Diastema closure with a micro-hybrid composite resin

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The presence of diastemas in the anterior aesthetic zone can be displeasing to a person's smile and many patients are motivated to improve their appearance either with orthodontic treatment or restoratively with veneers, crowns, and/or composite resin bonding.

Increased patient demand for optimal aesthetics with less invasive procedures has resulted in the extensive utilisation of free hand composite resin bonding in the anterior region. To achieve a successful directly bonded restoration, the dentist must have a comprehensive understanding of adhesive dentistry, which involves manipulation of composite resin, proper preparation and isolation, and an understanding of the optical properties of the natural tooth and their relationship to anatomical morphology.

Composite resin bonding to close diastemas is a conservative and a relatively inexpensive means of enhancing one's smile and is often carried out in a single visit procedure in many dental practices.

In selecting a composite resin material for this case there are certain features that are necessary:

1. Sculptability: the material should be easy to shape and sculpt with minimal slumping;
2. Fracture Toughness: resistance to fracture in stress bearing areas;
3. Modulus of Elasticity: similar modulus of elasticity to natural tooth structures;
4. Polishability: easy to attain polish and maintenance of gloss over time;
5. Shrinkage: minimal polymerization shrinkage to reduce microleakage and stresses at the restoration/tooth interface.

Venus, a microhybrid composite resin by Heraeus Kulzer has been chosen as the restorative material for this case. Use of a microhybrid composite resin not only provides the strength needed in these situations but also the aesthetics with good polishability and lustre.

The Bis-GMA based resin contains fillers consisting of barium aluminum boron fluoride silica glass and highly-dispersed silicon dioxide. The barium glass fillers average 0.7 microns characterized by a very narrow particle size distribution.

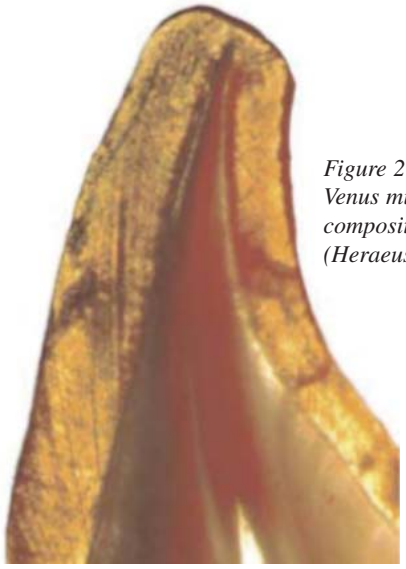

Figure 1: Natural tooth with translucent enamel and opaque dentine.

Figure 2: (right) Venus micro-hybrid composite resin (Heraeus Kulzer).

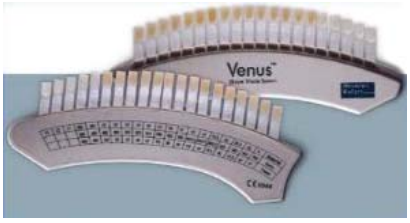

Figure 3: Venus shade system.

To achieve natural life-like restorations, the clinician needs to establish a chromatic colour map and layer the restoration with successive layers of dentine, enamel and translucent effects so that the restoration has optical properties that reflect, refract, absorb and transmit light naturally. This allows the restoration to feature polychromaticity, and have a depth of colour that appears like natural tooth structures (Figure 1).

Venus (Figure 2) is built around 23 shades in three opacities. These three opacities are an opacious dentine shade, enamel (body) shade and translucent shades. Shade selection is completed with a matched handmade 2 Layer shade guide (Figure 3), and a feature of Venus composite is it's "Colour Adaptive Matrix", which enables the natural tooth and restoration to blend optically with the filling virtually indistinguishable from the surrounding tooth structure.

The following case describes the use of direct composite resin to close diastemas in the anterior teeth to address the aesthetic concerns of the patient (Figures 4-7).

Restorative Sequence

1. Pre-operative assessment and Shade Selection: Assessment of the patient should be made along with any contraindications to treatment. Special attention must be made if there are any occlusal concerns like bruxing or in "deep bite" situations. Shade selection is made prior to treatment to compensate for the elevated value of teeth if dehydrated. Due to the different opacities/translucencies of the different tooth substrates - with dentine being more opaque and enamel more translucent - we need to choose materials that mimic this characteristic. Opaque dentine shades give the restoration a natural depth of shade (chroma) in the core of the filling. Enamel shades, which have medium transparency and chroma can be layered over this dentine shade to produce natural-looking shades in the anterior region. The incisal shades, which have the greatest transparency and least chroma, should only be used in combination with enamel and dentine shades for the build-up and are often used to imitate incisal edges.

2. Mock-Up: It can be difficult to select the correct shade and opacity and it is the

Figure 4: Pre-operative frontal view.

Figure 5 :Pre-operative smile.

Figure 6: Pre-operative Left lateral view.

Figure 7: Pre-operative right lateral view.

Figure 8: Rubber dam isolation - full arch.

Figure 9: Etching of tooth with adjacent area protected with Teflon tape.

Figure 10: Characterisation of enamel layer with white tint to simulate enamel crazing. Note this layer is unset and the resin tint is indented with a #8 file.

Figure 11: Digital ruler with fine calipers.

Figure 12: Digital ruler in use to measure correct width of the built-up restoration.

author's preference to begin with a trial mockup of the different shades/opacities of materials to ensure correct colour and translucency. This is a very quick buildup that gives the clinician a preview to the final result with minimal time and effort.

3. Isolation: The teeth were isolated with non-latex rubber dam (Flexidam - Roeko) using a full arch approach. The palate was sealed with a quick setting bite registration material (Figure 8).

4. Preparation: is completed with a pumice slurry and judicious use of a diamond bur to clean the surface for optimal adhesion.

5. Bonding: The teeth were then prepared for bonding using the "Total Etch" technique with 37% phosphoric acid on enamel for 15 seconds only. The adjacent teeth are separated by Teflon tape so that the etch is not inadvertently allowed on the adjacent teeth (Figure 9). A fifth generation bonding agent (Optibond Solo Plus - Kerr) was then applied using a scrubbing motion to allow good resin impregnation and cured.

6. Stratified (layered) build-up of artificial dentine: In closing the diastema, there is often the need to block the "shine-through" of the oral cavity. This is often seen as a silhouette of the cavity form with a grey translucent appearance of the restoration. It may be necessary to use an opacious dentine (A2O) replacement with higher colour saturation, allowing the light to be reflected back to the eyes. Opaque dentine shades exhibit the greatest depth of shade and are ideal for building up areas of lost tooth structure, which require their shade or lightness to be masked. Each increment is applied and contoured with a

Figure 13: Finishing with aluminium oxide discs.

Figure 14: Multi-fluted needle-shaped carbide burs used to finish the restorations.

Figure 15: Egg shaped carbide bur used in the lingual concavities.

Figure 16: Silicon carbide brush.

long bladed instrument (TNCVIPC, Hu Friedy) and smoothed out with an artists sable brush. Each increment is polymerized for 10 seconds allowing placement of subsequent increments without deforming the underlying composite layer. To prevent overbuilding of the artificial dentine layer, there is a need to monitor the composite from the incisal aspect to provide adequate space for the final artificial enamel layer. If this has been overbuilt, the clinician can cutback the composite with a rotary bur and re-bond to this cut composite.

7. Stratified (layered) build-up of artificial enamel: To reproduce the optical effects of enamel, a layer of translucent composite (T2) is overlaid over the dentine shade (A2). This translucent layer allows the colour of the underlying restorative material to show through, and gives the tooth a realistic depth and colour. Anticipating the final contour and developing the restoration in increments while considering the occlusion and anatomy allows the clinician to minimize the finishing procedures. This results in a restoration with improved physical properties with less microfractures.

8. Characterisation: Often tints and modifiers can be used to add internal characteristics to the restoration and these are often placed before the final enamel layer. In this case, no such tints were placed at the artificial dentine stage but placed into the final enamel layer to have a surface effect. The adjacent teeth exhibited enamel crazing so use of a white tint with a #8 endodontic file (Figure 10) was used to indent the unset enamel composite and form crack lines. This small crack was then refined with artists sable brushes to reduce their prominence.

Figure 17: Goat-hair brush and cloth mop for final high polishing in conjunction with diamond polishing paste.

9. Space closure: management of the spacing and symmetry of the teeth are crucial to the proper appearance of the restoration in these diastema closure cases. Measurement of the restorations can be carried out with a digital ruler with fine calipers (Dentagauge 3 - Erskine Dental) (Figures 11 and 12) to ensure correct shape and width of the restoration especially in relation to the contralateral teeth. The subsequent diastemas were closed between 11, 12, 13, 22, and 23 with the technique as described.

10. Finishing and Polishing: is carried out to reproduce the shape, contour and lustre of the natural dentition. Initial contouring is done with finishing discs (Figure 13) and multifluted burs (Figure 14). These multifluted carbide burs are used dry with light pressure. This dry finishing allows the clinician to visualize the margins and any flash present. The interproximal region was finished with silicon carbide finishing strips and occlusion is checked carefully to ensure there are no interferences in centric or lateral movements. The final polish is achieved with silicone rubber points that are composed of aluminium oxide parti-

Figure 18: Final smile exhibits harmonious integration of the restorative material to provide natural aesthetics.

Figure 19: Post-operative frontal view.

Figure 20: Frontal view of anterior teeth. Note correct colour, shape and form of the teeth and white crazing evident on the incisal edges to match her natural dentition.

Figure 21: Black and white photography can be used to check the correct value of the restorations.

Figure 22: Right lateral view.

Figure 23: Left lateral view.

cles and silicon that remove surface defects and establishes a high lustre. A silicon carbide brush can also be used (Figure 16). The final polish is accomplished with a soft goat-hair brush and fluffy cloth wheel mop with diamond finishing paste (Figure 17).

Conclusion

The closure of diastemas in the anterior zone to improve the patient's smile has been presented with direct composite resin bonding. A layered approach that mimics the polychromaticity of teeth allows us to build natural restorations. These restorations are practically invisible and blend harmoniously with the natural dentition. Correct hue, value, chroma, translucencies and opalescence provided with modern resin materials like Venus (Heraeus Kulzer) allow us to copy nature's beauty. The development of form, function and aesthetics with direct resin can be achieved with proper and meticulous technique to provide the patient with a natural looking smile with minimal economic and biologic cost (Figures 18-23).

Dr Christopher Ho received his Bachelor in Dental Surgery with First Class Honours from the University of Sydney in 1994 and completed a Graduate Diploma in Clinical Dentistry in oral implants in 2001. He is a Clinical Associate with the Faculty of Dentistry at Sydney University. In addition to teaching at undergraduate level, he has lectured and given continuing education presentations in Australia and overseas on a wide range of topics related to cosmetic and implant dentistry. He maintains a successful private practice centered on comprehensive aesthetic and implant dentistry in Sydney, Australia.