Creating Aesthetic Success Through Proper Clinician and Laboratory Technical Communication

John F. Weston, DDS, Erik Haupt, AAACD*

Q2 Q3 Q4 Q5 Q6

KEYWORDS

• Lab communication • Aesthetic • Porcelain • Ceramist

Q7

High-quality aesthetic restorations that look great, function ideally, and last can only be predictably produced through implementation of excellent communication techniques and systems between the doctor and ceramist. Often, communication to the laboratory is only thought about at the end of an appointment when the laboratory prescription is being filled out. With the availability of technology and the Internet, it is now easy to involve the laboratory via digital photographs. This article challenges one to begin including the laboratory early in the process and routinely use reliable techniques to transfer clinically significant information to the laboratory bench. It is easy to complete a great case once in a while, but only through developing a system and working together with a quality-conscious ceramist, can a dentist achieve real aesthetic success with every case. Setting the goals with the patient is important and can be a valuable source to review throughout case construction. Including the laboratory in these goals is an essential part of the equation, and reviewing these goals with the patient after completion of the case can be valuable in determining the success or failure of a particular case.

Q8

PHOTOGRAPHY

The first and most logical step is to document cases properly through quality photographic views. A single-lens reflex digital camera with a basic ring flash and 50 to 100 mm lens should be used. Having the proper camera system is necessary to create consistent results. The American Academy of Cosmetic Dentistry (AACD) has developed a photography guideline that is helpful in viewing and examining the aesthetic properties of a case. The 12 AACD-required photographs are an excellent starting

Q9

* Corresponding author.
E-mail address: erik@hauptlab.com

Dent Clin N Am ■ (2011) ■–■
doi:10.1016/j.cden.2011.01.007 dental.theclinics.com

point toward successful communication (**Figs. 1–3**). Properly exposed and framed photographs allow the ceramist to see what materials and techniques are necessary to create the final result. Additional photographs to consider beyond these would be shade reference views ~~of~~ lips in repose or at rest. Theseare valuable views to determine the final length of the central incisors, which is typically 2 to 3 mm should be displayed beyond the edge of the upper lip (**Fig. 4**). Lastly, it is important that all the photographs are taken with the teeth well hydrated. A tooth that is dehydrated will have a higher value and chroma than a hydrated one. These photographs set the foundation for all successful dentist/ceramist teams. Q10

MODELS

It is always valuable to record the detail of shapes and positions of the natural teeth before providing any treatment via models. Because of the availability of inexpensive PVS materials, alginate impressions are no longer the standard of care for opposing or preoperative models. The laboratory technician will often refer back to the original teeth many times while building a case to see what features of the patients' teeth need to be incorporated in the new design. Providing accurate and reproducible models is an important issue. Subtle details in texture, anatomy, and contours keep the ceramic restorations from looking contrived and can provide the element of "perfect imperfection" that natural teeth exhibit. One should never underestimate the value of what was working in a patients smile before the case was started. The most beautiful smiles are created in the laboratory by looking for ways to improve what nature provided instead of erasing and rebuilding from scratch. Q11

JAW RELATION RECORDS

There are many theories on the best way to manage restorations with regard to occlusion. There is also a great debate about which theory is right. However, there is no debate about the fact that there should be a consistent method that provides a reliable and repeatable record to mount models and build a case. In the end, the ~~model~~ must be able to occlude with function and comfort for sustained periods and not overload the muscles~~, joints, or teeth~~. Having accurate bite records helps to confidently cross-mount all models from preoperative to prepared to provisional, allowing the laboratory technician maximum ability to build an accurate occlusal scheme. Typically, once the reconstruction proceeds beyond the canines, a face bow transfer is indicated. This process requires the laboratory technician and doctor to have the same articulators. Q12

Fig. 1. An AACD-required photograph, front smile view.

print & web 4C/FPO

Fig. 2. An AACD-required photograph, front retracted view.

print & web 4C/FPO

Fig. 3. An AACD required photograph, front close-up view.

print & web 4C/FPO

Fig. 4. Properly framed, lips at rest or repose, note proper incisal display.

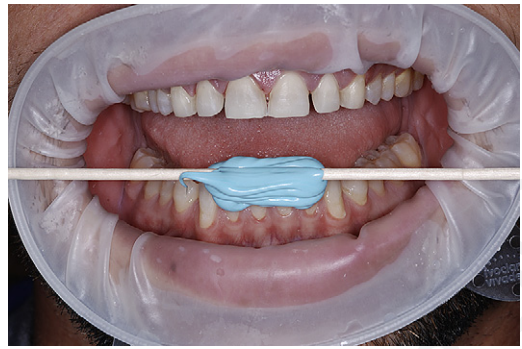

Fig. 5. Stick bite secured to lower teeth, horizontal to the plane of the earth.

The face bow can be transferred to the laboratory by sending the face bow hardware and bite fork mount, or the clinician can simply mount the upper model. Horizontal references, commonly called "stick bites" (**Fig. 5**) are also important at this stage to prevent the formation of a canted midline. Studies show that canted midlines are the most noticed of all midline discrepancies, and mounting the casts properly in relation to the plane of the earth and a patient's face can help prevent ~~canting.~~

SHADE COMMUNICATION

Proper shade reference photographs are one of the most important tools for communicating with a dental laboratory. Many dentist/ceramist teams are geographically separated thus eliminating the opportunity for the patient to drive back and forth between offices. Having the final shade incorrect is often the number one issue leading to an unsatisfied patient. ~~Always, multiple~~ views should be taken with and without retractors, using ~~multiple~~ shade tabs on hydrated teeth. These views will have the shade tab on a parallel plane with the referenced tooth (**Fig. 6**). It is also important to have the same amount of light on both the shade tab and the referenced tooth. Another important photograph for the laboratory is that of the prepared tooth. Many all-ceramic restorative materials, once seated, are influenced by the preparation shade. The laboratory technician needs to see a photograph of the dentin to appropriately build the intended shade. Using software, the laboratory technician can then

Fig. 6. A properly framed shade reference photograph.

digitally manipulate the images to discern levels of value and chroma (**Fig. 7**). It is also important to make sure that the laboratory technician's and clinician's computer monitors are calibrated so that each person sees the same color combinations. The camera has to be set with proper white balance, f-stop, and flash sync for properly exposed images. As a backup, a color calibration card can be used to make sure that the shade is properly represented in the images that are sent to the laboratory. What may seem intimidating to a dentist is simplified by working with companies that can set up the dental clinical camera, (Photomed Inc) for consistent results. Q13

DIGITAL SHADE COMMUNICATION

There are also computerized devices that can make shade matching available to even the most color-challenged individuals. A person can literally point the device on the surface of a tooth, and within seconds, a shade will be given on a liquid crystal display screen (**Fig. 8**). Although the shade may not be accurate in every case, it gives a starting point and with the assistance of photography, allows additional ability to extrapolate all the nuances within a tooth.

PORCELAIN CHARACTERIZATION

An important skill required in creating porcelain restorations that appear natural is controlling the amount of characterization. Natural teeth have varying amounts of incisal translucency, and the ceramist needs to recreate this characteristic accurately. What may seem simple often involves more that just placing porcelain across the incisal edge. There are many colors and effects seen within natural teeth that correspond to different incisal porcelain powders. ~~A helpful communication tool by~~ using Q14 examples of teeth from published books ~~allows dentists to~~ describe how much, value, chroma, and incisal character they desire. Whether natural teeth or restorations, color photographs of desired characteristics can prove invaluable. Additional information for incisal characterization can be obtained by taking a photograph at a 30° downward angle to the facial plane of the natural tooth (**Fig. 9**). This technique provides an excellent record of incisal translucency. Q15

PREPARATION DESIGN AND MATERIAL SELECTION

The teeth should always be prepared in a way that preserves as much tooth structure as possible. Once the goals of the case are determined, preparations should be

Fig. 7. Black and white conversion to see value.

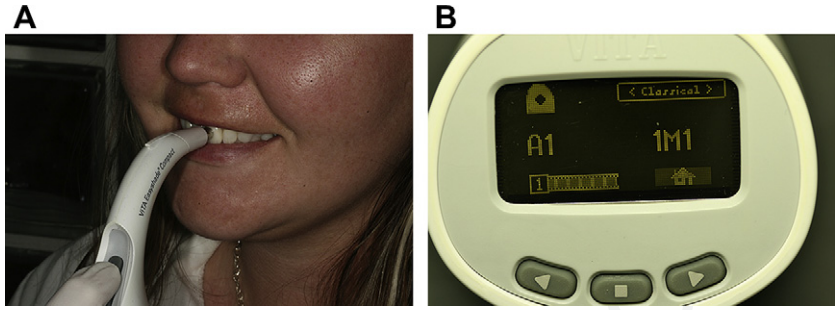

Fig. 8. Easyshade device in use, results are instant (*A*, *B*). Q23

decided clinically based on design parameters, shade requirements, and available tooth structure. Restorative material choices should be finalized in the laboratory to match the strength and aesthetic goals required by the case while meeting the preparation clearances provided. Blindly preparing teeth just to fit the parameters of certain restoratives could be considered inappropriate and, in some cases, malpractice. Porcelain veneering was initially introduced as a "no prep" procedure. Whereas bonding strengths were very high because of the large amount of enamel bonding available, the feldspathic materials used at the time had strength limitations. Now, because new materials such as lithium disilicate are available at minimal thickness, there is a resurgence of preparationless or minimal preparation options. This resurgence has created a positive effect on the profession as a whole and serves to reeducate the patients and profession to the important philosophy that minimal removal of existing tooth structure should always be a top priority.

TEMPORIZATION

One of the key concepts that dentist's need to understand is that provisionals serve as the foundation to building a successful case. The 2 most common methods to creating provisionals are using templates from a direct mock-up technique or laboratory wax-up. With a direct mock-up, the restoring dentist uses a flowable composite to add directly to the patients existing dentition creating an ideal smile. Once this mock-up is completed, the dentist makes an impression and uses this as a guide for the final temporaries. Another option would be to have the laboratory create a wax-up

Fig. 9. Clear incisal character displayed on natural tooth.

idealizing the patients existing tooth form. This wax-up is then used to create a matrix for provisional fabrication. Although the methods differ in technique, the result is that patients have a set of provisionals that they can wear while the final porcelain is created. Any functional or aesthetic issues can be worked out with plastic instead of the final porcelain provisional, thus allowing patients to approve their provisional smile before insertion of the final porcelain. Careful planning and attention to provisionals are essential for predictable outcomes and satisfied patients.

CASE PRESENTATION

When the patient first arrived to the office, it was immediately apparent that he was wearing down his anterior teeth. As a recent college graduate, he thought that having a better smile might help him be competitive in the job market. A recent survey by the AACD revealed that a person with a pleasing smile is more likely to get hired for a job (**Figs. 10** and **11**). A photograph of lips in repose or at rest showed minimal, if any, tooth display, with the central incisors measuring only 9 mm (**Fig. 12**). The first step was to prepare a mock-up ideal incisal edge position for teeth 8 and 9 using flowable composite. By starting with the central incisors, the dentist can develop the rest of the smile and the patient can visualize the intended result (**Fig. 13**). Photographs are made along with reduction guides and impression template for final provisionals before removing the mock-up. After consultation with the laboratory technician regarding the materials, it was decided that a thin application of lithium dislicate veneer would satisfy the restorative demands. Careful preparations were completed with diamond Q16 instruments while constantly referring to reduction guides to confirm that the preparations ~~stayed~~ within the enamel layer while ensuring a passive fit ~~devoid~~ of any sharp angles.

The Lava Chairside Oral Scanner C.O.S., 3M ESPE, was used to accurately capture Q17 digital impressions of the preparations and opposing arch along the CO bite record Q18 (**Fig. 14**). The prescription was filled out on the screen and the case e-mailed for processing. It takes about 3 days for the mounted, articulated, pinned models to arrive in the laboratory. The first step for the ceramist, after viewing the preparations, is to confirm the horizontal reference. As mentioned earlier, a midline cant will most often be noticed by even the most nondentally educated person, whereas a midline deviation will often go unnoticed. In general, a laboratory technician should mount the study casts in the same relation as a photograph of the patient with the provisionals. This

Fig. 10. Smile view showing short worn incisal edges.

Fig. 11. Close-up view shows severely worn incisal edges.

Fig. 12. Lips in repose shows lack of proper tooth display.

Fig. 13. Mock-up of incisal edges shows improved smile line.

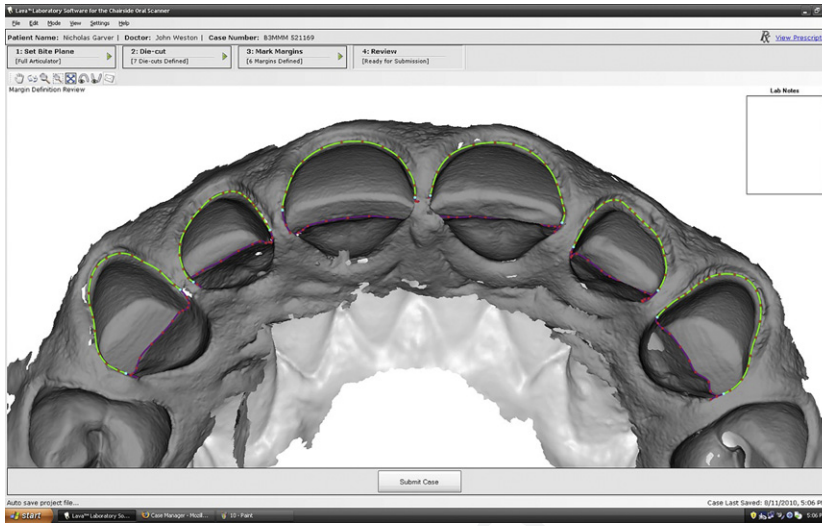

Fig. 14. Digital impression image from the Lava Chairside Oral Scanner C.O.S.

mounting should be compared with the stick bite as well. Once the case is properly mounted, fabrication of the ceramics can begin.

During the process of fabricating the case, the ceramist will often compare the porcelain shapes with those of the provisionals, original teeth, as well as photographs. By fabricating a matrix of the incisal edge positions of the temporaries, one is able to confirm that the porcelain design follows the patient-approved provisional created by the doctor (**Fig. 15**). The porcelain is layered in several steps to achieve the desired hue, value, chroma, and incisal character or halo effect. On completion of the ceramic, the technician etches the internal surface with the proper hydrofluoric acid so that they are ready for resin bonding.

On the day of insertion, the provisionals are carefully removed and the preparations cleaned and disinfected. For this patient, no anesthesia was used because the preparations were completely in enamel and the patient experienced zero sensitivity even after etching (**Fig. 16**). A dry try-in was performed to confirm the marginal and proximal fit (**Fig. 17**). Typical "total etch" porcelain to enamel bonding was accomplished using a fifth generation single bottle system (Adper Single Bond Plus Adhesive and RelyX

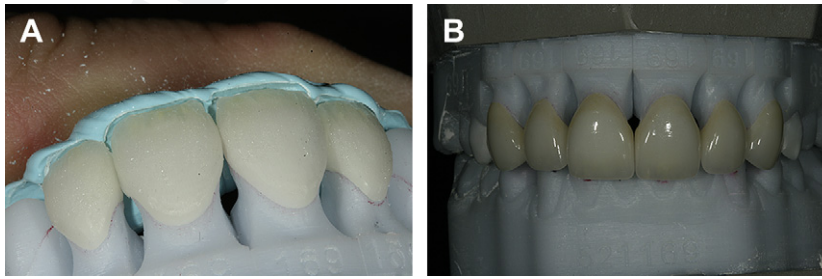

Fig. 15. (*A*) Incisal edge guide from the provisional provides a reference for the lab. (*B*) Restorations showing proper contours and color distribution.

Fig. 16. Etched preparations showing significant enamel bonding available.

Fig. 17. Dry try-in used to verify marginal and proximal fit.

Fig. 18. Immediate postseating.

Fig. 19. Improved smile line and natural aesthetics.

Fig. 20. Detail of incisal edge porcelain.

Fig. 21. Improved tooth display with lips at rest.

Transleucent Veneer Cement, 3M ESPE). A rapid seating technique was used, and all restorations were seated, tacked, and cement cleaned followed by final curing for 40 seconds with an oxygen barrier of glycerin gel.

Gentle cleaning at the margins was completed with a No. 12 BP blade; no burs were used on the facial margins. Lingual margins were finished with a fine red stripe football diamond (Brassler) and polished after occlusion verification using Shofu rubber tips, medium and fine. Interproximal areas were cleaned and polished using a yellow perforated diamond strip, Brasseler, and floss passed through to verify the interproximal cleanliness (see **Fig. 17**).

This case was finished with minor occlusal equilibration, addition of composite to lower canines, and full coverage bite guard therapy for nighttime use.

The final photographs of this case reveal the kind of results that can be achieved routinely by following proven systems and techniques. Having a clear understanding of the goals of a case and being able to communicate accurately with the ceramist are the keys to success. By using digital cameras and digital impression technology, we are able to improve our ability to not only communicate but also enhance outcomes and improve predictability even when the laboratory is long distance. This case is an example of how proper planning and communication produce excellent clinical results while improving function and aesthetics (**Figs. 18–21**).

AUTHOR QUERY FORM

ELSEVIER	**Journal:** DCL **Article Number:** 515	

Dear Author,

Please check your proof carefully and mark all corrections at the appropriate place in the proof (e.g., by using on-screen annotation in the PDF file) or compile them in a separate list. To ensure fast publication of your paper please return your corrections within 48 hours.

For correction or revision of any artwork, please consult http://www.elsevier.com/artworkinstructions.

Any queries or remarks that have arisen during the processing of your manuscript are listed below and highlighted by flags in the proof.

Location in article	Query / Remark: Click on the Q link to find the query's location in text Please insert your reply or correction at the corresponding line in the proof
Q1	Please approve the short title to be used in the running head at the top of each right-hand page.
Q2	This is how your name will appear on the contributor's list. **Please add your academic title** and any other necessary titles and professional affiliations, verify the information, and OK **JOHN F. WESTON, DDS, FAACD** **ERIK HAUPT, AAACD**
Q3	Are author names and order of authors OK as set?
Q4	Please provide professional degrees (e.g., PhD, MD) for the author "Erik Haupt."
Q5	Please provide affiliations for the authors "John F. Weston" and "Erik Haupt."
Q6	The following synopsis was created during prepress production because a separate abstract was not provided. Please confirm OK, or submit a replacement (also less than 100 words). Please note that the synopsis will appear in PubMed: High-quality aesthetic restorations that look great, function ideally, and last can only be predictably produced through implementation of excellent communication techniques and systems between the doctor and ceramist. With the availability of technology and the Internet, it is now easy to involve the laboratory via digital photographs. This article challenges one to begin including the laboratory early in the process and routinely use reliable techniques to transfer clinically significant information to the laboratory bench.
Q7	Please verify that the 3 keywords provided are acceptable. If they are not, please provide no more than 3 appropriate keywords.
Q8	As per editorial remarks "Please provide suggested readings in lieu of references."
Q9	Please verify the expansion of SLR.
Q10	Please verify the edit to "shade reference views ~~of~~ lips in repose or at rest."
Q11	Please provide the expansion of PVS.

Q12	Please verify edit to the sentence “In the end, the model…”.
Q13	Please provide the manufacturer location for “Photomed Inc.”.
Q14	Please verify edits to the sentence “A helpful communication…”.
Q15	Please provide complete details of reference pertaining to the information “JCD Volume 19 Issue #3” in the reference list and a citation for the same in the text, ensuring sequential order.
Q16	Does edit preserve intent in the sentence “After consultation with the…?”.
Q17	Please verify the manufacturer name for “Lava Chairside Oral Scanner C.O.S.” and provide its location.
Q18	Please provide the expansion of “CO.”.
Q19	Please verify corrections made to the name of products “Adper Single Bond Plus Adhesive” and “RelyX Transleucent Veneer Cement” and provide “3M ESPE’s” location.
Q20	Please provide the expansion of BP, if any.
Q21	Please provide the trade names, if any, for “fine red stripe football diamond” and “yellow perforated diamond strip” and the manufacturer location for Brasseler.
Q22	Please clarify if “Shofu rubber tips” is a product. If so, please provide the manufacturer name and location.
Q23	Please provide the manufacturer name and location of Easyshade device.

Thank you for your assistance.