

Biomimicry Simplified using a Novel, Hue-based Direct Composite Resin System

By Dr. Clarence Tam

Rationale for Choice of Material

The pursuit of natural restorations has been the mainstay of aesthetic dentistry for at least the last decade. It is known that the colour corollary of composite shades between manufacturers varies drastically, as well as with the reference Vita Classic shade guide¹. To further complicate matters, the opacities and colour saturation of respective enamel and dentin shades also varies between systems, creating the need to generate a site-specific colour map of the tooth in a pre-dehydrated state. Enamel is an achromatic, inorganic dominant material. The hue or true colour of the tooth comes from the dentin. Value (brightness) and chroma (saturation) are modulated in nature according to the thickness of the enamel². StyleItaliano is the first comprehensive anterior composite layering system to utilise a single, universal enamel shade, the thickness of which is designed to be modulated to generate

greater or less chroma with a particular hue of dentin. To simplify matters, dentin options are distributed only between five options which vary significantly in colour space, making selection efficient: Si0, Si0.5, Si1, Si2 and Si3. Effect shades consist of MP (Multiplo), which is a translucent flowable with opalescent properties as well as M (Masque or Masking), which is a flowable featuring greater opacity that blocks out “shine through” in augmentation or fracture repair cases. Posterior restorations are simplified via the use of a single posterior shade (P), which has a beautiful chameleon effect and ideal sculptability.

Enamel-Dentin Tooth Fracture

An 11-year-old male, exhibiting an uncomplicated enamel-dentin fracture of tooth 21 (#9) MIBP, was presented to the practice. He had been opening a farm gate while duck shooting and the latch had sprung up, impacting his tooth. He had no immediate or delayed sensitivity, and the tooth remained vital. He was not interested in pre-prosthetic tooth whitening but was interested in exactly recreating the subtle optical nuances of the area that was fractured. Medical history was positive for controlled ADHD, with known drug allergies to cotrimoxazole, Ceclor and Amoxicillin. At the initial consultation, the tooth was smoothed, and 2% CHX (aq) was applied. Dentin conditioner and a glass ionomer provisional restoration were then placed to insulate the dentin (Fuji BULK, GC America). Possible optical and pulpal sequelae were discussed and full informed consent given.

Procedure

It is well known that the optical properties of enamel drastically change in a dehydrated state. The refractive index of water is 1.33 and that of air is 1.00. Therefore, as the enamel interprismatic spaces lose water and gain air, they assume a lower refractive index, and gain a higher reflective index, essentially becoming more opaque. Shade selection was completed prior to application of topical anaesthetic, as the extended time of lip retraction (typically two minutes) could possibly affect the full state of hydration and thus incorrect colour selection. Shades selected were: dentin (Si2), enamel (E), masking



Fig. 1: Pre-dehydrated view. Shade selection via shade button technique

Fig. 2: Split rubber dam isolation. Pre-operative view

Fig. 3: Intraoperative view. Lingual shelf construction utilising Enamel (E) shade. Halo effect completed using a rolled worm of Si2 in corresponding areas

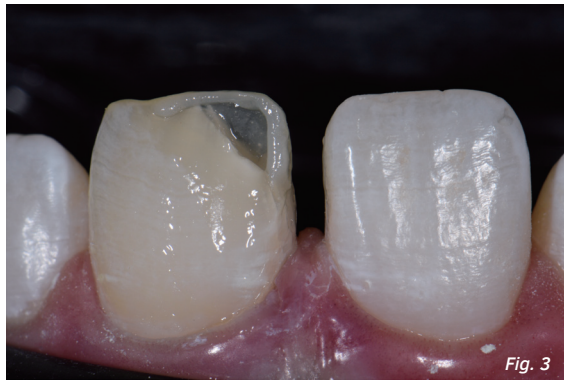


Fig. 4: Masking liner applied using the flowable Masque (M) shade



Fig. 5: Masque (M) liner after first application

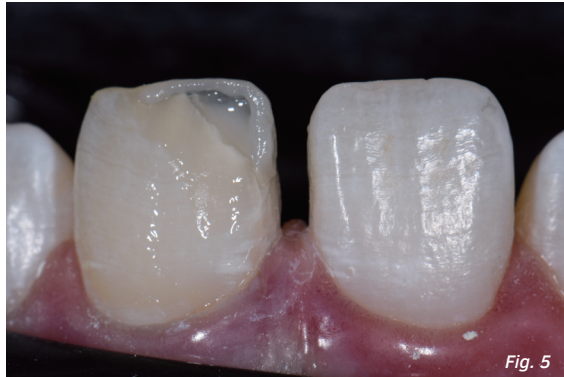


Fig. 6: Dentin body construction utilising shade Si2.

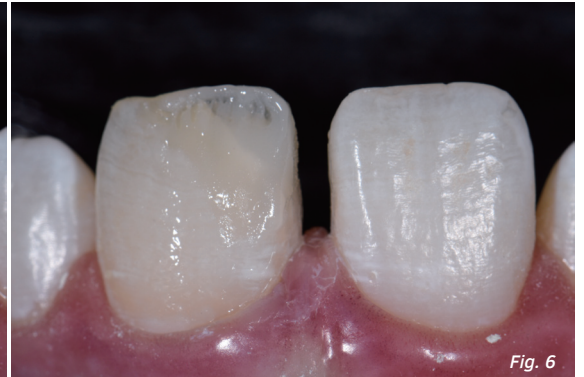


Fig. 7: Multiplo (MP) utilised in the negative space between the dentin fingerlings incisally. White tint utilised in a manner similar to the adjacent teeth using the pre-dehydrated photograph as reference

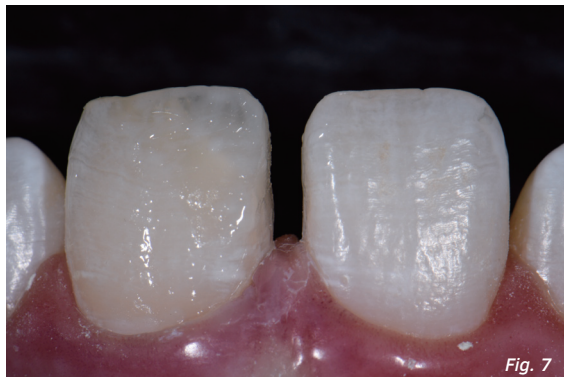
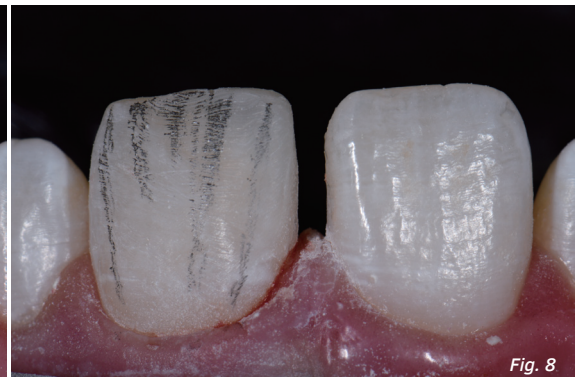


Fig. 8: Enamel (E) layer applied, and primary anatomy completed. Start of planning secondary anatomy



(M) and Multiplo (MP). Marked horizontal perikymata-like maverick effects were noted and white tint was also planned to mimic the hypocalcified streaks of the natural optics in the adjacent tooth structure. The patient was anesthetised using one carpule of a 4% Articaine solution with 1:100,000 epinephrine. A split dam rubber dam format was utilised for isolation before conservatively rounding the fracture margins, blending the preparation to infinity before utilising micro air abrasion (27 micron aluminum oxide). A total etch technique was utilised before bonding using G-Premio Bond (GC America). The lingual shelf was created freehand using a pre-crimped Mylar strip and the E (Enamel) shade. The proximal axial and incisal halo were accentuated by rolling a thin worm of Si2 and placing it along the incisal and mesiolateral borders of the tooth with the strip still in place. To maximise the ability to block out the shine-through of the oral cavity through the new restoration, a masking

liner (M) was utilised in multiple thin layers prior to placement of the dentin volume proper using Si2. Incisally, the dentin lobules were sculpted and cured. It is critical to always judge each respective layer from the incisal view prior to curing to ensure that it has not been overbuilt, and that the volume is accurate. A translucent, opalescent flowable was applied to the negative space created between the dentin lobules and cured. A white tint was utilised and streaked in a similar horizontal pattern using the pre-operative colour reference photograph as inspiration. Finally, the enamel layer was completed in a single increment to minimise the risk of join lines from incomplete blending. Primary anatomy was developed using Sof-Lex discs (Sof-Lex, 3M). Secondary anatomy was created using a series of fine diamond burs. Tertiary anatomy refers typically to texture. Fine horizontal texture was created to mimic that seen in the contralateral tooth using a coarse green-stripe diamond bur running lightly across

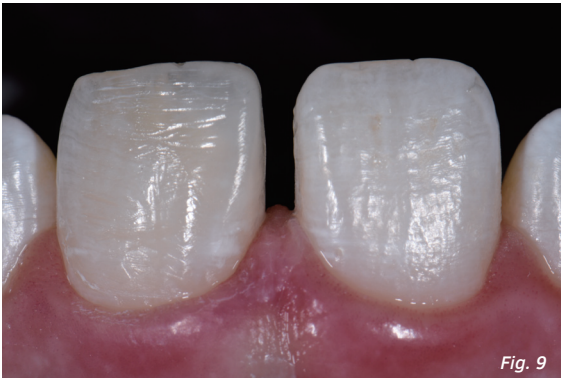


Fig. 9



Fig. 10

Fig. 9: Immediate post-operative result. Texture of perikymata visible

Fig. 10: Incisal view showing re-creation of line angle and integration of buccal embrasures with the arch form



Fig. 11



Fig. 12

Fig. 11: Muted indirect light post-operative photograph

Fig. 12: Post-operative retracted frontal view

the semi-finished surface at stall speed. The restoration was then polished to high shine incorporating the horizontal scratches into the surface texture design using diamond-impregnated silicone polishing cups (Double Diamond D-Fine, Clinicians Choice).

Conclusion

All in all, the patient received a restoration that was able to mimic the natural halo effect and translucency seen in the incisal window, married with hypocalcified tinting and a surface texture that allowed the restored tooth to aesthetically-integrate harmoniously into the dental arch once again. The patient was thrilled with the result and cannot wait to fracture another tooth so we can do this all over again. Just kidding. **DA**

Reference

1. Carney, M.N. and Johnston, W.M. Appearance Differences between Lots and Brands of Similar Shade Designations of Composite Resin Systems. *J Esthet Restor Dent.* 2017 Apr; 29(2): E6–E14.
2. Sikri, V.K. Color Implications in Dentistry. *J Conserv Dent.* 2010 Oct-Dec; 13(4): 249–255.



Fig. 13

Fig. 13: Post-operative retracted lateral oblique view

About the Author



Dr. Clarence Lam heads a practice in Auckland, New Zealand, which specialises in cosmetic and restorative dentistry. She is originally from Canada, where she completed her Doctor of Dental Surgery and General Practice Residency at the University of Western Ontario and the University of Toronto respectively. Dr. Tam is the Chairperson and Director of the New Zealand Academy of Cosmetic Dentistry. She is currently the only person in Australasia to hold Board-Certified Accredited Member Status with the American Academy of Cosmetic Dentistry. She frequently and continually lectures internationally.