

Laboratory Communication: The Key to Clinical Success

Greggory A. Kinzer, DDS, MSD
Affiliate Assistant Professor
School of Dentistry
University of Washington
Seattle, Washington

Private Practice
Seattle, Washington

Comprehensive communication between the clinician and technician ensures predictable esthetic treatment results.¹⁻³ From the initiation of treatment with the diagnostic work-up, to completion of the definitive restoration, effective laboratory communication is key to clinical success. If communication is compromised along the treatment pathway, the end result may not come out the way it was envisioned. When communication errors occur, the clinician and technician typically point fingers and blame each other for a treatment outcome that has missed the mark. Given the clinician's desire to create restorative results that meet the high esthetic demands of patients, laboratory communication must consist of more than the final impression and a laboratory prescription noting the choice of crown and selected shade. To facilitate predictable restorative results, the clinician must communicate to the technician essential esthetic information including the desired tooth position, arrangement, contour shade, and surface texture. This article will discuss the specific factors that need to be communicated to the technician to obtain predictable treatment results.

DIAGNOSTIC

Before beginning treatment on anterior esthetic cases, it is often necessary to perform a diagnostic wax-up or mock-up. This is especially true if significant changes in tooth position are required. If you as the treating clinician are going to perform the diagnostic wax-up, information with regard to the desired tooth position, tooth length, and tooth shape may be rather intuitive. However, most dentists do not have the desire or time to diagnostically wax their own cases, so this step is delegated to the technician. Essentially, the diagnostic wax-up is only as good as the information the

technician receives from the clinician. While it is true that the quality of wax-up varies from technician to technician, it is the responsibility of the dentist to provide the technician adequate guidance regarding where the teeth should be positioned. The restorative dentist should not only send the technician diagnostic models that can be mounted using a facebow and bite records, but clinical photos of the patient should be sent as well. Clinical dental photography is an essential tool to help relay valuable information on the patient's face, smile, and teeth.⁴ The purpose of the photographs is to enable the technician to see the teeth as they relate to the frame of the smile and in the patient's face. Hence, two of the most important photographs to send to the technician are with the lips in repose and a full smile. Other photos that reveal the relationship of the incisal and occlusal planes can be sent as well (Figure 1A through Figure 1C). Specific notes with regard to which teeth to lengthen and/or shorten and by how much should accompany the photographs and models. In addition, information about the patient (eg, male or female) as well as any patient input on arrangement and contour should also be sent. With this information, the technician can accomplish the goals of the wax-up while putting their specific "artistic touch" on the case (Figure 2A and Figure 2B).

Once completed, the diagnostic wax-up can be used for a multitude of purposes. It can be used to fabricate a preparation reduction guide and to do a rapid "mock-up" in the mouth. Most importantly, the contours from the diagnostic wax-up are used to fabricate the provisional restorations. The goal of the provisionals is to approximate the position, contour, and shade of what is anticipated in the definitive restoration.



Figure 1A through Figure 1C Initial presentation of a 38-year-old female reveals generalized acid corrosion. Moderate-to-severe tooth structure loss is present on the palatal of teeth Nos. 8 and 9 with continual chipping and shortening of the incisal edges.

By this point in treatment, it has mainly been the vision of the clinician and the technician that have dictated the proposed tooth position and contours. However, fabricating the provisionals and seating them in the mouth gives the patient the opportunity to evaluate the proposed contours as well as give their feedback to tooth position and contours. This author typically has the patient return to the clinic 1 to 2 weeks after the provisionals are placed for a provisional check and for the patient's feedback. At this appointment the esthetics and occlusion of the provisionals are evaluated and changes requested by the patient are integrated.

INFORMATION FOR THE TECHNICIAN

Provisional Model

Once the patient and the clinician agree on the esthetics and function of the provisional restorations, the information can be used as a "blueprint" for the final restoration (Figure 3A and Figure 3B).⁵ At this point, a model of the provisional restoration and dental photography should be all that is needed to provide the technician with adequate information to finish the case. To give the technician the exact information on tooth position, tooth length, and arrangement in three dimensions, an alginate impression is taken of the provisional restorations along with a facebow. The technician can then mount the model of the provisionals and make an incisal index or use it for measurements and comparison when baking the definitive restorations (Figure 4). As in the diagnostic phase, it is vital to give the technician some photographs of the pro-

visionals in the patient's mouth (Figure 3A and Figure 5). This again enables the technician to see the contour and arrangement of the provisionals in the mouth and how they relate to the frame of the smile.

Shade

Although the patient can be sent to the technician for a custom shade, it may not always be convenient—especially when working with a technician from another city or country. If this is the situation, dental photography plays a crucial role in capturing information for the technician on the shade of the

teeth as well as the surface texture.⁶ When taking shade photographs there are two essential factors to consider. First, ensure that the associated shade number in the photograph can actually be seen. If the number of the shade tab cannot be seen it makes it impossible for the technician to get any information. The second consideration is how the camera is positioned with respect to the teeth. If the camera is positioned directly perpendicular to the teeth or the shade tab, there is a tendency to get too much "bounce" or "reflection" from the flash, which will prevent the tech-

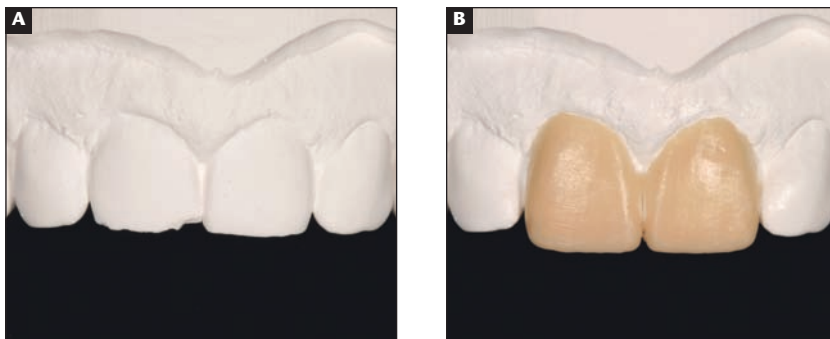


Figure 2A and Figure 2B The diagnostic wax-up was performed on teeth Nos. 8 and 9 to regain the original contours and esthetically lengthen the teeth.

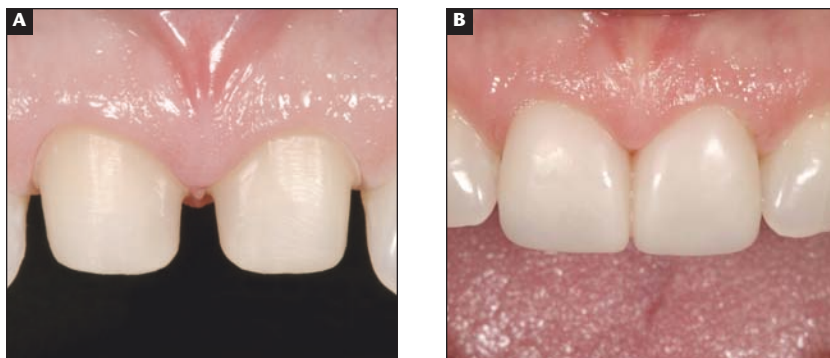


Figure 3A and Figure 3B The completed tooth preparations on the central incisors (A). A preparation reduction guide made from the diagnostic wax-up was used to control the amount of tooth structure removal. The completed provisional restorations (B). The goal of the provisionals is to try and approximate the position, contour, and shade of what is anticipated in the definitive restoration.



Figure 4 A diagnostic model of the provisionals can give valuable 3-dimensional information to the technician when fabricating the definitive restorations. Here, putty is used to make an incisal index of the provisionals.



Figure 5 A photograph of the provisional restorations in the mouth enables the technician to see the contour and arrangement of the provisionals in the mouth and how they relate to the frame of the smile.



Figure 6A and Figure 6B If the camera is positioned directly perpendicular to the teeth, or as in this example the A2 shade tab, there is a tendency to get too much “bounce” or “reflection” from the flash (A). This will significantly diminish the ability of the technician from properly seeing the color of the shade tab due to the excessive light reflection. The shade tab(s) should be positioned just under the incisal edge so that it is in the same plane as the natural tooth or provisional (B). The camera is then positioned at an angle slightly above perpendicular so that the flash is not directly reflected.



Figure 7A and Figure 7B A close-up photograph of the tooth to be matched (No. 9) will show the characterization of the incisal edge by positioning the camera from slightly above perpendicular (A). For information on the surface texture and finish of the tooth, the camera is positioned perpendicular to the teeth to increase the amount of flash reflection (B).

nician from being able to see the colors in the teeth or tab (Figure 6A). Ideally, the shade tab(s) is positioned just under the incisal edge so that it is in the same plane as the natural tooth or provisional. The camera is then positioned at an angle slightly above perpendicular so that the flash is not directly reflected (Figure 6B). Closer, more detailed photos can be taken of the teeth without the shade tab in place. Positioning the cam-

era from slightly above perpendicular will capture the characterization of the incisal edge (Figure 7A). To obtain information related to the surface texture and finish of the teeth, the camera is positioned perpendicular to the teeth to allow the flash to reflect the surface (Figure 7B).

Given the ease of use and immediate results, the majority of dental photography today is accomplished digitally.

However, along with this ease of use arise some issues that did not exist with 35-mm film cameras. When using digital photography for shade images it must be realized that similar cameras from different manufacturers each have their own interpretation of “color.” Although the relative color from all of the cameras may be used successfully for patient consultations, presentations, or before/after photographs, what is needed for the shade photographs is “accurate” color. To obtain “accurate” color, the images can be taken into a photo-editing program (eg, Adobe Photoshop) and color-corrected. Another issue that arises is how the images are viewed. There can be significant variability in the color of images when viewed on monitors from different manufacturers as well as different monitors from the same manufacturer. So, the colors within the shade photograph that you are seeing on your monitor may not be identical to the same image being viewed by your technician on their monitor. Although there is a standard shade tab in the photograph, the technician can be influenced by a monitor, for example, that displays too much red or too much green. To overcome the variability with different monitors, monitor calibration software (eg, Eye-One Match, GretagMacbeth) can be used. This software looks at the characteristics of the monitor it is calibrating by analyzing different colors and comparing it to what it knows the colors should look like. It then writes a profile for the specific monitor that allows all of the images viewed to appear more color-accurate. Ideally, the same software is then used on the technician’s monitor, thus producing color images similar to those viewed on the clinician’s monitor. Lastly, one should keep in mind the lighting conditions that are present during monitor use. The author’s technician works in a bright environment with significant natural light present. Although this is useful when working with ceramics, it can dramatically diffuse the quality of the image as viewed on the monitor. The solution to this challenge is to have the monitor viewing occur in a different location, or forgo viewing on the monitor and use printed images instead.



Figure 8A through Figure 8C The definitive restorations on the solid model and after adhesive cementation in the mouth. The final result restores the form and function of the central incisors, recreating the natural esthetics of the smile.

An alternative to the more traditional methods of visual shade analysis and transfer is to use a contemporary digital-shade-analysis device.⁷⁻⁹ These devices use an intraoral colorimeter or spectrophotometer and have been shown to provide accurate and repeatable shade determination. Aside from the obvious advantage of predictable shade analysis is the ability of some systems to perform a “virtual” try-in, thus allowing the technician to verify the color accuracy of the fabricated restoration before being tried in clinically. Although these devices provide accurate overall color, they often have difficulties representing areas of “translucency” and “internal characterization.” To resolve this problem, the information can easily be obtained and supplemented with conventional digital photography.

CONCLUSION

This article describes specific factors that need to be communicated to the technician to obtain predictable treatment results. Communication between the restorative dentist and the laboratory technician is essential to the function and esthetics of the definitive restoration (Figure 8A and Figure 8B). It is imperative that the clinician and technician

work as a team to ensure the predictability of the final result.

REFERENCES

1. Small BW. Laboratory communication for restorative excellence. *Gen Dent.* 2006; 54(2):86-87.
2. Miller MB, McLaren EA, Neuman K, et al. Stone models without faces. Part II: An international interview. Clinical perspectives. *Pract Proced Aesthet Dent.* 2001;13(5):391-394.
3. Magne M, Odaka Y, Hegenbarth E, et al. Stone models without faces. Part II: An international interview. Laboratory perspectives. *Pract Proced Aesthet Dent.* 2001;13(4):311-313.
4. McLaren EA, Terry DA. Photography in dentistry. *J Calif Dent Assoc.* 2001;29:735-742.
5. Derbabian K, Marzola R, Donovan TE, et al. The science of communicating the art of esthetic dentistry. Part II: Diagnostic provisional restorations. *J Esthet Restor Dent.* 2000; 12(5):238-247.
6. Derbabian K, Marzola R, Donovan TE, et al. The science of communicating the art of esthetic dentistry. Part III: Precise shade communication. *J Esthet Restor Dent.* 2001; 13(3):154-162.
7. Chu SJ. Clinical steps to predictable color management in aesthetic restorative dentistry. *Dent Clin North Am.* 2007;51(2):473-485.
8. Paul SJ, Peter A, Rodoni L, et al. Conventional visual vs spectrophotometric shade taking for porcelain-fused-to-metal crowns: a clinical comparison. *Int J Periodontics Restorative Dent.* 2004;24(3):222-231.
9. Chu SJ. Precision shade technology: contemporary strategies in shade selection. *Pract Proced Aesthet Dent.* 2002;14(1):79-83.

Dental photography plays a crucial role in capturing information for the technician on the shade of the teeth as well as the surface texture.