Periodontal Microsurgery
Macroesthetics
Orthodontics

CDA

JOURNAL OF THE CALIFORNIA DENTAL ASSOCIATION VOL 30 NO 11

November 2002

Oral Facial Esthetics

Cherilyn G. Sheets, DDS
Jacinthe M. Paquette, DDS

OF THE CALIFORNIA DENTAL ASSOCIATION
Journal
CDA Journal
Volume 30, Number 11
NOVEMBER 2002

DEPARTMENTS

FEATURES

CDA JOURNAL, VOL 30, Nº11

The "New" CDA

JACK F. CONLEY, DDS

November is an important month in the world of the California Dental Association. For one thing, it heralds the end of one administrative year for association leadership, and with the fall of the gavel marking the conclusion of the House of Delegates on Nov. 24, it marks the beginning of CDA's year 2003.

Pending approval and ratification actions by the House, achievements during the year 2002 offer strong evidence that a "new" CDA has been evolving. Those achievements were apparent to this observer during the fall session of the CDA Board of Trustees. Let us explain.

During our many years of watching the governance process up close, we have always seen a commitment to developing and approving programs or benefits for members and providing leadership on legislative and regulatory issues of importance to members. The difference between the past and the present is noticed not only in the level of activity, but also the quality of the accomplishments. The recent Board meeting required the trustees to review and approve a staggering number of new programs and initiatives in addition to the usual agenda of issues, programs, and reports. Instead of merely establishing policies or resolving issues or controversies, which usually commands the majority of the board's focus, much of the board's attention was spent reviewing new association programs and initiatives for the membership. Some of the trustees who were completing six-year terms of eligible service to CDA remarked about the progressive changes they had experienced during their tenure.

What is driving this change? Notably, the activities of the applied strategic planning process that have been discussed in CDA publications in the past few years are reaching implementation status. It was significant that the proposed initiatives, programs, or improved membership recruitment and application procedures (to name just a few) were viewed as having such potential value to the member that there was very limited debate. A packed agenda proceeded smoothly.

In our view, the most exciting program discussed, which offers the best view of the new CDA, is the Learning Center Initiative. As it is at the heart of the change we see enveloping this association, we believe it deserves some discussion here. The committee that developed the plan included chair Dr. Glenn Clark, professor at the University of California, Los Angeles; Dr. Carol Summerhays; Dr. George Maranon; and longtime CDA staff members Judith Babcock, director of the Division of Professional Development and Relations, and Ann Milar, manager of the Learning Center.

The goal within the strategic plan that led to the development of the Learning Center concept is "The dental community will look to CDA as the premier source of

CDA JOURNAL, VOL 30, Nº11

professional development opportunities." Not surprisingly, the mission of the Learning Center is to become that "premier source" of development opportunities. There are five primary areas where professional development will be focused, which include online learning, conferences and seminars, a leadership institute, corporate staff development, and allied dental health personnel education.

It is important to point out that online learning, conferences, and seminars are activities that will require collaboration with component dental societies and California's five schools of dentistry. With appropriate attention to development and design of these collaborative activities, all entities will benefit from a relationship that is noncompetitive, resulting in high-quality courses with reduced expenses.

From our perspective, perhaps the most interesting program (with greatest potential value to organized dentistry) to emerge from the center will be the Leadership Institute. Those who have volunteered service in organized dentistry have continually noticed the need for leadership development. The hit-or-miss approach of the various isolated leadership training programs has often failed to prepare volunteers to reach a level of effective contribution in a timely fashion. Improved leadership training should enhance volunteer experience, thereby increasing esprit de corps. An improved experience can lead to an increased retention rate within volunteer ranks. With greater experience, the association should benefit from improved leadership skills from the leadership corps at both the local and state level.

These comments should not be interpreted to mean that we are critical of current top leadership. The retention, and the commitment and performance at that level have been impressive. What organized dentistry has really needed for quite some time is a much broader base of well-qualified volunteers to serve on the various committees of the association. We have often heard the complaint that it takes too many years of experience in local and state activities for an individual to be considered qualified by one's peers to serve in positions of higher responsibility. Some individuals possess leadership skills and commitment without lengthy experience. Perhaps more of these individuals will receive an appropriate orientation and fine-tuning of their skills through Leadership Institute programs and be identified on a fast-track basis as qualified and ready to serve in important leadership positions.

The other part of the future success equation for the California Dental Association is staff. The Learning Center will also have oversight for corporate staff development. Over the years, CDA has been fortunate to attract many fine staff people, some of whom have maintained long-term commitment to the association and to organized dentistry. Members who are not familiar with the association and its organization and operation may not realize the importance of well-qualified staff in the day-to-day representation of our interests outside of the CDA workplace. Staff members represent us at various meetings such as the Dental Board and the Committee on Dental Auxiliaries. Others represent us in the ongoing activities of the legislative arena in Sacramento.

While those engaged in these positions today are extremely well-qualified and represent us well, it is important that the association have programs that will help finesse representation and presentation skills of existing staff and provide training for those who might serve in those positions in the future.

Together, volunteers and staff make up the team that represents not only the present, but also the future of the profession. The benefits that will arise from the Learning Center design should ensure a more proactive and effective organization in the future. We applaud the designers and look forward to the accomplishments of the new CDA.

CDA JOURNAL, VOL 30, Nº11

Prevention Task Force Backs Fluoridation, Sealants

By Collette Knittel

An oral health report issued in July by the Task Force on Community Preventive Services strongly recommends school-based dental sealant programs and community water fluoridation to prevent tooth decay, particularly among low-income families without private dental care and families who are at highest risk for oral health problems.

The task force is a 15-member nonfederal group of health experts convened by the Department of Health and Human Services and supported by the Centers for Disease Control and Prevention. Its role is to address a variety of topics important to communities, public health agencies, and health care systems.

"Two community-based interventions, applying dental sealants in a school setting and fluoridating drinking water, are both beneficial as well as equitable in preventing tooth decay among our most vulnerable populations," said CDC Director Julie Gerberding, MD, MPH. "If more communities would implement these programs, we could save many children from needless pain and suffering and save the nation millions of dollars in dental care costs."

According to the CDC, costs to treat severe cases of tooth decay for some children can be as high as $2,000 per child.

In examining the effectiveness of school-based dental sealant programs, the task force found that there was typically a 60 percent decrease in tooth decay on the occlusal surfaces of posterior teeth after sealant application. Currently, only 23 percent of 8-year-old children in the United States have dental sealants. The prevalence is far lower for children who may have a higher decay risk; only 3 percent of low-income children and only 11 percent of African-American children have received a dental sealant.

Another key finding of the task force was the overall benefit of community water fluoridation in preventing tooth decay. The fluoridation process, which involves the adjustment of the natural fluoride level in a community's water system to the optimal level of about 1 part per million, has been shown to be a safe, effective, and inexpensive measure in preventing tooth decay. Tooth decay typically decreased by 30 percent to 50 percent after starting or continuing water fluoridation. These decreases were seen in communities with varying levels of decay and among children of all socioeconomic levels. Although community water fluoridation was introduced more than 50 years ago, about 100 million Americans still do not have fluoride in their drinking water.

While largely preventable, tooth decay continues to affect the majority of Americans, with many in low-income and certain ethnic and racial groups experiencing higher rates of decay. By age 5, 60 percent of all children have had tooth decay, and more than 80 percent of 18-year-olds have experienced decay. Much of the caries in children remains untreated. Among 6- to 8-year-olds, 43 percent of Hispanic children, 36 percent of African-American children, and 26 percent of white children have untreated tooth decay.

"There is considerable opportunity for communities to increase their use of these proven measures to decrease tooth decay for both children and adults," said William Maas, DDS, who directs CDC's oral health program. "At CDC, we recently made cooperative agreement awards to several states to develop additional school sealant programs and to promote adoption of water fluoridation in communities."

The supplement "Interventions to Prevent Dental Caries, Oral and Pharyngeal Cancers, and Sports-Related Craniofacial Injuries: Systematic Reviews of Evidence, Recommendations from the Task Force on Community Preventive Services, and Expert Commentary" is available on the Community Guide's Web site, www.thecommunityguide.org/oral/.

New Book Addresses Abuse and Neglect Issues

A new book is available to help health care professionals learn to create a system for preventing, identifying, and dealing with abuse and neglect.

Joint Commission Resources has released How to Recognize Abuse and Neglect, which offers an overview of abuse and neglect issues, including common myths and misconceptions, statistics, relevant Joint Commission standards, strategies, and resources.

How to Recognize Abuse and Neglect offers real-life examples, strategies, and case studies to help health care professionals deal with abuse and neglect issues.

The book is designed for a broad spectrum of health care settings, including hospitals and ambulatory, long-term care, assisted living, behavioral health, home care, and foster care organizations.

CDA member Kathleen A. Shanel-Hogan, DDS, MA, contributed a section titled "Using Oral Indicators to Detect Abuse and Neglect."

Joint Commission Resources is a subsidiary of the Joint Commission on Accreditation of Healthcare Organizations.

How to Recognize Abuse and Neglect is available for $55 using order code RAN-100, by calling the Joint Commission Customer Service Center at (630) 792-5800 or by visiting Joint Commission Resource's Web site at www.jcrinc.com/.

Children's Books Can Ease Dental Anxiety

Making a child comfortable during his or her first few visits to the dentist can build a positive attitude about dental care that can last a lifetime.

Publisher Simon & Schuster has released a variety of children's dental-themed books that parents and dental practitioners can use to lessen a child's anxiety about the experience.

- Little Bill: A Visit to the Dentist is based on a TV series created by comedian and educator Bill Cosby. The book shows Little Bill going to the dentist and helping a little girl who is scared because it is her first time at the dental office.
- Dear Tooth Fairy: The True Story of How the Tooth Fairy Came to Be shows how the fairies that watch over the Land of Humans decided that children should have two sets of teeth: one to practice on and one to keep. When the first ones fall out, the Tooth Fairy gives gifts to children who leave teeth under their pillows.
- The Tooth Fairies Nighttime Visit is a rhyming book that shows tooth fairies on their nightly rounds of gathering teeth and includes two pages of fairy stickers.

These books are available at Simon and Schuster's Web site www.simonandschuster.com or can be ordered from any book store.

Huge Improvements Made In Americans' Health During Past 50 Years

Men and women are living longer, fewer babies are dying in infancy, and the gap between white and black life expectancy has been narrowing in the past decade, according to a recent report showing how Americans' health has dramatically improved during the past 50 years.

"Effective public health efforts, greater knowledge among Americans about healthier lifestyles and improved health care all have contributed to these steady gains in the nation's health," CDC Director Julie L. Gerberding, MD, said.

By 2000, infant mortality had dropped to a record low and life expectancy hit a record high, according to Health, United States, 2002, the 26th annual statistical report on the nation's health prepared by the Centers for Disease Control and Prevention.

The country has gained significant ground in fighting heart disease, stroke and injuries. AIDS emerged as a major killer in the 1980s, but deaths dropped after 1995 due to powerful new antiviral drugs. However, new AIDS cases are still being reported -- about 40,000 cases in 2000.

Among the key findings of the report:

During the past half century, death rates among children and adults up to age 24 were cut in half. Mortality among adults 25-64 fell nearly as much, and dropped among those 65 and older by a third.

In 2000, Americans enjoyed the longest life expectancy in U.S. history -- almost 77 years, based on preliminary figures. The life expectancy of men was 74 and for women almost 80. A century earlier, life expectancy was 48 for men and 51 for women.

- The infant mortality rate -- deaths before the first birthday -- has plummeted 75 percent since 1950. It dropped to a record low of 6.9 deaths per 1,000 live births in 2000, down from 7.1 the year before.
- Men and women who reach age 65 now live, on average, to age 81 and 84 respectively.
- The gap in life expectancy between blacks and whites narrowed during the 1990s. The life expectancy of white babies was about six years longer than for black babies in 2000, an improvement from the seven-year gap in 1990.
- Homicide rates among young black and Hispanic males aged 15-24 dropped almost 50 percent in the 1990s. Homicide remains the leading cause of death for young black men and the second leading cause of death for young Hispanic men.

UCSF School Of Dentistry Receives $1.3 Million

The Robert Wood Johnson Foundation has announced a grant of $1,345,320 over five years to the University of California at San Francisco School of Dentistry to improve access to dental care and increase student enrollment numbers of underrepresented minority and low-income students.

The grant is one of 10 given to national dental schools through the foundation's Pipeline Profession & Practice: Community-Based Education initiative. The initiative is designed to counteract the "silent epidemic" of oral disease affecting poor children, the elderly, and many members of racial and ethnic minorities that was outlined in the May 2000 Surgeon General's Report on the Oral Health of the Nation.

"These dental schools will work to reduce gaps in care through community-based education programs that expand patient care to underserved patients," said Judith Stavisky, senior program officer at the foundation.

California presents a challenge in the "silent epidemic" because the state's immigrant and pediatric populations are significantly larger than the national average, and there is a disproportionate number of underserved populations in the state, according to William F. Bird, DDS, DPH, UCSF clinical professor of preventive and restorative dental sciences and principal investigator of the grant.

The crisis also has a geographic dimension across the state. Sixteen of California's 58 counties have been declared as underserved by virtue of their underutilization of Denti-Cal.

50,000 Smokers Needed For National Lung Screening Trial

The National Cancer Institute has launched a new study to determine if screening people with either spiral computerized tomography or chest X-ray before they have symptoms can reduce deaths from lung cancer.

The National Lung Screening Trial will enroll 50,000 current or former smokers and will take place at 30 sites throughout the United States.

Participants in the trial will receive lung cancer screenings free of charge. Men and women can participate if they meet the following requirements:

- Are current or former smokers ages 55 to 74;
- Have never had lung cancer and have not had any cancer within the past five years (except some skin cancers or in situ cancers);
- Are not currently enrolled in any other cancer screening or cancer prevention trial; and
- Have not had a CT scan of the chest or lungs within the past 18 months.
- For more information about trial and to find the nearest center:
- Call the National Cancer Institute's Cancer Information Service toll-free, at (800) 4-CANCER (422-6237) for information in English or Spanish. The number for callers with TTY equipment is (800) 332-8615.
- Log on to cancer.gov/NLST.

National Library of Medicine Consumer Site Launches a Spanish Version

MEDLINEplus, the National Library of Medicine's consumer-friendly health Web site, now speaks Spanish. The new site is at medlineplus.gov/esp.

Recent surveys show more than 50 percent of adult Hispanics in the United States use the Internet. More than half of those, in fact, look to the Web for medical and health information. In response to this, the National Library of Medicine is introducing its popular consumer health information Web site, MEDLINEplus, in Spanish. Now users will find many of the authoritative, full-text resources that are available on MEDLINEplus en Español, too.

MEDLINEplus, available free of charge 24 hours a day, debuted in October 1998. Today the site has more than 560 health topics and receives over 1 million visitors per month.

Honors

The Pacific Coast Society for Prosthodontics has elected the following California dentist to office for 2002-2003:

Paul P. Binon, DDS -- president-elect

Madeline E. Kurrasch, DDS – vice president

Arun B. Sharma, BDS -- secretary-treasurer

Shane N. White, BDS -- organization editor

OSAP Launches New FAQ Database

For years, the Organization for Safety and Asepsis Procedures has been fielding questions from frontline dental workers. To allow 24-hour access to this valuable information, OSAP has compiled those questions along with expert answers in a new FAQ section.

The searchable database, posted at http://www.osap.org/resources/FAQ/index.php, categorizes questions into broad categories such as diseases and disease agents, equipment, latex allergies, office design and management, safety, personal protective equipment, and regulatory processes. Subcategories include disinfection, sterilization, handpieces, instrument processing, sharps safety, dental unit waterlines, waste management, state requirements, and X-ray safety.

OSAP will be constantly updating its database to provide dental workers with the answers to their most pressing questions.

CDA JOURNAL, VOL 30, Nº11

The Maturation of Esthetic Dentistry

CHERILYN G. SHEETS, DDS, AND JACINTHE M. PAQUETTE, DDS

AUTHORS

Cherilyn G. Sheets, DDS, maintains a full-time private practice in Newport Beach, Calif. She is the founder and executive director of the Newport Coast Oral Facial Institute and founder and chairman of the board of the Children's Dental Center in Inglewood, Calif.

Jacinthe M. Paquette, DDS, is a prosthodontist who maintains a private practice in Newport Beach, Calif. she is associate clinical professor at the University of Southern California School of Dentistry and education director for the Newport Coast Oral Facial Institute.

Twenty-five years ago, esthetic dentistry focused on bonded composite restorations. Today, esthetic dentistry has become sophisticated in approach, is multidisciplinary in scope, provides numerous potential treatment options, and is an integral part of most treatment plans. It has become popular for dentists to call themselves "cosmetic dentists" or "esthetic dentists," but the reality is that each of us addresses esthetic issues for our patients daily.

As clinicians, once we enter the world of esthetics and beauty, our comfortable world of precision and predictability seems to disappear. The adage "beauty is in the eye of the beholder" takes on a whole new meaning when a dentist has a disappointed or unhappy patient after completing work designed to be "esthetic." The parameters and guidelines that measure beauty may sometimes appear more subjective than objective. Is the patient unappreciative of the dentist's good work? Does the patient have a better "esthetic eye" than the dentist? Or is the patient crazy and/or impossible to please due to unrealistic expectations? These are all questions that can enter the clinician's mind when faced with patients who are displeased with their treatment outcome.

Unmet esthetic expectations can be emotionally draining, expensive, and time-consuming for everyone. The more that can be done at the beginning of the treatment planning process to lay the groundwork for a successful final outcome the better. A thorough examination, diagnosis, and treatment plan need to be coupled with precise esthetic templates or images, patient involvement in the design process, and systematic execution of the patient-agreed-upon treatment to ensure treatment success.

We have assembled some well-recognized clinicians who focus on multidisciplinary esthetic dentistry. In this issue, we will attempt to refine the diagnostic process involved in esthetic dental treatment.

- Stephen R. Marquardt, DDS, is an oral-maxillofacial surgeon who was trained as a mathematician prior to entering dental school. For more than a decade, Dr. Marquardt has been analyzing beautiful female faces in an attempt to discover a measurable and objective code of female facial beauty. It is now more possible to quantify the precise elements that make a female face more beautiful and less beautiful. Even more significant for dentistry, the same mathematical principles can be applied to the proportions of the teeth as they are exposed during smiling. He will

share with us some of the conclusions of his research that can be incorporated into final restorative design.

- Robert G. Keim, DDS, EdD, PhD, brings his expertise in the science of orthodontics to further develop the concept of treatment planning for esthetic success. His paper will serve as a guide to determine how orthodontics can be helpful in the overall esthetic treatment process.
- W. Peter Nordland, DMD, will illustrate the contributions that the periodontist can make as a key member of the esthetic multidisciplinary team. He will discuss procedures that can enhance a patient's esthetic result by "creating the picture frame" for the teeth by way of periodontal microsurgical techniques.
- Edward A. McLaren, DDS, and Robert Rifkin, DDS, will give a systematic flow chart for evaluating the restorative treatment options that are appropriate to solve esthetic problems.
- Jacinthe M. Paquette, DDS, and Cherilyn G. Sheets, DDS, will discuss how to use multidisciplinary care to create improved oral health, enhanced restorative results, and maximum esthetic improvements. Results of multidisciplinary esthetic reconstructive dentistry will be shared as examples of more complex esthetic/cosmetic treatments.

The exciting aspect of helping a patient achieve esthetic goals today is the power of synergy that is available through a multidisciplinary approach. For the patient, it often appears as if magic has occurred. Yet, there are times when the patient can achieve his or her goals through simple procedures that also carry a powerful impact -- procedures such as bonding, bleaching of teeth, and esthetic reshaping. Whatever the treatment plan and outcome, it is always important to remember three guidelines when doing esthetically driven care:

- Use the most conservative treatment that will accomplish the patient's esthetic goals.
- Leave the patient in a healthier state than when you began.
- Teach the patient how to maintain the result.

We hope that you enjoy this issue and that you will keep it for a reference for your future esthetic treatment planning process. We also hope that it will stimulate you to delve further into some of the philosophies and techniques presented to refine your esthetic skills. Most of all, we hope that you enjoy yourself and have fun as we explore together the fascinating world of facial beauty and the role that dentistry can play in achieving it.

CDA JOURNAL, VOL 30, Nº11

Achieving Facial Harmony Through Orthodontics

Robert G. Keim, DDS, EdD, PhD

ABSTRACT A substantial body of science allows the application of objective measurement techniques to augment a clinician's subjective assessment of facial harmony and beauty. These techniques have found wide application in all clinical disciplines involved with the enhancement of facial beauty, including esthetic dentistry, plastic surgery, orthognathic surgery, and prosthodontics. This paper will explore the applications of those techniques to the field of orthodontics.

AUTHOR

Robert G. Keim, DDS, EdD, PhD, is program director of advanced orthodontics and director of advanced specialty education at the University of Southern California School of Dentistry.

"All human growth studies sample a very heterogeneous population. Accordingly, it is biologically and statistically without meaning to try to establish 'normal standards' for human craniofacial growth when, for example, several parameters (distance, angles) are obtained from different samples of man." –**Moss 1982**

"A person's own craniofacial composite can be evaluated for what it is, and the nature of some of its morphological and morphogenetic relationships can be determined relative to standards for that individual rather than those for the population at large." –**Enlow 1982**

"The psychological security obtained from manipulating numbers (ANB, mandibular plane angle, etc.) does a disservice for the clinician. ... To the patient, evaluation of his appearance is validity, not a number or some recipe for changing it. To dentists, such 'scientific formulae' have appeal because they are logical. It is harder to determine if such is valid." –**Hixon 1972**

While the old adage "Beauty is in the eye of the beholder" is as true today as it was when the saying was first coined several hundred years ago, a substantial body of science has been established that allows the application of objective measurement techniques to augment a clinician's subjective assessment of facial harmony and beauty. These techniques have found wide application in all clinical disciplines involved with the enhancement of facial beauty. The fields of esthetic dentistry, plastic surgery, orthognathic surgery, and prosthodontics have all found wide application for various studies relative to the assessment of facial esthetics. This paper will explore the applications of those techniques to the field of orthodontics.

Analysis of Facial Harmony

Hundreds of papers have been published presenting various cephalometric, anthropometric, and soft-tissue analyses of facial harmony, both frontal and lateral. No attempt will be made here to review all of these. Many of these present normative or average values for various parameters of facial or dental measurement. The assumption is that these average, or mean, values should be regarded as treatment goals. The problem encountered is that application of these normative values as treatment objectives -- "treating to the mean" -- may or may not result in an esthetically desirable outcome. Sarver1 stated that "any analysis based on cephalometric or facial 'normative' values has one inherent weakness, and that is that beauty is not the norm." Indeed, if facial esthetics were regarded as falling along a normal distribution, i.e., on a bell curve, beauty would fall in the far-right portion of the curve. Average, or mean, appearance would fall squarely in the middle (**Figure 1**). Treating to the mean then is tantamount to striving for mediocrity. Clearly, any quantitative assessment of facial esthetics must be referenced specifically to the individual patient in question rather than toward any normative population values.

Recently, Marquardt2 has explored the application of a "golden decagon matrix," derived from two- and three-dimensional geometric extrapolations of the classical "golden ratio," to the analysis of facial esthetics with remarkable results. Marquardt has developed a set of "facial masks" that can be superimposed over facial photographs, frontal or lateral, of individual patients for the assessment of the fit of their face to an idealized symmetry based on the golden decagon matrix (**Figure 2**). The applicability of the facial masks holds up across all races and both genders. While applications of Marquardt's findings to clinical orthodontics have not yet been explored in the orthodontic literature, the prospect of their application, especially in the area of soft-tissue analysis, is intriguing.

Prior to the development of Marquardt's facial masks, Fishman3 proposed the centrographic analysis as an individualized, non-numeric approach to the assessment of facial symmetry, facial harmony, and facial balance from the lateral aspect (**Figure 3**). Like Marquardt's facial masks, Fishman's centrographic analysis holds up across all race and gender lines. This analysis is essentially a qualitative assessment of the skeletal structures of the face, along with a qualitative soft-tissue assessment, done on an individualized basis without comparisons to any standardized or normative values. Application of this technique provides the operator with a reliable means of objectively evaluating facial balance without comparing the individual to any population norms.

In developing the technique of centrographic analysis, Fishman employed characteristics that were found to be "common to the human species."3 It is interesting to note that Marquardt has also suggested that identification of those facial attributes that contribute to facial beauty is essentially the identification of attributes that lead to the visual identification of "humanness."4 In centrographic analysis, "graphic relationships that represent facial balance and harmony have been identified and applied to case diagnosis and treatment planning."

The analysis is based on the principles of centroid geometry. In its application to the analysis of two-dimensional cephalometric radiographs, the relationships of the centroids of four of triangles, constructed in the cranium, upper face, lower face, and face overall, and various anatomic structures are appraised for harmony and symmetry.

Fishman's analysis requires a minimal knowledge of cephalometric points and planes. Only five points are used: sella (S), nasion (N), basion (Ba), point A (A), pogonion (Pog), and gnathion (Gn). Five lines are drawn: A-Pog, S-N, N-Ba, Ba-A, and Ba-Gn. The intersection of a fifth line -- Na-Gn -- with the Ba-A line is marked. From these, the centroids of four anatomical triangles are constructed:

- The cranial centroid (CC), triangle Ba-S-N;
- The upper centroid (UC), triangle Ba-N-A;
- The lower centroid (LC), triangle Ba-A-Gn; and
- The facial centroid (FC), triangle Ba-N-Gn with the intersection of the N-Gn line with Ba-A serving as the upper anterior apex of the lowest triangle (**Figure 4**). The plane perpendicular to Ba-A through the facial centroid, termed the centroid plane, serves as the point of reference for analysis in the sagittal aspect (**Figure 5**). Individualized assessment of facial balance and symmetry is then accomplished by analyzing the relationships of these four centroids to Ba-A and the centroid plane.

Vertical skeletal harmony, or symmetry, is seen when the facial centroid is located directly on the Ba-A line. In situations where insufficient vertical development has occurred, the facial centroid will be located in the upper facial triangle. Likewise, excessive vertical development will result in the facial centroid being located in the lower facial triangle.

Horizontal skeletal imbalance is evaluated by assessing the anteroposterior positions of UC and LC to the centroid plane. An upper centroid located in front of the centroid plane is indicative of a protrusive maxilla and upper face. If that centroid is located posterior to the centroid plane, a maxillary retrusion is evident. Mandibular protrusion or retrusion is assessed in a similar fashion comparing LC to the centroid plane.

Dental characteristics of balanced facial form are also analyzed relative to the centroid plane (**Figure 6**). In a symmetrically harmonious face, the upper and lower molars will demonstrate a Class I relationship with the vertical centroid plane bisecting the distal root of the upper molar while appearing tangent to the distal surface of the lower first molar. Fishman

CDA JOURNAL, VOL 30, Nº11

FIGURE 1A.

FIGURE 1B.

FIGURE 1C.

FIGURE 1D.

FIGURE 1E.

FIGURE 1F.

FIGURE 1G.

FIGURE 1H.

FIGURE 1I.

FIGURES 1A THROUGH O. Attractive deviations from the mean. Each of the models pictured received an average Lundstrom's Facial Esthetics Scale rating of 1 (highly attractive) when evaluated by an independent team of raters. When analyzed by several different conventional cephalometric analyses, each of them displayed multiple scores that were greater than two standard deviations from the mean.

FIGURE 1J.

FIGURE 1K.

FIGURE 1L.

FIGURE 1M.

FIGURE 1N.

FIGURE 1O.

FIGURE 2. Marquardt's Lateral Facial Mask.

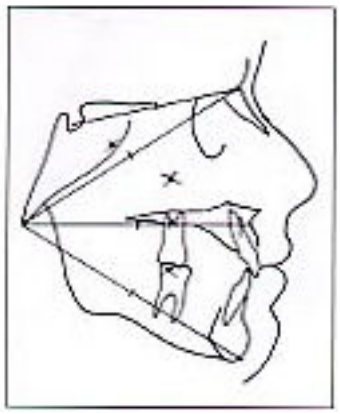
notes that the occlusal plane of the molars should fall below the Ba-A plane.

In a symmetrically harmonious face, the incisal edge of the lower incisor will be found tangent to a line that originates from the lower centroid constructed parallel to the Ba-A line. The labial surface of the lower incisor is positioned horizontally so that it lies tangent to the A-Pog plane. When the upper incisor is in proper occlusion with the lower incisor, the A-Pog plane will bisect its crown. Also, with regards to angulation, when the upper incisor is in proper occlusion with the lower incisor, the extrapolated long axis of the upper incisor should pass through orbitale. The lower incisor is properly inclined when its long axis intersects Ba-Gn at a point "approximately a third of the distance of the symphyseal segment of the Ba-Gn plane."

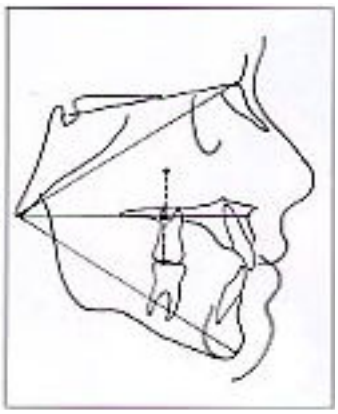
By employing both Marquardt's facial masks for lateral facial assessment and Fishman's centrographic analysis to the underlying skeletal relationships, a much clearer analysis of individual profiles is possible without unfounded reliance on population norms. Superimposition of Marquardt's lateral facial mask over Fishman's template for a balanced and harmonious profile shows remarkable correlation between the two independent assessment modalities (**FIGURE 7**).

By combining the two modalities, it is possible to establish individualized treatment goals, both skeletal and soft-tissue profile.

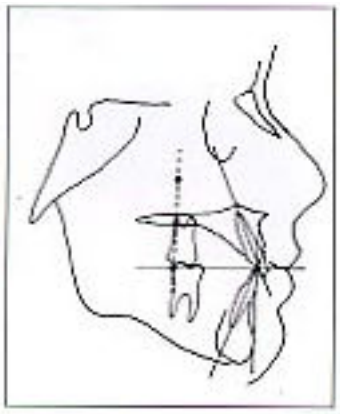
CDA JOURNAL, VOL 30, Nº11



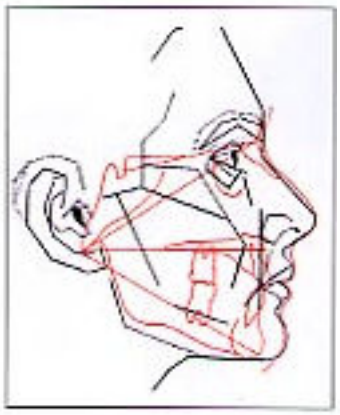
Figures 3. Construction of cephalomorphic centroids.



Figures 4. Centroid plane.



Figures 5. Cephalomorphic dental harmony.



Figures 6. Superimposition of CGA over Lateral Facial Mask.

Treatment

Regardless of what analyses a clinician uses for the assessment of facial symmetry and balance, the goal is to guide diagnostic and treatment planning decisions toward a successful, esthetic outcome. Treatment planning is a matter of identifying a specific list of problems, derived from clinical examination data and through analyses as the examples described above and others, then logically applying treatment modalities to address those problems. For example, a protrusive maxilla calls for headgear therapy in a growing individual or perhaps a combination of techniques including selective extractions. A similar situation in a nongrowing patient may well dictate a combination of orthodontic and surgical treatment modalities.

Just how much is possible in terms of orthodontic treatment? There are four basic approaches available to the orthodontist, to quote Sarver and colleagues:5

- Repositioning the teeth through orthodontic tooth movement;
- Redirecting facial growth through functional alteration or the use of strong modifying forces;
- Employing dentofacial orthopedics in which dentofacial (dentoalveolar) growth is altered through the use of strong modifying forces; and
- Utilizing surgical-orthodontic treatment.

Proffit and colleagues have proposed what they term an "envelope of discrepancy for the maxillary and mandibular arches in three planes of space."6 They note that "for any characteristic there are three ranges of correction: (1) a range of correction that can be accomplished by orthodontic tooth movement alone; (2) a larger range of correction that can be achieved by tooth movement plus functional or orthopedic treatment; and (3) a still larger range of correction that requires surgery as a part of the treatment plan." The range of correction by orthodontic means alone is about the same for adults as it is in children. As children become adults, the ability to achieve skeletal correction through orthopedic growth modification declines and vanishes. For the nongrowing individual, corrections of malocclusions greater than that possible through tooth movement alone require a combination of orthodontics and orthognathic surgery.

Since such an emphasis has been placed in this issue on the attainment of facial symmetry, it is of interest that the envelope of discrepancy is not symmetric. Greater corrections can be made by orthodontics and dentofacial orthopedics in the sagittal plane than in the transverse or vertical planes. A much greater degree of maxillary protrusion can be treated orthodontically than can a similar problem in the mandible. While not absolute limits, the guidelines in the next few paragraphs, suggested by Proffit and colleagues, serve as useful guides in answering the question posed above.6 "By orthodontic means alone, maxillary incisors can be retracted approximately 7 mm. They can be advanced only 2 mm. The same teeth can be extruded 4 mm, but only intruded 2 mm. In a growing individual, when orthodontic forces are combined with orthopedic and functional forces, the maxillary incisors can be retracted 12 mm, advanced 5 mm, extruded 6 mm, and intruded 5 mm. When surgery is performed in addition to orthodontics, as in a nongrowing patient, the maxillary incisor can be retracted 15 mm, advanced 10 mm, extruded 10 mm, and intruded 15 mm.

"In the mandible, the incisor can be retracted 3 mm by orthodontic tooth movement, advanced 5 mm, extruded

2 mm, and intruded 4 mm. Using orthodontics and orthopedics together, the incisor can be retracted 5 mm, advanced 10 mm, extruded 5 mm, and intruded 6 mm. When surgery is employed, the incisor can be retracted 25 mm (via mandibular set back), advanced 12 mm, extruded 15 mm and intruded 10 mm.

"The transverse envelope of discrepancy is much smaller than is the sagittal envelope. Orthodontically, maxillary premolars can be moved buccally 3 mm, palatally 2 mm, intruded 3 mm, and extruded 2 mm. Orthopedically, maxillary premolars can be moved buccally 4 mm, palatally 3 mm, intruded 4 mm, and extruded 3 mm. Surgically, they can be moved buccally 7 mm, palatally 4 mm, intruded 10 mm, and extruded 10 mm. Mandibular premolars have similar restraints with buccal movement of 2 mm, lingual 1 mm, intrusion of 3 mm, and extrusion of 2 mm being possible through orthodontics; 4 mm buccal, 2 mm lingual, 4 mm intrusion, and 4 mm extrusion possible through orthopedics. Surgery increases the possible values to 5 mm buccal, 3 mm lingual, 10 mm intrusion, and 10 mm extrusion. It is clear, as mentioned above, that the envelope of discrepancy is far from symmetric."

Numerous authors, including Holdaway,7,8 Gencov,9 and Subtelny10 have explored the relationship of the change in lip and soft tissue position relative to the underlying tooth movements. While there is a little disagreement between the various authors, it is fairly safe to assume that the relationship is about 1:1 for the upper lip relative to change in sagittal position of the upper incisor. That is, if the upper incisor is retracted about 2 mm, the upper lip will move back a similar amount. This is important to bear in mind when employing either Fishman's or Marquardt's assessment of lip position in treatment planning for optimum facial harmony.

Conclusion

Facial beauty is an enigmatic phenomenon. Poets and lovers the world over would be aghast at the very thought of clinicians' trying to objectively measure or assess the phenomenon. The abilities of clinicians to enhance an individual's innate beauty depends on upon their understandings of the possibilities of variation in the individual's own facial beauty. At least in general, dental professionals know what their technical limitations are relative to rearranging the hard and soft tissue of the mouth and face. They have a little better grasp on how to objectively assess facial harmony and complex symmetry. To what then do they compare their assessments, goals, and outcomes? Stated more plainly, to what do they compare their patient's facial beauty? One thing is very clear, comparisons to any population normative values for any parameters of facial beauty and harmony are of little if any value. Perhaps Shakespeare took a more correct approach in his comparisons, "Shall I compare thee to a summer's day?"

References

1. Sarver DM, Esthetic Orthodontics and Orthognathic Surgery. Mosby-Yearbook, St Louis 1998, p 3.
2. Marquardt SR, The Facial Masks. Marquardt Beauty Analysis, http://www.beautyanalysis.com/index2_mba.htm, 2002.
3. Fishman LS, Individualized evaluation of facial form. Am *J Orthod* 111:510-7, 1997.
4. Marquardt SR, Archetype Theory. Marquardt Beauty Analysis, http://www.beautyanalysis.com/index2_mba.htm, 2002.
5. Sarver DM, Proffit WR, Ackerman JL. In, Graber TM, Vanarsdall RL, Orthodontics Current Principles and Techniques. Mosby-Yearbook, St Louis, 2000, p 7.
6. Sarver DM, Proffit WR, Ackerman JL. In, Graber TM, Vanarsdall RL, Orthodontics Current Principles and Techniques. Mosby-Yearbook, St Louis, 2000, p 6.
7. Holdaway RH, A soft-tissue cephalometric analysis ant its use in orthodontic treatment planning, Part I. Am *J Orthod* 84:1, 1983.
8. Holdaway RH, A soft-tissue cephalometric analysis and its use in orthodontic treatment planning, Part I. Am *J Orthod* 82:279, 1984.
9. Genecov JS et al, Development of the nose and soft tissue profile. Angle Orthodontist 60(3):191, 1990.
10. Subtelny JD, A longitudinal study of soft-tissue facial structures and their profile characteristics, defined in relation to underlying skeletal structures. Am *J Orthod* 45:7, 1959.
To request a printed copy of this article, please contact: Robert G. Keim, DDS, EdD, PhD,
9737 La Canada Way, Shadow Hills, CA 91040.

CDA JOURNAL, VOL 30, Nº11

The Role of Periodontal Plastic Microsurgery in Oral Facial Esthetics

W. Peter Nordland, DMD, MS

ABSTRACT Periodontal plastic microsurgery incorporates the use of a surgical dissecting microscope in an attempt to increase visibility, minimize trauma, and enhance surgical results. This paper will attempt to demonstrate how periodontal plastic surgery utilizing periodontal microsurgery could contribute in the role of soft tissue modification to enhance the smile and ideally allow for improved oral facial esthetics.

AUTHOR

W. Peter Nordland, DMD, maintains a private practice in periodontics and implant surgery in La Jolla, Calif., and is an assistant professor of periodontics at Loma Linda University, the director of oral microsurgery at the Newport Coast Oral Facial Institute and an instructor for Pac-Live at the University of the Pacific.

Periodontal plastic microsurgery incorporates the use of a surgical dissecting microscope in an attempt to increase visibility, minimize trauma, and enhance surgical results. Miniature instruments such as microscalpels and microsutures have been developed with hopes to assist the surgeon and minimize tissue injury. Surgical magnification can allow the operator to see things that are not distinguishable with the naked eye, such as the difference between a composite restorative material, dentin, and enamel. Surgical magnification utilizes high-intensity illumination, which it is hoped can illuminate, magnify, and simplify tunneling procedures. It is also hoped that with increased magnification and visibility greater attention to the details of wound closure through microsuturing and knot-tying can be accomplished. If smaller incisions can accomplish what larger incisions had previously, then microsurgery is expected to translate into more rapid healing and less tissue trauma. Because the public is very aware of modern arthroscopic procedures, patients will readily recognize and accept the value of smaller access incisions, which can allow for more rapid healing. Microsurgery cannot accelerate epithelial healing rates unless it can create smaller distances for epithelial migration during the healing process. Assumptions should not be made that smaller incisions translate into more rapid healing unless reduced tissue trauma occurs and better wound closure through enhanced tissue approximation is demonstrated. Microsurgery may not make a procedure faster but could instead lengthen surgical

time. Well-controlled studies are needed to determine if microsurgery will minimize trauma and improve healing.

Symmetry, Shape, and Proportion

In as much as an individual's smile contributes to oral facial esthetics, then symmetry, shape, and proportion of the smile can play its own role in oral facial esthetics. The framing of the smile is dictated by the lip position, and the framing of the teeth is dictated by the gingival architecture. The gingival architecture can be modified with periodontal plastic surgery.1 Many of the existing periodontal surgical techniques2-5 have now been accomplished with a microsurgical approach, and new microsurgical modifications to those techniques are now possible. This paper will attempt to demonstrate how periodontal plastic surgery utilizing periodontal microsurgery could contribute in the role of soft tissue modification to enhance the smile and ideally allow for improved oral facial esthetics.

Variables of gingival architecture affecting symmetry, shape, and proportion will include excessive gingival display, uneven gingival levels, gingival recession/root coverage, interdental papillae reconstruction, alveolar ridge deficiencies, and preservation of the interdental papillae and alveolus following extraction and esthetic implant reconstruction. Although these variables can sometimes occur in combination, they will be discussed individually.

Excessive Gingival Display

Excessive gingival display (commonly referred to as a gummy smile) is a description for the situation whereby the patient shows too much gingiva. Another older synonym for this situation is delayed passive eruption. Commonly in the adult, the gingival margin will be located at or near the cementoenamel junction, and normally a patient will show very little if any gingiva over the central incisors when smiling. Three common causes of an excessive gingival display are vertical maxillary excess, excessive alveolar bone, and excessive gingiva. These can occur individually and in combination.

Figure 1. A patient who exhibits an excessive gingival display five years after orthodontic treatment states that she feels that she "has always had baby teeth."

Figure 2. A photo taken six weeks post-operatively following soft-tissue and bone recontouring with placement of the gingival margin at the cementoenamel junction displays the full enamel profile and a brighter smile.

Figure 3. Localized gingival hypertrophy was noted to last one year after orthodontic debanding.

Figure 4. Simple sculpting of the gingival tissue only will allow for a normal contour.

Vertical maxillary excess exists if there is an abnormally tall maxilla. In this situation, orthognathic surgery can be considered to move the maxilla to a new level. Orthodontic and oral surgical consultations will determine the ideal position of the maxilla.

In a classic study, Gargiulo measured dentogingival anatomy in humans and described four phases of gingival tissue position. In the case type where the gingival tissues cover the enamel, the distance from the marginal epithelium to the crest of the alveolar bone demonstrated tremendous individual variation.6 If one tries to develop a clinical consensus as to precisely how much bone resection is necessary when planning an esthetic crown-lengthening case, the answer is unclear and somewhat controversial. Several authors have suggested surgically removing the periodontal support to an extent, leaving a distance from the level of a planned restorative margin to the level of the newly recontoured osseous crest of 3 mm,7 2.5 to 3.5 mm, 8 and 4 mm9 in the exposed tooth. Unfortunately, not enough research presently exists to make exacting statements about how much bone should be removed when crown lengthening or sculpting in the esthetic zone.

Sometimes patients can present with gingiva covering so much of the tooth that it can create a diminutive appearance. When excessive gingiva covers enamel, the sulcus depth will increase, thereby allowing a safe harbor for bacteria and decreasing the ease of access for plaque removal. Osseous resective procedures have been developed to reshape the

Figure 5. A patient presents with composite restorations on the root surface and desires a more natural framing of her smile without long teeth.

Figure 6. A photo taken six weeks postoperatively following gingival augmentation with connective tissue grafting and tetracycline root demineralization shows complete root coverage.

Figure 7. A preoperative view of a patient desiring veneers. She had tetracycline staining and scrubbed vigorously for years, creating significant recession.

Figure 8. A six-week postoperative view following connective tissue grafts with tetracycline dentin demineralization. Root coverage to the cementoenamel junction will now allow normal length veneers and maximum bond strength to enamel.

dentoalveolar architecture to create a more favorable environment for periodontal maintenance and health.10 In esthetic crown-lengthening surgery, patient biotypes11 can play a role in the amount of rebound healing of the newly established gingival margin.12 Individual variation in gingival thickness will modify final tissue healing levels postoperatively. "Thick" tissue biotypes show the greatest tendency to rebound in a coronal direction.12

Excessive alveolar bone can be seen in both height and thickness. Because the full enamel profile is not visible, the anterior teeth will appear short and square (**Figure 1**). If there is excessive gingiva covering the enamel, reduction of gingiva and bone can create a more esthetic smile (**Figure 2**). Both bone height and thickness can also vary considerably. If the alveolar bone is abnormally high or thick, both the bone and gingiva must be treated together during surgery. Because excessive bony contours can predispose a patient toward gingivitis and periodontitis due to an inability to remove bacterial plaque effectively,10 the recontouring of the tissues can provide a functional as well as cosmetic benefit.

Excessive gingiva (gingival hypertrophy) can occur without an excessive amount of underlying bone. In this case, simple excision of the soft tissue without manipulation of the bone can achieve a normal-appearing result (Figures 3 and 4).

Uneven Gingival Levels

Uneven gingival levels can be seen when uneven incisal edge wear occurs. This is often seen as wear occurs with teeth that are rotated or angulated. As teeth wear and ongoing eruption occurs, gingival margins will be located at varying levels. Incisal edge fracture with ongoing eruption will also move the gingival margin on an individual tooth, giving it a different gingival margin height than the neighboring teeth. Adult orthodontic treatment that does not take incisal edge wear into consideration can mistakenly align worn incisal edges instead of positioning the cementoenamel junctions in their appropriate positions. Because the gingival level is usually located at or near the cementoenamel junction, uneven cementoenamel junctions will create uneven gingival levels. Orthodontic intrusion or extrusion can correct uneven gingival levels. Surgical resection of the marginal gingival can also be considered to create symmetry, shape, and proportion as long as roots are not exposed.

Gingival Recession and Root Coverage

Gingival recession can occur with a lack of attached keratinized gingiva (in height or in thickness), tooth prominence, trauma, inflammation, ill-fitting restorations, and pull from frena. Gingival recession exposes dentin root surfaces with potential sensitivity to hot, cold, sweets, and touch and a greater risk of caries. Root-coverage surgical procedures have demonstrated predictability in covering areas of exposed dentin.13 Root coverage with gingival augmentation can reduce or eliminate these concerns. (Figures 5 and 6). New attachment of gingival connective tissue to a previously exposed root surface has been demonstrated. 14 When root exposure poses a cosmetic or restorative concern, smile esthetics can be enhanced when the normal gingival anatomy is replaced with gingiva rather than placement of a tooth-colored, bonded restoration that can make a tooth appear longer (Figures 7 and 8).

Restorations bonded to enamel have proven very successful when compared with bonding to dentin. Dental restorations placed solely in enamel present greater bond strengths and reduced microleakage creating higher predictability for long-term success as compared with dentinal bonding.15,16

Figure 9. A preoperative view of a patient desiring new crowns. Note the 7 mm recession on the facial of tooth No. 10, most likely due to prominent root surfaces, thin tissues, overhanging crown margins, and overzealous oral hygiene. Without gingival augmentation, a significant asymmetry of new crowns would result.

Figure 10. Gingival augmentation with connective tissue grafts provides proper framing for the new, well-fitting restorative dentistry.

Because resin-dentin bond strengths degrade dramatically within a few years,17 it is preferable to avoid bonded restorations placed on root surfaces when possible. It is, therefore, more desirable to restore a tooth to the cementoenamel junction and then cover any exposed dentin with its natural covering, gingiva. Additionally, if restoration is planned on a tooth that has gingival recession, it is more desirable to have any exposed root surface protected and covered with gingiva, thereby allowing a more predictable enamel bonded restoration. Ideally, the dentist

Figure 11. Tooth No. 7 presents with a Nordland-Tarnow Classification 3-1 papilla, and tooth No. 8 presents with a Class 3-0 papilla. Several attempts by periodontists to graft the lost interdental papilla were made as well as overbuilding the mesial surface contour of tooth No. 7 with composite to reduce the black space.

Figure 12. A six-week postoperative view following microsurgical papilla grafting reducing the papillae to a Nordland-Tarnow Classification 1-2 papilla for tooth No. 7 and a Class 1-4 for tooth No. 8. The patient is now ready for restorative dentistry to close the remaining space and restore symmetrical contour to the maxillary anterior teeth.

Figure 13. Restoration of the maxillary anterior teeth with porcelain veneers. Note how the increase in the cervical restoration contour can be utilized to completely fill the residual embrasure space.

Figure 14. An obvious ridge collapse deformity in the tooth No. 8 area following extraction of an endodontically treated fractured root without bone grafting at the time of extraction is common. Note also the flattening of the papillae of teeth Nos. 7 and 9.

Figure 15. The patient presents with a vertical root fracture of tooth No. 8, necessitating extraction.

Figure 16. A human freeze-dried demineralized bone graft with a collagen membrane to retain the bone graft particles is placed to help preserve an anatomical soft-tissue contour.

Figure 17. A provisional replacement for tooth No. 8 is constructed using an ovate pontic. The pontic extends 2 mm below the soft tissue for support.

Figure 18. Gingival augmentation with connective tissue grafts provides proper framing for the new, well-fitting restorative dentistry.

Figure 19. Tooth No. 7 presents with a Nordland-Tarnow Classification 3-1 papilla, and tooth No. 8 presents with a Class 3-0 papilla. Several attempts by periodontists to graft the lost interdental papilla were made as well as overbuilding the mesial surface contour of tooth No. 7 with composite to reduce the black space.

Figure 20. A six-week postoperative view following microsurgical papilla grafting reducing the papillae to a Nordland-Tarnow Classification 1-2 papilla for tooth No. 7 and a Class 1-4 for tooth No. 8. The patient is now ready for restorative dentistry to close the remaining space and restore symmetrical contour to the maxillary anterior teeth.

should consider altering the gingival height if recession is present rather than risk increased failure with bonded finish lines on dentin. If the root is not covered with gingiva, the dentist might also face patient dissatisfaction with regard to sensitivity or cosmetic issues (Figures 9 and 10).

Modern gingival augmentation techniques can offer predictability in root coverage, regeneration of attachment, and cosmetics.1

Interdental Papilla Reconstruction

The lost interdental papilla can create phonetic problems, saliva bubbles, and cosmetic deficiencies. A papillary deficiency can be created through iatrogenic surgical removal, as part of tissue collapse following extraction, with periodontal pocket elimination surgery, with periodontal bone loss, and with orthodontic separation of overlapped teeth. Recently, classification of degrees of loss of the interdental papilla have been developed.18 Classification of degrees of tissue loss can help the practitioner evaluate the success of differing treatment modalities. The restoration of the lost interdental papillae may require orthodontic root alignment, restorative dentistry, or surgical addition of tissue. Some cases may require one treatment modality or all three, together or in various combinations. Microsurgical techniques have been developed to replace the lost interdental papilla.19 Dental restoration can become complex and involve multidisciplinary care when there is a loss of the interdental papilla (Figures 11 through 13).

Alveolar Ridge Deficiencies

An alveolar ridge deficiency or ridge collapse will occur when a tooth is extracted and the dentoalveolus and soft tissue collapses inward. Ridge deformities can create esthetic and functional dilemmas for the patient and restorative dentist. Abrams reported that 91 percent of the time, the loss of an anterior tooth caused a significant deformity.20 Ridge deformities have both soft-tissue (papilla and attached gingiva) and bony-alveolus components. Soft-tissue deformities can occur when surgical incisions are made in delicate areas (thin gingiva, alveolar mucosa, and papillae). Deformities of bone can occur following extraction of a tooth that has a thin dentoalveolus, previous endodontic surgery, endodontic failure, iatrogenic bone removal, intentional bone removal to gain a purchase, root fracture, or periodontal bone loss (**Figure 14**). Pressure atrophy from a removable prosthetic appliance (a flipper) can compress the alveolar ridge and allow the collapse of the adjacent papillae.

Preservation of the Interdental Papilla and Alveolus Following Extraction

Bone loss can compromise dental implant placement or make it impossible. A ridge deficiency will necessitate the overbuilding of prosthetic tooth structure, prosthetic gingiva, or acceptance of a space that can appear dark. Phonetics can be affected where the space can allow for the passage of air and saliva. Modern exodontia techniques focus on atraumatic tooth extraction and rebuilding of the alveolar ridge while maintaining the soft-tissue surroundings. Bone fill into an extraction socket originates from osteoblast progenitor cells at the periphery of the bony defect. If there is a large volume of progenitor cells, the defect will be small; however, if there is a paucity of progenitor cells (thin bony alveolus), a significant deformity will result. Addition of bone into the extraction socket and placement of a membrane at the time of extraction can minimize or eliminate a postextraction ridge deformity (Figures 15 and 16).

Figure 21. An osseointegrated implant was placed using a surgical guide stent with indexing at the time of implant placement.

Figure 22. A full smile is restored with an implant in the No. 8 location. Bone, soft tissue grafting and implant tooth replacement have assisted in providing normal soft tissue, hard tissue, and tooth contours.

Figure 23. A close-up view of the implant crown and soft tissue reconstruction.

Additionally, soft-tissue collapse can occur along with bone collapse unless steps are taken to maintain the soft tissue. Papilla preservation can be initiated prior to tooth extraction with interdisciplinary treatment planning. Ideally, the restorative dentist will fabricate an immediate tooth replacement using an ovate pontic bonded or bridged to the adjacent teeth (**Figure 17**). The concept of the ovate pontic allows for a natural-appearing emergence profile of the replacement and an ease of oral hygiene cleansability.5 The pontic should extend 1.5 to 2 mm below the gingival margin to support the surrounding facial gingiva and the interdental papilla. Occasionally, there can be a soft-tissue residual deficiency even after the meticulous attention to delicate extraction, bone grafting, and immediate placement of an ovate pontic (**Figure 18**).

This technique will not only maintain bone and soft tissue, but also allow the extraction of an anterior tooth without the patient feeling toothless. This will also allow the patient time to make a decision as to the final tooth replacement modality such as a bridge or an implant.

Esthetic Implant Reconstruction

If there is a deficiency in the surrounding dental anatomy following tooth loss, tooth replacement will be compromised. A ridge deficiency will require that the tooth restoration be anatomically larger to fill the extra space; or, if the tooth dimensions are anatomically correct, a residual space will result. Occasionally, dental restorations have masked deficiencies by adding gingiva-colored materials to disguise lost bone and soft tissue.

If attention is paid to the aforementioned details of maintaining the interdental papillae, gingival architecture, and alveolar bone, implant reconstruction can proceed without loss of the pre-existing dental anatomy. When the surrounding dental anatomy is maintained, implant tooth replacement can restore an anatomically correct implant crown (Figures 19 through 23).

Conclusion

Periodontal plastic microsurgery may play a role in oral facial esthetics. Microsurgical procedures could assist the surgeon with visibility and might minimize trauma for the patient; however, well-controlled studies are needed to determine if microsurgical techniques can create a difference in the final surgical outcome.

Acknowledgments

The author would like to thank Cherilyn Sheets, DDS; Jacinthe Paquette, DDS; David Hornbrook, DDS; Geoffrey Murray, DDS; Paul Dougherty, DDS; and Mary Walsh-Cole, DDS, for their help with the prosthetic restorative dentistry included in this manuscript.

References

1. Nordland WP, Periodontal plastic surgery: esthetic gingival regeneration. *J Calif Dent Assoc* 17(11):29-32, 1989.
2. Allen AL, Use of the supraperiosteal envelope in soft tissue grafting for root coverage. I. Rationale and technique. Int J Periodont Rest Dent 14(3):216-227, 1994.
3. Raetzke PB, Covering localized areas of root exposure employing the "envelope" technique. *J Periodontol* 56(7):397-402, 1985.
4. Langer B, Langer L, Subepithelial connective tissue graft technique for root coverage. *J Periodontol* 25(12):715-20, 1985.
5. Garber DA, Rosenberg ES, The Edentulous Ridge in Fixed Prosthodontics. Compend Contin Educ Dent 2(4):212-23, 1981.
6. Gargiulo AW, Wentz FM, Orban B, Dimensions and relations of the dentogingival junction in humans. *J Periodontol* July:261-7, 1961.
7. Ingber JS, Rose LS, Coslet JG, The "biologic width" -- a concept in periodontics and restorative dentistry. Alpha Omegan 70(3):62-5, 1977.
8. Palomo F, Kopczyk RA, Rationale and Methods for Crown Lengthening. *J Am Dent Assoc* 96:257-60, 1978.
9. Rosenberg ES, Garber DA, Evian CI, Tooth lengthening procedures. Compend Contin Educ 1:161-72, 1980.
10. Ochsenbein C, Osseous resection in periodontal surgery. *J Periodontol* Supp.:15-26, 1958.
11. Seibert J, Lindhe J, Esthetics and periodontal therapy. In, Lindhe J, ed, Textbook of Clinical Periodontology. Munksgaard, Copenhagen, 1989, pp 431-67.
12. Pontoriero R, Carnevale G, Surgical crown lengthening: A 12-month clinical wound healing study. *J Periodontol* July:841-8, 2001.
13. Miller PD, Root coverage using a free soft tissue autograft following citric acid application. I. Technique. Int J Periodont Rest Dent 2:65, 1982.
14. Cole R, Crigger M, et al, Connective tissue attachment to periodontally diseased teeth -- A histologic study. J Periodontal Res 15:1-9, 1980.
15. Sim C, et al, The effect of dentin bonding agents on the microleakage of porcelain veneers. Dental Materials 10:278, 1994.
16. Tjan A, et al, Microleakage patterns of porcelain and castable ceramic laminate veneers. J Prosthet Dent 61:276, 1989.
17. Hashimoto M, et al, In vivo degradation of resin-dentin bonds in humans over 1 to 3 years. *J Dent* Res 79(6):1385-91, 2000.
18. Nordland WP, Tarnow DP, A classification system for loss of papillary height. *J Periodontol* 69:1124-6, 1998.
19. Nordland WP, A Predictable technique for restoration of the lost interdental papilla. Presentation for the American Academy of Periodontology Annual Meeting (in press), 1996, 1998, 2000, 2002.
20. Abrams H, Kopczyk RA, Kaplan AL, Incidence of anterior ridge deformities in partially edentulous patients. J Prosthet Dent Feb 57(2):191-4, 1987.

To request a printed copy of this article, please contact: W. Peter Nordland, DMD, 850 Prospect St., La Jolla, CA 90237.

CDA JOURNAL, VOL 30, Nº11

Macroesthetics: Facial and Dentofacial Analysis

EDWARD A. MCLAREN, DDS, AND ROBERT RIFKIN, DDS

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.

AUTHORS

Edward A. McLaren, DDS, is the director of the Center for Esthetic Dentistry at the University of California, Los Angeles, and has a private practice limited to prosthodontics and esthetic dentistry.

Robert Rifkin, DDS, has a private practice in Beverly Hills, Calif.

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 esthetic 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.-4 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

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

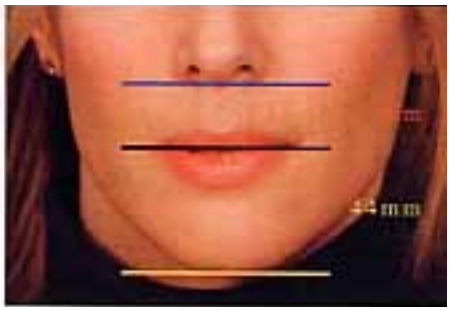


Figure 2. Ideal face: frontal view, lower facial third, 1:2 relationship.

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

Figure 4. Surgical solution via Le Forte 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. Lower figure shows excessive wear.

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 esthetics 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 preformed 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 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 nondental environment. The patient is evaluated from a frontal and sagittal view. Previously

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-cuspation.

published esthetic norms are evaluated.5,6 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.5,7

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, if 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 dimension8 (**Figure 4**).

Patients often have decreased lower facial height.9 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.10 Restoration of vertical face height through raising the vertical dimension of occlusion will sometimes dramatically improve facial beauty.11-14 (Figures 7a and b).

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.

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 evaluate 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 8**a).

For an individual patient, this position generates optimal facial beauty.2 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 8**b).

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 (nonetched) 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 esthetics 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 to improve facial esthetics.2,10,11 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 pogonion is placed anterior to the glabella point, this generally appears as a Class III skeletal relationship. (**Figure 11**).5

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.

Figure 15. Tooth structure with lips at rest.

Figure 16. Ideal smile.

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 women1,5,7 (**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 cants 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)1 (**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 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

Figure 17. Flowable composite.

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

Figure 19. Edges of maxillary anterior teeth follow the curvature of the lower lip.

30-year-old female displays 3.5 mm of tooth structure.15 (**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.16 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.1 Average lip mobility in a normal smile is between 7 and 8 mm. When a person smiles in an esthetic composition, the 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.17-19 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 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 unetched 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.20 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

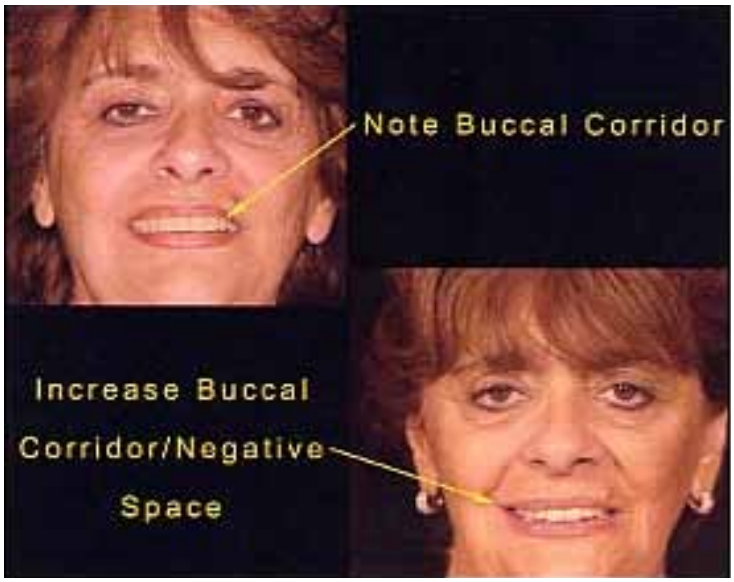


Figure 20a. The existing restorations overfill the buccal corridor.

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..

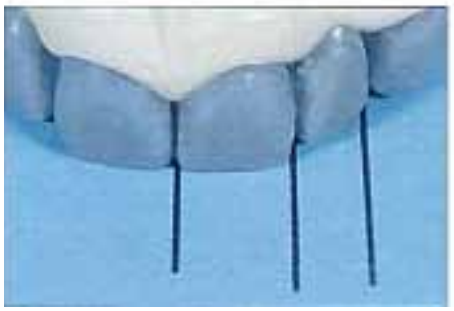


Figure 22. Lines drawn on paper to represent the optical width of the teeth.

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 20 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.21 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 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

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

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.

relationship 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.22 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.23 Recent literature has demonstrated that the actual measurements of most people's anterior teeth do not in fact follow the golden proportion.24 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, and gingival color are evaluated next.

There have been several gingival reference line relationships from maxillary bicuspid to the contralateral bicuspids 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.

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. Compend Contin Educ Dent 18(12):1183-6 Dec 1997.
3. Bowbeer GRN, The five keys to facial beauty and TMJ health. Functional Orthodontist May/June 1985, pp 13-28.
4. Mack RM, Perspective of facial esthetics in dental treatment planning. J Prosthet Dent 75:169-76, 1996.
5. Arnett GW, Bergman RT, Facial keys to orthodontic diagnosis and treatment planning, Part II. Am *J Orthod* Dentofacial Orthop 103(5):295-411, 1993.
6. Peck S, Peck L, Selected aspects of the art and science of facial esthetics. Semin Orthod 1(2):105-26, 1995.
7. Humphrey & Powell
8. Bell WH, Modern Practice in Orthognathic and Reconstructive Surgery. WB Saunders, Philadelphia, 1992.
9. Mack RG, Vertical dimension: A dynamic concept based on facial form and oropharyngeal function. J Prosthet Dent 66:478-85, 1991.
10. Rifkin RG, McLaren EA, Restoring vertical dimension and facial harmony with the conservative use of fiber-reinforced composite resin. Pract Proced Aesthet Dent 13(3):223-37, 2001.
11. Kois JC, Occlusal vertical dimension: alteration concerns. Compend Contin Educ Dent 18(12):1169-77, 1997 .
12. 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.
13. Atwood DA, A cephalometric study of rest position of the mandible, part I. J Prosthet Dent 6:504-19, 1956.
14. Dahl BL, Krogstad O, Long-term observations of an increased occlusal face height obtained by a combined orthodontic/prosthetic approach. J Oral Rehabil 12:173-6, 1985.
15. Vig RG, Brundo GC, The kinetics of anterior tooth display. J Prosthet Dent 39:502-4, 1978.
16. Lincow? Dental Anatomy book.
17. Sarver DM, The importance of incisor positioning in the esthetic smile: The smile arc. Am *J Orthod* Dentofacial Orthop 120:98-111, 2001.
18. Frush JO, Fisher RD, The dysesthetic interpretation of the dentogenic concept. J Prosthet Dent 8:558, 1958.
19. Ackerman M, The effect of maxillary position on anterior tooth display (thesis). Rochester (NY): University of Rochester, 2000.
20. VME
21. Kokich
22. Chiche
23. Rufenacht CR, Fundamentals of Esthetics. Quintessence Publishing, Carol Stream, Ill, 1990.
24. Preston J.

To request a printed copy of this article, please contact: Edward A. McLaren, DDS, UCLA School of Dentistry, Room 33-021 CHS, P.O. Box 951668, Los Angeles, CA 90095-1668.

CDA JOURNAL, VOL 30, Nº11

Beyond Cosmetics – The Esthetic Rehabilitative Patient

JACINTHE M. PAQUETTE, DDS AND CHERILYN G. SHEETS, DDS

ABSTRACT The evolution of the esthetic movement has been sustained over time because it touches a base psychological need for most people to feel they are attractive, youthful, and a vital part of society. Through well-organized team diagnosis and treatment planning, patients can benefit from a solid diagnostic and pre-restorative foundation that can more predictably produce consistent optimal treatment results. As the chief diagnostician and treatment supervisor, the restorative dentist must continue to advance his or her knowledge and training to provide the other team members with a concise treatment vision for the patient. With a newly developed synergy between the disciplines of dentistry for team treatment and with tremendous advancement in dental markets and equipment, it is possible to create natural-looking, esthetic rehabilitative treatments.

AUTHORS

Jacinthe M. Paquette, DDS, is a prosthodontist who maintains a private practice in Newport Beach, Calif. She is an associate clinical professor at the University of Southern California School of Dentistry and is co-executive director of the Newport Coast Oral Facial Institute.

Cherilyn G. Sheets, DDS, maintains a full-time private practice emphasizing esthetics and reconstructive dentistry in Newport Beach, Calif. She is the co-executive director of the Newport Coast Oral Facial Institute and a clinical professor of restorative dentistry at the USC School of Dentistry.

The esthetic implications of dental treatment have always been important, but the popularization of esthetics as a prime motivator in treatment is a more recent phenomenon. This esthetic movement -- which, in a large part, has been created by the popular media -- has continued and evolved because it touches a base psychological need most people have to feel they are attractive, youthful, and a vital part of society.1 Dental manufacturers also quickly recognized the growing importance of esthetics and have supported its development with a variety of new esthetic materials and products.

Other articles in this issue of the CDA Journal highlight the areas of objective and subjective projections of beauty and esthetics and how each specialty can contribute to an appropriate and comprehensive esthetic evaluation. Through well-organized team diagnosis and treatment planning, patients can benefit from a solid diagnostic and prerestorative foundation that can more consistently produce optimal results.2

This article will highlight some of the restorative techniques and approaches available for esthetic rehabilitative dentistry and their impact on beauty. It will also illustrate the collaborative results possible from using a multidisciplinary team approach to care.

Meeting patients' esthetic expectations can have many benefits for today's

Figure 1. Pretreatment photograph of patient's maxillary arch. She wanted all restorations replaced for esthetic reasons, and that the lingual position of the two maxillary right bicuspids corrected restoratively.

Figure 2. Pretreatment photograph of patient's mandibular arch. She wanted the older restorations replaced for esthetic reasons.

Figure 3. Patient's completed reconstruction showing a combination of porcelain-fused-to-metal crowns, porcelain veneer onlays, natural teeth, and porcelain veneers.

Figure 4. Frontal view of patient's completed dentistry also illustrating the improvement in oral health due to the improved marginal integrity, hygienic embrasures, and advanced oral hygiene training.

Figure 5. Patient's smile from the left view demonstrating the qualities mentioned in Figure 4.

Figure 6. Photo that the patient sent to the authors' office with a note saying, "Please tell all of the dentists that you work with how very happy I am with my new healthy and attractive smile. You can't imagine how much this means to me."

clinicians, including:

- The ability expand the services provided to an existing patient base
- while empowering them to improve their oral health.
- A renewed passion for dentistry that results from learning new techniques and working with new restorative materials.
- The development of a stronger, more synergistic working relationship with co-specialists to form an interdisciplinary team approach to better meet the patient's esthetic, functional, mechanical, biological, and psychological needs.
- An opportunity to treat a new pool of esthetic-oriented patients who otherwise may not have sought dental treatment.

Empowering the Patient

New patients are often motivated to seek treatment for esthetic reasons alone, while unaware of pre-existing dental problems. Their desires are typically simple, often revolving around the twin goals of having whiter and straighter teeth. With these patients, comes the opportunity for the dental practitioner to educate them not only in the more sophisticated esthetic choices available, but also in the benefits of good oral health for their total well-being. For pre-existing patients, exposure to sometimes very simple esthetic options such as tooth whitening can help them develop a positive attitude toward maintaining their oral health. For both classes of patients, the opportunity created by their desire for improved esthetics allows dentists to improve their overall dental health.3

A simplified checklist for comprehensive esthetic care is as follows:

- Comprehensive diagnosis and treatment plan.
- Specialist evaluations and recommendation, when indicated.
- Adjunctive questionnaires for smile analysis.
- Diagnostic wax-ups and consultations with laboratory technicians.
- Phase I: In-house treatment including oral health education; behavior modification; more detailed esthetic analysis; and simple esthetic procedures, i.e., bleaching, bonding.
- Interdisciplinary specialist treatment.
- Finalization of restorative treatment plan.
- Definitive restorative treatment.

Figure 7. Anterior magnified view of the patient's central incisors showing the wear and chipping of the incisal edges.

Figure 8. Diagnostic wax-up of the patient in Figure 1 demonstrating the possibilities to the patient and dental team of an esthetic reconstruction.

Figure 9. Master cast for the final treatment of the patient in Figure 1 showing a porcelain onlay, three porcelain-fused-to-gold crowns, and a porcelain veneer onlay for the maxillary right quadrant.

Figure 10. Master cast for the patient in Figure 1 showing two porcelain veneer onlays, two porcelain-fused-to-gold crowns, and a porcelain onlay for the maxillary left quadrant.

Figure 11. Final porcelain veneers for the patient shown in Figure 7, which restored the natural beauty and contours to her anterior teeth.

Figure 12. Completed maxillary arch with an assortment of bonded porcelain restorations, and metal-ceramic crowns.

- Follow-up patient education on maintenance of results, including protective appliances.

The patient illustrated in Figures 1 and 2 is an excellent example of an esthetic desire leading to improved oral health. She is a cancer survivor and wanted to celebrate her renewed health with an esthetic makeover of her mouth. Her desires were to correct the slight palatal positioning of the maxillary right bicuspids and to eliminate the grayish hue cast in her mouth due to her pre-existing alloys and old fillings. She went through a comprehensive examination, an extensive in-house periodontal therapy program, combined with educational sessions on the care of her mouth, and ultimately was reconstructed **(Figures 3 through 6)**. The most dramatic result in this patient's treatment was that although her primary motivation for treatment was esthetic enhancement, her most treasured result was that she had established oral health in the process and felt empowered to maintain the result. She is now a vocal proponent of the value of comprehensive esthetic care, including the establishment of individual responsibility for daily maintenance of oral health.

New Restorative Materials and Techniques

The techniques and materials introduced into the marketplace during the past decade have provided restorative dentists with a broader array of treatment options for their patients.4-6 The most significant of these is in the area of porcelain/resin adhesive dentistry. These esthetic conservative treatment options require knowledge of the best choices for the presenting clinical situation, i.e. preparation design, material selection, functional requirements, and the inherent esthetic properties of each material.

Initially, porcelain veneers were considered a treatment option for simple cosmetic corrections. Today, these ultrathin ceramic restorations continue to evolve into a frequently used treatment option to achieve goals for which enamel replacement is required. Additionally, porcelain veneers and their porcelain-bonded variations (inlays, onlays, veneer/onlays) continue to serve as not only esthetic, but also conservative options to idealize the functional and occlusal requirements in the more complex esthetic rehabilitative patient.

Figure 13. Completed mandibular arch with an assortment of bonded porcelain restorations and metal-ceramic crowns that, together with the restored maxillary arch, established for the patient a functional, esthetic, more hygienic, and more youthful mouth.

Figure 14. Preliminary view of a patient who had "a pretty smile" as her primary request.

Figure 15. The same patient in Figure 14 showing the breakdown in the periodontal architecture, and pre-existing restorations that were unesthetic and unhygienic.

Figure 16. Final photos of the patient showing the results of periodontal esthetic reconstructive surgery and final restorative dentistry on the patient's natural maxillary right cuspid and lateral, and anterior bridge abutment on the right central.

Figure 17. Final anterior photo of the patient in Figure 16 showing the overall effect of the combined esthetic periodontal microsurgery to gain root coverage and augment the pontic sites in the maxillary left central area and the fixed partial denture from the maxillary right central incisor to the left cuspid. The other teeth have not been restored.

Figure 18. Magnified view of the patient's maxillary left side demonstrating the healthy tissue subsequent to the grafting and tissue augmentation procedure with final restorations in place

A 50-year-old female patient illustrates these points. She presented with a classic example of a dentition with many years of traditional dental treatments. Her occlusal and restorative stability was compromised due to the complicating factors of parafunctional activity creating uneven wear, breakdown of restorations placed over various periods, marginal leakage, and esthetic compromises. **Figure 7** illustrates the wear and breakdown of the anterior dentition that were bothering the patient esthetically. A complete comprehensive examination was performed, and a diagnostic wax-up was initiated to help in the finalization of the treatment plan (**Figure 8**). The patient's treatment included an assortment of the varied porcelain bonded restorative designs to restore esthetic, functional, and occlusal harmony (Figures 9 and 10). The patient was able to reach her esthetic goals and achieve a more youthful, attractive appearance, while improving all parameters of her oral health, including her periodontal health (**Figure 11**). The maxillary and mandibular occlusal views illustrate the combinations of porcelain veneers, porcelain inlay veneers, porcelain onlays, and porcelain-fused-to-metal restorations utilized as part of a coordinated treatment plan **(Figures 12 and 13)**.

Maximizing Results With the Co-Specialist

The various specialties in dentistry have also benefited from the development of esthetically oriented techniques and materials, just as the restorative dentist has benefited. This is especially true in the field of periodontics. Microsurgical esthetic techniques to provide gingival augmentations, gingival papilla regeneration, and esthetically placed endosseous implants are becoming more common.7 The level of periodontal surgical sophistication available can "turn back the clock" for many patients with periodontal defects. Without the periodontist's ability to recreate a harmonious tissue framing of the dental complex, esthetic objectives will frequently be compromised or impossible to achieve.8

The female patient illustrated in

Figure 19. Patient presented with a concerned for leaking margins on an old anterior bridge. Significant anterior ridge resorption was present.

Figure 20. Master cast for patient with maxillary restorations including the anterior bridge that was made subsequent to periodontal reconstructive surgery of the anterior ridge and the development of anterior papilla.

Figure 21. Final photos of the anterior bridge replacement for the patient seen in Figure 20. Due to the periodontal reconstructive surgery, the patient was able to have a more natural appearance and a more hygienic situation.

Figure 14 was in her mid-30s and wanted a "normal smile." Her request was simple to verbalize, but very complex to meet. The preliminary photographs illustrate the impossibility of the challenge to correct the esthetic compromises through restorative care alone **(Figures 14 and 15)**. Her pre-existing fixed partial denture, from the maxillary right central incisor to the maxillary left cuspid was removed and a provisional bridge was fabricated as a surgical template for the periodontist. Preparation margins were placed where the final ideal preparations would be completed. The pontic for the missing maxillary left central was matched in height and contour to the maxillary right central incisor to act as a surgical template of the desired restorative contours. The periodontist performed several microsurgical treatments to cover the exposed roots, build up the labial tissue contours, and create an ovate concavity for the future fixed partial denture pontic. A final microabrasion session with the periodontist smoothed out the contours and blended all grafted areas into the pre-existing gingival tissues. Once the periodontist gave approval for the definitive restorative care, a porcelain-fused-to-gold fixed partial denture was created to finalize the esthetic and restorative correction **(Figures 16 through 18)**. This patient treatment example illustrates the dramatic change that can be achieved through the synergistic efforts found in a team approach to esthetic treatment.

Figure 22. Photographs provided by the patient's periodontist depicting the starting problems with angled implant placement, chronically irritated tissue, and lack of gingival papilla in the areas created by congenitally missing lateral incisors.

Figure 23. Photo taken by the periodontist at the time of tissue augmentation of the right lateral incisor area.

Figure 24. Photo of patient as she presented for treatment. She was dissatisfied with the size and angulation of the lateral provisional crowns and with the black triangles between her teeth.

Figure 25. Lateral profile of patient seen in Figures 22 through 24 showing the labial protrusion of the implant provisionals due to the screw-retained prosthesis limitations.

This level of effectiveness with periodontal therapy to enhance esthetics can be illustrated in numerous cases. A dramatic example of enhancement of restorative results through a multidisciplinary approach is shown with the patient in **Figure 19**. Even though her deficient pontic-to-ridge adaptation could have been corrected by restorative means alone, the esthetic implications of tooth length, compromised lip support, and lack of papilla were complicating factors.

Figure 26. Master cast of the same patient demonstrating the angulation problem with the implant fixtures. By utilizing custom-milled provisional and permanent abutments, the angulation problems can be mitigated.

Figure 27. Wax pattern post-milling demonstrating the idealized preparation form and the undulating gingival margin replicating the gingival tissue architecture.

Figure 28. Milling of the same pattern as shown in Figure 27 after casting the gold to the titanium collar.

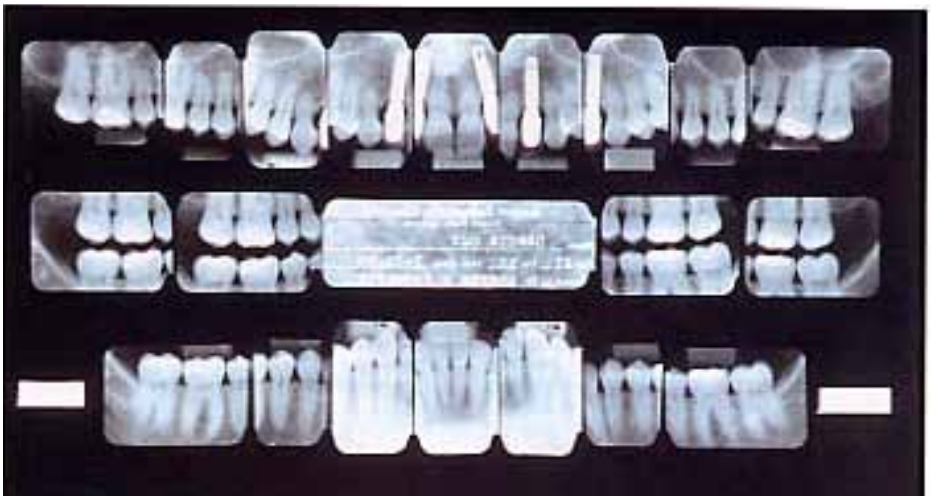


Figure 29. Final full-mouth radiographs of the patient showing the completed implant restorations in the maxillary lateral incisor positions.

By utilizing a microsurgical augmentive procedure, the dental practitioner could restore the deficient ridge appropriately in all three dimensions. The significant change in tissue volume provided the underlying architectural framework allowing normal harmonious tooth contours, embrasure spaces, tooth lengths, and a more hygienic prosthesis **(Figures 20 and 21)**.[9,10]

Even with best-intentioned efforts by the co-specialists, the more challenging esthetic final compromises may sometimes require modifications by the restorative dentist to achieve esthetic goals. Prior to presenting to the authors' office, the patient in **Figure 22** had endosseous implants placed into congenitally missing maxillary right and left lateral sites. This patient had already undergone orthodontic treatment and placement of implants by the oral surgeon, and was seeking periodontal surgery for augmentation of the compromised papillae at the implant sites. **Figure 23** was photographed by the periodontist at the time of the surgery designed to augment the deficient papillae. The patient was subsequently referred to the authors' office for care. She was dissatisfied with the previous restorative attempts to provisionalize the dental implants in the maxillary lateral positions.11 **Figures 24 and 25** illustrate a number of factors that were esthetically displeasing to the patient. The overall tooth symmetry was compromised predominately due to the angulation of the implants and the tooth size discrepancy. The facial exit of the implants required the buccal positioning of the provisional lateral incisors to cover the exit hole of the screw-retained provisional. In a young, attractive female, the lateral incisors should take on a less dominant role to that of the central incisors and have more delicate contour.12 **Figure 26** illustrates the buccal exit of the implants due to the thin bone anatomy in that region from the congenitally missing laterals. Modified surgical techniques sometimes allow the correction of these surgical limitations.

The treatment objectives for this patient were to reduce the lateral incisor space through either direct bonding or porcelain veneers on the four adjacent teeth. Also, the implants were to be restored with custom-milled implant abutments to correct the angulation problem and mimic the ideal gingival margin placement, providing an ideal environment for the final cement-retained porcelain-fused-to-metal crowns **(Figures 27 and 28)**. A full-mouth series of radiographs of the completed treatment show mesial composite resin bonding of the maxillary cuspids, porcelain veneers on the two central incisors, and the completed custom-milled gold abutments and porcelain-fused-to-gold crowns on

Figure 30. Final view of patient's right side showing the results of conservative mesial bonding on the mesial of the cuspid to increase the width, a custom-designed implant abutment and cement-retained crown, and a porcelain veneer to widen the central incisor.

Figure 31. The same patient as Figure 30 from a frontal view showing a natural appearance to her anterior maxillary teeth.

Figure 32. The same patient as Figure 31 from the left side showing a natural relationship between the veneered centrals, implant-supported lateral incisor crowns, and mesially bonded cuspids

Figure 33. Patient in Figure 33 at the completion of orthodontic treatment. Note the remaining interproximal spaces, which were more pronounced from a lateral view, and the provisional interproximal bonding on the three remaining lower incisors placed to close the spaces during orthodontic therapy

Figure 34. Magnified view of the patient's maxillary cast showing the lingually positioned margins to allow the technician to change the width of the teeth to change the interproximal anatomy. The preparations are precise and delicate.

Figure 35. Final maxillary veneers in position on the master cast.

Figure 36. Final patient smile showing the maxillary and mandibular porcelain veneers placed from cuspid to cuspid creating a more harmonious and healthy appearance.

the implant-supported lateral incisors (**Figure 29**). **Figures 30 through 32** show the final photographs of this anterior esthetic treatment restoring the patient to an esthetically pleasing and functionally sound state.

Improving Oral Health While Meeting Esthetic Desires

Of all the dental specialties that can assist in reaching esthetic goals, orthodontics provides one of the most beneficial long-term treatments. Frequently, orthodontic corrections can either eliminate or minimize the need for restorative treatment to reach esthetic goals. Routinely, patients should be directed for an orthodontic evaluation prior to restorative treatments, when indicated.13 The orthodontic treatment of the adult patient can eliminate crowding, more properly load the dentition, improve periodontal health, and create appropriate spacing for idealized contours of the future restorative treatment. The patient in **Figure 33** initially presented with some simple esthetic desires. Her primary goal was to have a lighter, brighter, smile; and she requested porcelain veneers to achieve that goal. Attempts at tooth whitening by prior dentists had not met the patient's expectations. A complete examination revealed crowding, and the patient was referred to an orthodontist for an evaluation. Complete orthodontic treatment was recommended, and the tooth arch to tooth size discrepancy required the extraction of one lower incisor (**Figure 34**). Bonding onto the interproximal surfaces of the lower incisors was done to provide interim esthetic correction of the resulting diastemata. Tooth size discrepancies in the maxillary arch also resulted in slight diastemata between the incisors.

The post-orthodontic restorative treatment plan included porcelain veneers for the maxillary and mandibular anterior teeth to eliminate the interproximal

diastemata and provide the patient with the tooth color enhancement she desired. **Figure 35** represents the epoxy resin master cast of the porcelain veneer preparations of the maxillary incisors. Note the palatal extension of the interproximal margins in the preparation design to enable the laboratory technician to recreate the appropriate contours for diastemata closure. **Figure 36** is the frontal view of the porcelain veneers in place on the master model prior to the final insertion. Following the patient's esthetic approval of the porcelain veneers, the veneers were bonded into place and a protective occlusal appliance was constructed for future protection of the restorations and retention of the final orthodontic results (**Figure 37**).

Conclusion

The ultimate goals in esthetic oriented treatment plans are to:

- Meet the patient's esthetic desires;
- Use the most conservative treatment possible to meet those goals;
- Enhance the patient's oral health in the process of treatment; and
- Educate the patient in how to preserve their dentition for a lifetime.

These goals begin at the time of diagnosis and represent general guidelines for any esthetic treatment. If a patient's esthetic goals can be met simply by bleaching their teeth, that would be an appropriate treatment plan. However, if there are structural/biological problems that require solutions concomitant with the esthetic desires, an appropriate esthetically motivated treatment plan could include all of the disciplines of dentistry to provide an ideal resolution to the patients' problems and desires. The American system of dental delivery is unique in the world, in part due to its advanced specialty educational system. Because of this system, it is possible to draw upon talented practitioners in multiple disciplines as a treatment plan is designed for a patient. The restorative dentist must assume the role of the quarterback of the team. Additionally, as the chief diagnostician and treatment supervisor, the restorative dentist must continue to advance his or her knowledge and training to provide the other team members with a concise treatment vision for the patient. With a newly developed synergy between the disciplines of dentistry for team treatment and tremendous advancement in dental materials and equipment, it is possible to create natural-looking esthetic rehabilitative treatments.

References

1. Goldstein RE. Esthetics in Dentistry. JB Lippincott Co, Philadelphia, 1976.
2. Roblee RD, Interdisciplinary Dental Facial Therapy. Quintessence Publishing Co Inc, 1994.
3. US Department of Health and Human Services, *Oral Health in America*: A Report of the Surgeon General. US Department of Health and Human Services, National Institute of Dental and Craniofacial Research, National Institutes of Health, Rockville, MD, 2000.
4. Yananoto M, The value conversion system and a new concept for expressing the shades of natural teeth. QDT Yearbook. Quintessence Publishing Co Inc, Chicago, 1992, p 9.
5. Geller W, Kwaitkowski SJ, The Willi's glass crown: A new solution in the dark and shadowed zone of esthetic porcelain restoration. Quint Dent Technol 11:233, 1987.
6. Rinn LA, The Polychromatic Layering Technique. Quintessence Publishing Co Inc, Chicago, 1990.
7. Nordland WP, Periodontal plastic surgery: esthetic gingival regeneration. J Cal Dent Assoc 17(11):29-32, 1989.
8. Garber DA, Salama MA, The aesthetic smile: diagnosis and treatment. Periodontology 2000 (11):18-28, 1996.
9. Chiche GJ, Pinault A, Smile rejuvenation: a methodic approach. AACD Symposium Edition, PP&A, 5(3):37-42.
10. Kokich VG, Nappen DL, Shapiro PA, Gingival contour and clinical crown length: their effect on the esthetic appearance of maxillary anterior teeth. Am *J Orthodont* 86(2):89-94, 1984.
11. Chiche FA, Leriche MA, Multidisciplinary implant dentistry for improved aesthetics and function. Pract Periodont Aesthet Dent 10(2):177-186, 1998.
12. Pound E, Personalized denture procedures. Dentists' manual. Denar Corp, Anaheim Calif, 1973.
13. Kokich VG. Esthetics: The orthodontic-periodontic restorative connection. Seminars Orthodont 2(1):21-30, 1996.

To request a printed copy of this article, please contact/Jacinthe M. Paquette, DDS, 360 San Miguel Drive, Suite 204, Newport Beach, CA 92660.

CDA JOURNAL, VOL 30, Nº11

Oral Gratification Out of Control

Robert E. Horseman, DDS

Current studies, along with a startling glimpse of Anna Nicole Smith, confirm our observation that obesity is so rampant in this country that it can almost be considered the norm. Concurrent research is pointing toward overmastication as the prime etiology of most TMJ problems and intractable love handles. We are obsessed with food. It functions nicely as nutritive Xanax and at the same time is the essential ingredient in all social intercourse.

We don't eat because we're hungry, but because it's time, or because food is constantly displayed on TV with only occasional interruptions for the programming. Food can be clearly heard importuning from the fridge, "Turn on the light, let's party down!"

Actually, we rationalize, there is nothing better to do and there is so much food, we owe it to the farmers to help reduce the glut. All this in spite of the fitness craze now in its third decade and the millions of dollars spent on diet foods. The exhortations of Suzanne Somers flogging the Thigh Master and the chimera of the six-pack abs are apparently not enough. The lip service given the fat-free diet also features lips wrapped around anything that tastes, smells, looks or feels good.

All the gondolas in the supermarket are accompanied by frowny citizens intently studying the percentage of calories derived from the fat in the foods they are about to purchase. The wheels of rationalization turn audibly in their heads. To aid them and us in this determination, the government has dictated that the nutritional value of the product be listed prominently on the package. This has the same effectiveness as cancer warnings placed on cigarettes because the amount is expressed in grams. In this country, the metric system has met with the same popularity you would experience upon learning the Osbourne family has moved in next door.

As a result, except for the scientific community that can at least pretend to grasp the concept, nobody has any idea of how much or what a gram is. Telegrams we know; cablegrams, sure, but the gram without a prefix is an entity completely outside our frame of reference. Look it up and find out how many grams are in a pound if you feel guilty for not knowing, but you'll forget it moments later without hesitation or regret.

You might accept that a milligram is one-thousandth of a gram, but you can't say that easily without lisping like Sylvester the puddy-tat. You could perhaps agree that a kilogram is a thousand grams, but does that mean you could hold that much in your hand or would you need a forklift? See, you don't know! If you could

hold a thousand grams in your hands, then a gram couldn't amount to a hill of beans, could it? That's what we think, and that's what the mayonnaise and potato chip manufacturers, for example, are slyly encouraging us to believe. Mayonnaise contains only 12 grams of fat, they assure us in the sincere manner of a used car salesman sliding quickly over the fact that the car has 200,000 miles on it. They are hoping you won't notice the small print on the label casually mentioning that the 12 grams of fat occurs in each and every tablespoon of the dressing. Potato chips have only 10 grams of fat per serving, they state in the same reassuring manner you'd use with a patient about to get an injection. And how much is a serving? It's one ounce. Six chips? Eight? Who would know? Nobody at our house, where a 12 ounce bag of chips in the presence of two adults lasts no longer than five minutes -- much less in the grimy paws of children and adolescents.

Further deliberate obfuscation of an already murky subject occurs when the agency in charge of Consumer Obfuscation decides to subdivide its fat report into saturated, unsaturated and polyunsaturated categories. They know they are on pretty safe ground here, because the same people who can't get a fix on a gram are going to come up equally clueless with all this saturation information.

We think the surgeon general, who may be too busy advocating the use of birth control devices to pay enough attention to more practical matters, should require warning labels to be placed on these products stating that the contents will go directly to the hips, supersaturating those areas and bypassing normal routes.

Laboratory tests with rats, while conceding that these animals in their natural state seldom wear form-fitting outfits, indicate that continued use of the product by a human consumer will require her to shoehorn herself into Spandex pants at considerable risk to her self-esteem. Then there is the additional possibility of laying out upwards of $4,000 for services rendered by professional fat removers wielding large suction hoses.

We dentists have shamefully neglected our responsibility here. What's the question most often asked us? "How soon can I eat on this, Doc?" Like they can't wait, haven't chewed anything for an hour and loss of oral gratification is threatening to unhinge them. Regretfully, our traditional response has been, "Don't chew on that side for four to six hours." Or, "Don't chew anything hard, fibrous, tough or sticky at lunch (or dinner) today." As guardians of the oral orifice and professional people wearing serious white coats upholding our pledge to care for the health of our patients, our response should have been, "Don't chew anything for six months, or better yet, never."

We concede that this may be an unworkable suggestion much like "be sure to floss every day." Even if implemented, dedicated trenchermen would soon figure out how to get their mass quantities of food transdermally, by I.V., or incorporated into suppositories. In the meanwhile, we see no harm in returning the word "gram" back to its proper definition of the female half of one's grandparents.