Conservative Dentistry and Bioesthetic Principles

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Conservative esthetic tooth restoration can present a challenge, especially when replacing worn incisal edges of anterior teeth and the cusp tips of posterior teeth. In the author's experience when restoring anterior teeth, the incisal shearing forces are of concern; compressive forces are kinder to dental restorations. If the natural enamel has been worn down, gold or porcelain may be required to withstand the forces exerted on the posterior teeth.

In this author's experience, the correct form of incisal and posterior teeth (replacement of cusp tips, ridges, and marginal ridges) can be restored with positive or additive coronoplasty, using flowable composite. The author has been using this technique for several years and has found the results to be esthetic, functional, and durable[1]; however, the author uses this technique only when using the principles of bioesthetic dentistry to establish a favorable occlusion and joint relationship.[1,4] Therefore, a short overview of these principles is vital to the understanding and a successful implementation of this technique.

Bioesthetic Principles

The concept of the bioesthetic principles was first introduced by Lee in 1990.[2] Because these principles were based on the findings of completely healthy and asymptomatic stomatognathic systems, they received immediate acceptance in the community of esthetic dentistry. The early acceptance continued to grow among an ever-increasing number of dentists that maintained these principles in their practice and in functional and esthetic presentations.[1,3-5] According to Lee, "bioesthetics is the study or theory of the beauty of living things in their natural form and function." The ideal stomatognathic system shares 3 aspects with Lee's bioesthetic principles:

1. stable condylar position (the form of the joint)
2. proper tooth form, as it occurs in nature, with unaltered anatomy
3. adequate vertical dimension of occlusion that allows the correct vertical and horizontal overbite and proper anterior-posterior relationship of the maxillary and mandibular teeth (form of the occluded dentition).

It has been the author's observation that when these 3 principles are present in a masticatory system, the neuromuscular release, combined with the reduced force on the dentition because of a more vertical chewing pattern, results in the preservation of individual teeth and maximum facial esthetics. It also allows for conservative restorations, because the shearing forces are minimized or eliminated altogether.

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 their most stable centric relation (CR).[1] It has been documented that the activity of the masseter and temporalis elevating muscles can be reduced only when the posterior disclusion is obtained by appropriate anterior guidance.[6] When proprioceptive anterior guidance is present, the posterior segment is verticalized, thereby eliminating eccentric contacts on cusp tips and incisal edges. It is also not the contact of the canines that decreases the activity of the temporalis and masseter muscles, because in true proprioceptive anterior guidance the canines do not contact at all. Rather, it is the elimination of posterior eccentric contacts that results from the proprioceptive anterior guidance.[6]

Adherence to these 3 bioesthetic principles allowed the author to develop conservative and effective restoration practices for his patients. The result was not only a dramatic improvement in the function and appearance of the dentition, but the treatment also eliminated any headaches and myofacial pain and tension. The relaxation of the facial muscles becomes evident in the relaxed general appearance of the patient's face.

Case Report

Clinical Examination and Diagnosis

A 20-year-old woman (Figures 1 and 2) presented with the complaint that she did not like the appearance of her smile, and that she wanted to have beautiful teeth like her sister. The patient was living a healthy lifestyle, was taking no medication, and her medical history was unremarkable. A thorough preclinical interview revealed that the patient suffered from chronic headaches, myofacial pain, and tension.

Dental records were obtained, followed by a comprehensive clinical examination that included a full periodontal evaluation, head and neck muscle examination, oral cancer examination, occlusal analysis, temporomandibular joint evaluation, and a tooth-by-tooth examination. Facial dimension analysis was completed as well.

The patient's oral environment contained no previous dental restorations; at the time of examination, it was caries free. The periodontal health was excellent; plaque and bleeding absence was more than 90%. Examination of the dentition revealed generalized moderate to severe enamel wear. There was a minimal overjet; anterior guidance was absent (Figure 3). No popping, clicking, or joint crepitus noises were present. The joint tomograms revealed slight flattening of the condylar heads, but the cortical plates were uninterrupted. The overall joint anatomy was relatively normal.

Diagnosis/Assessment

Although there were no joint noises or joint pain, it became apparent that the enamel wear and subsequent myofacial symptoms resulted from a mandible-to-cranial base discrepancy, most likely caused by a malocclusion. The lack of proper

Figure 1—Full face view at presentation. A 20-year-old woman unhappy with her smile, chronic facial muscle tension, and headaches.

Figure 2—Close-up view in full smile. Note the wear on the maxillary anterior teeth and the uneven incisal edges.

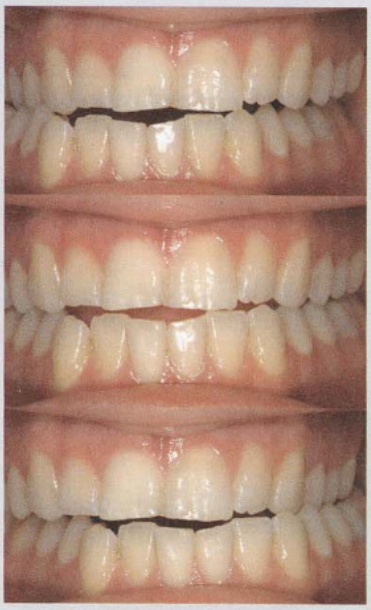

Figure 3—Intra-oral views: the incisal edges are worn and the posterior tooth anatomy is flattened. The lack of anterior guidance with multiple posterior eccentric interferences is evident in the test positions.

proprioceptive anterior guidance and the resulting posterior eccentric interferences lead to muscle hyperactivity, resulting in enamel wear and facial muscle tension.

Initial Treatment Plan

The initial treatment plan was to achieve a stable condylar position using a therapeutic maxillary anterior guided orthotic (MAGO), similar to the one presented (Figure 4). The MAGO is a condylar CR repositioning splint. When worn consistently throughout 24-hour periods and adjusted regularly, it will allow the mandibular positioning muscles to relocate the condyles into the most stable condylar position (SCP).[10]

The patient wore the splint for 2 months, presenting for regular adjustments, to allow full seating of the condyles. SCP was verified using the Panadent Condylar Position Indicator (Panadent). A hinge axis recording was taken along with joint tracings and Bennett movements, and the data was entered into the Panadent articulator. The maxillary diagnostic model was mounted at the hinge axis position to accurately reflect any change in the vertical dimension of occlusion.

The pretreatment and post-MAGO occlusions and mounted study models were compared (Figures 5 and 6), and it was determined that the first tooth contact in SCP occurred on the right second molars at a vertical dimension of 19.0 mm, as measured from the cemento-enamel junction (CEJ) of tooth No. 9 to the CEJ of tooth No. 24. By tracking condylar movement from centric relation to centric occlusion from the hinge axis position, the author was able to predictably alter the vertical dimension of occlusion (VDO) in a scientific manner.[7] This "fulcrum effect" resulted in occlusal posterior avoidance patterns, as the patient was posturing the mandible forward to avoid the second molar contacts. The posturing resulted in the hyperactivity of the masseter, temporalis, and lateral pterygoid muscles, and the subsequent attrition of the enamel.

This young patient had no previous dental restorations and no caries; the teeth were suffering only from the disease of attrition. Therefore, a conservative approach without any iatrogenic removal of enamel was pursued to restore the lost tooth structure.

The lengths of teeth in an average dentition have been established in the literature.[8] They were determined by Lee through observation and documentation of healthy stomatognathic systems:[9]

- Maxillary central incisors: 11.0 mm to 13.0 mm, with an average of 12.0 mm
- Maxillary canines: 11.0 mm to 13.0 mm, with an average of 12.0 mm
- Mandibular central incisors: 9.0

Figure 4—A stable condylar position was achieved using a correctly constructed and adjusted centric relation (CR) repositioning splint worn full time for 2 months.

Figure 5—Clinical view: Pretreatment centric occlusion (CO) and postorthotic (CR) bites.

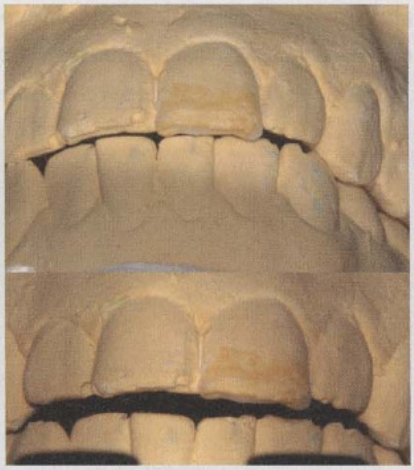

Figure 6—Pretreatment models (CO: VDO=17.0 mm) and postorthotic (CR: VDO=19.0 mm).

mm to 12.0 mm, with an average of 10.0 mm
- Mandibular canines: 11.0 mm to 15.0 mm, with an average of 12.0 mm
- VDO (as measured from the CEJ of the maxillary central incisor to that of the opposing mandibular central incisor): 16.0 mm to 20.0 mm, with an average of 18.0 mm
- Vertical overbite: 3.0 mm
- Horizontal overbite, or overjet: 2.0 mm.

These figures are averages and serve as dependable markers, but they should not be construed as automatic in the restoration of every dentition.

With Lee's human biologic model serving as a guideline, a thorough evaluation of the post-MAGO hinge axis mounted study models was pursued. The VDO at initial centric contact was 19.0 mm. It was decided to restore the case at this dimension (Figure 6), because it provided the necessary space to restore the lost enamel and anatomy of the anterior and posterior teeth, and it was situated comfortably within the averages of Lee's human biologic model.

There was one major problem: the angle of emergence of the mandibular anterior teeth to that of the maxillary anterior teeth. There were 2 main issues: 1) the mandibular incisors were somewhat retroclined in relation to the maxillary incisors and 2) there was no overjet between the right maxillary and mandibular canines (Figure 6).

Keeping in mind that one of the primary goals for this young patient was to be as conservative as possible, it was determined that an orthodontic movement of these teeth would be necessary to create the ideal interarch relationship between the anterior teeth. The new relationship would allow for restoration of these teeth with positive coronoplasty without having to remove or permanently alter the natural enamel in any way.

Invisalign Treatment

The orthodontic movement of the teeth was achieved using Invisalign (Align Technology). Invisalign uses a series of clear aligners that are milled from a computer-generated model of the patient's teeth. This model reflects the tooth movements as dictated by the clinician's prescription. Each aligner is worn for 2 weeks and it gradually moves the teeth into position. After completion of the Invisalign treatment, a new set of study models was taken and mounted with a centric relation bite in a Panadent articulator. These models were observed and the proper interarch anterior tooth relationship was verified (Figure 7). A conservative additive coronoplasty could now be used to restore the teeth.

To ensure that the joint was still stable, a new MAGO was fabricated and worn by the patient for 4 weeks, throughout the 24-hour periods, with regular weekly adjustments. The MAGO also served as a maxillary retainer, while the mandibular teeth were retained with the use of a lingual archwire. This allowed a correct occlusion of the mandibular teeth against the MAGO.

After the abbreviated MAGO therapy, a final open-bite CR record was taken and the final working models were mounted on a Panadent articulator. A complete wax-up was completed at first tooth contact with a VDO of 19.0 mm (Figure 8).

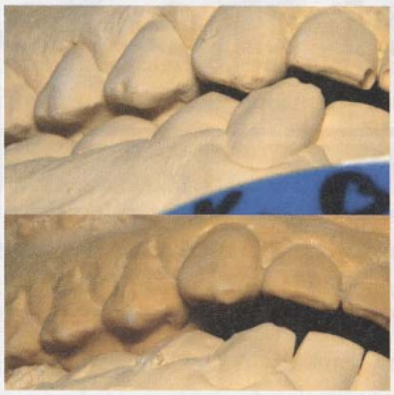

Figure 7—Postorthotic (CR) models (top) and post-Invisalign models (bottom). A more favorable interarch relationship was established with the Invisalign treatment.

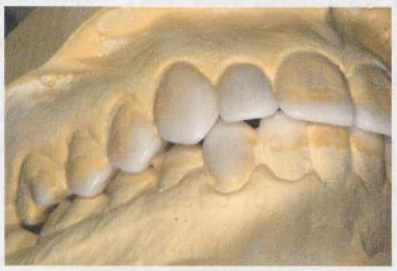

Figure 8—Diagnostic wax-up. The Invisalign treatment created proper overjet, allowing space for conservative restoration of these teeth so that proper anterior coupling could be established.

Restorative Treatment: Additive Coronoplasty

After completion of the diagnostic wax-up at the vertical dimension of 19.0 mm, a clear polyvinyl siloxane stent was fabricated over each wax-up. These stents are used to transfer the newly formed biologic tooth morphology from the wax-up to the mouth. The stents were made from the diagnostic wax-up, using RSVP (Cosmedent) (Figure 9). Portals were created with a #4 round carbide bur (Brassler USA) in the stents on all teeth. These portals allow the injection of the flowable

composite material into the stent and over the conditioned enamel surfaces of the teeth to transfer the proper anatomy and tooth form from the wax-up to the dentition, predictably and accurately.

Before scheduling the patient for treatment, the wax-up was presented for viewing and approval. The treatment sequence was discussed and questions or concerns were addressed. A shade match was taken to save time at the restorative appointment. Renamel Microfil flowable composite (Cosmedent), shade B2 was selected.

A full day was scheduled for the restorative treatment. No anesthesia was required because the only tooth preparation was a gentle roughening-up of the enamel on the areas to be bonded. The sequence of treatment was as follows:

1. Mandibular anteriors—teeth Nos. 22 through 27
2. Maxillary central incisors—teeth Nos. 8 and 9
3. Maxillary lateral incisors—teeth Nos. 7 through 10
4. Maxillary right canine—tooth No. 6
5. Maxillary left canine—tooth No. 11
6. Mandibular posteriors—teeth Nos. 18 through 21 and Nos. 28 through 31
7. Maxillary posteriors—teeth Nos. 2 through 5 and 12 through 15.

The mandibular anterior teeth were veneered with composite to create the ideal angle of occlusion with the lingual aspect of the maxillary anterior teeth. Using a prophy angle, the teeth were cleaned thoroughly with pumice, rinsed, and dried. Every other tooth was isolated by wrapping the adjacent teeth with Teflon (plumbers) tape (Figure 10) to prevent the interproximal spaces from bonding together. The tape does not interfere with the seating of the clear stent.

The uncovered teeth were then etched for 20 seconds with Ultra-Etch (Ultradent) (Figure 10), a 35% phosphoric acid solution, rinsed, and dried, but not desiccated. OptiBond Solo Plus (Kerr Corporation) was applied to the etched enamel, thinned with compressed air, and then light-cured for 10 seconds with a plasma arc light. The RSVP stent was then placed over the teeth and the flowable composite was injected into the portals of each tooth being restored (Figure 10). The clear stent allowed direct viewing until the composite filled the entire void space inside the stent over each conditioned tooth. The composite was then cured for 20 seconds facially, 20 seconds lingually, and 20 seconds incisally. Inevitably, some flashing occurred, but it was easily removed with a #12 scalpel blade. The result is seen in Figure 11.

The 2 maxillary central incisors were restored in the same manner. The lingual anatomy and incisal edges were restored, and the occlusion was verified. Because the VDO was increased, the maxillary central incisors were the only teeth occluding with the first tooth contact. The occlusion was verified with black occlusal film and ultrathin mylar shims. The rest of the anterior teeth were then restored one at a time, in the order mentioned. Each time the occlusion was verified with black occlusal film and the mylar shims. As soon as the anterior teeth were completed, the posteriors were restored one at a time. The positive coronoplasty of the posterior teeth involved the re-creation of the occlusal anatomy, including cusp tips, ridges, and inclines (Figure 12). After each tooth was restored, the occlusion was verified.

Figure 9—View of the mandibular clear stent.

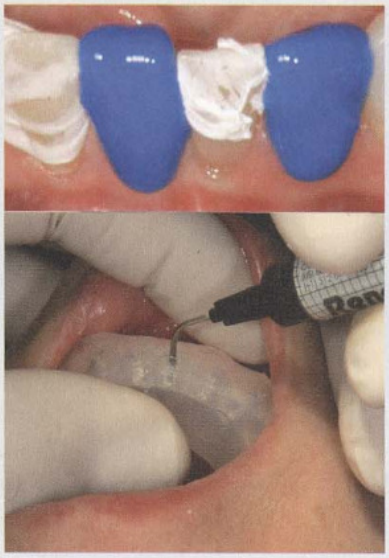

Figure 10—Isolation of the teeth with Teflon tape, etching of the teeth, and the injection of the flowable composite.

Figure 11—Fully restored mandibular anterior teeth.

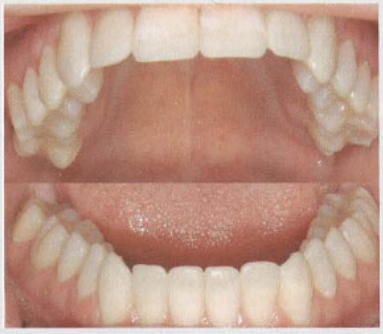

Figure 12—View of posterior occlusal form. The anatomy has been verticalized by the restoration of the cusp tips, inclines, and ridges.

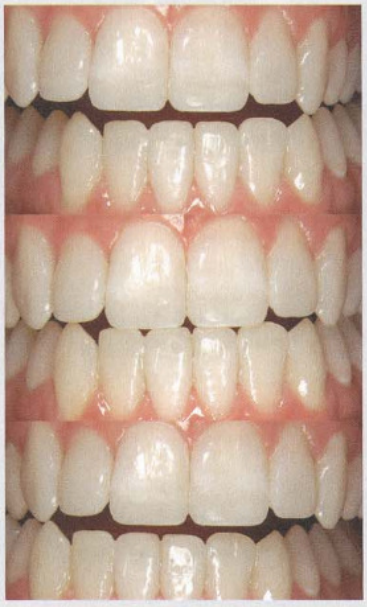

Figure 13—Postoperative test position views show adequate disclusion in eccentric movements and restoration of the anterior proprioceptive guidance.

Figures 14 and 15—Pre- and postoperative lateral oblique and frontal views. A stable condylar position combined with an increased vertical dimension of occlusion (VDO) and restored tooth form provide a relaxed face, improved lip support, and fuller smile.

Posttreatment Test Positions

The posttreatment test positions show anterior disclusion in eccentric movements, demonstrating the restoration of the anterior proprioceptive guidance (Figure 13). As the occlusion is verticalized and the anterior proprioceptive guidance is restored to the chewing system, the condensing and shearing forces on individual teeth are minimized, allowing for the conservative treatment option illustrated in this case with very minimal enamel preparation.

The increase in the length of the teeth, along with the increased vertical dimension of occlusion, created a result that was beautiful and functional. The patient reported that the myofacial tension and the headaches were eliminated completely. This well-being was the result of a favorable neuromuscular relaxation of the facial and neck muscles. The patient was also pleased with the increased tooth length and the appearance of her new smile (Figures 14 and 15).

Conclusion

It would have been very easy to recommend porcelain veneers for this patient to improve her smile; however, it would not have addressed the myofacial tension, headaches, and the overall enamel attrition. In the author's opinion, simply performing cosmetic dentistry would have been a "band-aid" approach to treatment, addressing the effect (enamel attrition), but not the cause (mandible-to-cranial-base-created malocclusion).

By applying the principles of bioesthetic dentistry, an accurate diagnosis and a conservative treatment plan were implemented. The esthetic goals of the patient were achieved while improving the patient's health and wellness.

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10. Roth R, Williams RE. *Orthodontic Philosophy and Case Reports.* Japan: Nissin Group; 2003:6-257.

Product References

Products: Panadent Condylar Position Indicator, articulator
Manufacturer: Panadent
Location: Grand Terrace, California
Phone: 800.368.9777
Web site: www.panadent.com

Product: Invisalign
Manufacturer: Align Technology
Location: Santa Clara, California
Web site: www.aligntech.com

Products: RSVP, Renamel Microfil Flowable composite
Manufacturer: Cosmedent
Location: Chicago, Illinois
Phone: 800.621.6729
Web site: www.cosmedent.com

Product: #4 round carbide bur
Manufacturer: Brasseler USA
Location: Savannah Georgia
Phone: 800.841.4522
Web site: www.brasselerusa.com

Product: Ultra-Etch
Manufacturer: Ultradent
Location: South Jordan, Utah
Phone: 888.230.1420
Web site: www.ultradent.com

Product: OptiBond Solo Plus
Manufacturer: Kerr Corporation
Location: Orange, California
Phone: 800.537.7123
Web site: www.kerrdental.com