

# Clinical Showcase

*Clinical Showcase is a series of pictorial essays that focus on the technical art of clinical dentistry. The section features step-by-step case demonstrations of clinical problems encountered in dental practice. This month's article is by Dr. Michael Racich, a member of the Canadian Academy of Restorative Dentistry and Prosthodontics. If you would like to propose a case or recommend a clinician who could contribute to Clinical Showcase, contact editor-in-chief Dr. John O'Keefe at [jokeefe@cda-adc.ca](mailto:jokeefe@cda-adc.ca).*



## Maxillary Central Incisor All-Ceramic and Porcelain-Fused-to-Metal Crowns

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Every so often, a unique clinical situation arises that offers an excellent teaching opportunity, such as afforded by this case. A 55-year-old patient wanted to replace the aging porcelain-fused-to-metal crowns on his maxillary central incisors for cosmetic reasons, but he had limited funds. We agreed to replace the restorations at cost if he allowed us to use 2 different techniques for investigative purposes. His vital maxillary right central incisor, which had no root discoloration, would receive an all-ceramic crown, and his nonvital maxillary left central incisor, which had severe root discoloration, would receive a porcelain-fused-to-metal crown. To create a further challenge in the restorative process, we chose a ceramic system that was new to us (Finesse, Caulk/Dentsply, Burlington, N.J.).

Figures 1 to 3 show the preoperative state of the patient's incisors. Not only were the crowns of the maxillary central incisors opaque and bulky (nonanatomic), but there was gingival discoloration from the nonvital tooth (Fig. 2). Before the existing restorations were removed, shade was determined with the Vitapan 3-D Master Shade Guide (Vident, Brea, Calif.), which allowed for the assessment of value, chroma and hue (Fig. 4).<sup>1</sup> We selected value from 1 of the 5 shade tab groupings; the value per grouping is similar in black and white and can be easily assessed with digital technology (e.g., FinePix S2 Pro camera, Fuji Photo Film Co., Tokyo, Japan or Adobe Photoshop, Adobe Systems, San Jose, Calif.) (Figs. 5, 6 and 7). We then chose the chroma (middle column/grouping) and then the hue (right column red, left



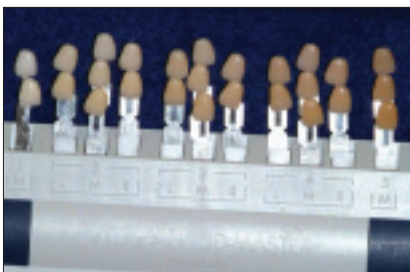
**Figure 1:** Preoperative smile showing colour (value) and shape mismatch of the central incisor restorations.



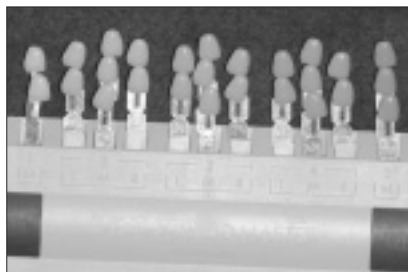
**Figure 2:** Retracted view showing gingival colour difference between the vital right central incisor (tooth 11) and the nonvital left central incisor (tooth 21) treated with cast post and core.



**Figure 3:** Incisal view showing the excessively bulky, nonanatomic restorations.



**Figure 4:** Vitapan 3-D Master Shade Guide.



**Figure 5:** Black and white view of the shade guide shown in Fig. 4; note the groupings or clusters of value ranging from highest (brightest) on the left to lowest (dullest) on the right.



**Figure 6:** The Vitapan 3-D Master Shade Guide has 5 value groupings from which the clinician selects the grouping that is the closest match to the patient's dentition.



**Figure 7:** The successful match is verified by digital conversion to black and white.



**Figure 8:** Tooth 21 after refinement of the preparation with the aid of a custom reduction guide fabricated from a diagnostic cast wax-up. Tooth 11 after removal of the porcelain-fused-to-metal restoration.



**Figure 9:** Completed all-ceramic (tooth 11) and porcelain-fused-to-metal (tooth 21) tooth preparations. Grooves can be placed in ceramo-metal preparations to help augment resistance form and facilitate accurate placement of the restoration during cementation.



**Figure 10:** Completed tooth preparations with reduction guide in place illustrating the greater removal of tooth structure and build-up material associated with the all-ceramic preparation relative to the porcelain-fused-to-metal preparation.



**Figure 11:** The junction of the middle and incisal thirds of a maxillary central incisor should be no greater than 3.5 mm. This provisional restoration required modification.



**Figure 12:** Meticulous technique results in optimally fitting provisional restorations that give both clinician and patient a working template to evaluate the restorative endeavours. In this picture a hybrid composite is being added to the margin of the provisional restoration before cementation.

column yellow) (Fig. 4). All clinical evaluating photographs were then sent to the laboratory. In addition, the patient was evaluated by the ceramist (Dragon Popovic, CDT, Arcade Dental Laboratory, Vancouver, B.C.) at the location where the restorations would be fabricated (i.e., his laboratory). This process ensured optimization of tooth shade and allowed evaluation of the patient's personality in the technician's working environment.

The existing restorations were removed and the teeth reinforced and prepared as indicated (Figs. 8 and 9). Preparation guides were fabricated from diagnostic wax-ups (Figs. 8 and 10).<sup>2</sup> To restore any tooth to proper anatomic form, proper reduction must be provided to create enough room for the definitive restorative materials. For example, the facial-lingual width of a maxillary central incisor at the junction of the middle incisal thirds should be no greater than 3.5 mm (Figs. 10 and 11), otherwise bulky restorations will result (Figs. 3 and 8).<sup>3</sup> Furthermore, sufficient reduction must be provided at the gingival aspects of the preparation. As Figs. 9

and 10 show, all-ceramic restorations require significantly more reduction, especially lingually, than do porcelain-fused-to-metal restorations.<sup>4</sup> It is also possible to place mesial-distal grooves in ceramo-metal restorations to help facilitate retention, resistance form and placement at the time of cementation (Figs. 8 to 10).

Provisionalization is the key to successful restorative dentistry. It allows time for the patient and the practitioner to evaluate all aspects of the treatment provided and it ensures that all treatment objectives are being met.<sup>5</sup> Exquisite, well-crafted provisional restorations increase patient and operator satisfaction and elevate the placebo effect significantly. As a result, the remaining clinical procedures such as impression-taking and cementation become predictable and routine (Fig. 9). Figure 12 shows the addition of hybrid composite (TPH, Caulk/ Dentsply) to the maxillary right provisional restoration (Protemp Garnet, 3M ESPE, St. Paul, Minn.). Note the gingival discoloration of the maxillary left central incisor. To mask out the dark root, axial subgingival



**Figure 13:** Axial trough root preparation.



**Figure 14:** Slot root preparation filled with a high-value opaquer.



**Figure 15:** Addition of characterization tints.



**Figure 16:** Close-up view of the cemented provisional restorations. Compare with the preoperative presentation (Fig. 2) to see improvement in the gingival colour associated with tooth 21.



**Figure 17:** Cemented provisional restorations. Compare with Fig. 1.



**Figure 18:** Mounted master cast with central incisor restorations ready for bisque try-in. The custom anterior-guided table was fabricated from a cast of the acceptable provisional restorations and was used to perfect the lingual and incisal edge anatomy of the definitive restorations.

preparation was performed with a  $\frac{1}{4}$  round bur to create a trough 3–4 mm deep (Fig. 13). White, high-value opaquer was flowed into the trough and cured (Fig. 14). Final additions of hybrid composite and the use of tints (Renamel, Cosmodent Inc., Chicago, Ill.) completed the optimization of the provisional restorations (Figs. 15 to 17).

When the patient returned for final impressions, casts were obtained of the existing acceptable provisional restorations, from which a custom anterior-guided table and the final restorations were fabricated (Fig. 18).<sup>6</sup> Custom anterior-guided tables ensured the precise recording of the anterior determinants of occlusion (especially the envelope of function). The cast of the acceptable diagnostic provisional restorations also gave valuable information to our ceramist about shape, texture, emergence profile and proportions. Soft-tissue casts were also fabricated and provided further clinical details for restorative success (Figs. 19 and 20).

The restorations were cemented with resin cements. The

all-ceramic crown was cemented with Calibra and Prime & Bond NT with self-cure activator (Caulk/Dentsply) and the porcelain-fused-to-metal crown was cemented with Bisco crown and bridge cement (Schaumburg, Ill.) and Clearfil New Bond (Kuraray America, New York, N.Y.). The manufacturers' instructions *must* be followed meticulously such that predictability of cementation for long-term retentive success and comfort is just that — predictable. The completed restorations are shown in Figs. 21 to 23.

A critical examination of Fig. 23 reveals that the maxillary left crown is slightly bulkier than the right. As no extrinsic custom stain was used on these restorations, all colour and effects were layered in. Because the porcelain selected was a higher-value porcelain than was recommended (Fig. 7), the ceramist had to compensate. Furthermore, close inspection of the gingival margin of the left maxillary incisor crown shows a slight greying of the margin (Fig. 22). In hindsight, more opacous cement should have been used.



**Figure 19:** Placing restorations on the soft-tissue cast helps the clinician to evaluate the emergence profile for tissue maintenance and esthetic considerations.



**Figure 20:** Tooth preparations and the soft-tissue cast. Again, compare the differences in reduction dimensions between the 2 styles of anterior tooth preparation.



**Figure 21:** Cemented restorations in place.



**Figure 22:** Close-up view of the cemented definitive restorations. A translucent resin cement was used for tooth 21 and contributed to slight greying of the cervical margin.



**Figure 23:** Incisal view of the cemented restorations. Tooth 21 appears slightly bulkier than tooth 11.

Overall, the patient and all members of the restorative team were satisfied with the final results. The following lessons were learned from this case:

- Assess the colour value preoperatively with black and white photography.
- Proper anatomic restorative form requires anatomic preparations.
- Provisionalization is the key to restorative success.
- A skilled ceramist can work with any system to provide exceptional results. ♦



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## References

1. Marcucci B. A shade selection technique. *J Prosthet Dent* 2003; 89(5):518–21.
2. Magne P, Belser U. Bonded porcelain restorations in the anterior dentition: a biomimetic approach. Chicago: Quintessence; 2002.
3. Rosenstiel SF, Land MF, Fujimoto J. Contemporary fixed prosthodontics. 3rd ed. St. Louis: Mosby; 2001.
4. Goodacre CJ, Campagni WV, Aquilino SA. Tooth preparations for complete crowns: an art form based on scientific principles. *J Prosthet Dent* 2001; 85(4):363–76.
5. Chiche GJ, Pinault A. Esthetics of anterior fixed prosthodontics. Chicago: Quintessence; 1994.
6. Lucia VO. Modern gnathological concepts- updated. Chicago: Quintessence; 1983.