

# Expertise

## Making The Transition To Multi-Layering Composite

Case Study by Dr. Gerard Lim, Singapore



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Clinicians used to the relative simplicity of single shade composites, for example, the very popular Z-250, Z-100 or Filtek A110 systems, can sometimes be daunted by the great array of both shades and opacities/translucence of composite systems of the Filtek Supreme XT system that cater to the higher expectations of some dentists and patients for direct aesthetic restorations. The wide array of choices and decisions to be made from the 35 shades from such a comprehensive system is both its strength and its Achilles heel.

Producing direct aesthetic composite restorations is an art. The dentists, like an artist must be able to discern and map out the subtle nuances of the gradations in colour, translucence and texture of the tooth to be restored. A large colour palette may be ecstasy to the experienced artist as it provides a range of possibilities to bring his art to fruition. The same colour palette can also intimidate the inexperienced with the number of decisions to make in selecting both shade and opacity, putting the inexperienced off from adopting such a system.

This article tries to bridge the gap for the clinician who wants to provide more aesthetic direct composite restorations for his/her patients but is used to using single shade techniques only.

There are four pre-requisites.

1. Ability to analyse the subtle gradations in colour and opacity changes of the tooth, or in other words to colour map the tooth.
2. Familiarity with the materials used. The clinician must have an idea of how the more opaque materials appear as the thickness of the more translucent materials layer varies over it. There is only one way to find out-through play!
3. Restore the correct anatomical features including shape, contour and surface texture.
4. Good hand-eye co-ordination to translate all the above into a restoration that blends in and does not draw attention to itself.

### Colour Mapping

What we observe to be the colour of a tooth is the result of the combined effect of the play of light (transmission, reflection and refraction) on both the dentin and enamel layers in natural teeth. This resulting luminescence from the scattering of light is known as opalescence. It is opalescence that gives teeth that natural "glow" or vitality. Colour mapping is analysing the distribution of the different colours and opacities that come together to make each tooth unique. The ability to colour map correctly is essential. Some are naturally gifted at this whilst others need to work at it.

Fortunately, there are many image editing computer programs that can help in this respect. A simple way to make the subtle gradations more obvious is to increase the contrast and reduce the brightness of a digital image of a tooth (Fig. 1). This basic photo editing facility is available in all photo editing programs, and even word processing programs like Microsoft Word.

Another technique is to utilize the "posterize" facility in photo editing software. Most computer programs can distill any subject to at least 256 colours to give a "life-like" picture. Picture editing programmes often have a "posterize" mode where you can choose how many colours you want your "poster" image to have. Take a digital image of some teeth, then posterize or simplify the image using 4-6 colours as you improve. The poster image produced will distill and map out the areas of transition in colour or value (gray level) to the number of levels chosen (Fig 2). Using this as a guide, you can look at the photo of the tooth to learn to discern the transition in colours and opacity of a tooth.



Fig. 1 Left photo is an unmanipulated digital image of a central incisor. The right image has the contrast increased and the brightness decreased. These changes make the demarcation of the subtler colour and translucent gradations more obvious.

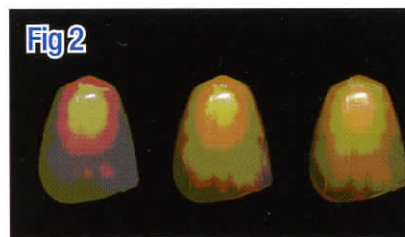


Fig. 2 Posterized images of the same central incisor, from left to right at 4, 5 and 6 levels. This can help map out the demarcation of the changes in colour and translucence.





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## Material Familiarisation

The second step is to play with your materials to familiarise yourself with its translucence/opacity to discover how the more translucent enamel shades interact with the more opaque dentin shades to produce different effects as the thickness of the enamel layer changes. The thinner the layer of the translucent surface material is, the more the underlying layer or colour will show through. As a start, the shade guide provided by the manufacturer on the combination of different colours and opacities to use to arrive at a desired VITA shade is a good guide (Fig 3). The learning curve using the newer Filtek Supreme XT is shorter compared with the original Filtek Supreme as the colours of the universal body shades are now closer to the actual VITA shade tabs and previous 3M products. Further changes in colour can be achieved using tints, but this will not be covered in this article.

Fig.3 Filtek Supreme XT Shade Wheel



Fig. 4. Class III cavity on upper left incisor with hollowed out area of the lingual aspect of the labial surface, which appears transparent (arrowed) from the labial aspect.

## Composite Materials

For a clinician just venturing out into direct aesthetic restorations, it may be more practical to purchase a few core colours to supplement your universal composite set, such as the Filtek Z350. In my practice, VITA shade A2, A3 and A3.5 would cover most situations. This may differ in different cultural groups and whether your patients like the bleached out piano key look! In the Filtek Supreme XT range, to produce these VITA shades will require the following combinations:

VIT A Shade	A2	A3	A3 5
Dentine Shade	A3D	A4D	A4D
Body Shade	A2B	A3B	A3 5B
Elamel Shade	A1E	A2E	D2E
Transparent Shade	C(clear)	Y(yellow)	Y(yellow)

Therefore, assuming you already have the Supreme body shades (or equivalent Z350 shade), you will have to purchase (beg, steal or borrow) A3D, A4D, A1E, A2E and D2E, and the translucent shades C and Y. This would probably be sufficient to cover all but the most extreme ends of the tooth colour spectrum.

## Class III with Hollowed-out Buccal Enamel

It may not be obvious, but this situation provides a good opportunity to learn the benefits of layering. Fortunately, most modern composites do not make any perceptible colour change after curing. Therefore, you are able to observe the interaction of the different layers and make changes where the outcome is not the effect desired, before any light curing is performed.

In this situation, the hollowed out enamel is very transparent (Fig. 4). Restoring the

tooth with a single body or enamel shade will result in an unesthetic outcome, as the transparent area will look too translucent, particularly in a relatively opaque tooth, whereas a dentine shade has the opposite effect, as the opacity of the dentine shade will shine through the transparent enamel spot, particularly in a very translucent tooth



Fig. 5. Transparent area masked with a body shade (Filtek Supreme XT A3B) as shown in diagram Fig. X.

The solution to this predicament can be solved using a two-shade technique. The very transparent area of the cavity where the enamel has been hollowed out lingually needs to be equalised with the adjacent areas in terms of colour and translucence. An enamel or body shade is used to restore the hollowed-out enamel defect so the hollowed out area merges with the surrounding areas of the tooth when viewed from the labial aspect. Which is selected depends on what matches the colour of the tooth better. In this case, it was judged to be the body shade, and this was used to fill the hollowed out area as illustrated graphically in Fig. 6, with the clinical effect of this addition shown in Fig. 5. To achieve matching translucence involves playing with the thickness of the composite layer. Increasing the thickness of the layer decreases translucence, and thinning the composite layer will increase translucence. The inner bulk of the cavity can then be restored with a dentine shade, using an enamel or body shade for the outer layer. In this case a body shade was used as the tooth was not that translucent in the mid-third where the restoration is visible from the front (Fig 7).

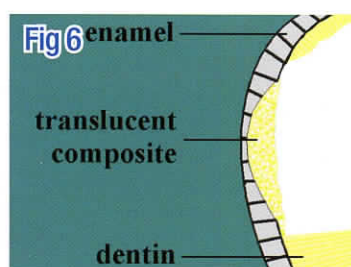


Fig. 6. Cross section through Class III cavity showing the hollowed out enamel area that looks transparent. This area needs to be filled-in with a translucent composite so that it appears optically similar with the surrounding area, before the bulk of the restoration in a dentine shade can be placed. If this is not done and a dentine shade composite is placed directly into the hollowed out enamel region, the opaqueness of the dentine shade composite may shine through.

## Class IV

The Class IV restoration usually benefits enormously from layering with a multi-shade technique. A well colour-matched single shade restoration in this situation is still a give-away because of its uniformity of colour and translucence. The following case is a patient who came as an "esthetic emergency" because his existing restoration on his upper right central incisor dislodged (Fig. 8). As his teeth had white patches, this will also allow demonstration on how to characterize the restoration to blend with the rest of the dentition.





Fig. 7. Restoration completed with core of dentin shade (A4D) and outer covering of body shade (A3B).



Fig. 8. Mesial-incisal composite restoration from the upper right central incisor dislodged.



Fig. 9. Silicone putty template seated in position.

### Determining Composite Shades To Use

In this case, the shade of the tooth to be restored was determined to be Vita A3. The Filtek Supreme XT Shade Wheel provides a good starting point. Its recommendation for a Vita A3 Class IV restoration is shown in Table 2. In addition, two other shades were utilized to characterize the tooth (Table 3).

Table 2. Filtek Supreme XT composite shades recommended by 3M Shade Wheel for Class IV shade VITAA3

Shade	Area
A4 Dentin	Dentin portion of tooth
A3 Body	Cervical to mid-third outer layer
Yellow Translucence	For translucence at incisal edge
A2 Enamel	Incisal third layer

Table 3. Additional Filtek Supreme XT Composite Shades Used for Special Effect

Shade	Purpose
WE (white enamel)	To create whitish incisal edge at translucent incisal portion of tooth
WD (white dentin)	To simulate white patches on the surface

A Class IV restoration free-hand build-up can be a challenging technique for some clinicians. Even for a skilled clinician, the availability of a template (Fig. 9) for restoring the tooth can be a great clinical time saver.

As this patient brought in the dislodged restoration, it was tacked into place with some flowable composite (without acid-etching) to allow a template to be made. A little silicone putty was mixed and adapted onto the lingual aspect of the tooth, making sure that it extended at least one tooth either side to enable the template to be securely localized. The template should also include the incisal edge of the tooth to be restored. If accidentally overextended too much over the labial surface, it would hinder the build-up. Therefore, should there be any excess, it can be trimmed off with a scalpel blade. Once the template is made, the tacked restoration can be easily pried off.

The enamel bevel plays a critical role in the retention of the Class IV composite restoration. The most common cause for dislodgement of this type of restoration is a bevel that is too narrow in a quest to "preserve tooth tissue". However, if this conservative restoration dislodges within a short time, the patient is recommended a crown instead. So much for tooth conservation! For predictable retention, a wide sinuous enamel bevel is required. From an esthetic point of view, this wide labial bevel provides a gradual transition from restoration to tooth. To make the transition even more difficult to detect, we can borrow a concept from military camouflage, known as breaking the outline—a technique to alter a familiar outline so it becomes unidentifiable. To break the regular outline of our usual sinuous bevel, a second more acute-angled, irregularly serrated bevel of differing width and depth, will make the tooth-restoration margin even more difficult to detect (Fig. 10, 11). The tooth is now ready to be restored.

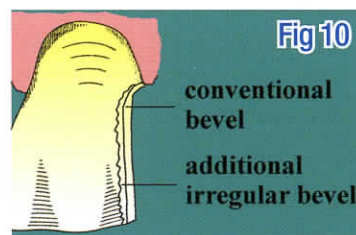


Fig. 10. In addition to the usual conventional enamel bevel. A second, more acute angle bevel made in an irregular, serrated manner with irregular width and depth will help camouflage the margins of the restoration.

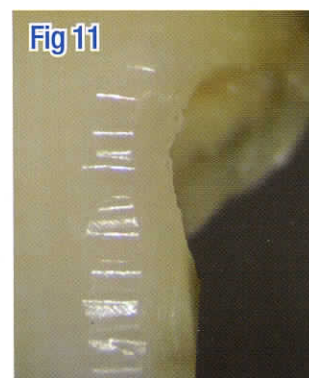


Fig. 11. A wide sinuous bevel is supplemented with a second serrated bevel of differing width and depth to break the outline of the restoration.





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Fig. 12. The lingual surface was layered onto the silicone template using an enamel shade WE. After light curing this layer, the template can be removed.



Fig. 13. The dentin layer, using Shade A4D is then placed onto the lingual layer. It is applied to simulate the mamelons incisally. Note the relatively rough surface that allows light to be scattered in different directions to simulate what happens at the amelo-dentinal junction.

Exposed dentin is lined with resin modified glass-ionomer cement and light cured. After etching and the application and light curing of adhesive as per normal, the template is seated to enable the lingual surface of the restoration to be laid down directly onto it. A white enamel shade composite ,WE , is adapted onto the template right to the incisal edge (Fig. 12). This will give the whitish edge or "halo" to the translucent incisal portion of the tooth. Once this lingual layer is light-cured, the template can be removed. The dentin layer selected, A4D can now be placed. It is built up to mimic the normal extent of dentin, including the mamelons along the incisal edge, then light cured (Fig. 13). Clinicians have a tendency to make everything nice and smooth. However, the dentin layer need not be smoothed but left undulating so that light reflected off this opaque layer is scattered in different directions, to mimic natural teeth.



Fig. 14. The cervical marginal portion is restored using a body shade, A3B, using a celluloid matrix and wooden wedge to prevent any overhangs at the gingival margin proximally.

A body shade, A3B is used to restore the cervical portion of the restoration. I prefer to use a wedged cervical matrix to restore this proximal area so that no overhangs develop (Fig. 14). However, a regular transparent matrix strip will produce a straight mesial edge, which in nature is gently curved or sinuous in outline. This discrepancy in the desired proximal contour will be corrected in

the subsequent build-up. Light cure.

Before finalizing the restoration, we have to ensure the restoration does not adhere permanently to the adjacent tooth, but still has good, proximal tooth contact. This can be achieved predictably by any of the following methods:

1. Petroleum jelly (Vaseline) applied onto the adjacent tooth surface.
2. Avoid etching adjacent tooth.
3. Place teflon (plumber's) tape on adjacent tooth.

If you choose to use petroleum jelly, use just a smidgen applied using floss, otherwise, as the composite is manipulated against the adjacent tooth, excess petroleum jelly may get incorporated into the restoration. Avoid etching the adjacent tooth is the simplest choice. However, there will still be weak adhesion of the restoration to the adjacent tooth that will require an instrument, e.g. plastic 6, to wedge the teeth apart to break this weak bond to the adjacent tooth. This procedure creates a heart-stopping crack sound that can be very disconcerting to a nervous patient. So warn your patient first! Teflon tape, which is demonstrated in this case, must be stretched taut without wrinkles proximally. The only disadvantage is the Teflon tape may cover the tooth whose characteristics you are trying to copy, as in this case!

Now we are ready to finalize. Transparent composite is placed between the mamelons and just inside the incisal edge to simulate the translucence often seen just inside the incisal edge. If more translucence is required, use the translucent composite right to the labial tooth surface, to tone down the translucence, overlay some enamel shade over it. Enamel shade is placed over the previously placed composite and moulded or sculpted to obtain the final shape of the restoration, overlaying it over the body shade placed earlier to build-up the cervical region, making sure to develop the sinuous outline of the mesial surface of the tooth. It is important that in sculpting this final layer, no voids are left at the interface between the different layers, particularly in the interproximal region. A little white dentin shade composite, WD was added and blended in to simulate the patient's white opaque patches on the labial surface. A little adhesive on a flat surfaced instrument can produce a very nice smooth surface. Once the shape is correct, the surface is smoothed to minimize finishing after the composite is cured (Fig. 15). Light cure. Alternatively, if a slightly textured surface is required to match the adjacent teeth, a bristle brush can be used to produce this effect.

There is a shallow but wide expanse of composite of different shades in the last finalization stage. This is done on purpose so that the effect of the subtle blending of one shade to the next can be modified, by varying their thickness or amount of overlap. If the shade combination looks wrong, the composite shade that is incorrect can be substituted with another before the final light cure. Although there is quite a lot of composite to polymerize at once, the normal concern we have with polymerization shrinkage affecting marginal integrity when restoring intracoronal cavities is not a problem in Class IV restorations. In Class IV restorations, the majority of the composite surface is



not bounded by tooth, which allows free polymerization shrinkage to occur without stressing the tooth-composite interface.

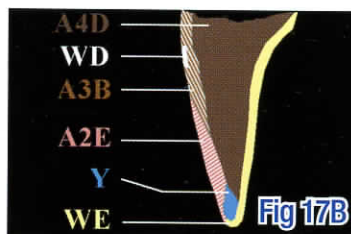


Fig. 15. Finalization of restoration. Teflon tape is placed as a separator, and the straight mesial outline produced by the celluloid matrix strip is converted to a natural looking gentle curving shape by the addition of enamel shade A2E, whilst the incisal portion was restored with a little yellow translucent shade Y between the dentin mamelons, then merged with the enamel shade to produce the required translucency. To simulate the existing white patches, a little white dentin shade, WD is swirled onto the enamel surface and the whole surface simultaneously shaped and smoothed to minimize finishing.



Fig. 16. Completed restoration after finishing with polishing paste, a little of which is still lodged between the teeth.

After the occlusion is perfected, finishing can be performed in the usual way. If need be, composite finishing (diamond or tungsten carbide) burs can be used to refine the shape and surface contours, then smoothed with increasingly finer grit of polishing disks and give it a final shine using composite polishing paste. This can take quite a bit of time if the final shape requires considerable work. It is more cost-effective to spend a little more time getting the final layer of composite to the correct shape and surface contour, so that finishing is a breeze. The restoration after polishing is shown in Fig. 16. Fig. 17 illustrates the colour map of the restoration. Have fun!

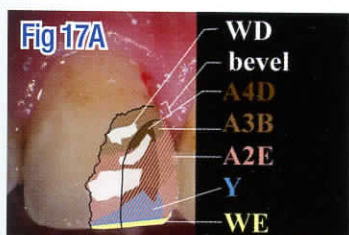


Fig. 17 (A) Colour map of distribution of shades Filtek Supreme XT shades used in the Class IV restoration. The width of the double bevel, is superimposed over the colour map. (B) Colour map in cross-section through restoration.