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DEHYDRATION EFFECTS ON TOOTH SURFACE TEXTURE



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INTRODUCTION

Through years of custom shade-taking experience, it becomes increasingly obvious that hydration and dehydration have a significant effect on the perception of how well the final shade and surface texture of restorations match a patient's other teeth. A patient presenting with a dry mouth, or less saliva, tends to display a lack of reflection on the teeth due to the dull appearance of the teeth's texture. A patient with composite bonding and a lack of saliva also will present teeth with a different value, which results in further restorative matching challenges.¹⁻⁴

Through years of custom shade-taking experience, it becomes increasingly obvious that hydration and dehydration have a significant effect on the perception of how well the final shade and surface texture of restorations match a patient's other teeth.

For laboratory technicians to achieve the best possible color and surface texture equivalent to patients' natural teeth, they must know and understand all of the oral environmental conditions that may present. These include a lack of saliva; pink, blue, white, gray, yellow, or brown tones; composite dullness; and low value. Therefore, technicians must consider the influence of direct bonded composites in the mesial-facial and distal-facial contact areas, incisal edge, or even full-facial veneers when attempting to match restorations with the surface texture of adjacent teeth.⁵ The combination of these factors will affect how well the final restoration complements the adjacent teeth in the mouth.



Figure 1: Retracted views of dehydrated teeth along with a custom shade-mapping guide.



Figure 2: Once hydrated, the patient's teeth appear shinier, and the color is more intense.

LABORATORY IMPACT

For technicians to visualize the effects of a patient's oral dehydration on the teeth in order to match the dull composite area, a specific technique for obtaining a custom shade can be used. Experience has demonstrated that by asking patients to hold their mouths open in a retracted position for approximately 20 seconds, the appearance of the patients' adjacent teeth and surface texture can be accurately documented.⁶

Because patients generally are not aware of the particular characteristics of their teeth, or what is involved in a custom shade-taking appointment, it is helpful to outline what they will learn by having them look closely at their teeth. Therefore, before initiating the aforementioned procedure, it is important to explain to patients what is being done and why, and to ease their apprehensions while they are sitting in the dental chair.

Technicians must then determine the best approach for rehydrating patients with a dry mouth. They can either moisten the teeth with water or use a glazing liquid in order to

elicit a more vivid color. If the patient's mouth dehydrates within 10 to 20 seconds of opening, technicians should consider one of these options. Without hydration, an intensity dilemma with the adjacent teeth will occur, making it difficult to accurately document the color.

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Dentists traditionally do not document or describe a patient's dehydration and tooth surface texture. That responsibility lies with laboratory technicians, who must document tooth texture and subsequently perform the proper final glazing procedure when completing the restorations. When restorations are sent to clinicians for cementation and they and their patients notice that something does not look quite right, many times the issue rests with the surface texture.³ Therefore, technicians must carefully consider dehydration and surface texture in their porcelain work to ensure that their restorations are a match.

This article presents three cases in which the patients exhibited tooth surface textures that were very dull in appearance after the dehydration effects took place.¹⁻⁴ As a result, careful consideration of the porcelain build-up and final porcelain application was required.

CASE STUDIES

CASE #1

In a case that represents a perfect example of dehydration and surface dullness (Fig 1), the patient's mouth was retracted for approximately 20 seconds in order to determine surface texture. A photograph was taken after time had elapsed, at which point the lack of color intensity and the subtle value in this color check was documented (Fig 2).⁷ When the patient's teeth were viewed in a hydrated state, the color was better due to the effect saliva has on the intensity of the value. In addition, the surface texture was no longer dull, but had come to life after the moisturizing effect.

The dark after-preparation or stump color of tooth #10 was exposed after the temporary was re-



Figure 3: The stump color was matched with the Simple Enamel and Prep Color Guide.



Figure 4: Canine enamel color was checked against the Chair Side Shade Selection Guide.



Figure 5: The mamelon translucency of the two central incisors exhibited a tan color.

removed (Fig 3). Using a custom-made after-preparation color guide, the technician determined the stump color to be After-Preparation Color 4 (APC 4).⁶ A common misconception among many dental professionals is that a stump color is only one shade. However, in this technician's opinion, this is untrue.

When a natural tooth is exposed through preparation, a variety of colors, as well as translucencies, are exposed that are mixed together in a layered effect. This continues through to the center of the tooth, or the stump. The stump color par-

tially determines the final porcelain build-up application. For example, if a tooth has a post and core, its silver color will appear only in a portion of the tooth and will, if not masked, assert an unwanted influence on the appearance of the final crown. As a result, as technicians layer their porcelain, they could be masking a dark color in one area, but not in another.

Another method of masking dark stump color is applying composite material directly to the tooth after preparation. However, care should be taken with the preparation de-

sign of the margin area, but composite should eliminate the need to cover a dark stump color.

To check the canine enamel color, another custom shade guide was used and found a CE-2, or blend, color, as a close match (Fig 4). Using the same shade guide, the mamelon color of the two central incisors was also checked and determined to be tan, or MA-2 (Fig 5). Post-cementation and with dehydration, the restoration was displayed in the mouth and then prior to dehydration, with saliva (Figs 6 & 7).



Figure 6: Post-cementation view with dehydration. The patient's shade matching was verified.



Figure 7: Prior to dehydration, the crown restoration was checked for matching purposes.

CASE #2

A patient who experiences dry mouth can dehydrate in as little as five seconds. Therefore, if a glazing liquid is offered to patients for hydration purposes during the custom shading appointment, they should be advised of the unpleasant taste and informed that it can be rinsed out immediately following the shade-taking procedure. In this case, a zirconia implant abutment was presented in the initial stage, post-surgery, without hydration (Fig 8).

The zirconia coping (GC Milling Center; GC Advanced Technologies; Costa Mesa, CA) was fabricated and placed over the top of the zirconia abutment in preparation for application of the color build-up (Fig 9).⁸ For this case, a computer-generated personal shade-mapping guide using nine different porcelain powder colors was created (Fig 10).

Segmentation of the porcelain build-up is sometimes necessary in the fabrication process because the restoration might require a crack line or mamelon effect only on one section of the tooth. A different enamel overlay will then be required for that particular area.

In this case, the porcelain build-up was initiated on one-half of the zirconia coping (Fig 11). After the first firing (Fig 12), note was taken of the restoration's contour and, upon examining a side view of the porcelain build-up (Fig 13), the porcelain layering technique was used to create the appearance of layered colors observed in natural teeth, and the restoration was baked (Fig 14). Different enamel layering (GC Initial Porcelain; GC America) was applied to create the crack line noted during the custom shading process (Fig 15).

The implant component can be seen alongside the completed porcelain restoration (GC Initial) (Fig 16). Three crowns, each with different surface textures (e.g., dull, rough, and shiny), were created (Fig 17). On the left, the TE1 dull surface was achieved using a rubber polish wheel. The middle crown, TE2, demonstrated the rough, chalky surface of a young person, in the B1-D2 shade zone. The TE3 shiny surface was accomplished using a regular glazing process.

A second set of *Chair Side Shade Selection Guide* (LSK Oral Prodthetics; Naperville, IL) surface textures is

shown in Figure 18. TE6, or natural, appears narrow between groove and lobe, imparting a three-dimensional appearance. TE5 exhibits a vertical groove only, and TE4 exhibits a subtle wave or ripple effect, similar to when a rock is thrown into a pond.

However, within a short period of time, the patient became dehydrated. Fortunately, as a result of effective enamel layering, so too did the appearance of the patient's crown restoration (Fig 19). The implant-supported restoration was cemented and is shown post-cementation, hydrated (Fig 20). The surface textures were a match. The final rest position photograph shows the patient hydrated, with the teeth again exhibiting a glossy appearance (Fig 21).

CASE #3

A young man who was accidentally struck in the mouth with a baseball bat presented for treatment of teeth #7-11, as well as the gingival areas involved in the incident. Bone grafting and implants were determined to be the only options to save his smile.

A traditional shade tab did not identify the patient's decalcification, but only his base shade (Fig 22).



Figure 8: View of the zirconia abutment preparation design prior to fabricating the zirconia coping.



Figure 9: View of the zirconia coping.

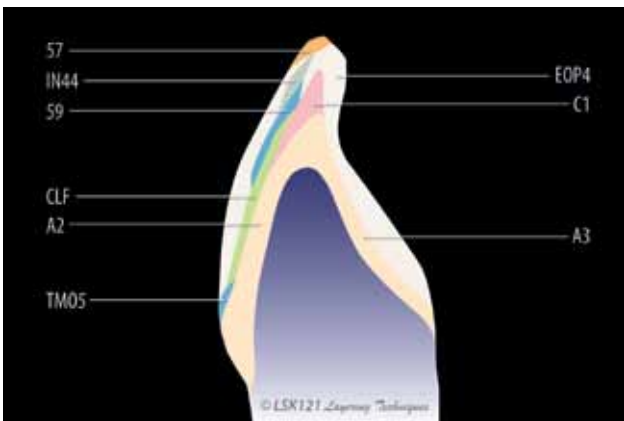


Figure 10: The technician created a computer-generated shade-mapping guide.



Figure 11: The first half of the porcelain build-up was applied to the preparation.



Figure 12: After baking, the appearance of the porcelain was noted.



Figure 13: Side view of the porcelain layering technique.



Figure 14: Post-baking view of the different effects that were created using the porcelain layering technique.



Figure 15: The second half of the porcelain build-up created a crack-line.



Figure 16: View of the implant component and final zirconia restoration.

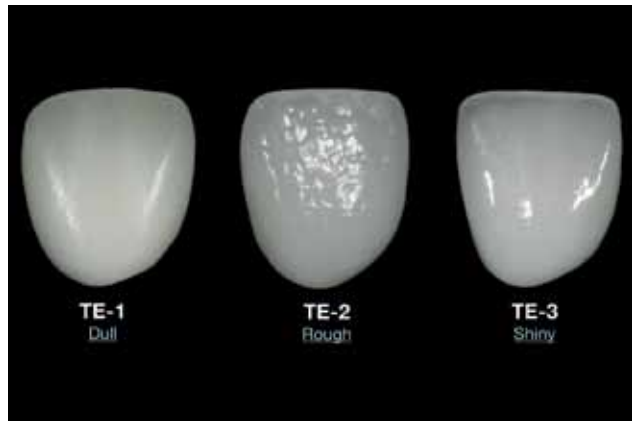


Figure 17: Three crown restorations were fabricated to illustrate different surface textures, such as dull, rough, and shiny.



Figure 18: A second set of fabricated zirconia samples demonstrate such surface textures as horizontal waves (TE-4), vertical waves (TE-5), and natural appearance (TE-6).



Figure 19: Image illustrating how patients with dehydration require crowns that exhibit a dull surface texture.



Figure 20: View of the definitive restoration in the mouth, with saliva.



Figure 21: The initial try in of the crowns in the mouth, which were hydrated and glossier in appearance.



Figure 22: During custom shading using a regular shade tab, the patient's unique calcification was not captured.



Figure 23: Using the Simple Enamel and Prep Color Guide, the calcification was clearly noted using the code OE-5.

However, by using the *Simple Enamel and Prep Color Guide* (LSK Oral Prosthetics) to check calcification and occlusion color, the total effect was captured with a Ridge Only White—OE (Occlusion Enamel) 5 tab (Fig 23).

The demonstration photograph from the guide and the patient's tooth were nearly an exact match. A comparison was made with the Incisal Only (DEC-2) tab from the *Chair Side Shade Selection Guide* in order to determine the extent of modification required for the case (Fig 24).

As with most young patients, this young man's teeth exhibited a very dull surface texture that was not difficult to match. Hydrated or dehydrated, the surface texture would be the same, making the technician's job much easier to master. After cementation, the patient was very happy with the perfectly blended and beautifully matched restorations (Fig 25). The shape, contour, and harmony of color within the patient's newly made-over smile were noteworthy.⁹

CONCLUSION

An ideal restoration will match patients' adjacent teeth when they are hydrated and dehydrated, which is not easy to accomplish. Although there are many tooth characteristics incorporated into the fabrication of crown restorations—including color and stump shade—if the surface texture is incorrect, all the work put into creating the crown will be futile. Difficulty with matching surface texture is one of the reasons the author produced his own shade guide and enamel color and after-preparation color guide.⁶



Figure 24: For modification purposes, the Chair Side Shade Selection Guide Incisal-Only tab was used for documenting the patient's tooth characteristics.



Figure 25: Post-cementation, full-face view of the perfectly blended and harmonious restorations in the mouth.

The patients described in the first two case presentations dehydrated more quickly than most, which made matching the surface textures for their restorations particularly difficult. However, the work was completed successfully because the technician was aware of the side effects caused by dehydration. When faced with similar cases, technicians should ask themselves: How much dehydration does the patient experience, and how quickly? What effect does dehydration have on the color intensity, surface texture, and internal color of the patient's teeth? What appearance do the patient's teeth exhibit the majority of the time?

The patient described in the third case presentation generally exhibited a dull surface texture, which is the type technicians prefer to match.

To achieve an ideal restoration, however, technicians may need to time the patient's dehydration, then match the restoration accordingly.

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