthetic enhancement requires looking at the larger picture (not just the teeth) and paying attention to the esthetic, functional, and biological details. This requires teamwork supported by verbal and visual communication with the patient, specialist, and technician. By laying out an architectural plan, we were free

to focus on creating a very satisfying artistic result. **OH**

ACKNOWLEDGEMENTS

The author mentions his gratitude to Dr. David Pumphrey and his team for beautifully transforming this patient's gingival health and appearance. The author also appreciates the artistry and precision of Wayne Payne C.D.T. of San Clemente, CA, who allowed us to make our vision a reality.

Lastly, the author dedicates this article to his daughters Lindsey and Brenna, and to his wife, Robyn as she wins her battle with lymphoma.

Dr. Hugh Flax is in private practice in Atlanta, GA. He is an Accredited member of the American Academy of Cosmetic Dentistry. In 1983, he graduated Phi Beta Kappa from Emory University School of Dentistry.

Oral Health welcomes this original article.

REFERENCES

1. Nixon, RL. In: Ruleracht, CR. *Fundamentals of Esthetics*. Quintessence Publishing, 1990: 329
2. Rifkin, PG. *Facial Analysis: A Comprehensive Approach to Treatment Planning in Aesthetic Dentistry*. *Pract Periodont Aesthet Dent* 2000; 12(9): 865-871
3. Chiche, G. et al. *Esthetics of Anterior Fixed Prosthodontics*. Chicago: Quintessence Publishing, 1994
4. Ruleracht, CR. Et al. *Fundamentals of Esthetics*. Chicago: Quintessence Publishing, 1990.
5. Spear, F. *Facially Generated Treatment Planning: A Restorative Viewpoint*. *Amer. Acad. of Cosm. Dentistry Annual Meeting*, Orlando, FL, 1995
6. Davis, N. *Lips and Smiles*. *American Academy of Cosm. Dentistry Annual Meeting*, San Antonio, TX, 1999.
7. Morley, J. *Smile Design Terminology*. *Dentistry Today*. June, 1996: 70
8. Lombardi, PE. *The Principles of Visual Perception and Their Clinical Application to Denture Esthetics*. *J Prosthet Dent*, 1973; 29:358-381.
9. Goldstein, PE. *Esthetics in Dentistry*. Philadelphia: Lippincott, 1976.
10. Hombrook, D. *Advanced Smile Design*. PAC Live Advanced Functional Course, October 12, 2000.
11. Dawson PE. *Evaluation, Diagnosis and Treatment of Occlusal Problems (2ndEd.)*. St. Louis: Mosby, 1989 pp. 1-13, 261-263, 318, 347, 350-351.
12. Garber DA, Rosenberg ES. *The Edentulous Ridge in Fixed Prosthodontics*. *Compend Contin Educ Dent* 1981; 2:212-233.
13. Marzola, R. et al. *The Science of Communicating the Art of Esthetic Dentistry. Part I: Patient - Dentist - Patient Communication*. *J Esthet Dent* 2000; 12: 131-133.
14. Tamow, DP et al. *The Effect of the Distance from the Contact Point to the Crest of Bone on the Presence or Absence of the Interproximal Dental Papilla*. *J Periodontol* 1992; 63 (12) 995-996.