Quality Digital Photography Can Enhance Dental Skills

Jack D. Griffin Jr, DMD
Private Practice
Eureka, Missouri
636.938.4141
Email: Esmilecenter@aol.com
Web site: www.Eurekasmile.com

We all crave respect from our peers and praise from our patients. Today's materials, techniques, technology, and equipment raise the expectations for more ideal clinical outcomes. Now, the weak link in achieving a great clinical outcome is most likely practitioner proficiency.

Honest analysis of our own work is the best way to improve dental skill. Digital photography makes self-critique easier than ever because of the instant feedback and the variety of ways there are to see the images. It can be very humbling to see our own work shown on large monitors or blown-up prints, or projected onto megascreens. Even so, evaluations must be done so that enhancements can be made for each individual case we do as well as for office materials and procedures as a whole.

It is difficult to judge our work thoroughly at the chair. Patient position, lighting, operator fatigue, eye accommodation, and other factors make accurate restoration evaluations almost impossible at the time of treatment. Digital photography provides a mechanism to look at clinical treatment independent of operatory limitations while adding the huge benefit of tooth image enlargement.

Images taken using 35-mm film can provide the ultimate in quality but require development, enlargement, or slide projection to equal the size enhancement easily achieved with digital images displayed on monitors that most offices now have. Film also has an inherent lag time between image capture, development, and subsequent evaluation. Digital images captured with a standard lens reflex (SLR) camera, macro lens, and

macro ring flash can provide images allowing almost instant film quality images [**QA: Not sure what you mean here.**].

This article describes techniques and clinical situations in which the practitioner can use digital photography to evaluate cosmetic treatment and to take these desired changes to the treatment room and to the patient. The two most common types of cases needing midtreatment evaluation are single anterior tooth matching and direct composite veneers; both techniques benefit greatly from image evaluation.

Capturing Quality Images Capable of Quality Assessment

It is preferable to own a camera that is capable of taking images with accurate human color and full tonal range, and has the ability to capture close-up macroimages with good light control. Nikon D70 or D200 (Nikon), Fuji S2 or S3 (Fuji Film), and Canon 5D or 20D (Canon USA, Inc) are good SLR cameras that take quality, consistent images and are nearly as easy to use as simple "point and shoot" nondetachable-lens cameras (Figure 1). They have great versatility and are worth the few extra dollars they may cost over simpler, less accurate cameras.

There are many companies now that can help take the frustration out of choosing a camera and the settings needed to capture accurate, consistent images. PhotoMed, Clinipix, and Doctors Eyes can provide the needed armamentarium that makes taking quality images easier, including mirrors that reflect light efficiently, retractors that are comfortable and effective, and contrastors that help make obscure color changes more obvious (Figure 2).

Today, it is trendy to take photographs with the patient's head tipped, eyes looking away from the camera, and even a fan blowing their hair like they have their head stuck out the sunroof. Those are cool for marketing but not for dental critique. No trick or dolled-up photography wanted here. Images need to be captured with the patient looking at the camera and their eyes parallel to the floor so that we can evaluate cant, midline, tooth proportion, and size. A real smile is needed so that gingival heights can be evaluated, not a par-

Figure 1—Example of a digital SLR camera with a 105-mm macro lens and ring flash. This camera is simple to use and offers the most diversity for esthetic treatment in the dental office.

Figure 2—The basic armamentarium includes a quality mirror, contrastor, and various retractors.

Figure 3—A sample esthetic series that can be used to create an office portfolio as well as for enhancements during treatment. Customize your own series to suit your particular needs.

tial grin to hide a gummy smile or deficient buccal corridor development.

Midtreatment Images and Use for Restoration Refinement

There is a need on all esthetic cases to take consistent pre- and postoperative images for marketing, liability, office portfolio development, and sometimes even just to remind a patient where they were before work was started (Figure 3). The key images for skill improvement are taken at midtreatment so that work can be evaluated from a different perspective before a particular case is finished.

A series of images is captured at the end of the operative appointment using the same techniques as the preoperative series. Then, an "enhancement" appointment is set up several days to a few weeks later. This time is used to load, review, and make notes of the images. Photographic software can be used to make arrows and notes on the images, or indelible markers and pens can be used to point out areas that need correction.

Many offices have operatory computers for practice management or digital radiography, and they are often the best way to view images without requiring extra software or equipment (Figure 4). If the goal is to complete the work in a single appointment without a follow-up visit, take the images, load them onto a computer, and evaluate them before the patient leaves. It is amazing how the different perspective makes needed changes crystal clear.

If a subsequent enhancement appointment is made, prints may appear with notes highlighting desired changes and placed in clear view (Figure 5). It must be remembered that printing induces inherent errors in color replication; every printer causes changes in the photographs according to the printing software, ink, and paper used. In addition, the operatory lights cause printed images to look different from how they would appear on the monitor. It is therefore best to look at the images on the computer monitor as well as the printed images with notes while refinements are made.

The sequence for digital photography evaluation is as follows:

- Full preoperative series

Figure 4—During enhancement appointments, the images are displayed on a monitor above the patient using the same operatory computer that is used for radiography and practice management.

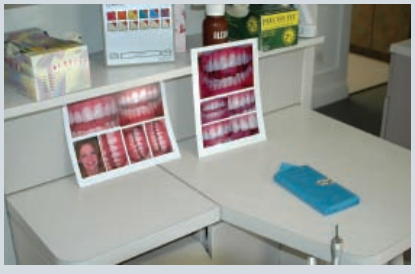


Figure 5—Printed images can be displayed with the monitor images for additional notes and comments about the enhancement plan.

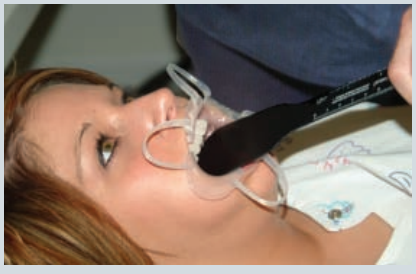


Figure 6—Retractors to reduce tissue shadows and a black contrastor are 2 tools that help to obtain images that are truly diagnostic.

Figure 7—The patient can hold the contrastor or the retractors while the staff stabilizes the camera and captures the images.

Figure 8—An image of the incisor needing repair next to the one we are matching.

Figure 9—An image of the prepared tooth is captured so that the composite/tooth transition can be evaluated.

- Placement of restoration(s)
- Repeat of full photographic series
- Maximum close-up of single tooth matching
- Patient dismissal
- Evaluation of images, notes made
- Enhancement appointment days or weeks later
- Final appointment for refinement and postoperative images according to image and patient scrutiny.

Single Anterior Tooth Matching

Midtreatment images, critique, and an enhancement appointment for single anterior tooth matching are perhaps the most neglected aspects of dentistry. This practitioner is not skilled enough to correctly restore every anterior tooth in one appointment. Close-up photography often improves reatment, as deficiencies become easily seen.

There are several components to quality photography in which single tooth color, morphology, and texture are trying to be captured. To do the best restoration evaluation, it is strongly recommended that an SLR-type camera with a ring light be used on a macro lens as described above. This will give the best opportunity to capture both a lifelike color image and size that allow for accurate color and anatomical replication.

Because we are trying to see and reproduce the intricate colors and textures of a single tooth, we want no shadow or reflected light to influence the image. Retractors keep tissues out of the way, and a dark contrastor behind the teeth lessens reflective lighting from behind the tooth (Figure 6). A maximum close-up is set on the macro lens, f-stop is set to a maximum, and a ring flash is used to decrease glare (Figure 7). The teeth should be dry without any pooling of fluid or bubbles so that surface texture and color variances are not hidden.

The close-up image is taken showing the tooth we are trying to mimic along with the one to be restored (Figure 8). In this case, a Nikon D70 with a Nikon 105-mm macro lens was used with a Nikon SB29 ring flash shot at f-51 in "M" mode with a shutter speed of 60. This close-up 1:1 evaluation would be impossible with today's point-and-shoot cameras because of the lack of camera sensor detail, color replication, and control of light exposure.

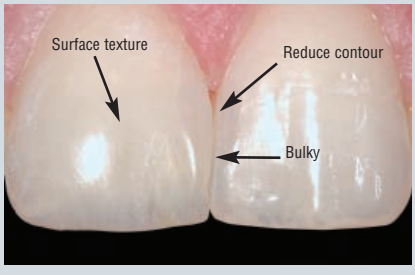


Figure 10—After the restorative appointment, images are taken and the patient is scheduled for a follow-up.

Figure 11—Restoration refinement is made, and a final image series is then taken.

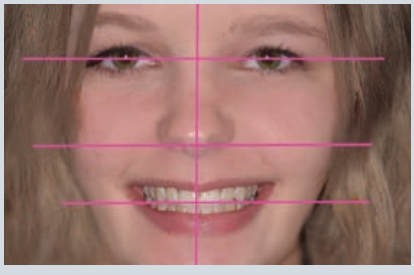


Figure 12—After a full intraoral and extraoral image series is taken, evaluations of cant, symmetry, and midline are made.

Figure 13—Gingival positions, tooth color, and buccal corridor are some of the things critiqued from a close-up smile image.

Figure 14—This is one of several intraoral views taken.

Figure 15—Incisal embrasures can be reviewed with a close-up view.

An overexposed image (ie, too much light) would be useless for evaluation because the many color nuances found in teeth would be obscured by the "overlighting." Shooting in "A" or "M" mode allows control over the amount of light that enters the camera by adjusting the aperture. This control is described in terms of f-stop and is as simple as turning a dial according to how far you are away from the tooth. Because we take the same few images over and over in dentistry, there are only a few f-stops to remember and, with practice, it becomes as easy as using a point-and-shoot camera.

The image is loaded onto the computer and looked at before work is done so that the amounts of dentin shade, tinting, enamel, and translucent composite are planned for. After tooth preparation, another image is taken so that the tooth-restoration interface can be evaluated later to make sure it is indistinguishable in the final restoration (Figure 9). After the restoration is completed, similar images are taken and loaded onto the computer.

Between appointments, or if there is time during the placement visit, the images are scrutinized and warranted corrections are noted on the computer or written on the printed image (Figure 10). Within 2 to 3 weeks, an enhancement is made and the desired corrections are made according to the image evaluation (Figure 11). Final images are then taken and saved for the office portfolio. If a concise, honest, and accurate evaluation is made and the enhancement plan is followed, a second follow-up appointment is seldom needed.

"Because we take the same few images over and over in dentistry, there are only a few f-stops to remember and, with practice, it becomes as easy as using a point-and-shoot camera."

Figure 16—Photoshop software has a filter tool, Find Edges, that can help focus on tooth edges as well as tooth outline without distractions like color or other tissues.

Figure 17—Many subtle aspects, such as polish and length of contacts, are easily seen at the higher magnification of the computer monitor.

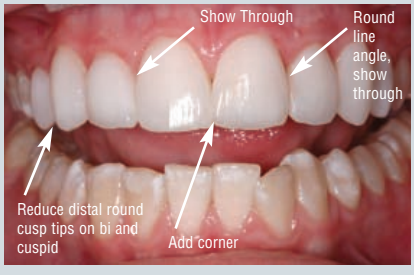
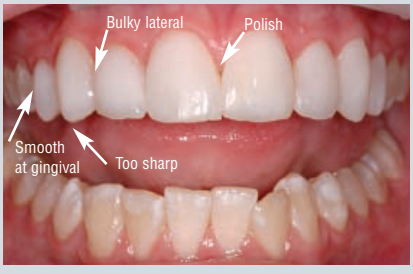


Figure 18—Interproximal line angles are easily evaluated from photo enlargements because of the flash glare on the tooth.

Figure 19—Elbow areas are often poorly extended and can be shown from various photograph angles with close-up macro images.



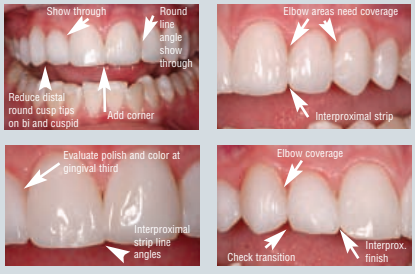


Figure 20—The images are printed with an ink-jet printer onto photograph glossy paper so that desired changes are easily remembered and seen. It must be kept in mind that printing causes some color changes and it is best to evaluate color on color-corrected monitors concurrently.

Multiple Direct Restorations

Perhaps the most exhilarating—as well as exasperating—procedure in dentistry is placing direct composite veneers. While it is not necessary to match a particular tooth in shade and texture, veneers are nonetheless tedious, and what very often looks good while the patient is reclined can be disappointing when the patient sits up. Photography can help with the major problem areas of cant, embrasures, symmetry, color consistency, and basic smile design. This practitioner has never even come close to a perfect case, but with digital evaluation we get closer.

The images presented in this article were captured with the Nikon D70 SLR camera in aperture mode using varying f-stop aperture settings with a 105-mm macro lens and ring flash. The only adjustment for this aperture setting is a single dial. This series, as opposed to the single tooth photography evaluation, can be done with some point-and-shoot cameras, like the Canon G5 or G6. Because we are not matching characterizations of individual teeth, ultimate macro images are not needed; however, when using translucent incisal shades, it helps to have full macro capabilities for color consistency.

Take a standard series of preoperative extraoral and intraoral images. The full face image, f-5.6, is critical so that cant, midline, and proportions can be checked (Figure 12). The smile, f-22, is taken to evaluate buccal corridor, gummy smile, and color (Figure 13). Gingival heights can be checked with a retracted view, f-40 (Figure 14). Close-up intraoral images are used to understand color changes in the tooth so that a plan can be made about the opacities of restorative materials needed and so that surface texture can be evaluated for polishing detail (Figure 15). Additional images from a multitude of angles are helpful.

Photograph editing can be a great adjunct in making images look more professional, but doing "digital dentistry" to hide defects or to cover deficiencies is a bad habit and does nothing to make our work better. However, these software programs have tools that can help us. Using Photoshop 7.0, the image in Figure 15 is analyzed by selecting "Filter," 'Stylize." then "Find Edges" from the menu, and an outline of the tooth edges is revealed (Figure 16). This tool is helpful because it gets rid of

Figure 21—Once the refinement changes are made, photographs are taken and immediate reevaluation is done to make sure that the desired changes are made correctly.

Figure 22—The Find Edges tool in Photoshop can help again to study proportions, incisal edges, and embrasure form. This image is compared to Figure 16 to evaluate changes.

Figure 23—Once the restoration is completed, final images are taken and archived for office portfolio and marketing purposes.

Figure 24—Note the dramatic improvements in the patient's smile.

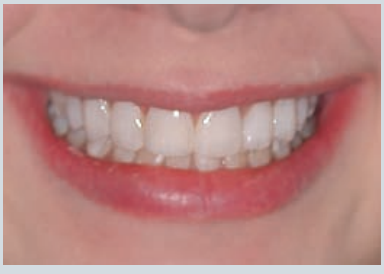


Figure 25—Despite happy patients, there is always that desire for clinical perfection that can sometimes seem fleeting.

Table—Ultimate Single Tooth Shade and Texture Images

Image size control: 100- to 105-mm macrolens on SLR camera on maximum close-up

Light control: Aperture control at maximum f-stop setting

Glare control: Ring light and dry tooth

Shadow control: Retraction of soft tissues from teeth

Enhancement of tooth opacities: Dark contrastor to reduce light behind tooth

Blur control: Keep camera and patient very still when depressing shutter

Quality control: Record in high-quality JPEG or RAW format on camera with camera sensor that reproduces accurate human color.

things that take our eyes away from the most important areas of embrasure, proportion, and symmetry. This view is particularly helpful in analyzing tooth heights and incisal edges.

Place the veneers according to codiagnosed goals between the patient and the staff. Then take a repeat series of images so that analysis can be made and the patient can be dismissed. In this office, veneers are placed in about 2 hours and the patient is scheduled in 1 to 2 weeks for a 1-hour enhancement visit. The images are evaluated and the necessary corrections are marked.

Evaluation of the images can be done in a variety of ways, and written or computer marks can be made on printed or digital images. Photoshop or other imaging software can calculatemeasurements or make lines pointing out needed changes (Figures 17 through 19). The images can be printed so that they can be taken to the follow-up appointment and displayed in the treatment room along with those on the operatory monitor (Figure 20).

As with the single tooth matching, digital image critique allows us to effectively evaluate the patient without the distractions of the operatory. Fresh eyes, a large monitor, and no patient allow a better focus on the restorations. After inspection of embrasures, anatomy, shade variances, and polish, notes should be written so that when the patient is in the chair, necessary corrections are not looked over or forgotten.

> "Post-treatment images should be compared to esthetic journals or whatever benchmark you use for outstanding dentistry, and then take notes about what you can do to improve to those levels."

After enhancements are completed, a final series of images is taken. Take the same full series of images as in the preoperative series with the same camera settings for consistency. Always reevaluate the final series, as was done with the midtreatment series, and don't be afraid to call the patient back if something wasn't corrected to your standards (Figure 21). In the same way, selecting *Find Edges* in Photoshop will allow you to inspect the refinements you made without the usual distractions (Figure 22).

After the final images are taken, it is tempting to just archive the images and forget about them, except for marketing purposes. Instead, use those images and compare each case you do so that changes in material, technique, or education can be made to improve quality (Figures 23 through 25).

Conclusion

Post-treatment images should be compared to esthetic journals or whatever benchmark you use for outstanding dentistry, and then take notes about what you can do to improve to those levels. Care should be taken to look at the teeth and not the skin, faces, or hair of the models that many publications feature in their articles or ads. Remember, it's not about showing off; it's about improving skills. It's all about honest evaluation and improvement. To increase that respect and praise we so crave, digital photography just may be the ultimate tool.

Disclosure

The author has no financial interest in any way in the products, materials, or suppliers mentioned in this article.