

# Methods of Intraoral Repair of Fixed Prosthesis:

## TECHNICAL AND CLINICAL PROCEDURES



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### Summary

Simplicity and innovation in restorative dentistry as in every field of dentistry, thanks to new materials can have fantastic results which until a few years ago were unthinkable. An anatomical knowledge of the tooth and its characteristics is very important in order to achieve excellent previous restoration. To develop the ability to recreate the correct anterior anatomy, teeth have to be studied in details. Fundamental is to practice their recreation using different materials such as wax, as the wax-up technique is still the fastest way to locate anatomical details, reproduce them, test their technical validity and correct it through minor adjustments. The first target to reach is the shape of each of our restoration in size, function and harmony.

Once the technical skills have been developed, it is important to know the materials and their characteristics because when technique and material combine together, the result is excellent. For the clinician it is fundamental to perform a correct diagnosis, and to do this it is necessary to take a detailed radiographic exam (bite wings X-rays or full mouth X-rays) and to use a magnification system. It is essential to work on a healthy periodontium: the first treatment phase is to eliminate gingival inflammation by teaching the patient proper oral hygiene methods, followed by simple scaling, or complete non-surgical periodontal therapy. Another important tool in order to achieve optimal aesthetic restoration is to take pictures of our cases, as the analysis of static images allows us to study the details, improving the final result. This article describes the most important steps to properly implement small previous restorations using only Enamel HRi Micerium. If the size of the reconstruction were bigger, we should use dentine composites. Thanks to Enamel HRi, the first and only material with the same refractive index as natural enamel (see the Graphic 1 “The refractive index of composite materials” on page 18), everything is much simpler.

### Simplicity and innovation in restorative treatment

In restorative treatment, as in the whole field of dentistry, thanks to new materials, we can achieve results that until a few years ago were unthinkable. The last generation composites satisfy the main needs of any dentist, being materials easier to use than ceramics and because of the possibility of correcting the restoration<sup>1</sup>. To achieve an excellent anterior restoration it is very important to know

anatomical knowledge of the teeth and of its characteristics. To acquire the ability to get the correct anatomy, first of all we should observe the teeth and practice to reproduce them with various materials such as wax. The mold technique is still the fastest system to identify anatomical details, to reproduce them and to check their validity and correct them by slight touch-ups<sup>2</sup>. The first goal to achieve is the shape of each restoration in terms of its dimensions, function and harmony; once acquired the technical skills, it is important to know the



Figure 1: Clinical image of the small fracture in the incisal edge of 11.



Figure 2: The anterior incisors are perfectly isolated by fixation made with a waxed interdental thread.



Figure 3: With a diamond ball bur perform a small bevel on the fracture line.



Figure 4: The surface is thoroughly cleaned with a sand polisher. It is important to protect the adjacent tooth with a matrix.



Figure 5: Polishing the enamel walls with a red rubber mounted to the blue ring.

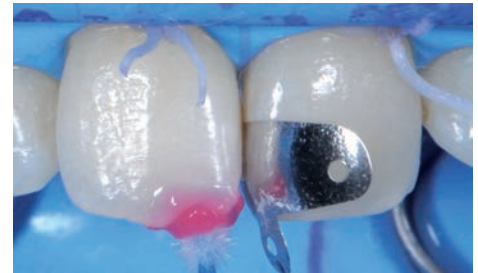


Figure 6: Application of ENAetch Micerium for 30 seconds. We can use a brush to distribute the acid homogeneously.

materials and their characteristics, because once we have relationship between technique and material excellence is born. The materials used in this article are the Micerium composites, which follow faithfully the stratification technique conceived by Dr. Lorenzo Vanini in 1995. From 1995 to the present, the technique and the materials devised by Dr. Vanini have been simplified and improved, above all, thanks to the new enamels for anterior restorations, Enamel Plus HRI, and for the posterior restorations Enamel Plus Function<sup>4</sup>. This article describes the most important steps to correctly perform small anterior restorations using only HRI Micerium enamel. Of course, if the reconstruction dimensions of the restoration were of a larger size, we must use some dentin masses.

Enamel Plus HRI has the same index of refraction than natural enamel. In clinical terms, this means that light it is reflected in the composite as it does in natural enamel. These characteristics allow HRI material not to lose value when moving from the gel phase to the vitreous phase, a problem that could not be resolved in all translucent compound masses present in the market and of having a thickness / value ratio directly proportional (when thickness increases value increases). These optical characteristics reduce the vitreous gray effect on the edge of the reconstruction (black line). Thanks to the physical qualities Enamel Plus HRI, we can better achieve compaction, resistance and luminosity. Enamel HRI Plus also simplifies the work, since it has the same index of refraction that enamel has and it allows to use thicknesses

similar to those of natural enamel and have blue and amber opalescent effect created by the same HRI (see clinical cases 1 and 2). The OA and OBN opalescents are used to increase the intensity of opalescence (see clinical case 3).

The most important thing for the dentist is to make a correct diagnosis and to do this, you must take a detailed radiological exam before hand (bite wings or state radiological) and use enlargement systems. It is essential to work in a healthy periodontium; patients should be instructed about oral hygiene methods and have a simple cleaning or a non-surgical periodontal preparation. Another important element to perform a good aesthetic restoration is the case photography. The analysis of the images allows us to study the form and the color, showing contour details of the surface, and analyze the dimensions of polarized color images, proposed by Dr. Vanini in the 80s and published in 2003. It also allows to show in an optimal way the chroma, the intensities of the value, the opalescence and the characteristics, while amplifying and defining the four basic shades of the tooth: yellow-orange, white, blue and amber. The HRI system is based on the theory of the “five dimensions of color” by Vanini-Mangani<sup>6</sup>.

The composite masses (dentines and enamels) introduced into the system have been developed to recreate in the most natural manner possible the five dimensions of color. The system provides 6 universal dentines, 3 universal enamels, 3 masses of intense white and 2 opalescent ones.

## Clinical case 1- (performed by Dr. Francesco Simoni)

Once the tooth to be restored is clinically and radiologically evaluated, we proceed to field isolate with a rubber dam (Figure 1). Of course, before proceeding with the restoration, it is important to evaluate the color and, to do this, the authors used Dr. Vanini color technique. Therefore, it is appropriate to introduce the concept of the five dimensions of color (6) as a means of synthesis and communication, in which to look for all parameters that contribute to the creation of the color of a tooth and that we will write down in a separate color sheet. In this manner we create a protocol that is standardized color communication and repeatable, which makes use of a precise stratification technique. In the color composition of a tooth we must consider all the factors that can be recognized by attentive observation and presented in the various clinical situations. These factors represent and constitute the five dimensions of tooth color: chroma, value (luminosity), intensity, opalescence and characterization. All the data related to the color of a tooth should be entered in a color tab already prepared, in which the dentist finds the essential guidelines to identify and recognize all dimensions of color with the help of the color tab and by careful observation you can gather a color map, which will help with the reconstructive phase, giving to the dentist all the necessary information for restoration planning and minimizing the possibility of error (1,6,7). Once the compilation of the color sheet is finished, we proceed

to the reconstructive phases. In the case in question, once evaluated the dimensions of reconstruction in on tooth 11, we decided not to perform anesthesia.

The rubber dam is indispensable, even for small reconstructions; as a general rule, in the upper incisors it is easy to have optimal control of the salivation, but what we usually forget is that the mouth is a wet environment and that the only way to have the best conditions for an excellent restoration is to use a rubber dam (8). The advantages derived from the use of the dam are well known and recognized by the international community. The use of the dam determines better and more comfortable access to the operating area: when we place the rubber dam over the arch, the soft tissues, like the lips, cheeks and tongue are retracted and protected from the action of the burs and other instruments. The retraction gives better accessibility and visibility, thus creating for the dentist greater operating comfort, especially with patients who present a small mouth opening and a hypertone of the tongue and facial muscles (9).

To optimize the placement of the rubber dam, proceed to its fixation with interdental thread waxed at 11 and 21 (Figure 2). Once the installation of the rubber dam is finished we proceed with the preparation of the small orifice. For this, it is important to protect the adjacent tooth with a matrix (Figure 4). On the fracture of tooth 11 we make a tiny bevel with a fine granulometry ball mounted bur contra angle to the red ring. The small bevel



Figure 7: Wash with water for 30 seconds and then with 0.2% chlorhexidine digluconate.

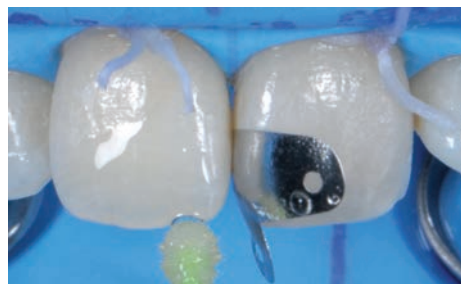


Figure 8: It is applied with an ENABond brush for 60 seconds.



Figure 9: Polymerization for 40 seconds.



Figure 10: It is applied with an ENASEal brush for 30 seconds.



Figure 11: The UE2 HRi Micerium enamel is stratified with a spatula.



Figure 12: A brush is used to facilitate the molding of the material.



Figure 13: Optimization of the incisal edge by a strip of paper.



Figure 14: Polishing the reconstruction with a red rubber bur.

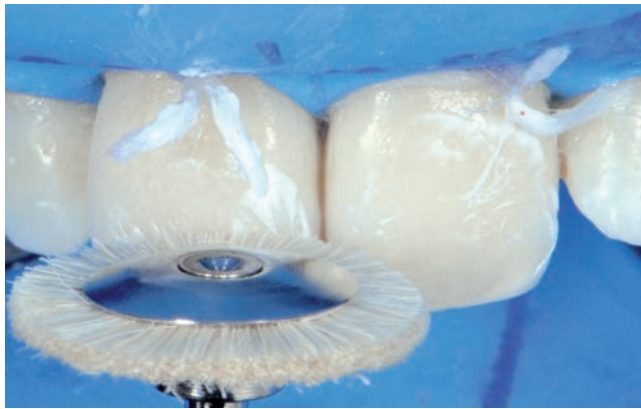


Figure 15: Polishing is improved with the ENASHiny Micerium method, using a brush with the ENASHiny A diamond paste and then ENASHiny B.

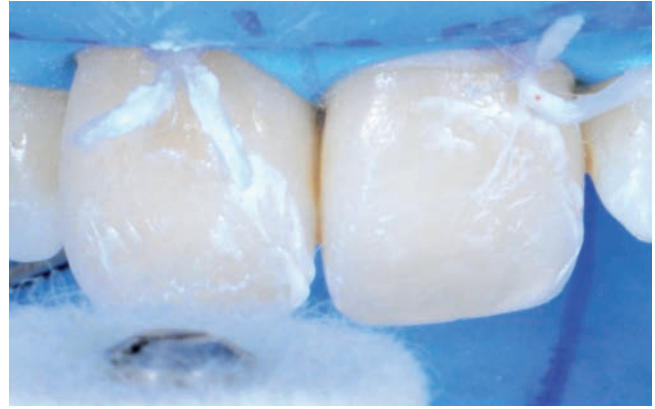


Figure 16: Polishing is completed, using the ENASHiny Micerium method, using this time a fi lter with the ENASHiny C paste.

is important to achieve a maximum integration of the restoration, mimicking the passage of natural enamel to Enamel HRi Plus. To optimize the preparation and achieve an excellent adhesion you can polish the surface with a micropulidora with aluminum oxide of 5 microns (Figure 4). Once we finish polishing, the enamel surface of the preparation must be carefully polished with a red rubber bur mounted counter angle to the blue ring (Figure 5).

After the finishing the sanding with the rubber bur, we can start with the adhesive phases, by applying for 30 seconds ENA etch Micerium <sup>(10,11)</sup> (Figure 6).

Then we use a brush to homogeneously distribute the etching material and wash with water for 30 seconds. The washing phase is important for completely removing all the acid gel and not leave residues that could compromise the adhesion. After washing off the gel with water, the surface of the tooth is washed with chlorhexidine digluconate.

Once we finish the etching and the area dries, we apply the enamel-dentinal adhesive system (first + bonding) ENABond Micerium. ENABond is applied with a microbrush and properly distributed throughout the surface for 60 seconds to optimally hybridize the dentinal network. Finally, we need to blow air for 5 seconds to remove the excess material and to evaporate the solvent, thus ensuring optimal adhesion<sup>(15)</sup>. After applying ENABond we need to polymerize the area for 40 seconds <sup>(1,16,17)</sup>. (Figure 9) and then a layer of ENASeal Micerium resin is applied, blowing delicately to create a thin layer (Figure 10). ENASeal is an adhesive photopolymerizable hydrophobic resin that we apply as a second layer to increase the elasticity of the system and reduce the water tree formation and ensure a more stable and durable seal. International review research has demonstrated in a clinical setting that a two-layer adhesive technique allows less permeability at the level of the hybrid layer <sup>(18-22)</sup>. It also polymerizes ENASeal for 60 seconds (Figure 9). The polymerization in this case has been performed with an halogen lamp <sup>(1-2,3)</sup>. Once the adhesive phase is finished, it is indispensable to ensure a

long life for the restoration, to apply with a spatula, some enamel, Enamel HRi 2 Plus (Figure 11). In this phase It is important to quickly create the correct anatomy, for this, we can use the C Micerium brushes (Figure 12), which allow easy distribution of the enamel. To improve the stratification of the material, it is advisable to preheat the enamel up to a temperature of 37-39° C with a thermal container; preheated material improves the original biomechanical characteristics, making the enamel more fluid and facilitating stratification <sup>(1)</sup>.

The last phase of our reconstruction is the one represented by the finishing and polishing and which constitute a fundamental moment for success of aesthetic restoration as they create an ideal relationship with the light and make the surfaces of the reconstruction less vulnerable to bacterial plaque in addition to achieving better aesthetic results that would last a longer time <sup>(1,24-27)</sup>. Once obtained an optimal anatomy for finishing and polishing of the incisal edge we will use metal strips first and paper later (Figure 13). For finishing the palatal we will use diamond burs first of a larger grain (30 microns) and a lower grade later (15 microns) mounted to the angle of the red ring, and we'll start with polishing with a red rubber mounted on a rectangle of the blue ring (Figure 14). Having already created an optimal vestibular anatomy through the modelling we can proceed directly to the polishing with the red rubber bur.

When rubber burs are used it is very important to use them with water to avoid pulp damage caused by excessive tooth overheating and not to "burn" the resinous matrix of the composite material, thus compromising the esthetic result (Fig. 28). We conclude with polishing using a goat hair-brush with ENASHiny diamond paste wheel, Paste A 3 microns first, and ENASHiny Paste B, which is 1 micron, later spraying abundant water. The polishing of the surface is made with a soft felt and with ENASHiny aluminum oxide paste, Paste C: first used without water at very low speed and then increasing watering abundantly (Figures 15 and 16). A well polished restoration is less vulnerable to bacterial plaque and more respectful with periodontal tissues and has a better aesthetic behavior over time <sup>29</sup> (Figure 17). Once the restoration is finished, you can appreciate the maximum naturalness UE2 HRi Micerium enamel brings, which, thanks to its properties, allows to have the same refractive index as the natural enamel, in clinical terms, this it means that the visible opalescence seen in the final photo is generated by the intrinsic qualities of the material.

### Clinical case 2 performed by Dr. Francesco Simoni

Once we have clinically and radiologically evaluated the tooth to be restored, we proceed with the reconstruction of tooth 11 (Figure 18). Of course, before proceeding to



Figure 17: Final image of the finalized restoration. You can see the maximum naturalness of the edge with the refractive index of HRi Micerium, which is the same as that of natural enamel.



Figure 18: Clinical image of a fracture of 11. The dimensions with respect to the previous case are higher, but also here we have used only the HRi Micerium UE2 enamel.



Figure 19: Final image of the finished restoration. Also in this case the naturalness and the simple characteristics that are demonstrated using a single mass of enamel.



Figure 20: Clinical image of the smile of a young patient with a fracture of 21.



Figure 21: Vestibular clinical image of the fracture of 21.



Figure 22: Palatal clinical image of the fracture of 21

the restoration, it is important to evaluate the color and, for this the author used Dr. Lorenzo Vanini's color technique. Once the color file was completed, it was decided to use a single UE2 Micerium enamel.

After evaluating the dimensions of the restoration it was decided to perform anesthesia. To improve the patient's comfort it was suggested to use pre-anesthetic creams to apply for 30 seconds in the area where the anesthesia will be administered. Once the tooth is anesthetized, we proceeded to assemble the rubber dam, as described in the first case. This is indispensable. After placing the rubber dam, we proceed with the preparation, as it has been explained in the previous case.

Once the preparation is finished, we apply the etching material and rinse with water. We then apply chlorhexidine and apply the ENABond adhesive system and the ENASeal. After polymerizing the adhesive, we continue with the stratification using only UE2 Micerium enamel; it is very useful to use a brush, which facilitates stratification and makes integration easier. The last phase of the reconstruction is finishing, polishing with the rubber wheel; these steps constitute as described in the previous case, a fundamental moment for the success of aesthetic restoration.

Once the restoration is finished you can appreciate the maximum naturalness achieved by using UE2 HRI

Micerium enamel, which by having the same refractive index as that of natural enamel, allows to achieve natural features using only one resin (Figure 19).

### Clinical case 3 (performed by Lorenzo Vanini)

In the third and final case, we have an obvious fracture of tooth 21, visible both clinically and at a distance of interrelation (Figures 20-22). The reconstruction dimensions in this case require the use of dentin masses and a more elaborate stratification technique to recreate all the dimensions of colors that are present. Once the compilation of the color file is completed, we proceed to the reconstructive phases. To achieve an anatomical stratification of this type is indispensable to have a stable palatal support on which to build the palatal enamel wall.

To do this, we create individual silicone mask frame, which was first proposed in the science by Vanini and Toffenetti in 1995. The mask can be made with a direct or an indirect technique. The first step to perform the mask with a direct technique is to rebuild the missing wall of the tooth with the composite and without using adhesives. Once the composite mold is finished, we proceed to finish the incisal guide using a diamond bur in the shape of an olive; a mold is made with a medium viscosity silicone and once removed from the mouth (after 5 minutes), the left over material is removed with a scalpel so that you only

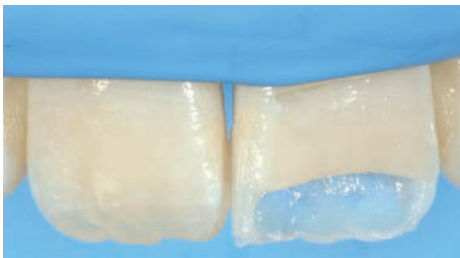


Figure 23: Once the edge preparation is finished, the palatine wall is reconstructed with EU 2 Micerium enamel by using the silicone mask.

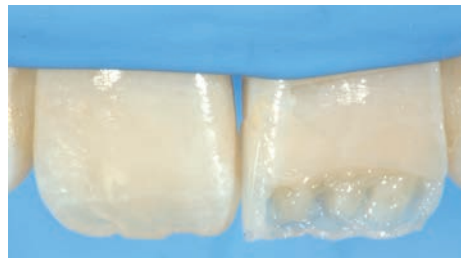


Figure 24: The dentinal masses are stratified by performing all three highlights with UD3 Micerium.

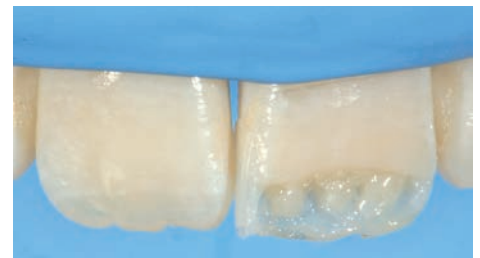


Figure 25: Once the stratification of the dentin masses is finished, the incisal edge is characterized in amber, applying a very thin layer of Micerium OA mass.

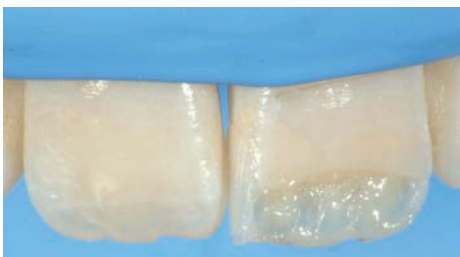


Figure 26: Characterization optimization by applying OBN Micerium to achieve greater opalescence.

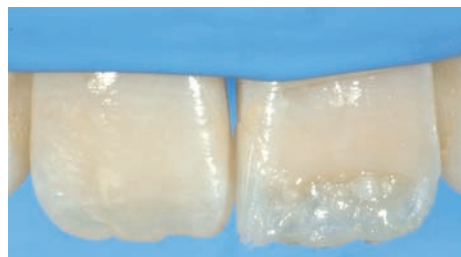


Figure 27: Before finalizing the layering, small IW Micerium white dots were made..

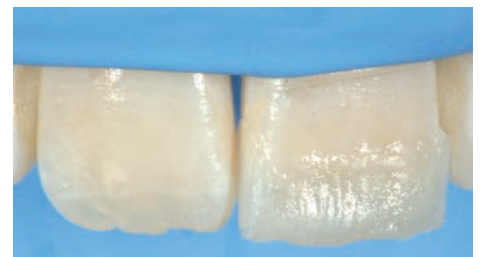


Figure 28: The reconstruction is completed by applying the last composite layer with the UE2 HRI Micerium enamel.



Figure 29: Final vestibular image of the finalized restoration. Naturalness and maximum integration are evident.

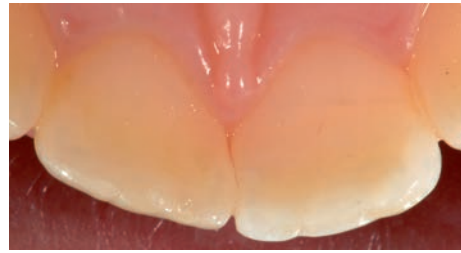


Figure 30: Palatal image of the finalized restoration.



Figure 31: Image of the patient's smile. The perfect harmony of the reconstruction with the lips is clear.

have the incisal group without the vestibular wall.<sup>1</sup> For the indirect technique it is necessary to take an impression from which a plaster model is obtained and from which the wax model is made. Once we obtaining the wax model we will make the mask matrix with a medium viscosity silicone material.

After isolating the field, we check the mask adaptation and get ready, to proceed as in the first clinical case. Once finish the preparation we apply the etching material, rinse with water and follow by applying chlorhexidine, ENABond and then the ENASEal. After polymerizing the adhesive, out of the mouth, a thin layer of Enamel UE2 HRi is applied directly on the matrix. The material is spread in a thin layer by using small a dry brush; the use of resin fluid in this phase changes the refraction index. Adding the enamel carefully, the mask is placed in the mouth and with the brush, the composite is carefully distributed towards the edges of the preparation. Before polymerizing, it is good to check the adhesion of the material to the cavity. Once we build the palatal wall, with the same Enamel UE2 HRi, we make the interproximal walls by using matrices or acetate strips stabilized with a wedge. We adapt the strip or matrix to the palatal wall just built and, by small additions of enamel, the interproximal

wall is shaped. Once we obtained anatomical form desired, we polymerize (Figure 2. 3).

After completing the addition of enamel, we proceed with the stratification of the dentin. With the previous system Enamel Plus we added in this phase a Glass Connector layer to increase from the inside the value of the enamel. With HRi enamel, thanks to its optical characteristics, it is no longer necessary because it has a high value. To create the three mamelons we used the dentinal mass UD3 for the body and UD1 for the terminal of the mamelons to characterize the most incisal part (Figure 24). In this phase it is important to leave a free space at the edge and between the mamelons to complete the reconstruction in an anatomically optimal way.

Once the stratification of dentin masses are characterized in amber, we apply a thin layer of OA mass to the incisal edge (Figure 25). After finishing the incisal edges, the interproximal spaces are closed.

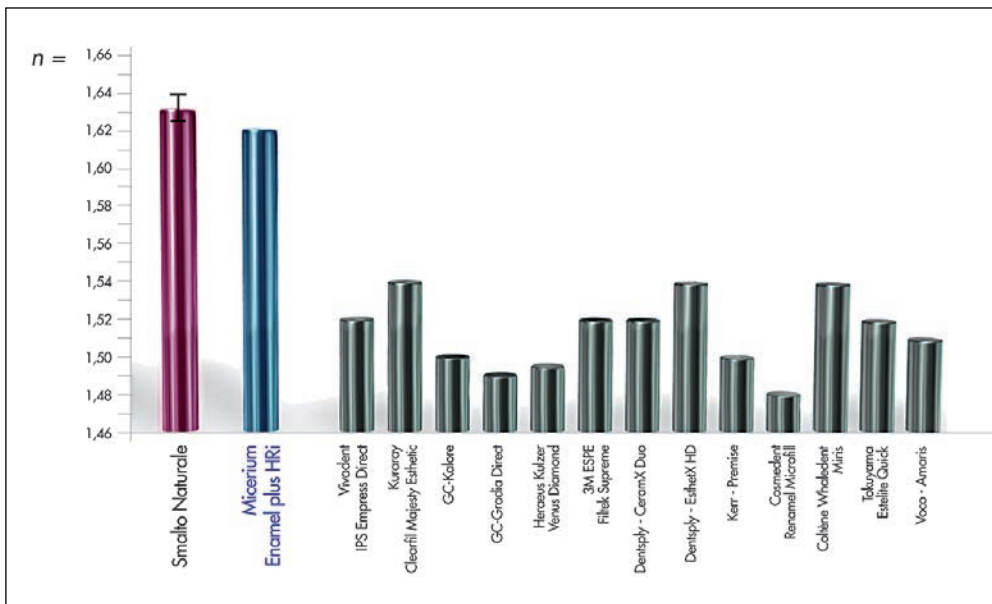
We now apply OBN to increase the opalescence, although already slightly present in the EU2 Enamel (Figure 26). Before finishing the stratification, we apply a small amount of IWS intense white dots (Figure 27).



Figure 32: It is very useful to take a photo with polarizer to be able to have more information on the characteristics of the tooth to be reconstructed.



Figure 33: Polarized images show the dimensions of intensity, opalescence and characterization present in the restoration.



Graph 1 - Refractive indices of composite materials. Elisometric measurements at 632 nm of natural enamel and masses of composite enamel made by the Fraunhofer Institute of Mechanics of Materials IWM, Halle (Germany).

The reconstruction is completed with a UE2 HRI layer (Figure 28). The last phase of our reconstruction is constituted by finishing and polishing with a rubber wheel; the same as we described in the first case, a moment fundamental to the success of the restoration esthetic. Once the restoration is finished, you can see the maximum naturalness and the vestibularly visible integration at the palatal level in relation to the lips (Figures 29-31). It is important to evaluate the integration of the restoration, by photographing the tooth, before and after reconstruction, with a polarizing filter. The polarized image allows us to assess the color dimensions recreated in the restoration and see if they are harmonized with those of the natural tooth. (Figures 32 and 33)

## Conclusions

This article describes clinical cases of reconstruction in the anterior teeth in three dimensions: small, medium and large reconstructions. In the first two reconstructions we only used the enamel, while in the third the stratification was performed by applying dentin masses, intense and opalescent.

In all of them, the characteristics and advantages offered by this material are countless, since in many cases, using only one enamel simplifies the reconstructive phase, while in more complex situations, it allows integration that cannot be obtained at the optical level, with other systems. HRI composite behaves in a similar way to natural enamel,

since increasing the thickness also increase the value. This is a great advantage over other materials because if we produce excess thickness of enamel, the reconstruction would look a little whiter, compared to the previous situation in which the color seemed more gray, producing an aesthetic less satisfying result. ■

## About the authors

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He is the author of numerous scientific publications, coauthor of the manual-atlas "New Aesthetic Concepts in the use of composite materials" published in 1995 by "Amici di Brugg", coauthor of the manual-atlas "The conservative restoration of posterior teeth 2" published in 2000 from the "Amici di Brugg" and author of the two-volume treatise "The conservative restoration of the anterior teeth" published by Acme Viterbo in 2003, of the Multimedia Integrated System "Direct restorations in composite in the anterior teeth" of UTET, co-author of the treaty "Aesthetics, Function and Posture" of 2018" published by Acme and chapters in various books on conservative and traumatology in Italy and abroad. Speaker at internationally renowned congresses, he has held advanced courses in reconstructive dentistry at numerous universities in Europe, the United States, Chile, Argentina, Brazil, Israel and China. He practices freelance in Chiasso (Switzerland), dedicating himself in particular to conservative, prosthetics and posturology.

**Francesco Simoni**, Graduated in 2005 in Dentistry and Dental Prosthesis from the University of Pisa. He is co-author of the chapter "Periodontal therapy not surgery" from Dr. Giano's book Ricci "Diagnosis and periodontal treatment" (Quintessence Edizioni 2012), in addition to author from many other scientific journal articles National and international. He is an active member of the Italian Academy of Aesthetic Dentistry (IAED) and of the Italian Society of Conservative Dentistry (SIDOC). He is a regular speaker at conferences on aesthetic themes.