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Cosmetic Dental Simulation Technology: Creating Integrated Desire

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Modern consumers like the ability to see potential results and what they are purchasing before making an expensive investment decision. The increased demand for cosmetic dentistry is also driving consumers to multiple offices for comparison shopping and doing their homework for cost and quality, as well as increasing their own dental knowledge. The ability to demonstrate to a patient what they could look like from undergoing cosmetic dental work before starting treatment can be very compelling; often compelling enough to motivate a patient to move forward with treatment. For some patients it is not until they see their current appearance and how much better they could look that they will begin treatment.

Viewing images of the potential outcome can also give patients uncertain of the expenditure for cosmetic dental work a reason to justify it. Seeing one's true image, as well as the commonly viewed mirror image, is important to help the patient see their true appearance, which can ultimately create desire. Dentists can use digital images to highlight asymmetries and other flaws that might otherwise never be noticed because of cognitive mapping. These images can then be altered to fit the patient's desires and show a whole new possible appearance for the patient.

Today's dental practices have many possibilities regarding how they interact with their patients. The myriad of options that exist for practice management software, computer integration, and digital technology are nothing short of fantastic. With so many changes happening every

year in computer technology, the interaction between the dental office and the patient can only continue to improve. The ability to diagnose, present and demonstrate treatment, store information, share information with other practitioners, and send claims with file attachments to third-party bill payers is nothing short of amazing. Patient comprehension of the possible treatment options and outcomes can be seen visually through computer-driven animations, real-life photographs, and video. Helping patients to better understand their problems can lead to a higher acceptance rate of both necessary and cosmetically driven treatment.

One technology that plays an important role in creating a mental image that can evoke an emotional response is computer image manipulation software. This software is often referred to in dentistry as "imaging software." However, this terminology is misleading to the rest of the world in that imaging software normally refers solely to software that manipulates and manages media files. Therefore, dentists should refer to their software as "a graphics software program." Dentists can manipulate a photograph of a patient's unattractive smile into one showing the beautiful smile he or she has dreamed about, which often is enough to compel the patient to move forward with obtaining treatment. This ability to see oneself as others see him or her is a very powerful tool in any dental office's motivational arsenal.

Having a visual blueprint before commencing treatment is critical in delivering the correct final outcome to the patient.

The more input received from the patient, the easier it is to deliver the ideal product. Additionally, having the patient sign off on the new appearance helps to hold the patient accountable if he or she decides at a later point that it is not what he or she wants after all.

Using a pretreatment photograph, the dentist can develop the desired shape of the teeth for a particular patient. Tooth-shape books can help guide the dentist and patient toward an overall style, but it is not until the patient sees the outcome on his or her face in a photograph that he or she becomes attached to a shape and final outcome. The photograph then becomes an integral laboratory communication tool that helps the technician to better understand the desired final appearance of the teeth. The technician can use the information to fabricate a diagnostic wax-up that duplicates the desired shape seen in the photograph three dimensionally, further showing the patient the potential shape of his or her teeth. Pairing the wax-up with the cosmetic simulation rendered from a graphics program helps to solidify the patient's decision regarding whether the shape and appearance are truly what is desired. If, after visualizing the new prototype smile in the cosmetic simulation photograph and in wax on an articulator, the patient is not pleased with the appearance, the dentist and technician can continue to gain input and modify the case or start over.

This treatment planning process not only prevents unnecessary treatment, but also eliminates unnecessary time and ex-



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pense. Some patients never know what they want. In cases where the dentist has gone through all the treatment steps and adheres the final product onto the teeth, a huge dilemma occurs if a patient does not like the result and wants to start over. Then, it must be decided how to fix the problem and who is going to pay for it. This legal dilemma can be avoided by obtaining written consent for each step as well as for cementing the final product. By doing this, the patient has been involved throughout the entire process and will have no legal recourse.

ESSENTIAL COMPONENTS

To create cosmetic simulations, dentists will require some essential enhancement components that are fast and easy to complete, such as whitening, veneers, gingival recontouring, bonding, diastema closures, rebuilding chipped/cracked teeth, and lengthening and reshaping teeth. Some programs use a smile gallery where the user can position and insert a new smile over the patient's existing smile. These smile galleries, although they can be a quick solution to smile design, do not take into account the true position of the bone, gingiva, adjacent teeth, root position and angulation, bite, and available space. So, although this type of quick

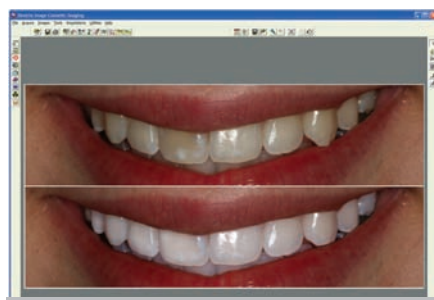


Figure 1 Screen capture of a whitening case using the Dentrix Cosmetic Imaging program. Image courtesy of Dentrix Image from DEXIS.

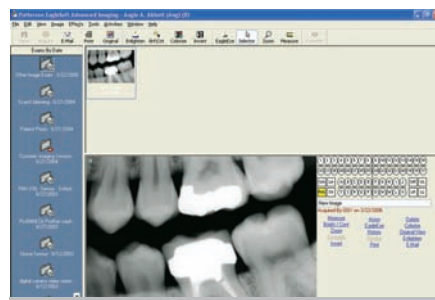


Figure 2 Screen capture of the Advanced Imaging module in EagleSoft. Image courtesy of Patterson Dental.

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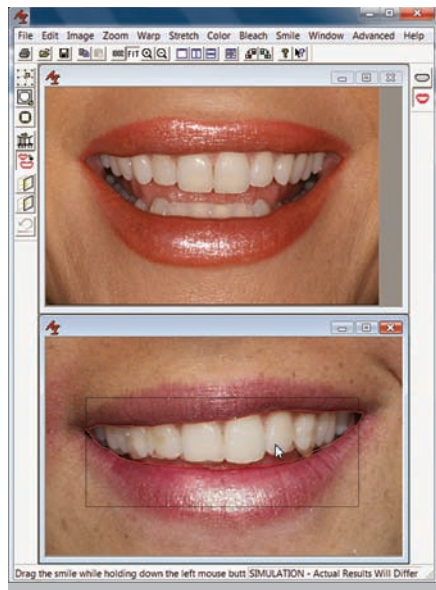


Figure 3 Screen capture of AlterImage conducting a smile-copy operation. Image courtesy of Seattle Software Design.

solution looks great, it may mask numerous limitations such that a case can never be performed to achieve the desired appearance. However, these galleries can motivate patients to start exploring options. It is for this reason that any computer-simulated image must carry some form of disclaimer stating that the final results may vary and that the image is only a simulation and not a guarantee of the final appearance.

Some additional equipment will be necessary before implementing any form of cosmetic image manipulation. Obviously, the first requirement is a professional (ie, a 35-mm single lens reflex) digital camera. This camera should have the ability to capture a high-resolution image of the patient's head as well as the capability to capture a close-up of the smile comprised of the lips and teeth. The headshot illustrates how great the patient will look with his or her new smile. This motivational picture provides the basis for how the patient can justify the expense. The close-up photograph illustrates the true shape and appearance of the new smile, which is somewhat lacking when looking at it from less magnification in the headshot. Because this close-up shot is so important to the overall appearance of the actual case, it is necessary to have a professional digital camera capable of capturing the needed information about the patient's teeth.



Figure 4 The patient wanted to see what it would look like to have her front teeth changed cosmetically. This picture showing 10 new all-ceramic crowns was exactly what she needed to see to have her start treatment. Image courtesy of Virtual Smiles.

Before dentists can begin using any graphics software, the image files will need to be transferred from the camera to a computer. So another necessary item is a media card for the camera and a card reader. After the information is downloaded to a computer and stored, it must also be backed up to another source that is either off site (typically a secure backup via Internet) or is portable and can be removed from the dental practice daily. All dental offices must back up their patient information daily, which must be kept or taken off site, so that if for any reason the computers are not available because of fire, theft, water damage, viruses, etc, then a new computer can be purchased quickly and the information reinstalled. Upon transferring the image files to the computer, the files should be stored in a manner that facilitates easy retrieval and search capabilities. Dentists can choose either an inexpensive software program that can be purchased over the Internet or a more expensive dental manufacturer-based software program that will integrate all of the photographs within the patients' charts. Finally, a printer might be necessary should the office want to print out simulations for the patients to take home and show other members of the family or anyone else who might have influence over the final decision. Creating image files for e-mailing is another option.

SOFTWARE PROGRAMS

Many different software program types can be used to simulate a more appealing cosmetic appearance from a photograph of a patient.

Generic Professional/Consumer Graphics Programs

This category consists of various types of graphics programs (image-manipulation software programs) that can be purchased from a technology store and used to manipulate a digital image of any format. Within this category are the generic programs for ordinary consumers and the highly evolved, professional-grade programs that graphic artists use. The program most commonly referred to within this category is Adobe® Photoshop® (Adobe Systems Inc, San Jose, CA). Although not developed for use within the dental industry, it lends itself well to simulating cosmetic alternatives for

dental patients. The limitation of this program is that it is very complicated and requires a lot of training to become skilled and efficient at quickly modifying an image. Also, the amount of time necessary for a beginner or novice to fabricate a quality simulation is too extensive to justify using the program. Despite that, the advantage is that it is one of the most comprehensive, technologically advanced programs available and, for less than a \$1,000, it is relatively inexpensive.

These programs can be basic or very complex and used for color correction, cropping, and subtle modifications that are somewhat limited in their abilities and not specifically developed to assist with cosmetic simulations.

Cosmetic Simulation Graphics Modules for Practice Management Software

There are only a handful of dental companies offering specific software programs that are fully integrated into all aspects of the dental office management software. These programs have numerous modules that can be purchased together or separately to customize each individual office's desires and needs. One particular module is for image manipulation and management. Being able to manage the patient's photographs and radiographs and still have them tied into the patient's dental records is ideal for ease of retrieval. The luxury of the system being incorporated into the practice management software is that there is a seamless integration to the patient's dental record that cannot be achieved with third-party software. The ability to look at a patient's chart and have any radiographs, photographs, or cosmetic imaging all in one place is priceless for organization and fluidity in the workplace.

Another key feature is the ability to label images so that they can be easily found based on name, keyword, or tooth number. When performing a consultation, this feature can be used to retrieve images easily, which allows dentists to show examples of the procedure being discussed. Showing completed cases can enhance the consultation and motivate a patient to move forward with treatment. Without this feature dentists might fumble through numerous photography files to find specific

examples to show to the potential patient. Additionally, the ability to categorize the photographs with searchable keywords is valuable during consultations when dentists want to showcase all of their previous veneer or crown restorations to a potential patient. Furthermore, the speed in which dentists can provide a cosmetic simulation is unrivaled.

These programs are oftentimes costly in comparison to generic consumer graphic programs, but the ability to quickly manipulate an image for a patient or to retrieve an image to discuss a case can easily justify the cost. These programs are much easier to use than other, more sophisticated programs available outside the dental industry. The appearance of the simulation, although good, is typically not of the same caliber as the programs used by graphic professionals. Examples in this category include Dentrrix® Cosmetic Imaging (DEXIS, Des Plaines, IL) and EagleSoft® (Patterson Dental Supply, Inc, St. Paul, MN) (Figure 1 and Figure 2).

Stand-Alone Dental-Specific Graphics Programs

This type of cosmetic simulation program is specifically designed for dental professionals to perform computer simulations. These quick and easy purpose-built software programs for cosmetic dental photographic manipulation are relatively inexpensive and simple to use. This type of program can be taught and delegated to anyone in the dental office to fabricate a quality cosmetic computer simulation while patients watch. These programs, however, do not handle image management, storage, or easy retrieval like the practice management software. This type of system is not as sophisticated as the big manufacturers' programs but it gets the job done quickly and easily while still providing a quality product. Examples of this type of program include Snap® Instant Dental Imaging (Snap Imaging Systems, Inc, Largo, FL) and AlterImage® (Seattle Software Design, Seattle, WA) (Figure 3).

Cosmetic Dental Image Simulation Companies

Another possibility is to hire a service that uses trained graphic artists using a program like Adobe Photoshop to do the work.



Figure 5 The author worked on this patient's image by modifying the gum height of her front teeth. The missing lateral with the canine in the lateral position needed to be modified as well as the premolar to appear as a lateral incisor. Then the contralateral teeth had to be shaped to match. Some whitening was added but still maintained the subtle color intricacies of her natural teeth. Image courtesy of Virtual Smiles.



Figure 6 This patient had some discolored teeth and a lot of wear to the dentition. The patient wanted to see a more youthful smile with whiter and longer teeth. Image courtesy of Virtual Smiles.



Figure 7 This patient wanted her whole smile redone but wanted to see what it might look like as she was unsure of what she wanted. After looking at photographs the author and the patient found aspects of smiles she liked and other things that she did not want. Using that input, the final appearance was custom created. Image courtesy of Virtual Smiles.

These services can create great simulations, but the office must be willing to let patients walk out the door and come back later to finalize the treatment consultation. Furthermore, should patients want a modification done, it would need to be sent out again. There is an upside: If the case is already sold, the quality of the image is unbeatable. Specialized companies that offer cosmetic dental image manipulation include Virtual Smiles® (Anaheim, CA) and Smile-Vision® (Newtown, MA) (Figure 4 through Figure 7).

Additional Factors to Consider

When deciding which image simulation methods to integrate into the dental office, dentists should also consider the amount of time that will be required to perform a computer simulation, the expenditure to obtain the final image, and the overall quality of the simulated image.

With the implementation of any new software or device in the dental practice there is always a learning curve after initial training. After becoming proficient with the software, then it is possible to determine the time typically needed to modify an image. The time expenditure is equivalent to the overall cost of manipulating an image after recapturing the initial investment of the technology. Based on that amount of time, dentists can then determine if it is best to pay someone internally to perform the task or have images sent out to a third party to provide the manipulation.

The ability to show an immediate result while the patient is emotionally engaged

in the moment is an extremely important consideration when evaluating the software programs that are available. An easy-to-use software program that creates a believable lifelike simulation quickly while the patient is watching is powerful. It is important with any of these different types of programs to obtain an impressive, quality cosmetic simulation. The quality of the image needs to look so impressive that it creates that “Wow Factor” to compel patients to move forward with treatment. This is where time is important; dentists need to decide if they will provide the simulation while the patient is present so that the patient does not leave the practice and the dentist loses the potential sale, or they prefer to have the patient come back for an even better picture. If it is not a realistic and believable appearance, it will not lend itself well to facilitating a potential patient to move forward with expensive elective cosmetic dental procedures.

CONCLUSION

When done well, cosmetic dental simulations can be a very lucrative tool in the dental office, establishing more desire for patients who are considering investing in elective cosmetic dental procedures. Using these programs can facilitate more case acceptance and cost justification for patients to undergo cosmetic dental therapy, and thus more revenue for the practice. Take the time to determine which one fits your practice’s needs the best because they all work very well in the right situation.