PEER-REVIEWED

Restoring the Tetracycline Stained Dentition

Blocking out discolored dentin while mimicking the natural tooth structure

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Restoration of the optical properties of the natural dentition is key to achieving esthetic success. Our perception of tooth color is an intricate phenomenon with numerous factors, such as lighting conditions, translucency, opacity, light scattering, gloss, and the human brain and eye, influencing the overall observation of tooth color.[1] If irregular tooth form and position is present with abnormal tooth color, the esthetic deficiencies are amplified.

Case Presentation

The patient in this case presented with an extremely low value of her teeth (Figure 1). In the past she had composite bonding in an attempt to lighten the color of her tetracycline-stained teeth and several years ago the bonding was removed, exposing the dark dentin shade and irregular translucency. To complicate the matter, when the composite was removed, the facial aspect of the teeth were left flat and abnormally textured from bur markings, resulting in unusual light reflection, which made the teeth look square and boxy (Figure 1 through Figure 3). The facioversion and rotation of teeth Nos. 26 and 27 resulted in asymmetrical mandibular incisal embrasures and distracting negative space (Figure 3). The patient desired a brighter and more youthful smile.

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Diagnosis and Treatment Planning

In 1948, tetracyclines were introduced as broad-spectrum antibiotics used in the treatment of many common infections in children and adults.[2] A side effect of tetracyclines is the ability to chelate calcium ions and to be incorporated into teeth, cartilage, and bone, resulting in yellow or gray to brown discoloration of both the primary and permanent dentitions with a prevalence of 3% to 6%.[2] The intensity of the staining depends on the time and duration of administration, as well as the dosage and type of tetracycline.[3] The severity of the staining, age of the patient, and esthetic goals dictate which treatment option—bleaching, direct resin, or ceramic restoration—is indicated.

The patient's tetracycline staining posed a challenge for the ceramist to ensure an effective masking of the underlying discoloration and simultaneously create the illusion of a natural intensity in tooth shade.[4]

In order to address the patient's esthetic concerns, 14 all-ceramic maxillary restorations (three full-coverage crowns, four veneers, seven onlay veneers) and 14 all-ceramic mandibular restorations (three full-coverage crowns, nine veneers, two onlay veneers) were treatment planned. The Authentic® Pressable All-Ceramic system (Jensen Dental, www.jensendental.com) was selected due to its strength, optical properties, conservative preparation design, and its ++ ingot was ideal for blocking out discolored teeth. The


FIG. 1


FIG. 2


FIG. 3

(1.) Full-face view: patient was dissatisfied with shade and position of dentition. **(2.)** Frontal view after bonding was removed, showing exposed irregular dentin. **(3.)** Frontal view shows flared out teeth Nos. 26 and 27.

patient desired a very bright, youthful smile and selected a bleach shade between Ivoclar Vivadent's (www.ivoclarvivadent.com) BL2 and BL3 shades, with internal coloring to be added to create a more life-like effect.

A comprehensive temporomandibular joint (TMJ) examination is always completed during the diagnostic phase. A stable Piper Stage I TMJ diagnosis was confirmed for both right and left TMJs after negative muscle palpation, negative history of clicking and symptomatic joints, TMJ Doppler auscultation, centric relation (CR) load testing, and normal range of motion testing was completed.[5,6] Six structural elements including disc alignment, disk shape, ligament anatomy, masticatory musculature, joint space, and condylar bone anatomy were assessed as normal.[5,6]

Clinical Protocol

With anteroposterior overlap of teeth Nos. 26 and 27 with the mandibular arch, the decision was made to first re-contour the portions of teeth Nos. 26 and 27 outside the preparation zone to achieve alignment and a more uniform arch form. A 0.8-mm facial and 1.5-mm incisal reduction was desired in this case, so a 0.5-mm depth-cutting diamond and 0.3-mm depth cutting diamond were sequentially used. The author used an indelible marker to mark the depth cuts to ensure that all tooth structure was cleared to the depth of the depth cuts. Contacts are cleared for several advantages: the technician is provided with control over placing and correcting misaligned midlines; alterations in color can be made in this area to mimic natural teeth; the lingual margin is placed in a free cleansing area; and it increases retention form.[7] Because the target incisal reduction is 1.5 mm and the author uses a round-ended diamond with a diameter of 0.75 mm at the tip, the author sank the diamond bur twice its diameter to ensure a 1.5-mm reduction. In order to help block out the discolored dentin, Renamel® Microhybrid composite shade B1 (Cosmedent, www.cosemedent.com) was bonded on the interproximal and facial surfaces of teeth Nos. 22 through 27. The author placed mechanical retention grooves with a quarter round bur on the facial surfaces of teeth Nos. 22 through 27 and a much higher value of the stump form was achieved (Figure 5). This created a much lighter stump form on which to build the porcelain.

The author prepared the mandibular anterior sextant first and a CR bite registration


FIG. 4


FIG. 5


FIG. 6

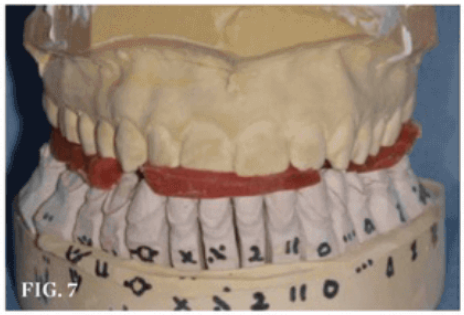
FIG. 7


FIG. 8


FIG. 9

(4.) Frontal view shows the 0.5-mm depth-cutting diamond being used. **(5.)** Higher value of stump shade was achieved with bonding Renamel Microhybrid composite. **(6.)** Frontal view shows how viscous liquid resin color modifier was used to blend provisionals to the maxillary dentition. **(7.)** A three-piece CR bite registration with Red Pattern Resin was used to accurately articulate the prepared mandibular arch to the unprepared maxillary arch mounted on the SAM 3 articulator. **(8.)** The pitch and bevel of the mandibular anterior restorations are established. **(9.)** Frontal view shows the completely prepared maxillary arch.

(Red Pattern Resin™; GC America, www.gcamerica.com) was taken. By taking the anterior bite registration first, then preparing one posterior quadrant at a time, accurate tooth reduction was ensured and vertical dimension was maintained. One posterior quadrant was prepared next. Then, a second bite registration was taken of the prepared posterior quadrant with the previously taken anterior bite registration in place. This sequence follows for the remaining posterior quadrant to be prepared with the anterior and contralateral bites in place. The result of this bite registration method is a three-piece CR registration with an exact recording of the preserved vertical dimension (Figure 7).

From the preoperative diagnostic wax-up mounted in CR position on the articulator (SAM® 3, Great Lakes Orthodontics, www.greatlakesortho.com), a thermoplastic matrix was fabricated and served as both a preparation guide and a matrix for provisionalization. Alike™ resin (GC America) was used to temporize, and the Kolor + Plus® kit (Kerr Corporation, www.kerrdental.com) was used to add ochre and gray characterization (Figure 6). For ease in trimming, the author sectioned the provisional distal to teeth Nos. 22 and 27. LuxaGlaze® (DMG America, www.dmg-america.com) was painted over the provisionals to create a lifelike enamel appearance.

The author used the acid-etch technique to bond the restorations in place. The preparations were etched with Etch-Rite™ 38% phosphoric acid gel (Pulpdent, www.pulpdent.com) for 20 seconds, washed thoroughly, and dried, followed by placing several coats of Dentin Desensitizer (Pulpdent). Several coats of OptiBond™ FL (Kerr) primer were then applied, followed by one coat of adhesive. These coats were slightly air dispersed then light-cured for 20 seconds. The restorations were cleaned with Ivoclean (Ivoclar Vivadent) for 20 seconds, rinsed, and air-dried. Then one drop of Silane Primer (Kerr) was applied and air-dispersed. Final cementation was completed with Calibra® Esthetic Resin Cement (DENTSPLY Sirona, www.dentsply.com).

Proper finishing of restorations is essential for success. Three burs were used to initiate the finishing process. A red-striped 30-grit diamond (Brasseler USA, www.brasseler.com) was used around all margins, followed by a yellow-striped 15-grit diamond (Brasseler USA), and then a white-striped 30-bladed finishing bur (Brasseler USA). Next, Shofu polishing points (www.shofu.com) were used starting with the no stripe point, then the yellow-striped, and lastly the white-striped polishing point. Interproximal finishing began with using a CeriSaw™ (DenMat, www.denmat.com) to first clear out excess cement in the interproximal areas. A red-striped Gateway™ Flexi diamond strip (Brasseler USA) was then used to smooth each interproximal surface. The last and most significant interproximal polishing was achieved with a series of Epitex® Strips (GC America). After the blue, green, gray, and then tan strips were used, flossing between the teeth was extremely smooth and the polishing sequence was complete.

The pitch and bevel of the mandibular incisors, or facial-incisal line angle, is critical in establishing a correct envelope of function and harmony with the opposing lingual anatomy of the maxillary restorations (Figure 8). Just as the erupting mandibular incisors are guided into position by the tongue and lips before the maxillary anterior teeth erupt, so too must lower incisal edge position be determined before the position and contour of the upper anterior teeth can be finalized.[5] Proper contouring of the facial embrasures completes the outline of the incisal edge contour. Incisal edges have a flat surface outlined with definite line angles with the incisal edge higher on the lingual with no embrasures on the lingual.[5]

After a few weeks, treatment proceeded with an identical preparation sequence performed on the maxillary arch with provisionalization matching the new definitive mandibular restorations (Figure 9). The maxillary restorations were delivered following an identical protocol as described for the mandibular restorations (Figure 10).

Conclusion

The patient presented with generalized dark staining that was masked by the final restorations. Internal coloring was layered into the ceramic of the restoration achieving a brighter, more youthful smile (Figure 10 through Figure 12). Balancing the restorative objectives of blocking out discolored dentin and mimicking the natural tooth structure, without over-opacification, is key. The patient's esthetic goals were met and all involved with the case were pleased with the results.


FIG. 10


FIG. 11


FIG. 12

(10.) Frontal view of the completed case. **(11.)** Final smile with the new restorations. **(12.)** Full-face view of the completed case.

Disclosure

The author has no relevant financial relationships to disclose.

Acknowledgement

Laboratory fabrication was completed by John Wilson of Wilson Dental Arts.

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