Aesthetic Restoration

How imitation of optical characteristics of enamel can help us

by Dr. Alexander Fetsych

Course Description

Often times the only material that allows full restoration of shape, color and function of a tooth, by direct method, with maximum preservation of tooth tissue is composite resin. This course goes into detail on how to achieve great aesthetic results by using composites of different varieties of shades as well as different levels of transparency and opacity. This allows implementation of the gradual material layering technique known as stratification. Today, anatomical stratification technique makes it possible to maximize the appearance of restored teeth very close to their natural appearance.

Course Objectives

1. To understand the concept of refractive index of enamel and how to use enamel composite that is similar.
2. To learn how to layer and stratify composite to achieve lifelike results.
3. To learn how to use stents in anterior composite reconstruction.
4. To understand how to polish and add surface characteristics that improve the final aesthetic result.

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Undoubtedly, the smile is the hallmark of a successful person. Today, there are a great number of techniques enabling dentists to improve smiles – from whitening to a series of complex multi-disciplinary procedures. However, in a lot of cases, use of traditional porcelain veneers to improve an aesthetic appearance of anterior teeth is not an optimal solution. Aside from aesthetics, patients' health is obviously a priority and with it are methods that present minimal invasion while improving the appearance of teeth.

The only material that allows full restoration of shape, color and function of a tooth, by direct method, with maximum preservation of tooth tissue is composite resin. Aesthetic results using composite of one shade are rarely satisfactory due to the fact that optical and color characteristics of enamel and dentin vary. Accordingly, restorative systems using composite offer a wide variety of shades as well as different levels of transparency and opacity. This allows implementation of the gradual material layering technique known as stratification. Today, anatomical stratification technique makes it possible to maximize the appearance of restored teeth very close to their natural color.

Optical Characteristics of Enamel and Dentin

Tooth color is the result of optical interaction of light with enamel and dentin. The main optical parameters of enamel and dentin are brightness, hue and saturation and are often referred to as the single concept of chroma.

Enamel is translucent. Tooth translucency is somewhere between opacity and transparency. With the thickness of enamel at 1mm, an average of 75 percent of light passes into dentin. General brightness of the tooth (level of whiteness) in its near entirety depends on brightness of the enamel. This fact is always considered when choosing a shade of composite. Everything depends on the intensity of orange color that determines the level of brightness. Tooth brightness does not depend on the shade of tooth and is easily determined by taking a black and white photograph. Tooth brightness is the main indicator of color and has to be determined at inception. Generally, the middle third of a tooth is brighter than the cutting edge of enamel, considering that it consists of unsupported dentin. Also, in such cases, the cutting age of enamel consists of blue and amber zones of opalescence. While using the technique of stratification, the effect of opalescence is achieved by application of opalescence mass on enamel. With age, natural enamel becomes thinner, visibly transparent and glass-like. Enamel also becomes smoother resulting in a lower level of brightness.

Dentin is more opaque than enamel. It determines hue and saturation of the tooth. Dentin is fluorescent, which means it absorbs the ultraviolet rays of light invisible to the naked eye, and radiates even in the visible spectrum.

Thus, the color of the tooth consists of three components: brightness, mainly determined by the characteristics of enamel, and hue and saturation, mainly determined by dentin. However, the color of the tooth is not the sole criterion for aesthetic restoration; shape, surface and the harmonious combination of these factors are also important aspects.

Experience shows that the stratification technique requires a considerable amount of time and does not always provide for predictable aesthetic results. A great deal depends on the skill and knowledge of the dentist. When the treatment selection is made in favor of direct composite restoration, whether done with stratification technique or not, we must always take into account the following two factors: the wear of the surface of the composite over time and the grayish effect of the composite in the tooth when working with composite enamel. This is a common problem for composite materials. In addition, when it comes to the classical technique of constructing the restoration it proves relatively difficult to control the thickness of opaque and transparent layers (enamel and dentin). This might potentially lead to a gray glow on the border of the tooth restored using composite and most of the time it is visible. This effect can be explained by identifying a refraction index (refraction) of the composite enamel and natural tooth enamel.

Currently, manufacturers are moving toward the introduction of nano-particles in the composite for the maximum reproduction of natural effects of enamel. Composite enamel, whose refractive index is similar to natural enamel and physical characteristics are improved, allows us to overcome these shortcomings and to simplify the layering technique. Simplified stratification can reduce the dependence of the predictability of the result on skills and craftsmanship of the dentist. Enamel's index of refraction of light is equivalent to the natural enamel and has the characteristic of opalescence. Accordingly, there is no need to use special blue or amber opalescence enamels, allowing you to simplify the technique of stratification while receiving the same aesthetic result.

I would like to present three different clinical cases in which we used the direct method of restoration with composite material.

Clinical Case #1 – Fracture of Tooth

The patient, female, age 14, complained of tooth #8 fracture and the pain inflicted by physical and mechanical stimulators. The pain immediately went away after the cessation of the stimulus. On examination, we discovered a "glowing" horn of the pulp; the level of hygiene speaks for itself (Fig. 1). The patient was in the process of orthodontic treatment and orthodontist asked not to restore the tooth until the end of the treatment, which lasted six months.


Fig. 1

We carried out anesthesia, rubber dam isolation and protocol, with the usual

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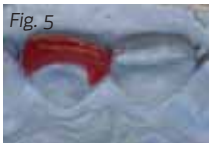
Fig. 2


Fig. 3


Fig. 4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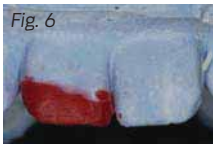
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Fig. 9


Fig. 10

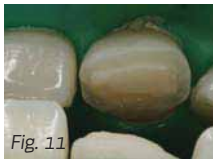
Fig. 11


Fig. 12


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Fig. 20


Fig. 21


Fig. 22

adhesive preparation. Flowable composite blocked the dentin (Figs. 2-4). After nine months the patient came in for the restoration of the tooth. Complaints were absent, which confirms the level of hygiene.

We took diagnostic X-rays, created molds for wax modeling and determined the shade. While choosing a color beside the shade guide and proper lighting, a mock-up of composite dentin and enamel as well as low exposure photos could be of help.

When the volume of the defect is large, the creation of the palatal wall for the silicone index greatly facilitates the process. It can be done with the old restoration, or with wax modeling, such as in this case. To prevent possible fracture, wax modeling was performed in the articulator (Figs. 5-7).

The silicone index was made from the wax-up model (Fig. 8).

During the second appointment, we isolated the operating field with a rubber dam (Fig. 9).

The cavity preparation on the lingual surface, the bevel had the form of a chamfer (concave semi-circle). The palatal and proximal walls created a straight shoulder. The connection of the composite to enamel should not coincide with the occlusal contact. Flowable composite placed nine months ago had not been removed completely, only from the enamel. The procedure was then followed by sandblasting, and adhesive preparation protocol (Figs. 10-12).

Heated layer of composite enamel is applied 0.5mm thick (on the silicone index) (Fig. 13).

The index is then placed in the mouth by condensing the composite at the junction of the tooth. Further, using the clear matrix we created the proximal wall. The thickness of composite is the same as the thickness of enamel. So we get an exact palatal wall with the exact form and without the need for correction of bite (Figs. 14-15).

The core was filled with the composite dentin with varying chromaticity in order to create the depth of color. In this case, we used three dentins – UD 4 (universal dentin, the VITA color A4), UD 3 (universal dentin, the VITA color A3) and UD 2 (universal dentin, the VITA color A2), as a result the overall chromaticity will be A2 VITA shade (Figs. 16-18).

The tips of mamelons were made brighter and then we placed a transparent opalescence material between them. In this case OBN (Opalescence Blue Natural). We then covered the base with universal enamel with the same brightness. This is also what we used for the construction of the palatal and proximal walls (Figs. 19-20).

During the third visit after seven days, when the teeth were rehydrated and the composite was "ripe," we produced the final


Fig. 23


Fig. 24


Fig. 25

polishing with polish pastes and brushes, creating a macro anatomy and micro texture closest to the one that was left in the tissues of the restored tooth and the adjacent teeth (Figs. 21-25).

This case report represents a 100 percent indication for a composite restoration. There is minimal threat to the vitality, even with the young age due to the minimal invasiveness. The aesthetic result can be seen from the before (Fig. 26) and after (Fig. 27) photographs.


Fig. 26


Fig. 27

Clinical Case #2 – Direct Veneering

Female patient, 39 years old, came in to improve the aesthetics of her teeth (Figs. 28-38). Upon inspection, we proposed four ceramic veneers of lithium disilicate but we gave as an option, a direct composite resin restoration.

Although our selection was for ceramics, the patient chose the composite for reasons of conservative approach and lower financial costs.

In the mouth using old composite we modified the form of the central incisors. They have been lengthened to reduce the appearance of the patient's age (Fig. 39). The modification was carried out without the use of etching and adhesive systems. We tested the occlusion with excursions.

First we created a silicone template (Fig. 40) by sculpting old composite to recreate the palatal wall, which greatly reduces the time necessary to complete the work and improve the quality of the final palatal wall, and its function. In many cases, to create an anatomically correct silicone palatal wall without an index is simply impossible.

The preparation consisted of excision of all composite and the decayed tissue (Figs. 41-42). Making the edges take the form of the lingual wall was with a chamfer, and the remaining walls were formed at 90 degrees. In addition, we made a mini chamfer on the cervical, as it was planned to increase the volume of the incisors.

Next, we sandblasted for optimal bonding with no prismatic layer of enamel on the labial surface. Using the silicone index we created a palatal wall and with translucent matrices, we created proximal wall (Universal Enamel – UE1) (Figs. 43-45).

Next, we filled the core of the cavity with dentin composite with varying chromaticity to create depth of color. The ending edges of the dentin layer should be parallel to the axis with no cavity in the tooth (Figs. 46-47).

The shape of the body is determined by the option of using opalescence dentine. In this case, the optimal opalescence appeared to be at the transitional stage from mamelons to the window, as part of a transitional age in dental morphology.


Fig. 28


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Fig. 34


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Fig. 36


Fig. 37


Fig. 38


Fig. 39

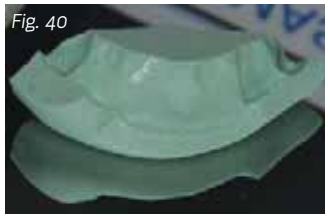
Fig. 40


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Fig. 42


Fig. 43


Fig. 44

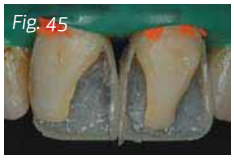
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Fig. 46

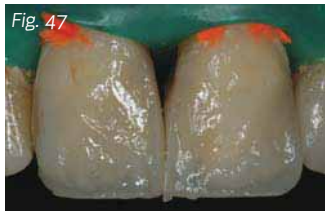
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Fig. 48


Fig. 49


Fig. 50


Fig. 51

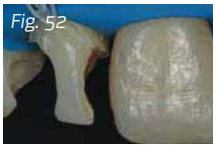
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Fig. 53

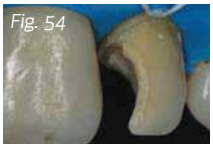
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Fig. 64

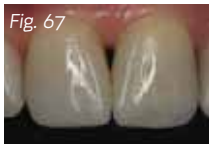
Fig. 67


Fig. 68


Fig. 69


Fig. 73


Fig. 74


Fig. 75

Next, we filled in the space between the body and the cutting edge of dentin with transparent opalescent material. It should not remain uncovered because of the low filling capacity.

Then we covered all enamel and perform the final polymerization (Fig. 48) with a substance that prevents access of oxygen (air block). We did rough polishing (Fig. 49).

Our patient started to smile (Fig. 50)!

During the second appointment we proceeded with the same preparation, so most of lateral incisors remained untouched. Also, teeth 8 and 9 required a small correction. Adhesion procedure was the same (Figs. 51-54).

First the cervical part was completed with high chromaticity dentine – UD5 and Universal Enamel (Figs. 55-56).

A silicone stent was used once again, so a palatal wall was created, and after the proximal walls were created (Figs. 57-58).

Three different chromacities of dentine were used judged by the size of cavity – in this case, it was because it lay in all three thirds (Figs. 59-60).

Opalescent Blue Natural application and covering with composite enamel (Fig. 61).

Final light curing with air block about six times of 40 seconds with a LED lamp (Fig 62).

We did rough polishing (Fig. 63-64).

During the third appointment we proceeded with the final polishing. This was done by covering with marking varnish for creating macro- and micro-geography (Fig. 65).

Figures 66-75 show polishing after seven days with three pastes.

Using composite makes it possible to achieve an aesthetic result like in this case (Fig. 76 before, Fig. 77 after), where the patient demands the most conservative approach and not a very expensive treatment. She couldn't stop smiling!


Fig. 65


Fig. 66


Fig. 70


Fig. 71


Fig. 72


Fig. 76


Fig. 77

Clinical Case #3 – Non-invasive Modification of the Upper Central Incisors

Sometimes we spend a lot of time on treatment and aesthetic changes are not significant. Sometimes, on the contrary, we need only slight modification, half an hour maybe and the result is there (Figs. 78-83).

The entire treatment consisted of isolation of the working field using rubber dam, sandblasting, adhesive and application of only one universal enamel (Figs. 84-88).

Results after seven days (Figs. 89-93).

Thanks to the optical characteristics of this composite enamel, such modifications can be made with just one type of the composite (Fig. 94 before, Fig. 95 after).

Conclusion

Using enamel composite with a refractive index that is nearly the same as the one of natural enamel allows us to simplify the technique of stratification. It is not necessary to use all three chromacities of dentin at the same time. Moreover, when locating the defect in the thickness of the enamel, one layer of universal enamel can be used. Also the automatic formation of opalescence of blue and amber-colored composite enamel on the cutting edge facilitates the stratification. In addition, the optical characteristics of enamel with a refractive index are the same as natural enamel. Such characteristics allow increasing the brightness of the restoration as well as its thickness and vice versa. The previous characteristics are very similar to those of natural enamel and contribute to the integration of color and highly aesthetic results. ■


Fig. 78


Fig. 79


Fig. 80


Fig. 81


Fig. 82


Fig. 83


Fig. 84


Fig. 85


Fig. 86

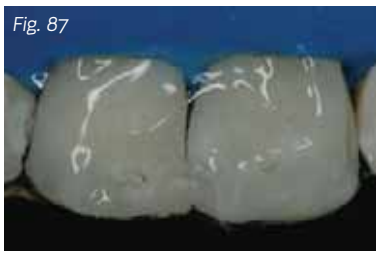
Fig. 87


Fig. 88


Fig. 89


Fig. 90


Fig. 91


Fig. 92


Fig. 93


Fig. 94


Fig. 95

Author's Bio

Dr. Alexander Fetsych lives and practices dentistry in Lemberg, Lviv, Ukraine. He studied at Lviv National Medical University and specializes in aesthetic and restorative dentistry. He also lectures, teaches master classes and is an opinion leader in Micerium.

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1. The only material that allows full restoration of shape, color and function of a tooth, by direct method, with maximum preservation of tooth tissue is…
   a. amalgam.
   b. porcelain.
   c. composite.
   d. glass ionomer.

2. A great technique to make it possible to maximize the appearance of restored teeth very close to their natural color is…
   a. Just close your eyes and guess.
   b. Anatomical stratification.
   c. Stock shade tabs and use the closest one.
   d. None of the above.

3. The main optical parameters of enamel and dentin are…
   a. brightness.
   b. hue.
   c. saturation.
   d. all of the above.

4. With the thickness of enamel at 1mm, an average of 75 percent of light passes into dentin.
   a. True
   b. False

5. The layering technique has been simplified by…
   a. moving away from nano materials.
   b. always using a extremely opaque lining material.
   c. the development of composite whose refractive index is similar to natural enamel.
   d. none of the above.

6. The creation of the palatal wall can be helped by…
   a. constructing a silicone index.
   b. use of the old restoration.
   c. use of Wax modeling.
   d. all of the above.

7. In many cases due to the minimal invasiveness with composite, there is a threat to pulp vitality.
   a. True
   b. False

8. If the defect is in the thickness of the enamel...
   a. many times just one layer of universal enamel can be used.
   b. one must change the color of the underlying dentin.
   c. all the enamel must be replaced.
   d. none of the above.

9. The use of the Rubber Dam is contraindicated because of…
   a. the time factor.
   b. contamination with saliva is unavoidable.
   c. saliva and blood do not cause any negative effects on bond strength.
   d. none of the above.

10. The final results of these cosmetic cases with composite resin…
    a. can come out looking very natural.
    b. can often improve a patient's self image.
    c. is dependent on the skill of the dentist.
    d. all of the above.

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