Rejuvenation Via Biologically-Guided Technology

Written by Robert P. McBride, DDS Tuesday, 13 September 2011 14:30

INTRODUCTION

Although tooth wear, or attrition, is considered to be a common attribute of the aging process,1 a segment of the population with attractive and functional dentitions that experiences no pathologic tooth wear has been and is continuing to be researched. Dr. Robert L. Lee, a dentist and biologist, originally researched people with these qualities—some well into their nineties and beyond—in order to discover whether there were common elements within their oral systems that might account for their enduring state of oral biologic health. His studies disclosed that they all shared several basic attributes, which have become known as the optimal biologic principles of “bioesthetics,” a term he defined as “The Study or Theory of The Beauty of Living Things in Their Natural Forms and Functions.”2Besides having no pathologic wear, this population segment also demonstrates healthy periodontal tissues, relaxed muscles, good facial form and esthetics, and asymptomatic temporomandibular joints (TMJs) (Figures 1a to 1c).

Figures 1a to 1c.

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Tooth wear is associated with decreased chewing efficiency and teeth sensitivity as well as compromised esthetics both through a decrease in tooth length and consequential midface collapse.3 With the decline in caries rate coupled with extended life expectancy, tooth wear has increased in magnitude as a concern for dental clinicians.4 It is also common in the young adult and teenage population, many having had minimal or no restorative treatment.

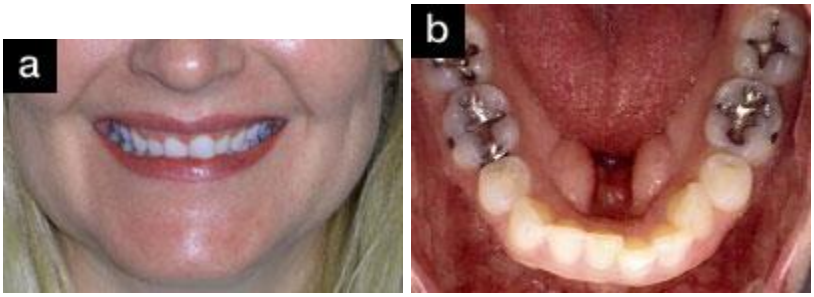
Addressing this problem first requires an accurate diagnosis of the etiological aspects of tooth wear.4Although dental research continues to pour forth an explosion of new technology and workable solutions hardly imagined in the past, any attempt to treat a worn dentition with any of these technologies without an understanding of its underlying cause would carry with it a high probability of failure.

This article will chronicle the diagnosis and treatment of a patient with severe tooth wear and orofacial challenges through a stepwise application of the bioesthetic principles. It will also demonstrate a conservative solution that required no reduction in tooth structure. Although tooth reduction attendant to operative and prosthetic treatment is common procedure, the author knows of no patient that relishes having their teeth “ground down.” Intrusion into tooth structure opens the door to dental discomfort, future endodontic procedures and breakage of teeth as well as their restorations. These inherent sequelae can be greatly reduced, or even eliminated, with new procedures mindful of tooth structure removal. In the world of composite dentistry there are now materials that afford a more conservative approach to restorative and rehabilitative treatment planning.5 This is especially exciting when considering treatment possibilities available for the younger population.

CASE REPORT

The treatment as described below was done in a manner similar to cases of other dentists trained in bioesthetic dentistry that are holding up remarkably well over time.6-8

Background and Discussion of the Case



Figures 2a to 2b. Occlusal stress evidenced by (a) worn teeth, midface collapse, lip support loss, and (b) lingual tori.

Our patient presented with occlusal stress resulting in large mandibular tori and tooth wear (Figures 2a and 2b). The wear was a factor in the loss of occlusal vertical dimension (OVD) resulting in significant midface collapse. She was treated to optimal function and esthetics through orthodontic care and composite-addition technology. Restorative treatment of the teeth was performed solely through the addition of composite materials without intrusion into tooth structure. While the materials used in this case are state of the art, it is important to note that its long-term success will have been through application of the principles underlying bioesthetics.2

Bioesthetic dentistry is based upon the aforementioned research of that segment of the population gifted by Mother Nature with attractive, unworn, and lasting dentitions whose teeth arrangements and relationships to the TMJs are such that their chewing and swallowing functions are more vertical than horizontal in nature.9 This occurs through a governing blend of the following factors:

1. Stable seated condyles coincidental with simultaneous full teeth contacts in occlusion.
2. Unworn, high profile posterior teeth in conjunction with sufficient anterior horizontal and vertical overlaps.
3. Posterior clearance from opening to full closure without premature posterior contacts through the proprioceptive guidance offered by 1 and 2 above.

Neither the teeth, TMJs nor periodontium of these chewing systems break down as they are not burdened by the shear stress imposed upon those lacking the above attributes.2,10These aspects inherent within the chewing systems of this population segment constitute the bioesthetic principles that guided the author's decisions in all phases of this case. As mentioned before, the author and his bioesthetic colleagues have experienced long-term success with their patients using laboratory-fabricated restorations guided by the bioesthetic principles.6

The patient cited in this case report had extreme reservations about dentally intrusive procedures such as onlays and crowns. The author has experienced success for some time using composite additions based on considerations of tooth conservatism and the limited financial resources of some patients. Composite addition restorative treatment (positive coronoplasty) was favored based on this and reinforced by the success of a bioesthetic colleague, Hal Stewart, DDS, in treating many patients over the years using full-dentition composite additions guided by the bioesthetic principles 9,10 The restorative procedures selected in this case were based upon the lasting treatment success of several patients rehabilitated in a similar manner; one case will be illustrated below and the other as a Web-published sidebar by Dr. Hal Stewart available at dentistrytoday.com.

Figure 3. Severe occlusal vertical dimension (OVD) overclosure, retracted anterior teeth, parafunctional wear with central incisor length of 8.5 mm completely covering the lowers.

Figure 4. Diagnostic centric-related study models.

The author and patient reviewed the most conservative option for treatment and agreed to use a positive coronoplasty treatment approach realizing that if future composite resin failure occurred, they could be easily replaced based upon the technique employed in the additive procedures. Also, materials research and evolving computerized CAD/CAM technology is growing daily, and stronger materials and techniques are being developed that could offer a replacement of the composite additions if desired or needed in the future.11Bonded adhesive technology was used both in the replacement of several amalgam fillings as well as composite additions on all teeth.

The patient's presenting concern was being embarrassed by a "gummy" smile and short, worn teeth accompanied by a lack of lip support. All of her anterior teeth had lost significant length due to parafunctional wear and were retracted, completely covering those of the lower when closed. Prior to the start of treatment the OVD (upper to lower central incisor CEJ to CEJ) was 8.5 mm—the length of the upper central incisor, which completely covered the lower incisors (Figure 3). The treatment plan was to re-establish a proper OVD and to regain lip support through both orthodontic and composite addition treatment guided by the bioesthetic principles. Total care was divided into 6 separate phases.

Conservative Full Mouth Rehabilitation Utilizing the Principles Found in Optimal Biologic Chewing Systems: A 6-year and 9-year Followup

Hal. R. Stewart, DDS

Case 1: Kristi—A 6-year Followup

Kristi was 22 years of age when her case was completed in 2005.1 Her teeth were severely worn with no previous or existing decay or restorations (Figures 1a and 1b). She suffered from headaches, facial muscle pain and tension. A conservative treatment approach utilizing positive coronoplasty (composite bonding addition) appealed to her and her parents. Upon stabilization of her condyles through maxillary anterior guided orthosis (MAGO) therapy2 a definitive diagnosis and treatment plan were created. Invisalign was utilized for slight repositioning of her anterior teeth to create a more ideal inter-arch relationship. Then full mouth positive coronoplasty was performed (Figures 2a and 2b). The result was a beautifully functioning chewing system not only evident in her smile but seen in her whole face as a result of relaxed muscles. The case has held up very well and no other dental treatment has been needed for the past 6 years (Figures 3a and 3b).

Figure 1a. Kristi's chief complaint was facial muscle tension and headaches. She was concerned about her worn front teeth.

Figure 1b. Pre-op with patient closed in centric occlusion.

Figure 2a. After conservative full-mouth bioesthetic restoration Kristi felt immediate relief of her muscle pain, tension, and headaches.

Figure 2b. Immediate post-op centric relation = centric occlusion.

Figure 3a. Five-year post-op and Kristi is still comfortable with no muscle tension or headaches.

Figure 3b. Five-year follow up.

Case 2: Diane—A 9-year Followup

Diane was initially seen by Dr. Hal Stewart in 2001 (Figures 4a to 4d). Her case was completed in 2002 (Figures 5a to 5d). Treatment included: condylar stabilization through the MAGO therapy; teeth restoration by a combination of subtractive coronoplasty on selective teeth; remake of crowns on three molars (18, 19, and 31); positive coronoplasty on all of her remaining teeth through bonded composite additions. The photos illustrate that no wear, no loss of tooth length, and no loss of occlusal vertical dimension occurred over a nine-year period (Figures 6a to 6d). Diane has remained comfortable, her occlusion stable and she is still thrilled with the esthetics of her smile.

Figure 4a. Pre-op full-face 2001.

Figure 4b. Pre-op tooth No. 9 measurement = 10.0 mm.

Figure 4c. Pre-op tooth No. 22 measurement = 8.5 mm.

Figure 4d. Pre-op vertical dimension of occlusion measurement = 16.0 mm.

Figure 5a. Immediate post-op full-face 2002.

Figure 5b. Immediate post-op tooth No. 9 measurement = 11.0 mm.

Figure 5c. Immediate post-op tooth No. 22 measurement = 10.0 mm.

Figure 5d. Immediate post-op vertical dimension of occlusion measurement = 17.0 mm.

Figure 6a. Nine-year follow up.

Figure 6b. Nine-year follow up tooth No. 9 measurement = 11.0 mm; no

change from 2002.

Figure 6c. Nine-year follow up tooth No. 22 measurement = 10.0 mm; no change from 2002.

Figure 6d. Nine-year follow up vertical dimension of occlusion = 17.0 mm; no change from 2002.

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Dr. Stewart graduated from Baylor College (1989) and also studied at The Pankey Institute in Fla, the Schuster Center in Ariz, Las Vegas Institute for Advanced Dental Studies in Nev, and Orognathic Bioesthetics International (OBI) in Neb. Currently, he is the president of the Texas Academy of Cosmetic Dentistry. Dr. Stewart is an international mentor for the Schuster Center and has been on the teaching faculty of OBI since 2007, which is a not-for-profit teaching organization. He has published clinical articles in *Contemporary Esthetics and Restorative Practice*. He can be reached at hal.stewart@verizon.net .

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Phase 1: Case Diagnosis and Treatment Planning

Data was gathered, including centric-related models mounted on a Panadent PCL jaw simulator (Panadent Corporation) along with intra and extraoral photographs. An orthodontic consultation (Dr. Gerald Eidenmuller, Orange, Calif) was commenced and treatment goals were developed to address the patient's concerns through application of the bioesthetic principles. It is important that there be a shared philosophy of treatment between general practitioner and specialist.2 Orthodontic goals included increasing OVD and developing proper anterior and posterior teeth relationships envisioning the later addition of composite additions on all teeth in accordance with the principles.

Phase 2: Orthodontic Treatment

Orthodontic treatment was itself phased. All first bicuspids were absent, associated with previous orthodontic treatment. Initial treatment included intruding and tipping the maxillary anterior teeth forward to regain lip support and eliminate the gummy smile (Figure 4 and 5). The lower anteriors were also moved forward, leaving spaces in the first bicuspid areas. Titanium implants (Straumann USA) were then placed in these spaces and were utilized in finishing

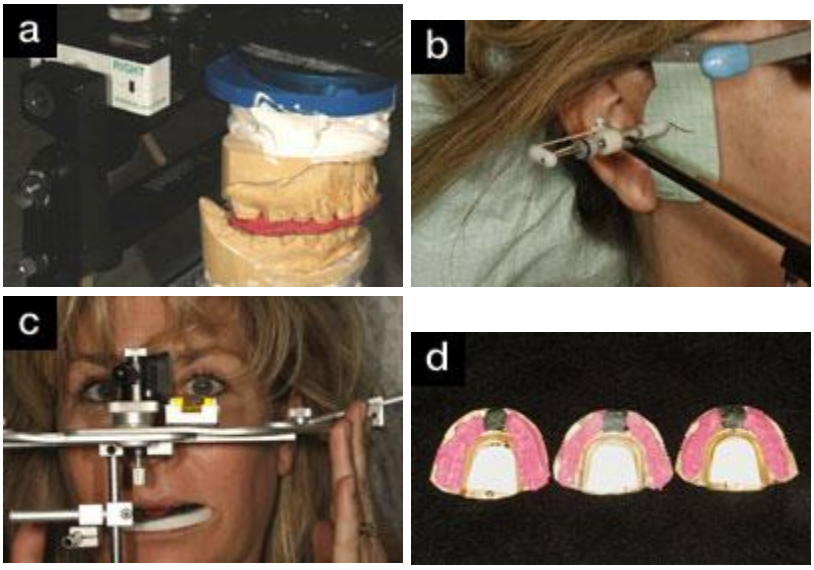
the orthodontic treatment, to be restored later. This orthodontic treatment phase increased her upper to lower central incisor CEJ to CEJ distance from 8.5 to 13.5 mm.

Figure 5. Orthodontic mechanics forward tipping and intruding upper anteriors, diminishing gummy smile.

Figure 6. Evaluation of teeth positioning and OVD prior to removing orthodontic mechanics.

Phase 3: Continuing the Diagnosis

Orthodontic mechanics were not removed until centric-related models disclosed proper teeth relationships for the proposed composite addition treatment phase (Figure 6). Although the patient had no TMJ-related symptoms, condylar stabilization was assured through the addition of a bonded composite tab, a “Lucia jig” of sorts, on the lingual surfaces of the upper central incisors disallowing posterior teeth contacts.12,13 The tab increased the anterior OVD to 16.0 mm and was maintained for several days to allow for condylar seating, with the patient experiencing no dental or TMJ discomfort. Condylar stability was verified through matched open centric relation interjaw registrations taken the day of composite tab placement and several days later using a Condylar Position Indicator System (CPI system [Panadent Corporation])14 (Figure 7a). TMJ movement recordings were then made from the stabilized axis positions through an Axi-Path Recorder System (Panadent Corporation) to establish condylar angulations, Bennett movements and hinge axis locations, which were transferred to the patient’s skin with marking ink (Figure 7b). These values were then programmed onto the Panadent articulator.



Figures 7a to 7d. (a) Verification of stable condyles through Condylar Positioning Indicator System (Pandent). **(b)** Establishing condylar angulations, Bennett movements and hinge axis locations with Axi-Path Recorder System. **(c)** Facebow transfer related to true hinge axes. **(d)**

Verification of centric relation accuracy through exact matching of three open jaw registrations.

Phase 4: Pretreatment Wax-up and Injection Stent Fabrication

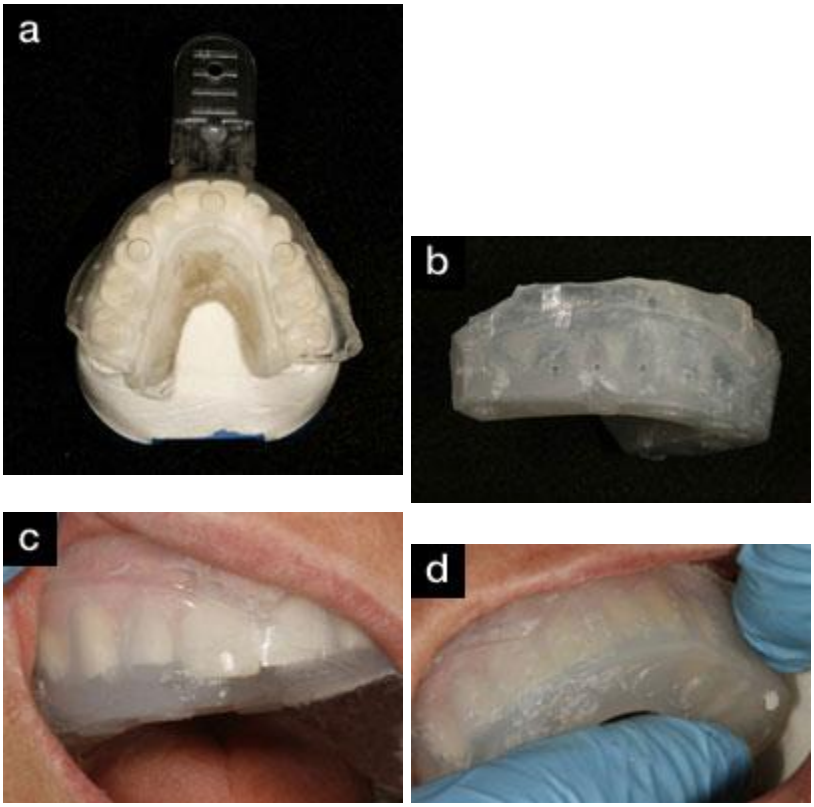
Accurate post orthodontic models were fabricated by means of alginate (Orthoprint [Zhermack]) impressions taken in perforated stainless steel trays. The alginate was mixed with 50° water to slow setting time to allow for its injection onto the occlusal and interproximal details of the models. The impressions were then poured with a dense, vacuum mixed stone, (Fuji Rock [Fuji International]) and trimmed. The upper model was mounted onto the Panadent PCL articulator via a true hinge axis recorded by referencing a Panadent facebow to the hinge axes inked markings (Figure 7c). The lower model was mounted to the upper model by means of an open-centric relation interjaw registration. The fidelity of the interjaw registration was verified through exact matches with several others taken in the same manner (Figure 7d). Wax was then fashioned onto the models by the author to establish proper anterior and posterior teeth anatomy.

The design of the full mouth wax-up was guided by the morphology inherent in attractive and unworn chewing systems that are personified within the principles of bioesthetics.2 The new OVD of 16.0 mm allowed for the development of ideal form of both anterior and posterior teeth, as well as to fashion an occlusion allowing the mandible to return to full tooth contacts without premature posterior interference. This combination of attributes expedites a proprioceptively guided verticalized closure inducing a tolerable encumbrance upon the teeth, supporting periodontium and TMJs.15,16

Phase 5: Esthetic Evaluation

Alginate impressions were taken of the wax-up and poured with laboratory stone (Denstone [Modern Materials]). To evaluate the proposed esthetics, a stent was fabricated over the model. (Invisacryl A .040” Clear [Ministar Thermal Former, Great Lakes Orthodontics]) Polycarboxylate temporary material (Structur 2 SC [VOCO America]) was placed into the 8 anterior-most incisal areas and transferred onto the patient’s teeth as a “test façade” to wear 24 hours to evaluate how the proposed teeth length and form would influence the surrounding soft tissue (Figure 8). At first look, it appeared to both the author and patient that the teeth additions might be too long, but it was decided to leave them as they were. After having the facade in place for 24 hours to allow for the influence of the new lip support, it was noted that the incisors could stand lengthening. Flowable composite additions were done chairside to mutual agreement and the façade was worn another 24 hours to confirm the new lengths.2

Figure 8. Esthetic test façade to evaluate proposed tooth length on surrounding soft tissues.



Figures 9a to 9d. Stent fabrication and usage. **(a)** Clear acrylic tray fashioned to impress upper waxed model. **(b)** Finished stent with composite exit portholes. **(c)** Stent in place with G-aenial flowable composite (GC America) exiting through porthole. **(d)** Stent in place with Kalore composite exiting through porthole.

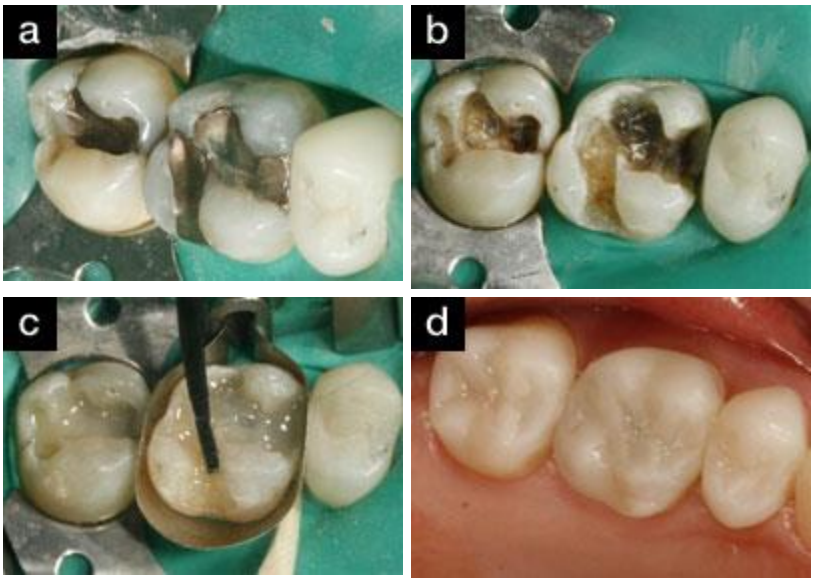
It is important that the mouth models used in the fabrication of the composite addition stents are pristine representations of both the teeth and surrounding soft tissue. Well-made stents embody all of the bioesthetic principles that lie within the centric-related wax-up models. This results in the composite additions requiring minimal, if any modifications after their placements. The stents were fabricated in a similar manner as those used for the two other cases illustrated.

Stock, clear plastic trays (Clear Impression Trays [CLINICIAN'S CHOICE]) were adapted to the wax-up models to develop stops and allow for a relatively uniform thickness of stent material (Figure 9a) Clear vinyl polysiloxane (VPS) material (Crystal Affinity [CLINICIAN'S CHOICE]) was injected around the details of the wax-ups, then into the trays and placed onto the models. The trays were then removed from the models, the VPS material removed from the trays and then tried in the mouth for accuracy. Port holes to each tooth were made through the stent to facilitate the expression of the composite material during its placement (Figure 9b).

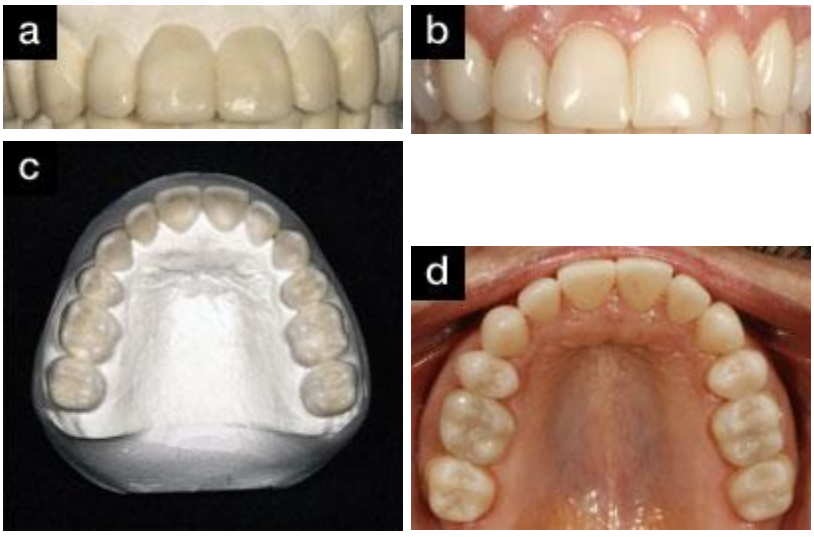
Phase 6: Positive Coronoplasty (Composite Additions)

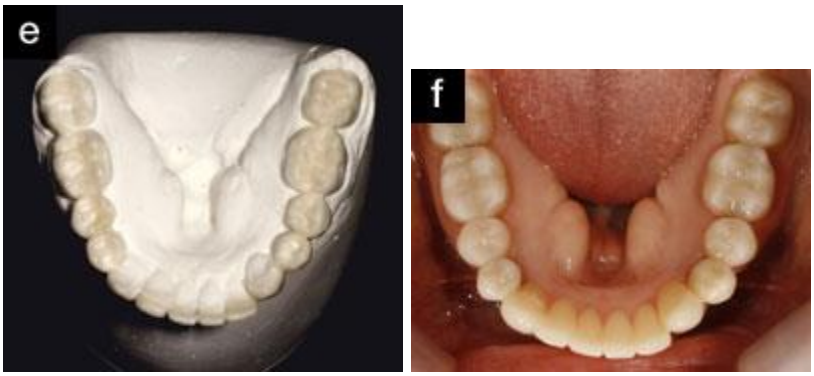
The anterior composite 360° additions were placed one tooth at a time from anterior to posterior—alternately; one upper, then one lower—using a total enamel etching technique (37% phosphoric acid [Bisco]) followed by placement of an adhesive. (Optibond Solo Plus [Kerr Corporation]). Flowable composite (G-aenial Universal Flo [GC America]) was used for the anterior dentition. The material was introduced onto the stent, which was then placed firmly onto the teeth, the excess flowable composite exiting through the porthole (Figure 9c). The additions were placed on every other tooth and then polished. This eliminated the need for interproximal separation while etching an adjacent tooth as the polished interproximal surface prevented any new addition material from adhering to it. The tray is removed and the small spine of flowable material left within the stent snaps off easily upon its removal. The addition is then finished and polished to completion (Top Finisher System [Cosmedent]). After each addition, occlusal contacts were

idealized. The posterior teeth additions were made with a non-flowable composite (Kalore [GC America]). The material is somewhat thermoplastic and the compules were warmed in a water bath at 160°F. This decreased its viscosity, which allowed the excess material to easily exit through the port holes (Figure 9d). The posterior additions were done one at a time using plumber's tape to separate the interproximal tooth surfaces during etching. Those that required amalgam removal were restored internally prior to their occlusal additions via the stents (Figures 10a to 10d). They were finished in the same manner as the anterior additions.

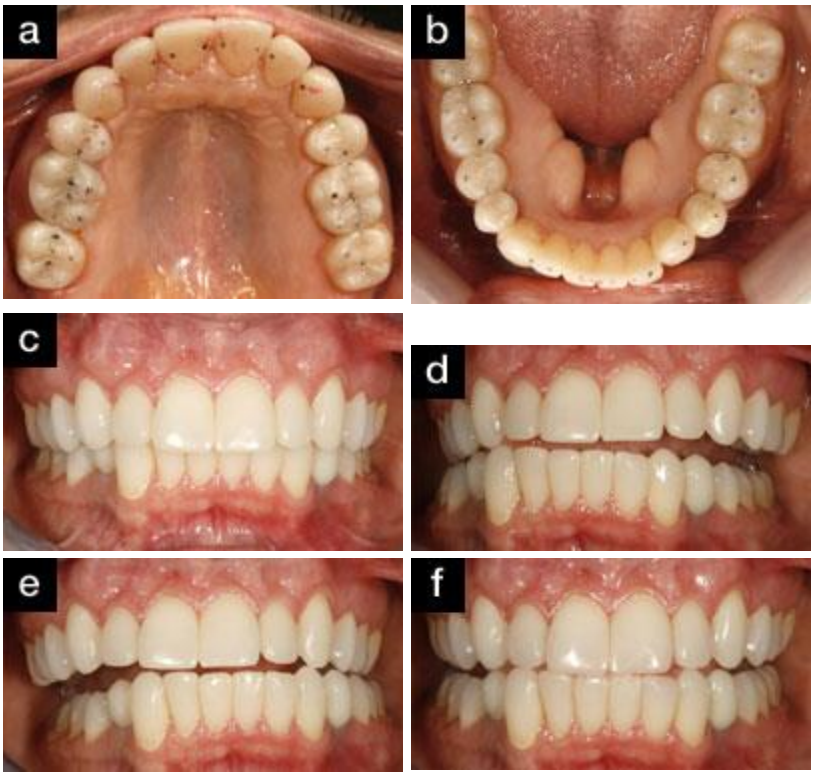


Figures 10a to 10d. Restoration progression. **(a and b)** Amalgam removal. **(c)** Replacing the tooth internal with G-aenial flowable composite. **(d)** Finished composite additions.





Figures 11a to 11f. Composite additions mimicking that of waxed models. **(a)** Closeup of upper anterior wax-ups. **(b)** Closeup of maxillary anteriors. **(c)** Occlusal view of upper waxed model. **(d)** Occlusal view of upper finished case. **(e)** Occlusal view of lower waxed model. **(f)** Occlusal view of lower finished case.



Figures 12a to 12f. Functional fidelity of wax-up models to finished case—few adjustments required. **(a)** Functional contact markings of upper model. **(b)** Functional contact markings of upper model. **(c)** Centric occlusion equals centric relation. **(d)** Right chew test position. **(e)** Left chew test position. **(f)** Protrusion test position.

The above-mentioned procedures leading up to well-made stents left very little, if any, flash material after composite placement. Minimal finishing and polishing was required as the composite surfaces mimicked that of the polished wax of the models (Figures 11a to 11f). While the composite additions were being placed, it was interesting and exciting for the author to experience the nuances of both the developing form and function reflecting those of the wax-up models in an exacting manner through their precise matching with intraoral occlusal contact areas and functional test

positions (Figures 12a to 12f). Through a combination of orthodontic and composite addition treatment, the patient's anterior OVD was increased approximately 7 mm (Figures 13a to 13 d). Since the upper anterior teeth were intruded during orthodontic treatment, the OVD measurement was taken between the CEJ's of molars and translated proportionately. *"Increasing anterior vertical dimension with stable joints can be an esthetic event, since it provides a dentoskeletal face lift plus space for beautiful unworn tooth form."*2 The patient experienced no post-treatment discomfort and was ecstatic about her new facial appearance and smile (Figures 14a and 14b).

Figures 13a to 13d. Total treatment increased patient's OVD by 7 mm. **(a)** Closeup of anteriors pretreatment. **(b)** Close-up of anteriors post-treatment. **(c)** Left lateral view pretreatment. **(d)** Left lateral view post-treatment.

Figures 14a and 14b. Pre- and post-treatment views. Note rejuvenated smile and relaxed facial appearance through neuromuscular release—a dento-skeletal facelift.

Closing Comments

It is the shared belief of the author and his colleagues trained and experienced in bioesthetic diagnosis and treatment that tooth wear is but one of many afflictions of a system veering from the bioesthetic principles and not a normal circumstance of the aging process. Application of the principles offers a paradigm of diagnosis and treatment that transcends solely treating the results of disease and dysfunction through technical intervention; they act as a guide in

directing technology as an essential means towards a predictable end of establishing or regaining a patient's oral beauty and function. The author feels that the examples displayed in this article guided by application of the optimal biologic principles of bioesthetics attest to their validity and truly embody the meaning of *Primum non nocere*, meaning "First do no harm" that lies within the body of our hippocratic oath.

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Disclosure: Dr. McBride reports no disclosures.