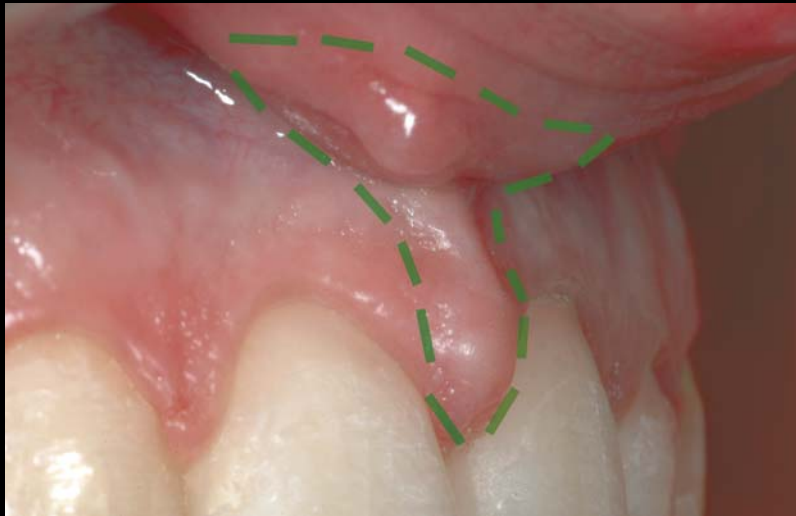


# USING DIGITAL PHOTOGRAPHY TO VISUALIZE, PLAN, AND PREPARE A COMPLEX PORCELAIN VENEER CASE

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*Visualization and a pre-operative plan are critical to efficient and thorough case preparation. Congenitally missing teeth, coupled with improper tooth positioning, can compromise the aesthetic rehabilitation outcome. Utilizing pre-treatment digital photography as an outline for tooth reduction and laser tissue re-contouring may help to create a symmetric and pleasing smile, even under less ideal conditions.*

## Learning Objectives:

This article discusses the use of digital photography as a case-planning tool, the gingival treatment protocol to correct the emergence profile and tissue discrepancies, and the preparations needed to gain acceptable tooth proportions with missing and misshapen teeth. Upon reading this article, the reader should:

- Recognize digital photography as a tool to plan, prepare, and evaluate the cosmetic case.
- Understand preparation guidelines to correct missing and misshapen teeth for conservative porcelain veneers using images as a guideline.
- Understand basic luting protocol for cementation of ten veneers with a photographic follow-up.

*Key Words: digital photography, porcelain veneers, prosthodontics*

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Bonded porcelain veneers have been used successfully for over 20 years to create seemingly ideal smiles despite natural and iatrogenic limitations.<sup>1</sup> Aesthetic dentistry allows clinicians to correct smile deficiencies when teeth are congenitally missing, misaligned, or improperly placed.<sup>2,3</sup> Despite the ability to make dramatic aesthetic improvements, dentists must temper expectations in light of previous dental treatment, congenital limitations, or patient experience.

Visualization is the key for success in any case. Photographic evaluation, along with clinical examination, laboratory mock-up, and practitioner experience, form the basis for tissue preparation and smile restoration. These are all important when selecting preparation techniques and materials for an optimal aesthetic outcome.

Photography can be a useful adjunct to case planning. When used in conjunction with laboratory waxups, digital previews, and direct mock-ups, predictable tooth preparation can be achieved (Table). Anatomical and functional challenges must be incorporated into a thorough treatment plan with consideration for soft tissue position, preparation design, and idealized tooth positioning for excellent long-term results.<sup>4,5</sup>

### Table

#### ***Applying Photography During Aesthetic Restoration Using Porcelain Veneers***

Photography can be used for a variety of purposes during aesthetic rehabilitation using porcelain veneers, including:

- Preoperative marketing, documentation, and evaluation;
- Formulation of a tissue-reduction blueprint and guide;
- Maintenance of a reference during tooth preparation;
- Laboratory communication to transfer treatment goals and information on the teeth's preoperative appearance and preparation design;
- Postoperative technique and material evaluation, marketing, and documentation.



**Figure 1. A lateral photograph was captured to allow evaluation of the tooth proportions and smile heights. Tooth #6(13) had been moved mesially to fill the space where tooth #7(12) was missing.**

### **Treatment of Congenitally Missing Lateral Incisors**

When lateral incisors are congenitally missing, many factors must be considered to allow the clinician to decide if the incisors should be brought into a lateral position or if the spaces should be widened to facilitate implant placement or restoration using a fixed partial denture (FPD).<sup>6</sup> The patient's overall aesthetic desires, existing occlusion, and practitioner limitations are some of the many factors that must be addressed when finalizing treatment goals.<sup>7</sup>

Transforming canines into lateral incisors can be an aesthetic challenge because the hard tissue architecture of the canine eminence, the darker natural color, the increase in buccolingual and mesiodistal dimensions, and soft tissue shapes are often inconsistent with laterals. For these, and other reasons, it is more common to create spaces for aesthetic bridge or implant placement.<sup>8</sup>

### **Case Presentation**

A 25-year-old female patient presented for cosmetic consultation with only 2 weeks remaining for her preexisting orthodontic treatment. The patient desired tooth whitening, improved proportions, and removal of the excess tissue display evident during smile. The initial treatment plan included moving tooth #6(13) distally to its normal location, followed by composite buildup of tooth #10(22) to hold a more normal size and position in the arch, and movement of teeth #9(21) and #10 to the



**Figure 2. Redundant tissue was evident on the maxillary lip and excessive gingival display was evident. The small size of the lateral incisor was also noted.**

patient's left to correct the midline and cant. This treatment would then be followed by placement of an implant-retained or FPD restoration for tooth #7(12), with veneers on the remaining incisors to correct proportions.

### ***Pre-treatment Photography, Analysis, and Preparation Guide***

Once orthodontic therapy was completed, a full series of images was taken with a digital SLR camera, a 105-mm macro lens, and a ring flash (ie, Nikon D70s, Nikkor 105mm macro lens, Nikon SB29s Speedlight) in "A" aperture priority mode with varying aperture settings (f/stop). Prior to the restorative appointment, the images were loaded on a computer, analyzed, and a written preparation plan was created.

A full-facial image was captured with the patient in a natural smile to allow the clinician to clearly identify the incorrect midline and canted central incisors. Notes were made on the images to move the midline 2 mm to the patient's left; the need for cant correction was also observed. Lateral smile views were subsequently captured to clearly communicate the number of teeth that were evidenced during natural smile. This photographic evaluation allowed the clinician to observe the darker, wider, and more prominent position of the canine as compared to a typical lateral incisor. The patient's excessive gingival display was also evident in the premolar region, and redundant lip tissues were all evident from the right perspective (Figure 1). The left side showed a narrow tooth #10 with a mesial space (Figure 2).

Intraoral images were taken in full occlusion and showing both arches slightly opened (f/32). The aforementioned smile deficiencies were marked, along with the areas that required tissue reduction to correct them. The desired midline and cant were noted on the photos, as well as the proposed distal of the laterals (this case in blue). Ideal tooth proportions and a symmetrical smile design with central dominance and a height-to-width ratio of about 75% were used as a basis for smile enhancements.<sup>9</sup>

The central incisors were measured and approximately 70% of their width was estimated for the lateral incisors, as measured from the proposed midline. The photographs were marked in blue to function as a reference during tooth preparation and to provide the technician room to correct the existing deficiencies.

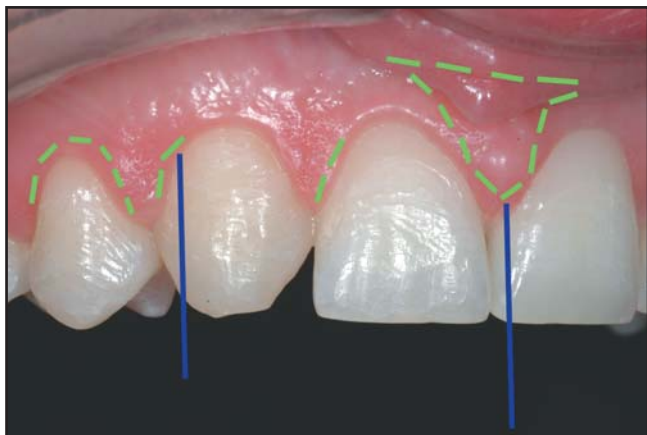
The distal aspect of the desired lateral was also marked in blue on magnified images using similar measurements at f/45 according to the aforementioned protocol (Figure 3). Frenum reduction, emergence profile changes, and gingival crown lengthening were marked with green. On the left side, the mesial aspects of teeth #9, #11(23), and #12(24) required reduction to compensate for the midline shift in this direction (Figure 4). The extent of tissue removal to correct the heavy frenum and redundant lip were evaluated, and a plan was made for their removal (Figure 5).

### ***Soft Tissue Reduction With Photographic Guidance***

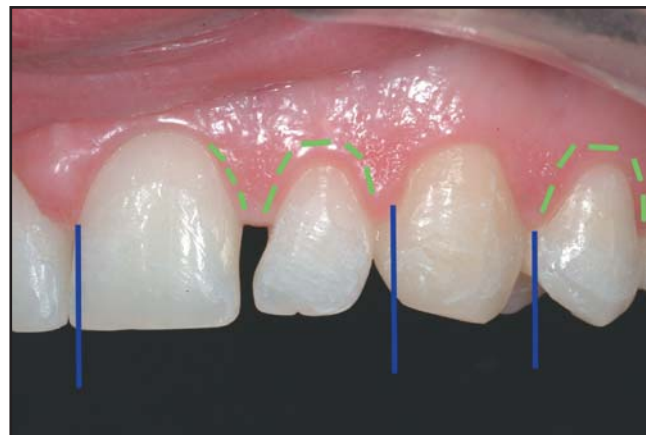
At the preparation appointment, printed versions of the marked images were placed on the countertop and the digital images were displayed on the operatory monitor for easy reference. These images were reviewed prior to tooth preparation so visualization of the case could be made and referred to throughout preparation.

A direct composite mock-up was fabricated prior to anesthesia delivery so that incisal edge position, phonetics, and aesthetics could be evaluated. Photographs were taken to capture the indicated changes, and an impression was made for laboratory consultation.<sup>10</sup>

A diode laser (ie, Odyssey, Ivoclar Vivadent, Amherst, NY) was applied at a low power setting to ensure predictable control and to eliminate unexpected tissue healing.<sup>11</sup> The frenectomy was completed and care was taken to remain approximately 4 mm from the



**Figure 3.** The markings provided a framework in which tooth reduction and gingival modifications would be performed. Print and computerized versions of these images were viewed in the operatory during treatment.



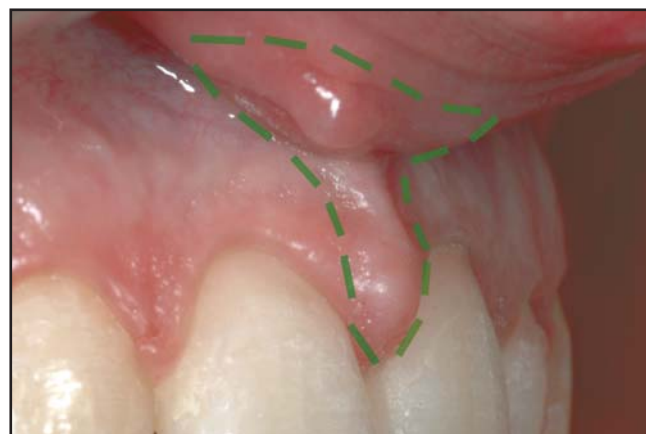
**Figure 4.** The required tissue modifications were marked on the photograph of the lateral aspect to create natural-looking emergence profiles. The blue lines represented the desired tooth positions with the necessary midline shift.

dry-wet line during removal of the redundant lip tissue. Crown lengthening and emergence profile corrections were completed using the treatment planning photos as a guideline on the right side (Figure 6). On the left side, crown lengthening was performed on the premolars and minor amounts of soft tissue were removed from the lateral to broaden the emergence profile and to match the proposed width increase (Figure 7).

### **Tooth Preparation**

Using the photographs as guides, minimal tooth reduction (between 0.3 mm and 0.5 mm) was performed with a finishing diamond. The teeth were reduced in an ideal form and the incisal edges were reduced approximately 0.5 mm and beveled towards the facial aspect to facilitate development of incisal characterization and a definitive stop when seating the veneers (Figure 8).<sup>12</sup> The margins were slightly subgingival with a subtle rounded chamfer.

Intraoral measurements were combined with the marked photos to guide interproximal reduction. Calipers were used to measure the central incisors, reduced to approximately 70% of that measurement, and then locked at that position. These devices were then used to measure the mesial reduction of tooth #11 until sufficient reduction was performed for the lateral incisor (Figure 9). The locked calipers were then moved to tooth #6 where the tooth was prepared in excess of 1 mm to accommodate ceramic thickness.<sup>13</sup>



**Figure 5.** The excessive frenum and lip tissues were marked for recontouring.



**Figure 6.** A diode laser was used at a low setting (1.5 watts) to remove the excess tissues. The diagnostic photographs were used as the blueprint to measure the necessary tissue changes while maintaining biologic principles.





**Figure 7.** The gingival tissues were recontoured by following the marked photographs; modifications were limited by the patient's biologic width. Tissue charring was cleaned with hydrogen peroxide on a microbrush.



**Figure 8.** A minimally invasive preparation design was created using a finishing diamond. Margins were taken just below the modified tissue heights.



**Figure 9.** Calipers were set and locked at a 70% width of the central incisors, and mesial reduction of the mesial aspect of tooth #11(23) facilitated development of sufficient space for the lateral incisor.



**Figure 10.** Occlusal view demonstrates the required narrowing of the transformed canine on the distal and facial aspects. The canine adjacent to the small lateral incisor was reduced on the mesial aspect to provide the lateral space required and to shift the midline.

The preparations were photographed and evaluated. Slight preparation enhancements were then made. The facial aspect of the canine was leveled considerably to ensure reduced thickness on the lateral incisor (Figure 10).

A retraction paste (ie, ExpaSyl, Kerr, Orange, CA) was injected along the gingival margins, allowed to sit for five minutes, and then rinsed (Figure 11). Two polyvinylsiloxane impressions were fabricated with a bite registration using midline- and occlusal-plane guide sticks. The provisional restorations were subsequently constructed.

#### **Laboratory Communication**

The impressions, models, and bite registration were sent to the laboratory with the photos obtained prior to and during treatment. Pre- and post-gingival recontouring, bite registration, and preoperative photographs were used to ensure accurate communication to the laboratory.<sup>14</sup> The images included shade tabs adjacent to the preparations to demonstrate the underlying tooth color that required coverage.

Hand-stacked feldspathic porcelain (ie, Noritake, Henry Schein, Melville, NY) with moderate translucency was chosen as the restorative material because of its ability to be fabricated with only 0.3 mm to 0.4 mm of thickness while maintaining strength, beauty, and fit.<sup>15,16</sup> These veneers were selected because of their excellent fit and the minimal amount of tooth preparation required, particularly because of the patient's young age.<sup>17</sup>

### **Restoration Delivery**

At two weeks, the patient reported only minor discomfort following the initial procedure and slight sensitivity to cold during the provisionalization phase. The temporary restorations were removed with hemostats and scalers, without the need for anesthesia. A retraction cord was placed in several places to control tissue leakage.

The restorations were tried in, removed, cleaned with 38% phosphoric acid, silanated, a bonding agent was applied, and the material was air thinned. The teeth were isolated with retractors (ie, See-More, Discus, Culver City, CA), and the central incisors etched for 15 seconds with 38% phosphoric acid. Several coats of a dentin bonding agent (ie, Cabrio, Discus, Culver City, CA) were applied and then air thinned. The central veneers were placed first with a self-cure luting cement (ie, Insure Yellow Red Light, Cosmedent, Chicago, IL), cured, and cleaned up. The remaining teeth were luted into place, working posteriorly from the centrals (Figure 12).

The tissues were healing well with slight redness and inflammation after five days (Figure 13). Residual cement between #9 and #10 and in various areas was removed. At three weeks post-cementation, the tissues healed very well and final incisal shaping and lingual polishing was done with rubber polishers (Figures 14 and 15). A full series of images was repeated with the same poses and camera settings used in the preoperative images.

A final full series of images was repeated at 18 months for case evaluation and documentation. There were improved tooth proportions, good gingival health, and a more pleasing overall smile. On the left side, the spaces were closed and redundant lip tissue was more pleasing with natural tooth proportions (Figure 16). The tissues at this time had accepted treatment very well with very little inflammation.

The full-facial smile showed better tooth symmetry with a correctly placed midline and cant of the central incisors. It is much easier for the patient to give a full, natural smile after completion of the enhancements, and with patient consent, she can be a great marketing tool, using the pre- and post-operative images.

### **Conclusion**

Despite the limitations of a missing tooth and questionable orthodontic position, the result was cosmetically



**Figure 11.** A hemostatic agent and retraction putty were placed and rinsed after 5 minutes, followed by impression capture using a polyvinylsiloxane material.



**Figure 12.** The definitive lateral and canine veneers were tried in, cleaned, and cemented prior to removal of excess cement and following placement of the centrals.



**Figure 13.** Adjustments were made five days post-cementation. Healing was progressing normally and the patient experienced no postoperative discomfort.



**Figure 14.** Postoperative lateral view three weeks following cementation. Note the appearance of the healed gingival tissues and improved aesthetics despite the apical gingival margin location of the original canine.



**Figure 15.** The central, lateral, and canine proportions were acceptable and the gingival recontouring was tolerated well, despite slight inflammation three weeks postoperatively.



**Figure 16.** Analysis of the preoperative photographs allowed the clinician to guide the required tooth reduction so that proper tooth proportions were created along with soft tissue enhancements.

acceptable, and these smile enhancements should last for many years to come (Figure 16). Not all of the compromises in tissue heights were able to be corrected, but most of the treatment goals were met.

The key with this case was visualization, preparation, and communication with the patient and lab regarding expectations, which were all made possible with a thorough plan that featured digital photography evaluation.

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# CONTINUING EDUCATION (CE) EXERCISE No. X



To submit your CE Exercise answers, please use the answer sheet found within the CE Editorial Section of this issue and complete as follows: 1) Identify the article; 2) Place an X in the appropriate box for each question of each exercise; 3) Clip answer sheet from the page and mail it to the CE Department at Montage Media Corporation. For further instructions, please refer to the CE Editorial Section.

The 10 multiple-choice questions for this Continuing Education (CE) exercise are based on the article "Using digital photography to visualize, plan, and prepare a complex porcelain veneer case," by Jack D. Griffin, Jr, DMD, FAGD. This article is on Pages 000-000.

**1. Which of the following is not a critical pre-preparation component for complex veneer case planning?**

- a. Evaluation of photographs.
- b. Thorough clinical examination.
- c. Direct mock up or laboratory waxup.
- d. Even and smooth tooth reduction.

**2. Photography can be used during porcelain veneer cases for the following reasons EXCEPT:**

- a. Case documentation.
- b. A soft and hard tissue reduction blueprint.
- c. To plan gingival reduction to avoid biologic width violation.
- d. As a preoperative communication tool with the laboratory.

**3 Which of the following are factors that must be weighed before reaching a final treatment goal:**

- a. Patient expectations.
- b. Existing occlusion.
- c. Practitioner skill and limitations.
- d. All of the above.

**4. The purpose for the direct composite mock up is all of the following EXCEPT to:**

- a. Check phonetics.
- b. Verify aesthetics.
- c. Analyze the restoration's opacity.
- d. Check the incisal edge position.

**5. The incisal edges were reduced:**

- a. To provide additional strength to the porcelain.
- b. To correct cant in smile and move midline.
- c. To allow the ceramist more opportunity for incisal character and translucency and provide seating stops.
- d. To aid in soft tissue healing and plaque control.

**6. A full series of photographic images was captured before tooth preparation and numbing. They were then:**

- a. Loaded on a computer, analyzed, and used to form a written treatment sequence plan.
- b. Sent to the web site company to download for marketing.
- c. Printed and used for in-office promotion.
- d. Evaluated for decay and periodontal disease.

**7. Transforming premolars into lateral incisors can be challenging for the following reasons EXCEPT:**

- a. The hard tissue contours of the canine eminence.
- b. A lighter tooth color that must be darkened to mimic a incisor.
- c. An increased mesio-distal dimension that must be narrowed.
- d. Soft tissue emergence profiles that are inconsistent with lateral incisors.

**8. At what point in the procedure were photographic images taken?**

- a. Preoperatively.
- b. Following tooth preparation.
- c. Post-cementation.
- d. All of the above.

**9. Photography was used during this case for the following reasons:**

- a. Visualization, temporization, permission.
- b. Visualization, preparation, communication.
- c. Preparation, customization, meditation.
- d. Preparation, cementation, finalization.

**10. Laboratory communication included all of the following EXCEPT:**

- a. Bite registration.
- b. Models.
- c. Photographs.
- d. Periodontal measurements.