A pictorial essay illustrating the root to crown concept using a single-file preparation system and CAD/CAM technology

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Introduction

Indirect restorations are the restorative method of choice on most endodontically treated teeth which have lost substantial amounts of tooth structure. A core build-up with or without post placement may be required to supplement retention and resistance form. Today, it is hard to envisage the laboratory fabrication of an all-ceramic restoration without the use of any CAD/CAM technology. The introduction of optical intra-oral scanners allows for a complete digital workflow between dentists and laboratory.

A key benefit of digital impressions is that the scanned preparation can be immediately evaluated on the computer monitor, thus permitting any inadequacies to be corrected immediately. Digital acquisition also eliminates numerous manual processing steps in the dental practice: the selection of the impression trays; the mixing of the impression materials; waiting for the impression material to set; and the production of a plaster model, and registering a bite. Fewer treatment and processing steps result in fewer sources of error and a more predictable outcome of the final result.

This pictorial essay illustrates the workflow of a clinical case report of a maxillary premolar that required root canal treatment, core-build up and placement of a new porcelain crown, using the latest materials and techniques.

Case Report

Figure 1a: A 45-year old, female patient presented with discomfort on her maxillary left first premolar that was restored with a lithium disilicate crown.

Figure 1b: After removal of the original crown, extensive decay of the remaining tooth structure was evident.

Figure 1c: The decay was removed and the pulp was exposed.

Figure 2a: A temporary crown was fabricated using Integrity™ Temporary Crown and Bridge Material (Dentsply Sirona) and temporarily cemented.

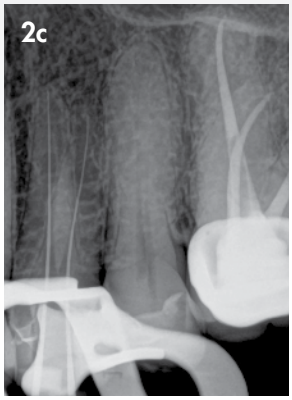
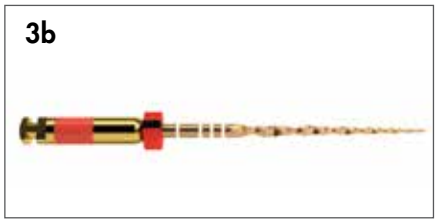


Figure 2b-c: The temporary crown was accessed and an emergency root canal treatment was done. Length determination was determined using a ProPex Pixi™ electronic apex locator (Dentsply Sirona) (Figure 2b) and confirmed radiographically (Figure 2c).



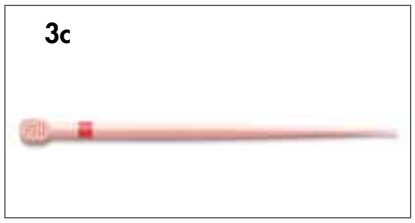


Figure 3a: At a follow-up visit, a micro glide path was prepared with a size 10 K-File in the buccal and palatal root canal systems before the glide paths were expanded with a reciprocating WaveOne® Gold Glider instrument.

Figure 3b-c: Root canal preparation was completed with a Primary WaveOne® Gold file before two Primary WaveOne® Gold Gutta Percha Points (Figure 3c) were used to confirm the cone-fit radiographically. After following a standard irrigation protocol, the two canals were obturated with the Primary WaveOne® Gold Gutta Percha Points, AH Plus® Cement and the Calamus® Dual Obturation System.

Figure 4a-e: A post space was prepared in the palatal root canal, the access cavity and post canal space were cleaned with air abrasion using the bicarbonate soda in the Aqua-abrasion unit (Velopex). The canals and the access cavity were simultaneously etched with 36% phosphoric acid (Dentsply Sirona), before a mixture of Prime&Bond Universal™ Adhesive (Figure 4a) and Self Cure Activator (Figure 4b) were applied according to the manufacturer's instructions. A fiber post (XPost™, no.2) (Figure 4c) was cemented using Core-X™ flow dual-cure core build-up material (Figure 4d), while the same material was used to build-up the core inside the temporary crown. Figure 4e shows a periapaical radiograph of the root canal treatment after obturation and core build-up. The temporary crown was removed and Figure 4f illustrates the clinical result of the core build-up.

Figure 5a: The margins of the crown preparations were improved by using diamond coated ultrasonic tips (Sonic Tip for Crown Prep, Komet1), driven by an ultrasonic scaler before retraction cord was packed for gingival retraction.

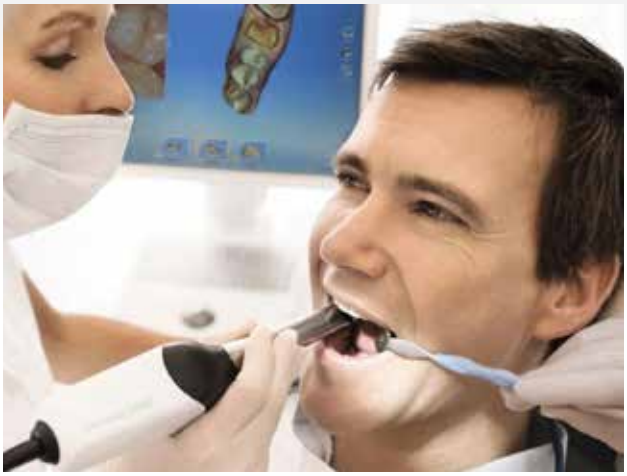


Figure 5b: An optical impression was made using the Omnicam acquisition camera on the Sirona Connect Unit (Dentsply Sirona) of the preparation, antagonist and bite registration. The temporary crown was modified and cemented with a non-eugenol temporary cement.

Figure 6a: Sirona Connect software computed a virtual 3D model and the preparation margin was drawn in using the automatic margin detector before it was electronically submitted to the dental laboratory.

Figure 6b: The biogeneric software created a patient specific restoration, with precise morphology of the restoration.

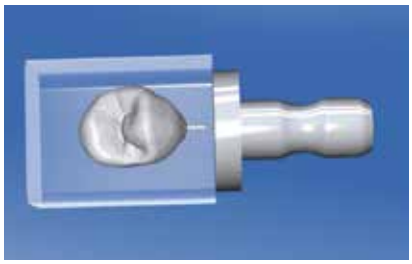


Figure 6c: The dental technician then made corrections to the proximal and occlusal contact points. In the milling preview the position of the restoration within the ceramic block was viewed before the milling unit was activated to initiate the machining process.

Figure 7a: An inLab MC X5 milling and grinding unit (Dentsply Sirona) was used to grind the crown from a shade A2, lithium disilicate block.

Figure 7b: Shows the completed lithium disilicate crown after the crystallisation firing cycle, polishing, staining and glazing in the dental laboratory.

8a

8b

8c

Figure 8a-c: At the cementation appointment, the temporary crown was removed and the tooth preparation cleaned with a slurry of pumice and water to remove any remnants of temporary cement. The internal surface of the crown was etched with 9.5% hydrofluoric acid for 20 seconds, rinsed with water and air-dried. A generous amount of silane coupling agent was applied to the etched internal surface of the crown, left undisturbed for 30 seconds before it was air-dried for 15 seconds. The enamel and dentine of the tooth preparation was etched with 36% phosphoric acid for 15 seconds before it was rinsed with water and lightly air-dried. Prime&Bond Universal™ Adhesive was applied to the etched tooth preparation and the etched and silanated internal surface of the crown before the solvent was evaporated using a light air stream from the 3-in-1 syringe. Shade A2 of Calibra® Ceram Adhesive Resin Cement (Figure 8a) was dispensed into the crown before it was seated onto the tooth preparation. The margins were light-cured for 5 seconds and the excess cement removed before all the exposed margins were light-cured for 20 seconds. The final, highly aesthetic occlusal and buccal view of the bonded crown with good contact points, anatomic contour and excellent marginal adaptation can be seen in figure 8b and figure 8c respectively.

Conclusions

1. The use of the WaveOne® Gold Glider, a single reciprocating glide path instrument to expand the glide path allowed for easy root canal preparation with the reciprocating WaveOne® Gold Primary file.
2. Core build up was achieved by using XPost™ in combination with the Core-X™ flow dual-cure core build-up material. Because the Core-X™ flow dual-cure core build-up material can be used for post cementation and core build up at the same time, it simplifies the procedure and saves valuable clinical time.
3. The Sirona Connect unit with the Bluecam acquisition camera allows clinicians to obtain very accurate digital impressions that can be sent to the laboratory to manufacture and to characterise the final shape and form to obtain a high level of aesthetics.