

DENTAL TECHNIQUE

# Replacement of maxillary incisor crowns over discolored substrates in a single visit with a CAD-CAM system and lithium silicate ceramic



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The use of computer-aided design and computer-aided manufacturing (CAD-CAM) has become popular in many dental offices. Advantages include fewer appointments, elimination of the definitive cast and interim restorations, and improved communication among patient, clinician, and technician.<sup>1</sup> The system is

based on data acquisition by means of scanning, software processing, and fabrication of the restoration.<sup>2,3</sup>

A prosthetic rehabilitation aims to reproduce the functional and optical properties of the natural teeth. Cast post and cores or discolored dental substrates present a major challenge to the optical properties.<sup>4</sup> In general, highly translucent glass-ceramics available for CAD-CAM, such as feldspathic porcelain, leucite-reinforced ceramics, or lithium disilicate, might not be adequate to mask discolored substrates. Ceramics used as frameworks, such as zirconia, alumina, or the opaque versions of lithium disilicate, require significant tooth preparation and an additional laboratory procedure; unlike CAD-CAM systems, they need to be veneered with porcelain to ensure adequate esthetics. Recently, a lithium silicate ceramic reinforced with presintered zirconium dioxide particles has become available for the CAD-CAM system. It is indicated for the fabrication of

## ABSTRACT

Discolored substrates constitute a challenge to the esthetics of the definitive restoration. Because of technique sensitivity, the generally prolonged treatment time is a drawback to both the patient and the dentist. The technique described presents the replacement of ceramic maxillary incisors crowns over discolored substrates in a single visit by using a milling machine. Translucent blocks of a lithium silicate ceramic reinforced with zirconium dioxide particles were used. Intraoral scans of the trial restorations and of the tooth preparations were performed. The crown parameters were defined in the software. Ceramic blocks were milled in the presintered phase and characterized. The crowns were cemented at the end of the appointment with excellent esthetics. (*J Prosthet Dent* 2019;121:22-5)

veneers and anterior and posterior crowns and is characterized by excellent mechanical and esthetic properties. It also has the potential for masking discolored substrates because it contains zirconia particles.<sup>5,6</sup>

The purpose of this dental technique article was to describe the clinical and laboratory protocols for the single-visit provision of CAD-CAM ceramic restorations over discolored substrates.

## TECHNIQUE

1. Observe the appearance of the restoration (Fig. 1). Select the shade with a shade guide (VITA 3D Master; VITA Zahnfabrik) compatible with the material of choice. Analyze the size and shape of the teeth and the gingival appearance. Using a periapical radiograph, determine

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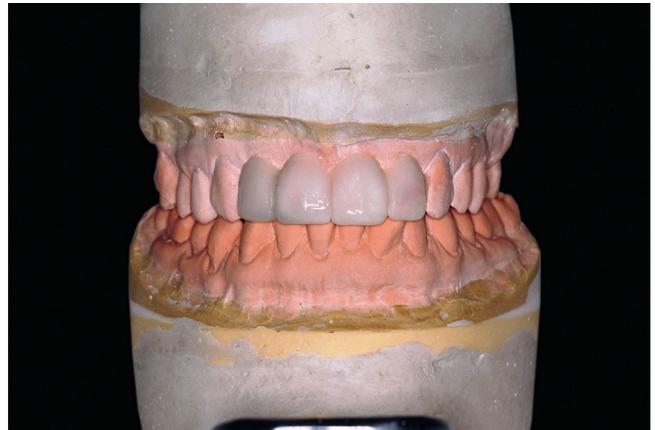
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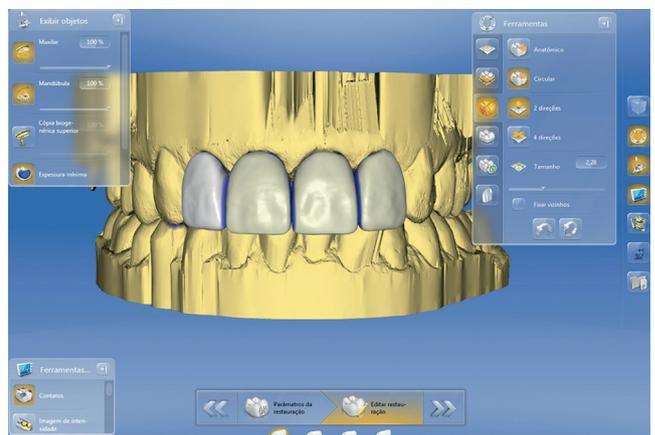
**Figure 1.** Initial view showing compromised esthetics of maxillary incisors caused by anatomical discrepancies, color alteration, gingival recession, and poor marginal adaptation of existing crowns.



**Figure 2.** Diagnostic waxing with articulator mounted preliminary casts.



**Figure 3.** Complete removal of existing central incisor crowns and tooth preparation of lateral incisors. Right maxillary incisor has cast post and core.



**Figure 4.** Definition of crown parameters in 3-dimensional software.

whether existing endodontics and posts are satisfactory.

2. Make maxillary and mandibular impressions with irreversible hydrocolloid (Cavex Color Change; Cavex Holland BV) and an interocclusal record with polyvinyl siloxane (Occlufast CAD; Zhermack). Pour in Type IV dental stone (Durone; Dentsply Sirona) to obtain the diagnostic casts. Mount the diagnostic casts on an articulator (A7 Fix; Bio-Art) and diagnostically wax (Fig. 2).
3. Make an impression of the diagnostic waxing with polyvinyl siloxane (Express; 3M ESPE) and develop trial restorations by filling the impression with bis-acrylic resin (Protemp; 3M ESPE) and seating it intraorally. Observe the esthetic and functional parameters and make corrections, as necessary.
4. Select the restoration type and material in the software (CEREC Premium 4.4.3; Dentsply Sirona). Scan the trial restorations (CEREC Omnicam;

Dentsply Sirona) to obtain the digital cast used as the parameters for the definitive crowns.

5. Remove the existing complete crowns and refine the tooth preparation. If necessary, use composite resin (Filtek Z350; 3M ESPE) to make a foundation restoration (Fig. 3). Use an opaque composite resin to mask the cast post and core. Prepare the other teeth involved in the rehabilitation (lateral incisors). Obtain the shade of each tooth preparation.
6. Perform the gingival displacement with cords (Pro Retract; FGM Dental Products). If necessary, use a hemostatic agent (ViscoStat Clear; Ultradent Products, Inc) to control bleeding. Obtain the digital casts of the maxillary and mandibular arches with the scanner.
7. Correlate the maxillary and mandibular casts and the interocclusal record in the software. Determine crown margins and dimensions (Fig. 4). Ensure 1.2 to 1.5 mm of minimum restoration thickness for crowns and 0.6 to 0.7 mm for veneers according to the manufacturer's instructions (VITA SUPRINITY A1 T block; VITA Zahnfabrik).



**Figure 5.** Completed restorations. Discolored preparations masked.

8. Select the milling machine (inLab MC XL; Dentsply Sirona) and the milling mode. Choose the size of the block and position the restoration into the block in the software (Cerec Premium, 4.4.3; Dentsply Sirona). Install the block in the router and start the milling process.
9. Perform an esthetic and functional intraoral evaluation of the milled crowns to verify the fit and the need for adjustments. Adjust the crowns in the presintered phase with diamond rotary instruments and rubber polishers (EVE Ecoceram; Odontomega). Proceed with the crystallization of the crowns in the ceramic furnace (iPress Intelligence; EDG). Follow the manufacturer's instructions regarding temperature, closing time, firing time, cooling, and vacuum time. Characterize the crowns (VITA AKAZENT; VITA Zahnfabrik) and apply the glaze (VITA AKAZENT; VITA Zahnfabrik).
10. Acid etch the intaglio of the crowns with 10% hydrofluoric acid (Porcelain Etchant; FGM Dental Products) for 20 seconds. Apply silane coupling agent (RelyX Ceramic Primer; 3M ESPE) for 60 seconds. Etch the tooth surfaces with 37% phosphoric acid (Condac 37; FGM Dental Products) for 30 seconds on enamel and 15 seconds on dentin. Remove the etchant by washing thoroughly for 30 seconds. Apply the primer. Remove excess solvent with a gentle air stream for 5 seconds and apply the adhesive (Adper Scotchbond; 3M ESPE). Light polymerize for 20 seconds (Radii-cal; SDI). Lute the crowns with dual-polymerizing luting agent (RelyX ARC; 3M ESPE),<sup>7</sup> light polymerize the margins for 5 seconds, remove excess cement with a #12 scalpel blade, and then light polymerize each surface for 40 seconds (Radii-cal; SDI). Polish the edges with silicone rubber points and evaluate

occlusal contacts. Evaluate the esthetic appearance of the restorations (Fig. 5).

## DISCUSSION

The CAD-CAM system simplifies crown fabrication,<sup>1</sup> avoiding the need for an outside laboratory and reducing the treatment time when compared with conventional techniques. Discolored substrates, such as cast post and cores, increase the difficulty in obtaining adequate esthetics in the definitive restoration.<sup>4</sup> Masking discolored dental structures with traditionally fabricated ceramic crowns is challenging because it will depend on the material thickness and opacity.<sup>4,8</sup>

The lithium silicate ceramics reinforced by zirconium dioxide particles (VITA SUPRINITY; VITA Zahnfabrik) have better mechanical properties than most of the glass-ceramic materials.<sup>9</sup> After crystallization, the incorporated zirconia particles reinforce the ceramic glassy phase.<sup>9</sup> Translucent (T) blocks were used to mask discolored substrates because they have greater opacity than the highly translucent (HT) blocks. Satisfactory esthetic results were achieved with the characterization technique. For this, the minimum thickness of preparation recommended by the manufacturer must be respected (1.2 mm for crowns and 0.6 mm for veneers). However, depending on the degree of the substrate discoloration, a thicker preparation might be necessary. One limitation of the characterization technique in monolithic structures is the impossibility of mimicking the different translucency in various tooth regions, for example, the higher translucency of the incisal edge.

However, despite the benefits provided by CAD-CAM described previously, some limitations are present; for example, the quality of results depends on operator experience, and the cost of the system is high. Also, some systems do not allow dynamic simulation of the occlusion.<sup>9</sup>

## SUMMARY

A technique for fabricating restorations over different substrates in a single visit with a CAD-CAM system was described. Diagnostic waxing facilitated the predictability of the process. The material of choice to mask the substrate was successful and provided good esthetics and patient satisfaction.

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## Noteworthy Abstracts of the Current Literature

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### Antifungal and mechanical properties of tissue conditioner containing plant-derived component: an in vitro study

Naito Y, Yumoto H, Kumar Hs K, Matsuo T, Hirota K, Miyake Y, Nagao K, Tomotake Y, Jimbo R, Ichikawa T

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**Purpose.** To evaluate the antifungal activity and mechanical properties of a novel antifungal tissue conditioner containing *Juncus* powder.

**Material and methods.** *Juncus* powder was mixed with GC tissue conditioner at concentrations of 2.5%, 5.0%, and 10.0% by mass. The cylindrical specimens of *Juncus*-mixed tissue conditioner (dimensions: 10 mm in diameter and 2 and 6 mm in height for antimicrobial and mechanical tests, respectively) were prepared. The specimens placed on the bottom of the 24-well tissue culture plate were cultured with *Candida albicans* CAD1 for 2 and 4 days. The proliferation of the *C. albicans* in the wells was determined by measuring the optical density of fungal culture, and the surface of the specimens were also observed by scanning electron microscopy (SEM). To assess the mechanical properties of the specimens, the fluidity and hardness of *Juncus*-mixed tissue conditioner were measured using the methods certified according to ISO 10139-1.

**Results.** *Juncus*-mixed tissue conditioner significantly exhibited growth inhibitory effect in a *Juncus* concentration-dependent manner after both 2- and 4- day cultures. SEM observation showed that the amount of *C. albicans* on *Juncus*-mixed specimens drastically decreased, and biofilm formation was markedly inhibited. Moreover, both mechanical properties were found to be within the ranges regulated and specified by ISO.

**Conclusions.** These findings demonstrated that the tissue conditioner including *Juncus* powder has a significant growth inhibitory effect against *C. albicans*, and it is suggested that the application of *Juncus*-mixed tissue conditioner may prevent denture stomatitis and oral candidiasis in denture wearers.

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