

LAYERS TO A BEAUTIFUL SMILE: COMPOSITE RESIN STRATIFICATION

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ABSTRACT

A beautiful smile with better dental aesthetics has always been the patient's prime expectation. Like all other fields, the field of cosmetic and restorative dentistry has evolved over time. Worldwide research has been aimed at crafting solutions to provide the patient with minimally invasive, cost effective and yet aesthetic restorations. A number of different stratification techniques for composites have been advocated. A vast majority of clinicians still utilize monochromatic techniques when aesthetically restoring teeth with composites whereas some believe in the use of a polychromatic approach with multiple shades, tints and opaque to create life-like restorations. Unless the clinician is well acquainted with all the available options, choosing the appropriate layering technique and necessary materials can become very tricky and challenging. This paper aims to provide a review of the various composite stratification techniques described in literature and to acquaint the reader with the basic concept working behind these techniques.

Key Words: Direct veneers, Composite resins, cosmetic dentistry.

INTRODUCTION

One of the major concerns of patients seeking dental treatment is aesthetics.¹ An enhanced smile with better dental aesthetics and long-lasting effects has always been the patient's prime expectation.² Like all other fields, the field of dentistry has evolved over time. Worldwide research has been aimed at crafting

solutions to provide the patient with minimally invasive, cost effective and yet aesthetic restorations.³ Owing to the advancements in dental materials and restorative skills, a smile can now be improved cosmetically with the help of both direct and indirect procedures.⁴

Every new dental material is developed with the aim to optimize aesthetics and to make the restorative procedure minimally invasive.⁵ From the discovery of enamel etching by Bunaocore in 1955 and the Bis-GMA resin by Bowen in 1961,⁶ Resin composites have improved tremendously over time, especially in the last two decades.⁷ With their improved aesthetics, color stability and clinical longevity as well as affordable cost and preservation of tooth structure compared to porcelains, composites can now be considered the preferred treatment modality for the restoration of both anterior and posterior teeth.^{8,9} Many of the deficits pertaining to the aesthetics or function of teeth can simply be restored by the use of direct composites, either as restorations or as veneers.¹⁰

Along with enhancing the material properties, efforts have also been made by the clinicians in improving the application technique of composites, so as to achieve a better color matching between the composite and the natural tooth tissue.¹¹ Advent of stratification or the layering techniques has hence

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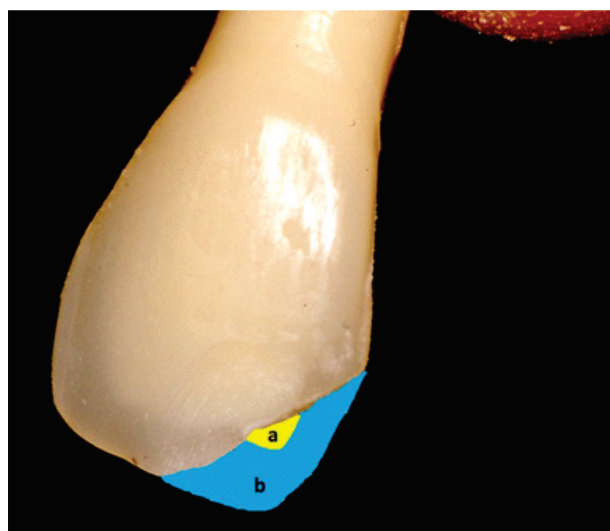


Fig 1: Dual shade technique - Identifying the different shades of enamel(b) and dentin(a)

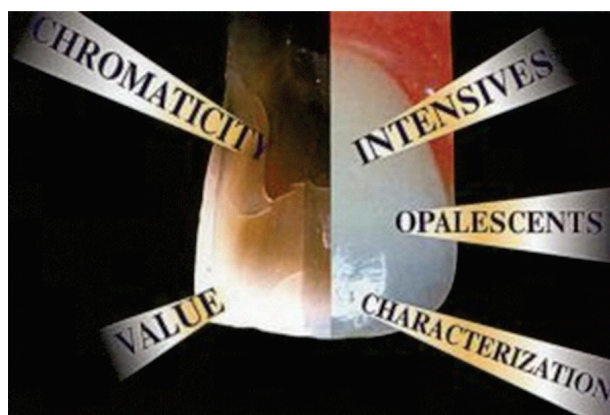


Fig 2: Vanini's Anatomic Stratification: The five color dimensions³⁰

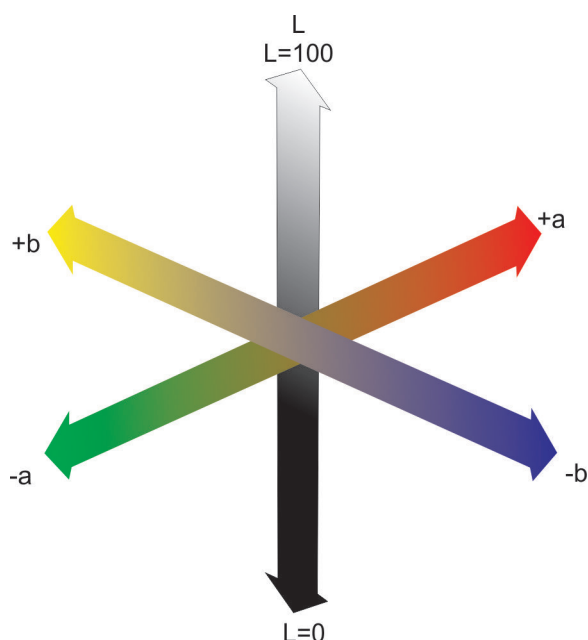


Fig 3: Tristimulus L*a*b* color measurements

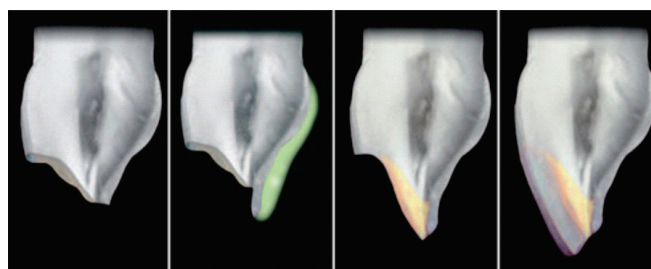


Fig 4: Buccolingual approach for tooth restoration via Natural Layering Concept¹³

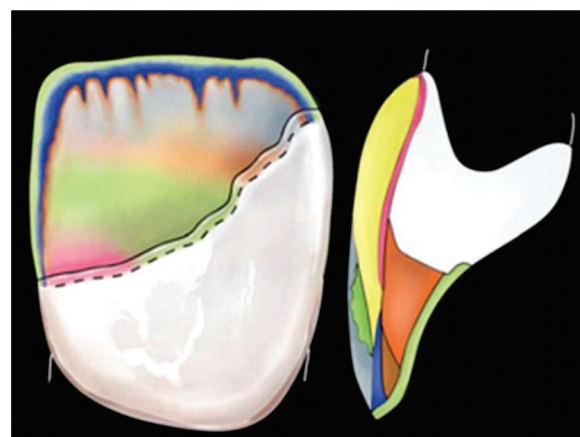


Fig 5: Polychromatic Technique: Color chart for selection of composite shades⁴⁶



Fig 6: Style Italiano - Restoring tooth with two shades only⁵¹

broadened the spectrum of composites efficiency in recreating the anterior aesthetics.¹² Initially, efforts were made to imitate the layering techniques used for porcelain restorations.¹³ This resulted in complicated procedures, rendering the use of composites somewhat technique-sensitive.¹⁴ Subsequent simpler layering techniques were introduced based on the concept of reproducing enamel and dentin layers as found in a natural tooth.¹⁵ To achieve cosmetic results that are both aesthetic and predictable, composite layering

techniques must be easy, effective, and repeatable.¹⁶ A common consensus today exists that in order to achieve indiscernible aesthetic composite restorations, a 'biomimetic' incremental layering technique is mandatory, employing a number of different shades of enamel-like and dentin-like materials (depending on the patient's requirement).^{17,18}

DISCUSSION

A number of different stratification techniques for composites have been advocated in the literature.¹⁹ A vast majority of clinicians still utilize monochromatic techniques when aesthetically restoring teeth with composites²⁰ while some believe in the use of a polychromatic approach with multiple shades, tints and opaque to create life-like restorations.²¹ Unless the clinician is well acquainted with all the available options, choosing the appropriate layering technique and necessary materials can become very tricky and challenging.²²

All the composite layering techniques that have been published so far are at least theoretically based on the concept of reproducing the histological layers as found in a natural tooth.²³ Different techniques that have been proposed in literature include Monochromatic Technique, Dual-shade Layering Technique, Vanini's Stratification Technique, Natural Layering Concept, Histological Layering Technique, Polychromatic Layering Approach, Incremental Monolayering and Style Italiano.

Monochromatic Technique

The most common and widely practiced technique for anterior composites is the monochromatic technique.¹⁹ As the name implies, it involves the use of only one composite shade to replace the lost tooth structure, whether only enamel or both enamel and dentin. Most of the time, employing a monochromatic technique does not yield optimal aesthetic results²⁰, since the complicated color and optical properties existing in a natural tooth cannot be reproduced by any single composite shade.²⁴ This leaves the patient highly discontented with the final restorative outcome.²⁵

However, recent advancements in the creation of enhanced restorative materials have led to the development of a newer "light-cured nano-hybrid composite" (Nuance™, Philips Oral Healthcare, www.philipsoralhealthcare.com) that allows the reproduction of the natural aesthetics using only a single shade of the composite for the whole of the restoration.²⁶ This nanohybrid composite contains "multi-faceted fillers" that both reflect and refract light, replicating the exact optical properties of the natural tooth and hence eradicating the requirement for any polychromatic approach.²⁷ When used in a thin section, it exhibits

translucency, as required for restoring the incisal edges of anterior teeth, while in a thicker section, this nano-hybrid absorbs light, perfectly mimicking the darker, saturated appearance of the natural chromatic dentin.²⁸

Dual Shade Layering Technique

Dual-shade technique employs two different shades of resin composites for the restoration of lost tooth structure (Fig 1). It is usually recommended for beginners who are unfamiliar with the concept of composite layering.¹⁹ A darker, more opaque shade is selected to recreate the lost dentin, followed by the use of a more translucent composite shade to build up the enamel.²⁰ It is, however, the clinician's skill that enables the selection of appropriate composite shades to emulate the natural tooth layers in both form and color.²⁹

Vanini's Stratification Technique

Lorenzo Vanini introduced the concept of anatomic stratification. This technique of stratification is based on the restoration of the lost enamel and dentin tissues to their proper location and thickness, guided by the five color dimensions of teeth.³⁰ The five color dimensions include (Fig. 2): Chromaticity – high chroma for dentin, Value – strictly associated with enamel and decreases with age, Intensives – like white areas in enamel owing to defects in mineralization, Opalescent – confined to the incisal third only and responsible for creating the halo effect of enamel, Characterizations – include mamelons and bands for dentin and margins, stains and cracks for enamel.^{19,30-32}

Prior to any clinical intervention, a chromatic chart is created based on the patient's tooth color dimensions.^{31,33} Restorations are constructed by initially building up the lingual/palatal enamel and then the interproximal walls using the same composite shade.³⁰ Depending on the size of the preparation, one or more high chromaticity shades are then selected to restore the opaque dentin, paying special attention to "chromatic desaturation" from the gingival to the incisal third. Any characterizations, intensives or opalescents must be incorporated at this stage. Finally, the labial or buccal enamel layer of a higher translucency is laid down trailed by the finishing and polishing procedures.¹⁹

Natural Layering Concept

Natural layering concept, proposed by Didier Dietrich, involves the use of two separate composite masses to restore the tooth anatomy.³⁴ The concept is based on the employment of natural tooth as a model and identification of the optical properties of true dentin and enamel.³⁵ It utilizes the "tristimulus $L^*a^*b^*$ color measurements and contrast ratio", where L^* is the lightness or value, a^* is hue over the green-red axis and b^* is the hue over the blue-yellow axis (Fig 3).³⁶

Dietschi suggested the selection of a composite material to replicate dentin that should have a single hue, a single opacity but a large chroma (beyond the usual four Chroma levels of the VITA system).^{34,37} He described three different types of enamel as young, adult and old.³⁸ This characterization is based on the changes in value L^* and the contrast ratio in relation to the age of the tooth, with the enamel becoming yellower, less opalescent and more translucent with the advancing age.^{34,37-40} The technique involves the placement of lingual enamel layer, followed by the use of a high chromatic shade to build up the dentin and a last layer of translucent enamel to complete the restoration (Fig 4).⁴¹⁻⁴² In cases where special optical effects are seen in the tooth such as areas of hypocalcification or areas with high opalescence, special tints or effect materials may be used to mimic the natural tooth.^{34,41}

Histological Layering Technique

Another stratification technique by the name of Histological Layering Technique (HLT) has been proposed by Jeff T. Blank. The technique is based on the concept of replacing the lost tooth layers with a composite material that closely resembles the natural tissues in both color and opacity.²³ If only the enamel layer needs to be restored, then a single enamel shade of composite is selected and used. However, with larger and deeper preparations, two different shades are used for restoration of the dentin and enamel respectively.⁴³ HLT has been advocated as requiring “minimal artistic skills” such that even inexperienced clinicians can achieve excellent cosmetic results within minutes.⁴⁴

In case of direct composite veneers, HLT's principle of replacing only the lost tissue layer faces a slight variation. In most of the cases, direct composite veneers are minimally invasive or at times require no significant tooth modifications at all.⁴ Hence, no tooth layer is literally being restored. However, in such a case, the operator must create both the chromatic dentin layer incorporating the contours and mamelons as well as the translucent enamel layer with the replication of the natural halo effect at the incisal edge.²³ The result would be a life-like restoration with optimum aesthetics.

Polychromatic Layering Approach

Newton Fahl Jr. strongly recommends the use of a polychromatic approach for creating stratified composite restorations. It is an advanced clinical technique that utilizes a number of different composite shades to build up the lost or affected tooth substrate.⁴⁵ With this technique, the clinician is able to control the color as well as the form of the final restoration, thereby achieving highly aesthetic and effective results.^{46,47} In order to master this stratification technique, the clinician must be well-versed with the material characteristics and

the optical properties of both the natural tooth and the available materials.^{29,47-48}

Polychromatic approach is favored by the fact that our natural dentition is also polychromatic, with a variable thickness and hence, a varying chroma and translucency of dentin and enamel in different parts of the tooth.²¹ For this reason, this technique suggests the selection of a single dentine shade with a chroma preferably one shade higher than the natural tooth.²⁶ For replacing enamel, a combination of chromatic and achromatic shades must be used. Chromatic enamel shades are preferred in the gingival third where a more saturated color and a higher opacity can be perceived while in the incisal third, achromatic shades with higher translucency are utilized so that the underlying mamelons may be visible.^{26,48} For a medium-sized class IV direct composite restoration or a direct composite veneers, Fahl suggested the use of the following different shades of composite⁴⁶:

- i A dentin shade with large chroma and small value
- ii A shade for body enamel, opposite to that of dentin, with less chroma and more value
- iii A translucent effect shade for enamel to create effects in the incisal third
- iv A “milky white semi-translucent effect enamel” shade with a high opacity to build up contours and halo effect
- v A “value effect enamel” shade that forms the outer most final layer of the restoration
- vi Opaquers to be used in combination with the enamel and dentin shades in cases where a strong discoloration of the underlying tooth needs concealment.

A color chart may prove helpful in the selection of various composite shades for restoration buildup (Fig 5). Polychromatic technique, though somewhat technique-sensitive and time consuming, can work wonders in emulating natural dentition and satisfying the patient's cosmetic anticipations.⁴⁵

Incremental Monolayering

Incremental monolayering has been described as a simplified technique for achieving optimal aesthetic results related to the development of a new hybrid composite that resembles the natural tooth in terms of the optical parameters (Clearfil Majesty Esthetic, Kuraray America, Inc.). To create imperceptible aesthetic restorations, in each case, a “low-shrinkage flow able” composite is first placed on the tooth surface as a liner. This is followed by the placement of the hybrid composite by monolayering of only one shade of the material.⁴⁹

A relatively newer nanohybrid material, Herculite® Ultra™ (Kerr) has also been proposed for the incremental monolayering. The material is said to possess good handling properties, especially sculpability and an excellent “chameleon effect” to mimic the natural aesthetics.⁵⁰

Style Italiano

A latest introduction to the field of aesthetic and restorative dentistry is a relatively easy yet highly aesthetic technique famous by the name of Style Italiano. Style italiano is basically a group of famous Italian dentists who are the ambassadors of this restorative technique. The concept, actually originated by Dr Walter Devoto and Prof Angelo Putignano, aims to equip clinicians with the knowledge and skill necessary to create aesthetic composite restorations that are “feasible, teachable and repeatable”.⁵¹ The technique utilizes special color recipes for producing layered restorations with only two masses of 3M™ ESPE™ Filtek™ Supreme XTE Universal Composites.^{52,53} This makes Style Italiano essentially a variation of the dual-shade layering technique. It proclaims the use of only one shade to recreate dentin and one to restore enamel (Fig 6).⁵⁴ The Style Italiano concept asserts that aesthetics of a restoration are not dependent merely on the number of shades, but also on the morphology and thickness of the composite layers.⁵³ A 0.5 mm thickness of the enamel layer has been considered as the ideal value to achieve optimum aesthetics in the anterior restorations.⁵⁴

CONCLUSION

Achieving aesthetic durable composite restorations, especially in the smile frame, is highly satisfying not only for the patient but for the clinician as well.²⁰ Composite restorative techniques have evolved over time and now offer infinite possibilities to restore teeth, both in function and aesthetics. Composites, with the advancements in layering techniques, offer the most conservative, cost effective and aesthetic solutions for cosmetic restoration of teeth. It is, however, the clinician’s professional and ethical obligation to master the art and science of dental aesthetics, equipping himself with the latest successful techniques and materials so as to provide his patients with state-of-the-art treatment modalities.

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