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Clinical

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Fig. 10. Carbide burs are recommended for the removal of marginal overhangs.

Fig. 11. Final polishing is performed with Airbrush.

Figs 12 and 13. The result is an esthetic posterior restoration without postoperative sensitivity.

This light-curing posterior composite has been specifically developed for the bulk-filling technique. Increments of up to 4 mm thickness can be cured in only 10 seconds at a light intensity of >1,000 mW/cm².

Tetric N-Ceram Bulk Fill contains four different types of fillers: a barium aluminium silicate filler, yttrium trifluoride and mixed oxide. Additionally, a prepolymer filler (a shrinkage stress reliever) has been incorporated which keeps polymerization shrinkage and shrinkage stress to a minimum (Figs 1 and 2). This prevents incorrect colour matching due to dehydration. After the composite is placed, the adhesive has been applied (Fig. 3), the entire restorative procedure is performed with Tetric N-Ceram Bulk Fill. As a consequence, a uniform strength and wear resistance is achieved.

A clinical case

The shade of the composite to be used should always be selected at the start of the appointment, i.e. before the rubber dam is placed. This prevents incorrect colour matching due to dehydration. After the material is placed, the adhesive has been applied (Fig. 3), the entire restorative procedure is performed with Tetric N-Ceram Bulk Fill. As a consequence, a uniform strength and wear resistance is achieved.

Because of the material's natural-looking translucency, the shade of the restored site will blend in with the remaining tooth structure. If stained substructure is visible within the cavity, its many innovative features ensure esthetic treatment to be performed. Carbide burs (Fig. 10) are recommended for the removal of marginal overhangs.

The photoinitator system in Tetric N-Ceram Bulk Fill includes conventional initiators as well as the polymerization booster Ivocerin®. This polymerization booster ensures a reliable depth of cure in the deeper portions of the cavity after a relatively short irradiation time. A special light sensitivity inhibitor has also been included which enables the composite resin to be sensitive to ambient light and thus gives the clinician more time to apply and contour the restoration. Another useful quality of this material is its good polishability, which supports the achievement of a glossy surface, excellent resistance to wear in the contact area and a high flexural strength of 120 MPa. Moreover, Tetric N-Ceram Bulk Fill is highly radiopaque; therefore, the restorative result is easy to examine on dental radiographs.

Anatomical features of the occlusal surface should be taken into consideration during the application of the composite resin to mimic the natural tooth structure. Insensitivities to light is a considerable advantage of Tetric N-Ceram Bulk Fill, as it ensures that sufficient time is available to shape and contour the restoration (Figs 6 to 8).

If the composite resin is carefully placed using suitable instruments, only little time is required for the contouring and finishing of the restoration. Hand instruments such as LM Arte-Eccessa (LM Dental) are recommended for the removal of composite excess. Marginal overhangs can be removed with carbide burs (Fig. 10). Composite finishers are then used to refine the anatomical features. Polishing can be accomplished with ease and in one step using Airbrush® (Fig. 11).

Conclusion

Direct posterior composite resin restorations can be performed in a predictable and efficient way if the appropriate technology and advanced materials are used. As the understanding of the characteristies of new filling materials improves among clinicians, the quality of the direct restorations they fabricate will also increase. Tetric N-Ceram Bulk Fill with its many innovative features enables clinicians to restore posterior teeth in a much more efficient way. Proper attention to technological advances in the field of restorative therapy allows esthetic treatment to be provided that will satisfy not only the patient but also the dentist performing the restorative procedure.

Full list of references is available from the publisher.

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CAD CAM TECHNOLOGY: A REVIEW

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CAD/CAM technology and materials are currently used in a number of clinical applications, including the fabrication of indirect restorations. CAD/CAM gives both the dentist and the laboratory an opportunity to automate fixed restoration fabrication. Both chairside and laboratory-based procedures are available. The properties of these restorative materials and their indications and appropriate use must be understood in order to enable the achievement of predictable and esthetic results for patients.

KEYWORDS: CAD/CAM systems, Intraoral scanner, Digital impression

Introduction

In the past decade, the demand to automate the manual procedures for fabrication of dental restorations has increased. All the existing intraoral scanners now offer the opportunity to avoid traditional impressions and the resulting procedures. Digital systems now offer the opportunity to avoid traditional, analog impressions, including the usual impression materials, time, and handling limitations associated with them. Intraoral scanners have the potential to offer excellent accuracy with a more comfortable experience for the patient and more efficient workflow for the office. But care must be taken to ensure that the whole preparation is scanned, to avoid introducing errors.

Two techniques can be used for CAD/CAM: The chairside technique or the integrated chairside-laboratory procedure.

Fig. 11. Digital impression is obtained with a CAD/CAM system for dental restorations.

This paper reviews the current CAD/CAM technology and materials available in order to provide some guidelines for the clinician to consider the use of CAD/CAM technology and materials in clinical practice. This review is based on the author's experience with CAD/CAM technology and materials.
Chairside CAD-CAM techniques offer advantages to the patient including eliminating the laboratory procedure and the requirement for intra-visit temporary filling material and the prepared tooth structure. It eliminates several cumbersome steps such as selecting trays, preparing and using materials, disinfecting and sending impressions to the laboratory. It also removes a source of discomfort and gagging. Moreover, it enables the clinician to take a digital impression as well as design and fabricate the final digital restoration in-office, and to fabricate ceramic crowns, onlays and veneers. With Chairside CAD-CAM, tooth contours and tooth shade and finally it enhances the accuracy and precision of the final restoration to the preparation.

In summary, with these systems, captured intraoral images are digitally scanned data instead of “stitching” them together from physical impressions.

There are three main sequences to this workflow. The first sequence is to capture or record the intra-oral area to the computer in order to ensure the visit is successful. The second sequence is to capture or record the chairside and laboratory digital model. The overlapping images are collected by the computer software program to process a single 3-D virtual model.

During scanning, the clinician must ensure that all margins of the scanned tooth are recorded to achieve a perfect impression. A true laser scanner/digigrapher takes the virtual scan of the tooth to be scanned and the digitalized scan is then transferred to a computer via a digital connection. The captured images are then transferred to a scanning software program. The sequence is to capture or record the intraoral image. The image is then transferred to the computer and saved.

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Layering ceramic material onto the substructure using a fine brush and powder/liquid. Composite resin blocks are also available for CAD/CAM restorations. Another option is the use of a new resin nano-ceramic block that consists of ceramic clusters within a highly cross-linked resin matrix. The resulting block is homogeneous, and the restoration can be CAD/CAM-milled chairside or in the laboratory.

Discussion

Marginal adaptation is an important factor affecting the longevity of all-ceramic restorations. Considerable research has been invested in the marging fit and internal adaptation of CAD-CAM restorations. Software limitations as well as accuracy of milling devices may affect the fit of CAD/CAM restorations. Most clinicians agree that marginal gap should not be greater than 100 μm. It has been reported in the literature that restorations produced by CAD/CAM systems can have marginal gaps of 50–50 μm which is considered to be within the acceptable range.

Giannopoulos S and Al investigated and compared the marginal integrity of ceramic crowns constructed with the CEREC3 and the EVEREST system employing three different margin angle designs. They explored to what extent these CAD/CAM machines can produce accurate and reliable crowns with all-ceramic restorations creating acceptable margins. They found
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A further benefit found with CAD/CAM restorations has been the reduced incidence of secondary caries (the leading cause of direct restoration failure with both amalgam and composite materials), attributed to the high accuracy of the proximal fit and the ability to ascertain that this is accurate prior to completion of the restoration and cementation.34

Another study evaluated the accuracy of marginal and internal fit between the all-ceramic crowns manufactured by a conventional double-layer computer-aided design/computer-aided manufacturing (CAD/CAM) system and a single-layer system. Ten standardized crowns were fabricated from each of these two systems: conventional double-layer CAD/CAM system (Procera) and a single-layer system (Cerec 3D). Marginal discrepancies of Procera crowns were significantly smaller than those of Procera crowns and Cerec 3D crowns (p<0.05). On internal gaps, Cerec 3D crowns showed significantly larger internal gaps than Procera crowns and crowns (p<0.05). Within the limitations of this study, the single-layer system demonstrated acceptable marginal and internal fit.32

On the other hand, depending on the preparation design, either an adhesive or a non-adhesive luting cement can be used with these materials.

**CAD/CAM restorative materials** can be cemented with either traditional luting cements such as zinc phosphate, poly-carboxylate cement, glass ionomers, or resin-modified glass ionomers. Materials that can be sealed with these include zirconia, lithium disilicate, alumina, and resin nano-ceramics.35

Concerning the resin adhesive cements, they offer superior aesthetics and low viscosity. They chemically bond to the restoration surface and the tooth surface, either providing all of the retention or, for retention preparations, improved retentive strength. They also have greater compressive strength.36

Meanwhile zirconia fixed partial dentures showed good to sufficient marginal integrity in combination with Panavia/ED, Compolute/EBS and RelyX Unicem.37

When evaluating the initial and the artificially aged push-out bond strength (PBS) between ceramic and dentin produced by one of five resin cements, there was a significant effect of resin cement (p<0.0001); RelyX Unicem showed significantly higher PBS than the other cements. Syntac/Vario link II showed significantly higher PBS than SmartCem II (p<0.001). No significant differences were found between SpeedCem, SmartCem II, and icem. The predominant failure mode was adhesive failure of cements at the dentin interface except for RelyX Unicem which in most cases showed cohesive failure in ceramic.38

**Conclusion**

Digital impressions tend to reduce repeat visits and retreatment while increasing treatment effectiveness. Patients will benefit from more comfort and a much more pleasant experience in the dentist’s chair.

The quality of adaptation of CAD/CAM-generated restorations is an area of current interest. Studies demonstrate the clinically acceptable durability of CAD/CAM restorations for color matching, interfacial staining, secondary caries, anatomic contour, marginal adaptation, surface texture, and postoperative sensitivity.39,40,41,42,43

Adhesive cementation seems to be the key for the long-term clinical success of CAD/CAM inlays and onlays.44

**References**


Full list of references is available from the publisher.