Daniele Rondoni, born in Savona in 1961, lives and works in his hometown where he has been the manager and director of his own laboratory since 1982. He got his Dental Technician Degree at "P. Gaslini" Professional Institute in Genoa in 1979 and still operates in the field of professional training as a teacher and counsellor for the Italian School for Dental Technicians. Particularly devoted to the study of morphology and dental aesthetics, he actively collaborates to the development of materials used for aesthetic dental restorations. He authored the text "Ceramic Multilayering Technique" and a lab manual about the use of composite materials, aimed at establishing working protocols for both indirect technique and composite pressing on metal structures and implants and thus introducing his own method, named "Inverted Layering System".

The Stability Over Time of Composite Restorations Through Proper Treatment of Surfaces

Daniele Rondoni

See **Daniele Rondoni** at Spectrum dialogue Techno-Clinical day in Chicago on **February 24 & 25, 2012**

The tooth surface is an array of multiple irregularities, the combination of which is what we can more properly define as MACRO and MICRO texture. (Figs. 1-3)

The texture of the surface greatly affects the brilliance of the enamel in its relation with the reflection of light, which, with the passage of time and therefore with the change in age, will differ continuously going from rich and clear in young teeth, through the adult stage, until it totally disappears from the teeth of the elderly.

The macro texture is represented by the vertical components as lobes, grooves or depressions, which persist over time even in the teeth of the elderly, while the micro texture, visible in the horizontal components, represents the growth lines of the tooth enamel and are not very visible in adult teeth, and rarely present in the teeth of the elderly.

The surface texture, as mentioned before, adjusts the brightness of the tooth and therefore, the reflection of an elderly tooth on a smooth surface will be more intense and homogeneous, generating a low value aspect of the enamel. On the other hand, on the rough surface of a young tooth, the beam of light bounces and therefore this dynamic on the surface of a young enamel will give it a higher value appearance.

The need for a complete coverage in aesthetic restoration requires operators to implement an effective finishing and polishing system, for reproducing ideal surfaces for different ages, regardless of the material used for restoration. For a technician, it is normal to use a technique that reproduces the surface morphology in ceramics, which is considered the material of excellence in aesthetic restorations, either when used on traditional metals or on the more aesthetic structures in zirconium oxide or alumina, which are now certainly more appreciated by patients. (Figs. 4-8)

Therefore, we can define that the surface of modern ceramics make it possible to obtain natural textures using a mechanical process that must include both diamond drill bits, and diamond paste, without the use of glaze, which we know may adversely affect the reflection of light and therefore the brightness of the final restoration.

Fig. 1: Young texture

Fig. 2: Adult texture

Fig. 3: Elderly texture

Fig. 4: White ceramic training 1

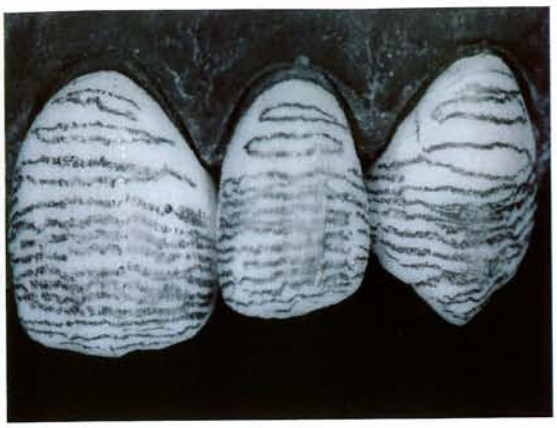

Fig. 5: White ceramic training 2

Fig. 6

Fig. 6: White ceramic training 3

Fig. 7

Fig. 7: Ceramic after finishing

Fig. 8: Ceramic after polishing

Finishing, polishing and buffing represent crucial stages for obtaining an ideal aesthetic restoration, since the proper balance between light, surface and therefore reflection will also favor the correct result of the final color.

The development of new materials for cosmetic dentistry, in combination with the needs of the patient, is increasing orienting the clinicians search for materials that can meet the patient's need for functional management over time without any adverse effects on the final appearance. This has given rise to an even greater use of solutions containing composite materials with new aesthetic concepts, such as enamels with a high refractive index HRI (Enamel Plus HRi Micerium S.p.A.), the nanohybrids which, with their innovative composition, are able to reproduce the same optical response as natural tooth enamel, as can be seen in figures 9-13 and improve the mechanical properties, compared to conventional composites or micro-particles.

The combination of finishing techniques, which until now have only been used for ceramics, when applied also to micro-hybrid composites allows us to achieve excellent results in aesthetic restorations, both in direct and indirect techniques, with the use

Fig. 9: Extracted tooth in which the mesial section has been removed

Fig. 10: Reconstruction of the labial area only, with the thickness of the natural enamel using Enamel Plus HRi (palatal view)

Fig. 11: Side view

Figs. 12-13: Front view

of these materials for complex prosthetic cases as well. With the finishing it must be possible to obtain and maintain the size and contour to determine the correct tooth shape, defining the correct areas of transition thereby giving correct torsion axles to the morphology. Since in the first stage of finishing we will deal with the vertical components, it is essential to work with tools that rotate in a direction that is longitudinal to the tooth, reducing the material while maintaining the necessary proportions, thereby obtaining individual vestibular sulcus and lobes. At this stage it is important to pencil mark areas and limitations that characterize the surface of the tooth, respecting the three vestibular surfaces based on the shape to be reproduced, and considering both the biotype and the age of the patient. Later, in the second phase of finishing, we determine the horizontal components that represent the growth lines of the enamel. Here, with the rotating tools it is necessary to follow a horizontal course, with respect to the primary lobes and transition areas.

For this phase as well, it is important to pencil mark the horizontal traces, considering that the lines are more intensive in the incisal plate, while in the cervical area they are more prominent and less numerous.

In order to properly implement the system, it is necessary to have perfect knowledge of the shapes and especially how these combine with the other dental components. Furthermore, it is also important to fully understand the instruments available and choose the most suitable for the different phases, details and positions.

So before starting the finishing, after choosing which and what kind of rotary instruments to use, carefully observe the correct sequence and direction of work in order to obtain an effective finish.

However, it is necessary to set a more evident surface structure, a young type of tooth, which later during polishing, will be ideally adapted to the restoration age desired (mechanical aging of the restoration). The tools used in finishing are diamond tipped ball point with a grain size of 40 microns. A diameter of 3 mm for the first finishing phase of vertical components, and a second point, 1 mm in diameter with the same diamond grain size, for finishing horizontal components. For transition areas or more defined and flat surfaces, a tip mounted on cone-shaped silicon carbide is used, completing the primary modeling of the shape. In the incisal plate it is possible to increase the micro-roughness by using a flamed diamond tip, always 40 microns in size, used mainly in a horizontal direction to increase the

Fig. 14: Composite after post-polymerization

Fig. 15: Draw transition areas and lobes

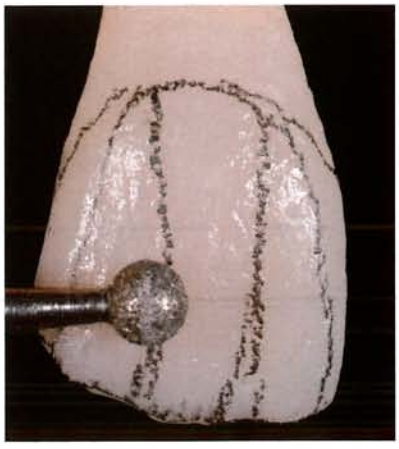

Fig. 16: Finishing of vertical components

Fig. 17: Finishing of surfaces and areas

Fig. 18: Draw enamel growth lines

Fig. 19: Finishing horizontal components

Fig. 20: Finishing incisal surface

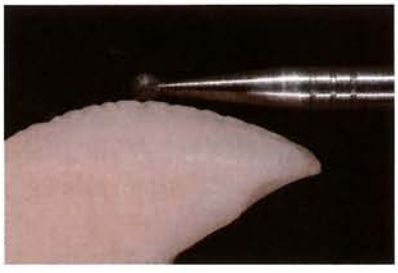

Fig. 21: Finishing main central group

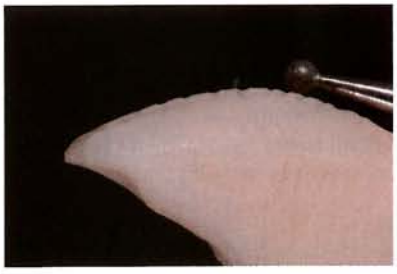

Fig. 22: Finishing cervical surface

reflection in this area (Shiny finishing kit, Micerium SpA). This type micro-morphology typical of young teeth, even if already in the adult phase, this characteristic rough feature is more homogeneous and less noticeable, with a more uniform but more intense reflection on the surface. (Figs. 14-25).

The polishing stage must always be preceded by smoothing with a sandpaper cone (Micerium SpA), which reduces the intensity of the first finishing and causes a mechanical aging effect based on the age of the restoration that must be created and above all it optimally prepares the surface for final polishing (Figs. 26-29). The work of the paper cone can be oriented based on the established morphology and thereby obtain a more natural texture than that obtained to this stage. The greater the intensity of this passage, the older the final appearance of the tooth.

Before continuing with the polishing phase it is important to check the quality of the surface texture obtained thus far by covering the surface with Ag powder (Fig. 30), so that only morphological traces are visible and then evaluate the need for other finishing interventions before polishing. It has been demonstrated that new generation composites respond well to polishing using diamond paste and aluminum oxide (Shiny pastes A, B and C, Micerium SpA), and for efficient sequential use they should be selected in different sizes and used with goat fiber brushes and cotton pads (Micerium SpA) (Figs. 38-39)

In this delicate phase of work it is important to

Table 1: FINISHING – The sequence must take into account the surfaces and shapes modeled in the previous phase	
1. drawing	pencil
2. vertical components	3 mm sphere
3. horizontal components	1 mm sphere
4. transition area	conical mounted tip
5. micro-roughness horizontal incisal plate	flamed diamond tip

Fig. 23: Horizontal cervical finishing

Fig. 24: Horizontal transition area finishing

Fig. 25: Incisal micro-roughness

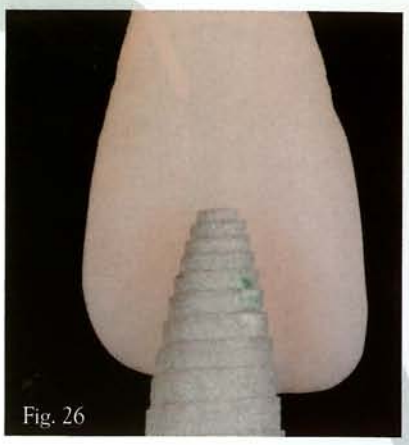
Fig. 26

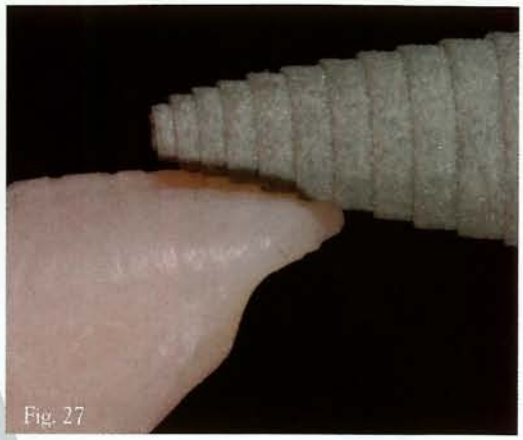
Fig. 27

Figs. 26-27: Smoothing of incisal surface

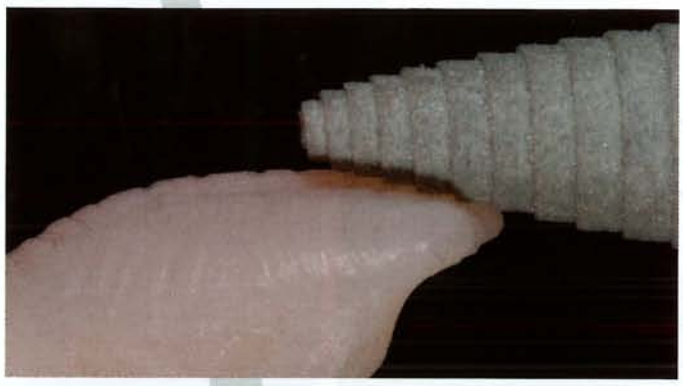

Fig. 28: Smoothing of central body

Fig. 29: Smoothing of cervical surface

Fig. 30: Control texture with TEMPSILV powder

Fig. 31: Polish with Micerium Shiny 3 micron diamond paste

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Fig. 32: Polish with Micerium Shiny 2 micron diamond paste

Fig. 33: Shine with aluminum oxide C

Fig. 34: Shine with Shiny felt

Fig. 35

Fig. 36

Fig. 37

Figs. 35 - 36 - 37: Final result with different reflections of light

Table 2: POLISHING	
1. mechanical aging smoothing	sandpaper cone
2. horizontal passage	brush and paste at 3 micron
3. horizontal passage	brush and paste at 2 micron
4. overall passage	brush and paste at 1 micron
5. overall passage	cotton felt

keep the micromotor at a very low rpm (approx. 10,000 rpm) as well as to reduce the pressure on the restoration, avoiding friction on the surface that could damage the set texture.

The first passage with diamond paste and goat brushes should follow the horizontal movement of the texture mapped with a 3 micron diamond paste (Shiny A paste, Micerium SpA). A second passage is carried out with a 2-micron diamond paste (Shiny B paste, Micerium SpA), always following the same technique. The third step is carried out with aluminum oxide paste at 1 micron (Shiny C paste, Micerium SpA) (Figs. 31-33). Final polishing is achieved with cotton felt, through which the convex surface, more exposed to wear than concave ones,

Fig. 38: Shiny TSY Finishing kit

Fig. 39: Diamond paste with aluminum oxide

Fig. 40: Roughing with carborundum tip

Fig. 41: Finishing of vertical components

Fig. 42: Intercusp groove

Fig. 43: Primary fissures

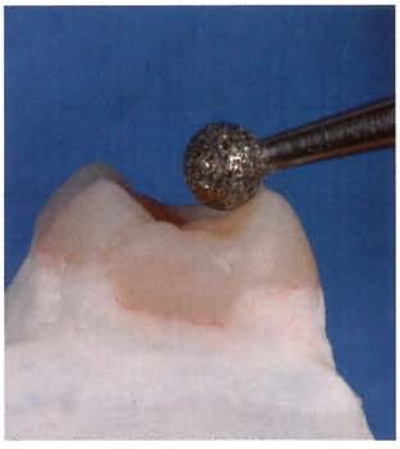

Fig. 44: Primary occlusal depressions

Fig. 45: Escape route depressions

will obtain a specular effect of increased reflected light. During this passage, the marginal convexity can also be highlighted thereby creating a better reflection of the light. (Figs. 34-37)

Proper finishing is also essential for rear restorations where the respect for morphological details is essential for proper function (Figs. 40-49)

Fig. 46: Horizontal components

Fig. 47: Aging with paper cone smoothing

Fig. 48: Occlusal polishing with Shiny diamond paste and goat brushes

Fig. 49: Polishing with aluminum oxide and felt

Fig. 50

Fig. 51

Fig. 52

Figs. 50-51-52: Veneers made of high-refractive composite Enamel plus HRi

Conclusions

It is therefore possible to obtain, through more simple stratifications, almost exclusively additional, ideal front aesthetic restorations (Figs. 50-52), where a combination of finishing and polishing procedures will result in a compact and shiny surface. We must consider that the retention in time also depends on key factors such as proper selection of the composite material, the quality of the composite, polymerization, and lastly the level of the patient's oral hygiene. SD

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