DAILY TECHNIQUE

Alumina All Ceramic Restorations

The Magic of Illusion Using Vita VM7

Pinhas Adar MDT, CDT

Matching the single anterior crown to natural dentition is not the challenge it was twenty years ago. Today's materials allow the dental laboratory technician to fabricate single anteriors in a simple manner that produces all of the illusive qualities of natural dentition. Mixing stains and modifiers to create the illusion of depth and translucency is no longer necessary. Most ceramic materials produced today mimic natural teeth through enhanced optical properties. This does not mean that fabricating a single central incisor does not require effort, time or talent. As always, the technician's hands and knowledge ultimately decide the quality of the final outcome. In addition, the laboratory technician must observe and understand the characteristics of the materials they use and the natural teeth they are trying to replicate. The ceramist must also understand that every patient's teeth differ in shape, thickness, size and optical properties.

Key words: Alumina copings, soft tissue, VM7, single central restoration, restorative team

This article features VitaVM7 (Vident, Brea, CA. USA). Vita VM7 is a veneering material that is compatible with any Alumina-based coping with a CTE of 7.2 - 7.9 which includes Vita Inceram, Spinell Alumina and Procera. The wear characteristics of the VM7 material are very similar to natural enamel and its low solubility makes it highly durable in the oral environment producing a long wear life.1 It possesses enhanced color stability even after multiple firings and can be layered to create a perfect match with the adjacent dentition.

In contrast to popular belief, reproducing a single central is possibly the easiest restoration in dentistry. It is however, probably the most time consuming for the technician and the most costly to the patient. What makes reproducing the single central easy is that the natural tooth provides us with the perfect guide. The adjacent tooth exhibits all the detail and characteristics necessary to create a matching crown. Technicians that couple this information with today's materials and the techniques pioneered by various ceramists from around the world, will find that the single central can be matched quite predictably. However, additional steps are regularly required to achieve such success. A perfect example is that the first crown made often becomes the custom shade guide. This guide then serves as the definitive roadmap for matching the natural dentition. These extra steps, however, ultimately result in an increased time commitment from the patient, dentist and laboratory technician.

The first step in fabricating a single unit is to understand nature and realize that every clinician and technician has unique capabilities and limitations.

The patient Figure 1a wanted to replace the crown on #9 that did not match her existing natural dentition. When observing natural teeth, it is quickly discovered that not all teeth are created equal. The right amount of internal layering and translucency must be incorporated into the single tooth restoration in order to blend with the natural environment (Figs. 1b,c).

The patient in Figure 2a also had a single crown on #9 that did not match her existing natural teeth. In this case the natural teeth have a lot of opacity

Fig. 1a. Pre-operative view of a young girl with composite bonding on tooth #9.

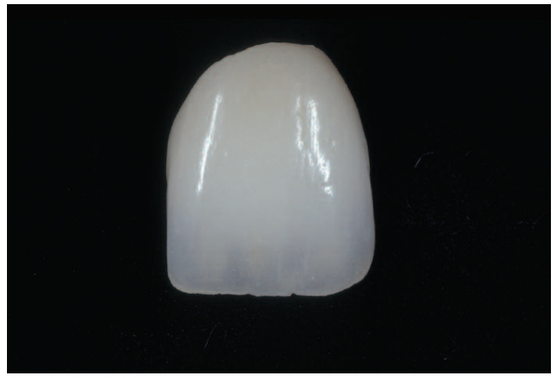

Fig. 1b. The finished veneer crown.

Fig. 1c. Post-operative view of a single Spinnell crown with Vita dur Alpha.

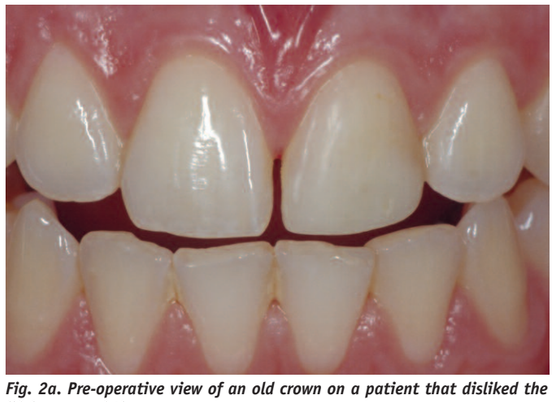

Fig. 2a. Pre-operative view of an old crown on a patient that disliked the lifelessness of the crown.

Fig. 2b. Post-operative view of the new Spinell crown shows the harmonious blend with the natural environment in both texture and internal characterization.

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Fig. 3a. Pre-operative view of a crown illustrating the inadequate soft tissue health and violation of the biological width.

Fig. 3b. Orthodontic eruption of the previous crown to bring the soft tissue and bone towards the incisal.

Fig. 3c. Post-operative view of the single Alumina crown with VitaVM7 note the harmonious blend with the adjacent natural environment and a much healthier soft tissue profile after developing a better emergence profile.

"No matter how good the ceramist is the illusion of reality will never be achieved without correcting the tissue."

requiring a slightly different layering technique than for the previous case. The abundant opacity and calcifications must be carefully placed to mimic the natural situation.

The inflammation and gray shadowing of the surrounding soft tissues compromise the esthetics of the single crown (Fig. 3a). Metal shining through the crown can cause this grayness, but in this case it is caused by a biologic width infringement. No matter how good the ceramist is the illusion of reality will never be achieved without correcting the tissue.

To overcome this challenge, orthodontics were performed in order to erupt the old crown, repositioning the soft tissue and bone levels incisally (Fig. 3b). This was followed by a surgical procedure to idealize the biological width. Figure 3c shows the final single crown restoration. The soft tissue has adapted nicely exhibiting improved gingival architecture and color in harmony with the adjacent teeth.

The patient shown in Figure 4a disliked her single central incisor #8. Orthodontic eruption had previously been done to level the soft tissue as described in the previous case. The tooth was then prepared (Fig. 4b), impressions taken and a temporary fabricated. A final master model was made from the impression so that an Alumina coping could be constructed.

An Alumina coping can be fabricated in two ways. In the first, the Alumina is cut back at the margin to create a porcelain shoulder. If the finish line of the preparation is deep enough subgingivally, a second technique can be used. In this case, a cutback of the Alumina coping and subsequent porcelain margin are not necessary (Fig. 4c). With any all-ceramic substructure there is a lack of fluorescence and this optical challenge must be overcome. A more fluorescent powder (called Effect Liner) can be used around the subgingival area to alleviate this problem. These powders can be used to control the fluorescence in the restoration as well as support light distribution. Since dentin fluoresces more strongly than

Fig. 4a. Pre operative view of an unhappy patient with #8 after orthodontic eruption.

Fig. 4b. Prepped tooth showing the dark tooth structure.

Fig. 4c. Alumina coping on the master die.

Fig. 4d. Alumina coping overlayed with 50% Liner Effect EL1 and 50% EL5.

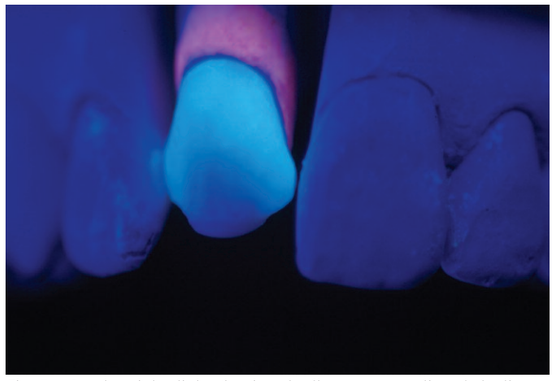


Fig. 5a. An ultraviolet light showing the fluorescent quality of the liner and the lack of fluorescence in the actual Alumina coping.

Fig. 5b. Supporting the value with Base Dentine 1M1.

Fig. 5c. Full contour build up of dentin 1M1.

Fig. 5d. Cutting back the incisal in an irregular manner.

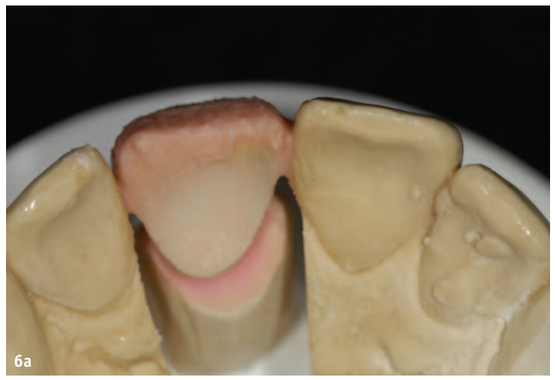
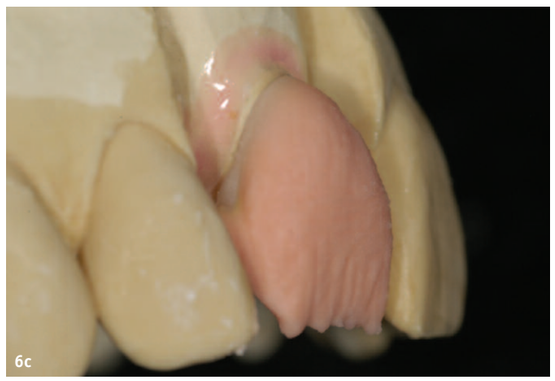


Fig. 6a-c. Different angles demonstrate the cut backs used to develop the space for the enamel.



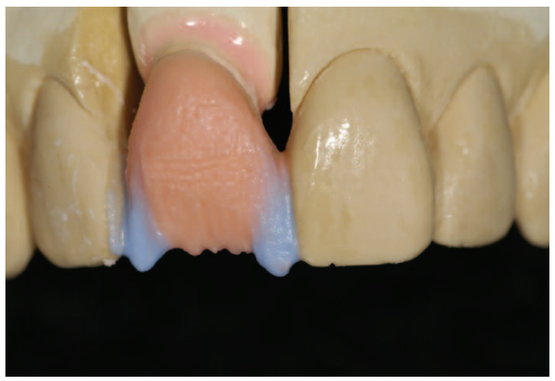


Fig. 6d. Applying incisal light on the mesial and distal.

Fig. 6e. Applying 50% Incisal light mixed 50% with EE9.

Fig. 6f. Completing the incisal wall with a segmental build up.

enamel, this is the perfect area to place Effect Liner in order to increase light conductivity and prevent shadowing.

To develop the highly color saturated cervical area for this patient, Effect Liner EL1 is mixed with EL5 (60:40%). Mixing the very light EL1 with EL5 develops high color saturation similar to the adjacent natural tooth (Fig. 4d). In Figure 5a the coping with the Liner material is illuminated with ultraviolet light, demonstrating the impressive fluorescent qualities of this Liner product after firing. This high fluorescence will illuminate the surrounding soft tissues around the crown. When there is a need to overcome spacing problems due to insufficient tooth reduction, various Liners can be overlaid on the entire Alumina coping to create either brightness or darkness. This also creates a more fluorescent layer over the Alumina substructure to produce the optimum result even without ideal space for proper crown thickness.

Next, Base Dentine is applied to support the value. If the Base Dentin is not used to support the brightness, the pure dentin will appear low in value. Figure 5b shows that the dentin build up extends beyond the incisal of the Alumina coping. Be careful not to cover the Effect Liner with the Base Dentine in order to allow the Liner's optical properties to shine through the body of the crown. The Liner can, however, be covered with standard dentin to control the contrast.

Once the Base Dentine is applied it is overlaid with a dentin. In this particular case the Base Dentine and dentin shade are 1M1 (3D Shade Guide, Vita). The cervical Liner can now be overlaid. Always build up the dentin shade to full contour in order to visualize the outcome (Fig. 5c). Once the shape is realized, it is easier to return to the same shape after the cutback. After the full contour has been determined, space for the incisal layers must be made either by cutting back with an instrument or brush (Fig. 5d). The cutback must be irregular so it can better blend with the incisal layer and avoid a definite demarcation between the layers. Allow sufficient space for the incisal layers proximally, incisally and facially. Figure 6a shows the incisal view of the cutback. Figures 6b and c show the lateral view compared with the adjacent natural central. It is important to look at the build up from every angle in order to determine the sufficient space required for the incisal layers. In this case a very routine mixture of Incisal Light, Incisal Light mixed with Incisal Effect EE9 (50:50%) and pure Incisal Effect EE9 were used. The buildup is started by applying Incisal Light to the mesial and distal of the incisal third (Fig. 6d). Once the mesial and distal corners are built to the correct height, continue building with a 50:50 mixture of Incisal Light plus EE9 (Fig. 6e). Repeat these steps until the incisal frame is complete (Fig. 6f).

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The canvas is now created and the internal effects can be applied. In this case there is a slight low value band on the incisal third just below the mamelons. The Incisal Effect EE11 is mixed with stain liquids so that it becomes very fluid. It is then painted on the surface to create the desired depth and horizontal band (Fig. 7a). The mamelon effects are achieved by mixing MM1 with MM3 in a 50:50 ratio with stain liquid. Stain liquid improves handling and makes it easier to mimic the internal structures found in the incisal of natural teeth. Figures 7a-d provide different views of the mamelon application. Note that there is still sufficient space for the enamel overlay to complete the build up. To further enhance the low value band, a clear incisal ceramic is overlaid in a thin layer (Fig. 7e). To complete the build-up the incisal effects are overlaid with the same mixture and in the same segmental manner as before, (Fig. 7f). A mixture of Incisal Light and EE9 mixed half and half with clear (Figs. 8a, b) is placed over the entire shape and built slightly larger than full contour to account for shrinkage (Fig. 8c).

Figure 8d shows the facial-incisal view of the developed layers. The incisal edge must be in line with the adjacent tooth. If the incisal has to be repositioned, it should be manipulated while the ceramic is moist so that the effects will move with it.

Fig. 7a. Applying EE11 horizontally.

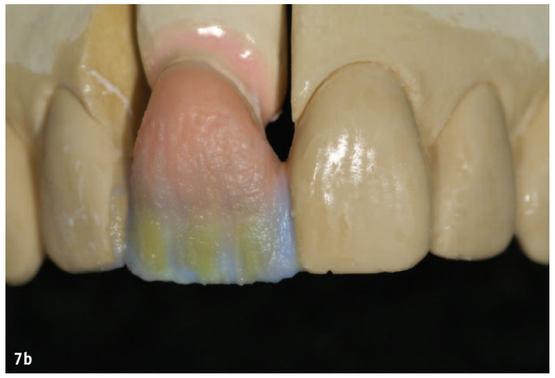

Fig. 7b-d. Applying mamelon MM1 mixture with MM3.

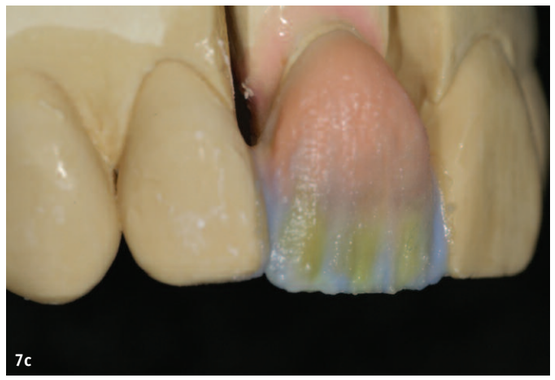

Fig. 7e. Applying clear overlay on the low value band.

Fig. 7f. Overlaying the incisal segmental build up with the same mixture.

Fig. 8a. Continuing the segmental overlay.

Fig. 8b. Continuing irregular overlay to emphasize the internal structure.

Fig. 8c. Completed buccal overlay of the segmental build up.

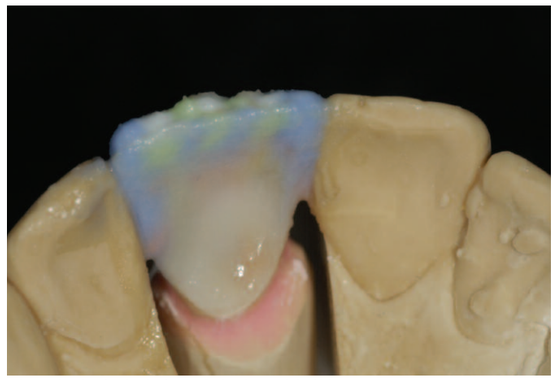

Fig. 8d. The incisal view of the buccal build up.

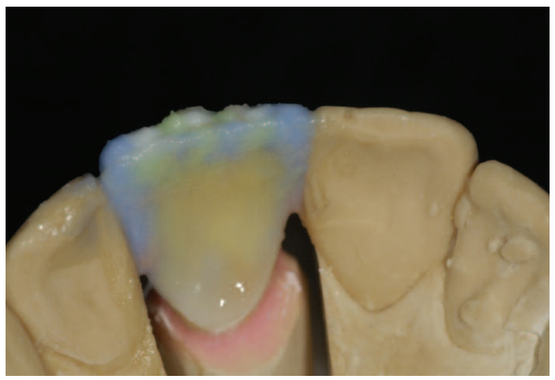

Fig. 8e. Applying the Mamelon effect on the lingual wall MM1 with MM3.

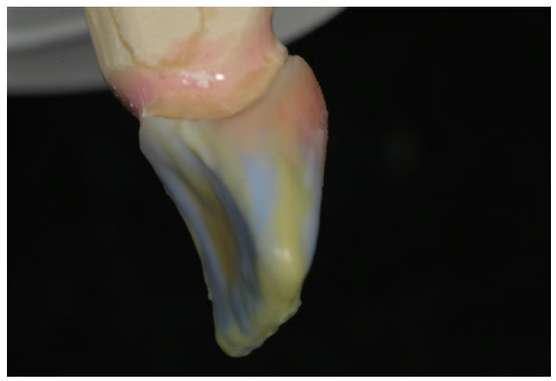

Fig. 8f. Continuing build up of incisal from the lingual to complete the shape.

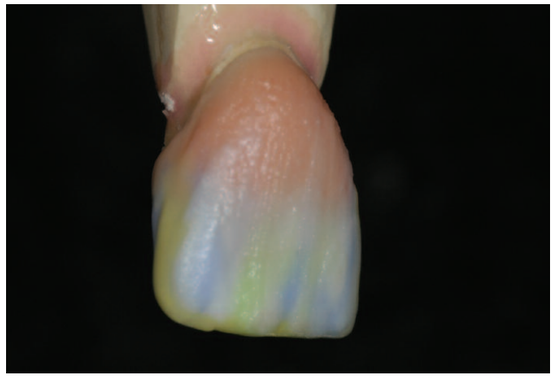

Fig. 9a. Applying a mixture of 1M1 with incisal light half and half to develop the halo effect on the incisal edge.

Fig. 9b. Completed first bake on the model.

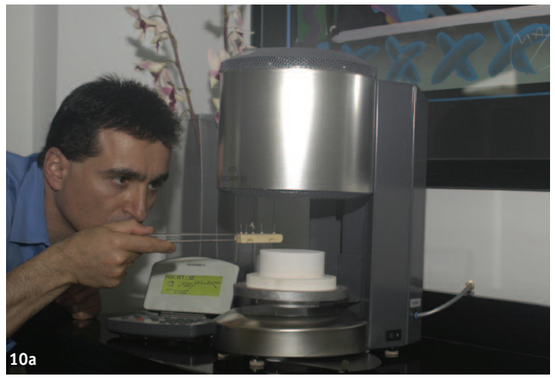

Fig. 10a-b. Drying the internal structure before baking to position it before overlaying enamels.

"The biggest challenge is to visualize the final shape and thickness, in order to develop the effects at the right depth."

Due to the lack of spacing on the lingual side, effects are added using an MM1 with MM3 mixture (Fig. 8e). Incisal is then added (Fig. 8f) to complete the lingual shape. While the ceramic is still wet, a 50:50 mixture of Dentin 1M1 and enamel is added around the incisal edge to create the halo effect (Fig. 9a). Once the first bake is completed (Fig. 9b) it is easy to see the internal structure that was developed in the build up. The tooth is still a smaller version of what the final will be. The chance to add or take away effects is still possible if necessary.

At this point we try the crown in the mouth. During this step, pay special attention to the internal characterizations. You may choose to make the mamelons stronger or add other effects like white striations or a band of low value. These additional effects are quickly dried under the ceramic furnace (Fig. 10a) so that they will not move. Then set-fire the effects in a quick bake (Fig. 10b) with a starting temperature of 600ºC with a dry time of 1 minute. The high temperature should be 800ºC with a rate of climb 80ºC per minute. Hold this temperature for one minute followed by immediate removal from the muffle. This will guarantee that the effects will stay in the same position that they were applied in. After baking, evaluate the restoration in the mouth again (Fig. 11a). This ensures that nothing has moved and there is no need for further enhancement.

Once the internal characterization is complete and stabilized, overlay the crown (Fig. 11b) with more translucent layers. For this, Opal Translucent shades EO1 and EO3 were overlaid. Around the cervical area, Incisal Effect EE4 diluted with Incisal Effect EE6 was used. These layers should be in very thin increments so that the internal structure will shine through the effects.

The biggest challenge is to visualize the final shape and thickness, in order to develop the effects at the right depth. Once the translucent layers are overlaid, the effects should be visible in the completed crown. After the second bake, use the solid model to check the contact points and contours, trimming the soft tissue away so that the

Fig. 11a. Further characterization stabilizing internal structure intra-orally.

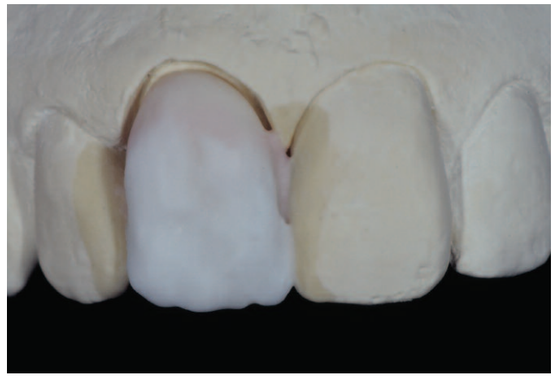

Fig. 11b. Overlaying more translucent and opal effects to complete the final shape and build up on a solid model.

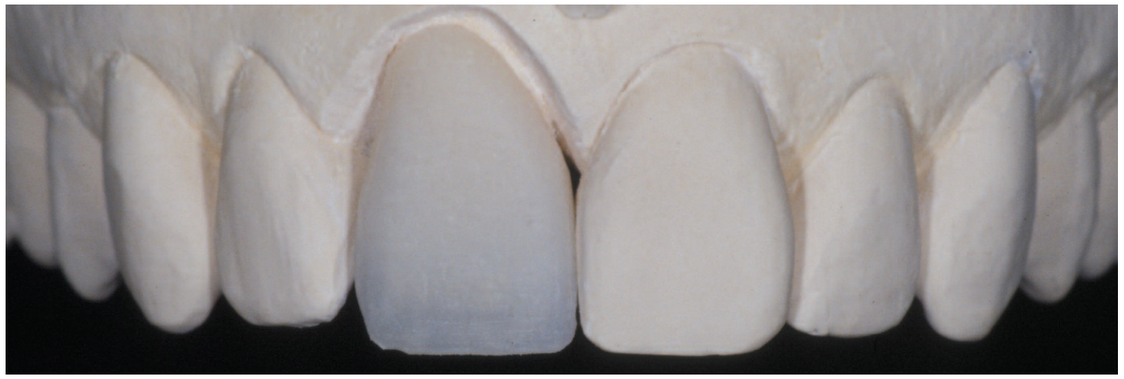

Fig. 11c. Shaping and contouring the second bake on a solid model before final glaze.

Fig. 12. Final crown after glaze and manual polishing.

Fig. 13a. The smile view of the final crown intraorally.

Fig. 13b-c. Lateral view of the final alumina crown intraorally.

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"In nature no two teeth are alike, but there is some sort of harmony and a feeling of belonging."

crown fits all the way down without interference. Using diamond burs, develop the final surface texture (Fig. 11c).

Once the final anatomy and texture is completed, sandblast the crown with 50-micron aluminum oxide using low pressure to clean the surface, and then steam clean the crown. Apply glaze liquid and run the restoration through a rapid glaze firing cycle. The starting temperature of the glaze cycle is 550ºC with an 80ºC per minute rate of climb to 900ºC, with a one-minute hold. The crown should then be manually polished with rubber wheels and diamond paste (Fig. 12). Figures 13a-c show various intra oral views of the finished crown (Alumina coping layered with VitaVM7). It blends harmoniously with the adjacent teeth and appears very lifelike. The emergence profile of the new VitaVM7 crown provides better soft tissue support.

When matching a single central incisor, it is crucial that all members of the restorative team recognize the importance of creating color and architectural harmony with the surrounding soft tissues. In order to achieve this, adequate tooth reduction is essential. Tooth preparation requirements vary depending on the clinical situation and the type of restoration employed. In some cases, more aggressive tooth preparation is required in order to accommodate significant volumes of opaque material needed to neutralize the dark underlying tooth structure. In other instances where the color and brightness of the underlying tooth structure is desirable, a less aggressive tooth reduction can be realized. The morphology, emergence profile, surface texture and the tooth luster must be duplicated in a precise manner. Manual polishing is one of the keys for developing the illusion that the crown is a real tooth.

In nature no two teeth are alike, but there is always harmony and a sense of belonging. Successfully reproducing this in a single central restoration depends not only on the skills of the ceramist, but the entire restorative team. This includes the patient who ultimately must make the time commitment needed to realize the desired outcome. Although the single unit is one of the easiest things to do in dentistry, it is also one of the most time consuming. Time is always an irretrievable commodity and there is no replacement for it. Time is money, and this fact makes the single central an expensive restoration to fabricate.

Acknowledgements:

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Product List

Indication	Name	Manufacturer/Distributor
Diamond polishing paste	Karat	VITA
Fine structure ceramics	VM7	VITA
Ceramic materials	Vitadur Alpha	VITA
Ceramic effect materials	Interno	VITA
Discoloration treatment	Alzent	VITA
Full ceramic framework	VITA In-Cream	VITA
Full ceramic framework	VITA In-Cream Spinell	VITA
Full ceramic framework	VITA In-Cream Zirkonia	VITA
Full ceramic framework	Procera	Nobel Biocare

Bio

Master Ceramist Pinhas Adar studied initially in Tel Aviv, Israel and then with Mr. Willi Geller in Zurich, Switzerland. He has more than twenty-five years of experience in all phases of dental laboratory technology. Mr. Adar practices, teaches and does research from his laboratory in Atlanta, Georgia. Mr. Adar works together with leading clinicians worldwide and specializes in the many facets of porcelain esthetic restorations on both natural teeth and osseointegrated implants. He is the president of Adar International, Inc., and an active member of the American Academy of Esthetic Dentistry and the International Oral Design group. He is also a center for Oral Design International. He is the US coordinator for Oral Design, USA. He is on the advisory board of the Amara Institute. He is on the editorial board of the Quintessence Yearly Journal, the Journal of Esthetic Dentistry and the Journal of Collaborative Techniques.

Mr. Adar has lectured and presented live television programs in the United States, Europe, Israel, the Far East and Australia, as well as a multitude of programs nationally on the multidisciplinary approaches in optimizing esthetics. He has the distinction of being the first ceramist to address an international meeting of the American College of Prosthodontists.

He has developed instructional videotapes on all aspects of porcelain laminate veneers, and has contributed chapters in texts on posterior ceramic restoration and porcelain laminate veneers, published by Quintessence Publishing Co., Inc. He has contributed text to a multi-disciplinary book published by Quintessence Publishing Co., as well as numerous magazine articles. He is also one of the co-authors for the upcoming Quintessence book entitled "Porcelain Laminate Veneers - An Esthetic Essential".

He is currently working on the production of educational DVD's for the dental industry on different topics such as porcelain laminate veneers, crowns, temporaries, etc.

Mr. Adar is an accomplished artist, and produces various works of sculpture as a creative outlet. His passion is to teach and set a new standard in dentistry.

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