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# Conservative Full-Mouth Rehabilitation Using the Principles of Bioesthetic Dentistry



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According to bioesthetic principles, the importance of the beauty of living things in natural form and function is acknowledged and emulated in dental restorations, not only with individual teeth but also in the overall facial appearance. This author supports the philosophy, enforces the results of previous findings, and utilizes an actual case to support the validity of these procedures. This article presents a clinical application of these principles in a case where both first molars of the mandible and the anterior teeth of a middle-aged patient suffered excessive wear due to improper occlusion.

The Bioesthetic Principles were first formulated by Robert L. Lee, DDS, MS.<sup>1</sup> They were readily recognized and continue to be used in practice and presentations by dentists in esthetic and functional dentistry.<sup>2,3,4</sup> "Bioesthetics is the study or theory of the beauty of living things in their natural form and function," states Lee. In dentistry, the ultimately desirable stomatognathic system has 3 aspects in common with Lee's Bioesthetic Principles:

1. The form of the joint/stable condylar position

2. The form of the teeth/tooth, as it occurs in nature and unmolested by the ravages of diseases, such as caries, attrition, and abrasion
3. The form of the occluded dentition, ie, adequate vertical dimension of occlusion, allowing the correct vertical and horizontal overbite of the anterior teeth.

When these 3 biologic principles are present, the neuromuscular release reveals maximum facial esthetics, esthetically pleasing dentition, and a comfortable and efficient masticatory system. When these principles are observed, the overall result achieved is a natural and enduring beauty.

The functional goal of bioesthetic dentistry is to maximize anterior guidance and verticalize the posterior segment with the normal physiologic position of the condyles in centric relation (CR). Dentists have found that the activity of the masseter and temporalis elevating muscles can be reduced only when the posterior disclusion is obtained via appropriate anterior guidance.<sup>5</sup> It is also believed that elimination of eccentric posterior contacts decreases the activity of these muscles. Williamson stated that it is not the con-

tact of the canines that decreases the activity of the temporalis and masseter muscles but the elimination of posterior eccentric contacts.<sup>5</sup>

By applying the principles of bioesthetic dentistry, an accurate diagnosis was established for the patient described in this article and the subsequent treatment was derived. The physiologic and esthetic improvements upon completion of the treatment were significant, resulting in patient appreciation and gratitude.

#### Clinical Examination and Diagnosis *Subjective and Objective Findings*

A 42-year-old woman presented with a primary complaint of exces-

sive wearing of the first molars on both sides of the mandible (Figure 1); the presentation was by a referral for a specific evaluation of this condition. The patient was in good general/medical health, but tension in the muscles of facial expressions was discernible upon extraoral observation. This was especially evident around the eyes (Figure 2). Hypertension and soreness were revealed upon examination of the facial muscles—the masseters and temporales. When questioned about the tension in the facial muscles the patient responded that she was not really aware of it; she was most likely just used to it and attributed its presence to stress.

A thorough examination of the

joints revealed no joint symptoms, such as popping, crepitus, or pain. Tomograms of the temporomandibular joint revealed that the anatomic form of the condyles was normal with the cortical plate uninterrupted.

Examination of the dentition revealed: no decay; porcelain inlays were present on teeth Nos. 3, 14, and 15; severely worn resin onlays on teeth Nos. 19 and 30; a porcelain-fused-to-metal (PFM) on tooth No. 18; a mesioocclusal composite on tooth No. 21; and an occlusal composite on tooth No. 31. The resin onlays on the mandibular first molars were considerably worn, as were the anterior teeth. Note the flattened anatomy of the teeth, par-



**Figure 1**—Intraoral right and left lateral views of the patient's dentition at presentation. Note the worn first mandibular molars on both sides as well as the wear on the anterior teeth.



**Figure 2**—Facial views of the patient at presentation. Note the tension of the facial muscles, even when smiling.



**Figure 3**—Intraoral views at presentation. The anatomy of the teeth is flattened, particularly evident in the canines and the first molars. The lack of anterior guidance is evident in the test positions.

ticularly evident in the canines and first molars (Figure 3). The lack of anterior guidance was evident in the test positions (Figure 3). The vertical dimension of occlusion, as measured from the cemento-enamel junction (CEJ) of tooth No. 9 to that of tooth No. 24, was 16 mm and the lower midline was oriented 0.5 mm right of the maxillary midline (Figure 4). A periodontal fitness evaluation was completed and the patient's periodontal health was found to be excellent.

#### Diagnosis/Assessment

It was suspected that the wear of the patient's mandibular first molars, the wear of the rest of the dentition,

**"The muscular hyperactivity and the lack of anterior guidance resulted in the excessive wear of the dentition."**

and the hypertension of the facial muscles were because of an unstable mandible-to-cranial base relationship, most likely caused by malocclusion. The muscular hyperactivity and the lack of anterior guidance resulted in the excessive wear of the dentition.

#### Treatment Plan

The patient was presented the options of addressing only the chief complaint and having crowns placed on the mandibular first molars or addressing the real cause of the problem, using the entire stomatognathic

system, by using the principles of bioesthetic dentistry. The patient selected the more comprehensive treatment.

#### Clinical Procedure

A proper joint form, or stable condylar position (SCP), was achieved using a correctly constructed, fitted, and adjusted condylar CR repositioning splint, similar to the one shown in Figure 5. This maxillary anterior-guided orthosis (MAGO) was prepared and worn full time by the patient for 6 weeks. During this time, the appliance was adjusted twice weekly to allow the seating of the condyles. The SCP was verified, using the Panadent Axis Positioning Indicator (API) (Panadent Corporation). When it was determined that a stable condylar position had been achieved (3 consecutive open centric relation bites a week apart with the API showing no more movement of the condyles), the hinge axis position was determined and the condylar tracings and Bennett movements were taken. The final diagnostic study models were mounted in the Panadent Articulator at the hinge axis position, so that any change in vertical dimension of occlusion could be accurately reflected in the articulator. The pretreatment and postorthotic mounted study models were compared (Figure 6), and it was determined that the first tooth contact in CR occurred simultaneously on the second molars. This "fulcrum" effect resulted in occlusal pos-



**Figure 4**—The vertical dimension of occlusion between teeth Nos. 9 and 24 was 16 mm. The lower midline was oriented 0.5 mm right of the maxillary midline.



**Figure 5**—A stable condylar position was achieved using a correctly constructed and adjusted repositioning splint, worn full time for 6 weeks.



**Figure 6**—Pretreatment and postorthotic mounted study models.

**“The patient was posturing the mandible forward to avoid the second molar interference.”**

terior avoidance patterns. The patient was posturing the mandible forward to avoid the second molar interference. This posturing resulted in the hyperactivity of the masseter, temporalis, and lateral pterygoid muscles, and the subsequent attrition of the enamel.

The patient was adamant that only minimal natural tooth structure be removed where necessary during the rehabilitation procedures. She wished to avoid all preparation procedures (reduction of natural enamel) of the anterior teeth, if at all possible. This wish was kept in mind in determining the final treatment plan.

The average lengths of healthy

unworn teeth, common to all masticatory systems, have been established in the literature<sup>6</sup> and were determined by Lee through observation of healthy stomatognathic systems<sup>7</sup>:

- Maxillary central incisors = 11 mm to 13 mm, with an average of 12 mm
- Maxillary canines = 11 mm to 13 mm, with an average of 12 mm
- Mandibular central incisors = 9 mm to 12 mm, with an average of 10 mm
- Mandibular canines = 11 mm to 15 mm, with an average of 12 mm
- Vertical dimension of occlusion

(as measured from the CEJ of the maxillary central incisor to the CEJ of the opposing mandibular central incisor) = 16 mm to 20 mm, with an average of 18 mm

- Vertical overbite = 3.0 mm
- Horizontal overbite = 2.0 mm.

These figures are averages of the human biologic model and should serve as guidelines in treatment planning and not be taken as “cookie cutter” dimensions that are an automatic requirement in the restoration of every dentition.

Keeping in mind the human biologic model, a thorough study of the postorthotic hinge-axis-mounted study models was pursued. Coronoplasties—negative (equilibration) and additive (wax)—were performed on the models to determine how best to



**Figure 7**—Blue die-sop was used to determine exactly where and how much negative coronoplasty is required for each tooth.



**Figure 8**—With some minor negative coronoplasty on the premolars and the maxillary right canine, adequate occlusion was achieved at a vertical dimension of 17 mm.



**Figure 9**—Negative coronoplasty brought the anterior teeth closer together so that they could be restored conservatively with positive coronoplasty while creating bioesthetic tooth form.



**Figure 10**—Diagnostic study models. The mandibular first molars were reduced for full coverage. The premolars were equilibrated to bring the vertical dimension of occlusion to 17 mm. The anterior teeth were waxed up to achieve proper anterior occlusion.

achieve anterior guidance, proper vertical dimension of occlusion, and verticalized posterior tooth form.

Diagnostic study models were pinned and sectioned. In this manner, the individual posterior teeth could be removed so that the auto-rotation of the mandible could be observed at the laboratory bench. The remaining teeth were painted with blue die-sep and negative coronoplasty was then performed on the mounted study models. The purpose for the use of the die-sep was to determine exactly where and how much negative coronoplasty was required on each individual tooth (Figure 7), thereby enabling the procedure to be performed intraorally and accurately. The models were mounted in post-splint CR at the hinge-axis position

**“Because of the extreme wear on the teeth, it was determined that the mandibular first molars required full coverage.”**

so that the model would reflect precisely what would happen intraorally. The first teeth to occlude were the left second molars at a vertical dimension of 19 mm, followed immediately by the right second molars. At this vertical dimension, the anterior teeth were still too far apart and would have to be lengthened considerably to effect their occlusion. The first and second molars were removed from the pinned models, and the auto-rotation of the mandible was then observed.

The next teeth to occlude were the second premolars at a vertical

dimension of 17.5 mm. With some minor negative coronoplasty on the premolars and the maxillary right canine, adequate occlusion was achieved with these teeth at a vertical dimension of 17 mm (Figure 8). This procedure brought the anterior teeth closer together, so that they could be restored conservatively with positive coronoplasty (Figure 9). The solid diagnostic study models were then placed in the articulator.

Because of the extreme wear on the teeth, it was determined that the mandibular first molars required full coverage. Therefore, these teeth were reduced by approximately 2 mm on the study model. Tooth No. 18 already had an existing PFM; it was treatment planned for a crown along with tooth No. 31. These teeth were reduced by 2 mm as well. The premolars were then equilibrated exactly as they had been on the pinned models to bring the vertical dimension of occlusion to 17 mm. The anterior teeth were then waxed up to achieve proper anterior occlusion (Figure 10).

When these 12 teeth were finalized in wax, and it was determined that proper occlusion and tooth form could be created at the desired vertical dimension occlusion (VDO), the rest of the teeth were waxed in, and the final wax-up was created (Figure 11). This model would serve for fabrication of clear polyvinyl siloxane (PVS) stints that would be used to transfer the newly formed biologic tooth mor-



**Figure 11**—The final wax-up models. These were used for fabrication of clear stints to transfer the newly formed biologic tooth morphology to the oral environment.



**Figure 12**—View of the mandibular clear stint.



**Figure 13**—Portals are created in the stints for the injection of the flowable composite material. This is a very accurate way to transfer the wax-up to the mouth in composite.



**Figure 14**—Injection procedure of the composite. The clear stint permits easy observation and allows the material to be cured before removing the stint.

“These portals would allow the injection of the flowable composite material into the stint and over the conditioned enamel surfaces of the teeth to be treated.”

phology to the oral environment.

The stints were made from the diagnostic wax-up, using RSVP (Cosmedent) (Figure 12). Portals were then created with a #4 round carbide (Brasseler USA) in the stints on all the teeth that were to have positive coronoplasty (Figure 13). These portals would allow the injection of the flowable composite material into the stint and over the conditioned enamel surfaces of the teeth to be treated. In this manner, the proper anatomy and tooth form could be transferred from the wax-up to the intraoral dentition

predictably and accurately.

Before the final treatment, the patient was brought in and the wax-up was presented. The treatment sequence was discussed, and any questions or concerns of the patient were addressed. The composite shade match was taken at this time and was determined to be a B-1 of the Renamel Microfill Flowable (Cosmedent).

#### *Crown Preparation and Negative Coronoplasty*

The patient was scheduled for a

full day. Bilateral mandibular blocks were given using a 3% carbocaine anesthesia with no epinephrine. The anesthesia was chosen and administered so that its effects would have worn off by the afternoon appointment. At full anesthesia, the mandibular molars were prepared for crowns, and negative coronoplasty was performed on the premolars and maxillary right canine. Using the diagnostic treatment models as a guide, the negative coronoplasty was performed easily in just a matter of minutes with a medium Brasseler diamond bur #8274-016. The occlusal form of the teeth was verticalized with the negative coronoplasty by accentuating grooves and fossae, reducing marginal ridges but not flat-



**Figure 15**—The composite injection procedure was performed first with the maxillary central incisors and then with the mandibular incisors. Occlusion was then adjusted so that these 4 teeth occluded at the correct VDD of 17 mm with the condyles in stable condylar position.



**Figure 16**—The occlusion was established for the maxillary/mandibular incisors. Note the location marked on the maxillaries.



**Figure 17**—The result was verified with a mylar shim, along with the occlusion of the premolars.



**Figures 18 to 20**—Postoperative right lateral view shows adequate anterior disclusion in eccentric movements and restoration of the anterior proprioceptive guidance.

tening cusp tips. The teeth were then polished with a 30-fluted Brasseler bur #H274UF-016. The mandibular molars were provisionalized with nonbioesthetic provisionals made from a PVS template of the prepared worn dentition. Integrity (Dentsply Caulk) was used to make these provisionals, which would cover the teeth until the afternoon appointment. Another set of bioesthetic mandibular molar provisionals were made from the bioesthetic wax-up template; these would be trimmed and polished over the noon break. The MAGO was seated and the patient dismissed for lunch.

#### *Positive Coronoplasty*

Upon returning in the after-

noon, the patient's mandible was no longer anesthetized. The anterior teeth were cleaned thoroughly with a prophyl angle and pumice, rinsed, and dried. The teeth were then etched with Ultra-Etch (Ultradent), a 35% phosphoric acid solution. The etch was placed on the incisal edges only, and great care was taken to prevent the etch from touching more enamel than absolutely necessary. The enamel was etched for 20 seconds, rinsed off, and dried but not desiccated. Optibond Solo Plus (Kerr Corporation) adhesive was then placed on the etched enamel and cured. The RSVP stint was placed (Figure 14), and the predetermined shade of Renamel hybrid composite (Cosmedent) was injected

into the portal until it filled all the void space inside the stint. This procedure was easily observed through the clear stint. The composite was then cured.

The above procedure was performed first with the maxillary central incisors and then with the mandibular central incisors (Figure 15). The lower molar provisionals were removed so that the mandible could autorotate in centric relation with the central incisors occluding at the desired vertical dimension of 17 mm. The occlusion was established for these 4 teeth (Figures 15 and 16), and the result was verified with a mylar shim along with the occlusion of the premolars (Figure 17). The canines and remaining posterior



**Figures 21 to 23**—A favorable neuromuscular release of the muscles of facial expression is evident in the comparison of the pre- and postoperative photographs. The longer tooth form provides a fuller smile and more lip support in the postoperative photographs.

**“Bioesthetics is not a technique but rather an observation and application of the attributes of long-lasting dentitions found in healthy individuals.”**

teeth were then treated, each time verifying the occlusion on the central incisors using a mylar shim.

The bioprovisional crowns were then seated on the mandibular molars 1 at a time and the occlusion was checked again and adjusted, using mylar shims and articulation paper. The occlusion was tested and verified, all composites were polished with the Brasseler EP Esthetic Polishing System (Brasseler), and a final polish was performed with an enamelized biocomposite polishing paste (Cosmedent) and a goat hair chamois. Interproximal contacts were opened with a #12 scalpel blade and verified with floss.

#### Postoperative Observations

The postoperative test positions show adequate anterior disclusion in eccentric movements, evidencing the restoration of the anterior proprioceptive guidance (Figures 18 to 20). As the posterior occlusion is verticalized and the anterior proprioceptive guidance is restored to the stomatognathic system, the forces on individual teeth are minimized. This allows conservative treatment options' such as bonding, with little or no enamel preparation.

The favorable neuromuscular release of the muscles of facial expression is evident in the comparison of the pre- and postoperative photographs (Figures 21 to 23). The longer tooth form provides a fuller smile and more lip support. The

patient was pleased with the results and especially delighted with the improved and more relaxed appearance of her face.

#### Conclusion

Bioesthetics is not a technique but rather an observation and application of the attributes of long-lasting dentitions found in healthy individuals.<sup>8</sup> It is a conservative interdisciplinary approach to the restoration of the stomatognathic system to its natural form and function. In this case, it would have been a natural tendency for a restorative dentist to focus on the patient's primary complaint—the deterioration of the lower first molars—and immediately address the obvious need with a treatment plan for placement of crowns on these 2 teeth. However, this approach addresses only the effect, completely ignoring the cause of the wear not only of the first molars but also of the rest of the dentition.

The bioesthetic, or biologic, approach first asks why is the wear occurring and then addresses the cause, before restoration of any individual teeth. In this case, the cause was a mandible-to-cranial base discrepancy as the result of the tooth interferences in the natural autorotational closure of the mandible. It has been the observation of this author that when both options are presented and explained, patients will generally elect to address the entire stomato-

gnathic system and opt to treat the cause as well as the effect. By establishing a stable condylar position, maximum anterior guidance, and verticalized posterior tooth form, the elevator muscle activity is greatly reduced, thereby eliminating excessive eccentric contact of the posterior teeth.

As illustrated in this case study, more conservative restorative techniques can then be used. The final result is not only a pleasingly esthetic smile but also an overall improvement of the facial appearance, with the facial muscles relaxed and comfortable. A natural and lasting beauty was achieved in a very conservative manner. ●

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