achieved by means of the photoinitiator Ivcoter® for example, which is employed by Ivoco Vivadent. Good mechanical properties such as high flexural strength are incorporated. Additionally, a prepolymer filler (a shrinkage stress reliever) has been incorporated which keeps polymerization shrinkage and shrinkage porosity to a minimum (Figs 1 and 2). This prevents incorrect colour matching due to dehydration. After the carious tissue has been removed (Figs 3 and 4) and the adhesive has been applied (Fig. 5), the entire restoration procedure is completed with Tetric N-Ceram Bulk Fill. As a consequence, a uniform shade of the restored site will be obtained (Figs 3 and 4). The shade of the restored site will be in line with the remaining tooth structure. If stained substrate is visible within the cavity, the clinician may opt to place a layer of Tetric® N-Flow Dentin first. This material has a higher opacity and is thus capable of masking the darker colour of the underlining dentin.

Although the incremental technique has been advocated for the reduction of shrinkage stress, the composite resin described above is an ideal option for the restoration of deeper cavities using the bulk-filling technique. The successive build-up technique makes it possible to ensure correct occlusal morphology through the incremental placement of composite. Thin-bladed placement instruments and special brushes are used to sculpt and contour the restored site. The composite is applied in bulk increments to rebuild each anatomical entity of the affected area. Each cuspal portion is reconstructed with one increment of composite resin, imparting to each of the cusps its adequate anatomical form.

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 carious tissue has been removed (Figs 3 and 4) and the adhesive has been applied (Fig. 5), the entire restoration procedure is completed with Tetric N-Ceram Bulk Fill. As a consequence, a uniform shade of the restored site will be obtained (Figs 3 and 4). The shade of the restored site will be in line with the remaining tooth structure. If stained substrate is visible within the cavity, the clinician may opt to place a layer of Tetric® N-Flow Dentin first. This material has a higher opacity and is thus capable of masking the darker colour of the underlining dentin.

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The size and location of the cavities determines the number of increments needed. Relatively small Class I cavities can be filled with a single bulk increment. Medium-sized and large cavities are restored with several increments until the composite is rehult with an increment of maximum 4 mm thickness. Anatomical features of the occlusal surface should be taken into consideration during the application of the composite resin to mimic the natural tooth structure. Insensitivity to light is a considerable advantage of Tetric N-Ceram Bulk Fill in 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-Eccesia (LM Dental) are recommended for the removal of composite excess. Marginal overhangs can be removed using carborundum burs (Fig. 10). Composite finishers are then used to refine the anatomical features. Polishing can be accomplished with ease and in one step using an Airbrush® (Fig. 11). The result is an esthetic posterior restoration without postoperative sensitivity (Figs 12 and 15).

Conclusion
Direct composite resin restorations can be performed in a predictable and efficient way if a number of factors are taken into account. Several new filling materials improve 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.
Chairside machining (CAD-CAM) technology offers advantages to the preparation and fabrication of all-ceramic restoration, manufactured at the chairside in a single visit. Chairside CAD-CAM techniques offer advantages to the patient including eliminating the laboratory procedure and the requirement for intra-Visit temporary and the prepared tooth structure. It eliminates some cumber-some steps of the process by selecting trays, preparing and using materials, disinfecting and sending impressions to the laboratory. It also removes a source of discomfort and anxiety. Moreover, it enables the clinician to take a digital impression as well as design and fabricate the final unit in office, and to fabricate cosmetic crowns, onlays and veneers. With digital imaging, margins and contours and tooth shade and finally it enhances the accuracy of the final restoration to the preparation.

In summary, with these systems, chairside technique: 
1. The clinician may either scan the preparation directly and then send the scan to the laboratory, or can take a traditional impression, after which a stone model is poured and the laboratory prepares the final restoration.
2. The digitalization of the dies was performed by a laser scanner and the digital models were transferred to the CAD program.
3. The overlapping images are “stitched” together by the computer software program to process a single 3-D virtual model.
4. The final sequence requires a computerized milling process.

Chairside CAD/CAM restorations, an esthetic option requiring minimal post-milling esthetic adjustment to minimize chairside time. As an esthetic option requiring minimal post-milling esthetic adjustment to minimize chairside time.

Discussion
Marginal adaptation is an important factor affecting the longevity of all-ceramic restorations. Considerable research has been invested in the margin fit and internal adaptation of CAD/CAM restorations. Soft limitations as well as accuracy of milling devices may affect the fit of CAD/CAM restorations. Most clinicians agreed 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.

Gianottenos S and Ai investigated and compared the marginal integrity of ceramic copings constructed with the CEREC3 and the EVEREST system employing three different margin angles. They explored to what extent these CAD/CAM machines can produce caries-matched margins that ensure creating restorations with acceptable margins. They found

![Fig. 1. Scanning the preparation](Image)

![Fig. 2. Draving the limit line](Image)

![Fig. 3. Designed molar restorations using dental designer software. Occlusal view](Image)

![Fig. 4. Designed molar restorations using dental designer software. Occlusal view](Image)
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that the average Chipping Factor (CF) of the CEREC copings was 2.8% for the 0° bevel angle, 5.5% for the 50° bevel angle and 10% for the 60° bevel angle. For the EVEREST copings the average CF was 0.0% for the 0° bevel angle, 5.2% for the 50° bevel angle and 2.0% for the 60° bevel angle. Univariate Analysis of Variance and multiple comparisons showed that there was a statistically significant difference in the quality of margins between the two systems for the 0° and 60° bevel finishing line.89

Mjör and Al have evaluated CAD/CAM restorations and found that they have a marginal fit as good as or superior to that of traditional impressions. 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 approximal fit and the ability to ascertain that this is accurate prior to completion of the restoration and cementation.90

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 copings 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 copings and crowns (p < 0.05). Within the limitations of this study, the single-layer system demonstrated acceptable marginal and internal fit.91

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.92

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 retentive preparations, improved retentive strength. They also have greater compressive strength.93 Meanwhile zirconia fixed partial dentures showed good to sufficient marginal integrity in combination with Panavia/ED, Compolute/EBS and RelyX Unicem.94

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/Varionlink II showed significantly higher PBS than SmartCem2 (p=0.001). No significant differences were found between SpeedCem, SmartCem2, 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.95

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.96

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.97-99

Adhesive cementation seems to be the key for the long-term clinical success of CAD/CAM Inlays and onlays.100

References


Full list of references is available from the publisher.

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