Digital vs. analogue workflow on ten ceramic veneers in the maxilla

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_Introduction_

Different materials and treatment options are available in aesthetic and restorative dentistry for the anterior region. The conventional protocol, including an analogue impression with polyether or polyvinylsiloxane, a master cast and die fabrication, waxing and pressing of ceramic materials, requires exceptional skills and is technique-sensitive. Intraoral scanning and digital impression taking provide an accurate alternative method for transferring information from the mouth to the dental laboratory. The digital file is always on the computer and can be immediately processed or at any time, unlike with the conventional procedure.

Regarding materials, various newer products, such as pressed or milled ceramics, offer enhanced strength and functionality; however, in thinner dimensions, they lack the inherent aesthetic beauty of conventional materials such as feldspathic porcelain. As patient demand for better aesthetics has increased in recent years so too has the need for restorative materials that closely mimic the patient’s natural dentition. Initially used for the creation of porcelain dentures, feldspathic porcelain has emerged as the premier aesthetic material for custom veneer restorations. In recent years, the use of hand-layered powder/liquid feldspathic porcelain has been revived based on its highly aesthetic values and little to no preparation requirements. By keeping preparation to a minimum, less tooth structure is removed and procedures are much less invasive, which is exactly what patients desire.
In contrast, the conventional methods of ceramic fabrication have been described as time-consuming, technique-sensitive and unpredictable owing to the many variables, and thus CAD/CAM may be a good alternative for both dentists and laboratories. CAD/CAM may also reduce the fabrication time of high-strength ceramics by up to 90 per cent. Furthermore, industrially fabricated blocks are more homogenous, with minimal flaws, and CAD/CAM restorations have been found to compare favourably with other restorative options.

As far as optical properties and CAD/CAM are concerned, the fact of complex optical illusion phenomena in anterior aesthetics cannot always be met with monochromatic aesthetic materials without the need for final characterisation by a dental technician. In order to overcome such aesthetic disadvantages of a monochromatic restoration, multichromatic ceramic blocks have been developed to create a 3-D layered structure. These ceramic blocks offer a gradient of chroma from the cervical to the incisal areas that replicate dentine and enamel in the same block. The aim of this case report is to compare the analogue versus the digital workflow on ten ceramic veneers in the maxilla, in terms of aesthetic outcome, length of procedures and technical sensitivity for both the dentist and the dental technician.

Fig. 15a_Feldspathic veneers with try-in paste.
Fig. 15b_CAD/CAM veneers with try-in paste.
Fig. 15c_First quadrant feldspathic veneers and second quadrant CAD/CAM veneers simultaneously with try-in paste.

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Fig. 8a_Mock-up silicone index.
Fig. 8b_Intraoral photograph of the mock-up.
Fig. 9a_Preparation through the mock-up.
Fig. 9b_Check of the preparation depth, with the use of the silicone guide, palatal aspect.
Fig. 9c_Final preparation of the teeth.
Fig. 10_Analogue impression with polyvinylsiloxane.
Fig. 11_Digital impression with TRIOS.
Fig. 12a_Digital planning of the provisional restorations.
Fig. 12b_Provisional restorations intraorally (Telio CAD).
Fig. 13_Analogue workflow (refractory dies, built-up veneers, adjustments, staining/glazing).
Fig. 14_Digital workflow (3-D printed model, CAD/CAM veneers, adjustments, staining/glazing).
**Case report**

A 35-year-old patient presented at the office with the chief desire that the aesthetics in the anterior region be changed (Fig. 1). A diagnostic wax-up was performed, followed by mock-up fabrication, in order to obtain a preliminary visualisation of the final outcome. Orthodontic treatment was proposed in order to align the teeth in a more favourable position for veneers requiring minimal preparation and to reduce the overbite. One year after treatment, the patient returned for the final prosthetic rehabilitation (Figs. 2a, 2b).

**Methods and materials**

Digital smile design according to Coachman and Calamita^9^ was performed, from which a treatment plan of crown lengthening and veneers on teeth #15–25 (Fig. 3) was proposed. A conventional diagnostic wax-up was also produced (Fig. 4). Both digital and conventional mockups were applied, and agreement was attained concerning tooth shapes and proportions. Crown lengthening was performed, guided by the digital mock-up, with the use of an acrylic transparent double crown lengthening guide that indicated the borders of the gingivectomy and alveolectomy needed in periodontal surgery for aesthetic rehabilitation (Figs. 5, 6)^10^.

After six months of tissue stabilisation (Fig. 7), a mock-up was produced with Telio CS C&B (Ivoclar Vivadent) chairside (Figs. 8a, 8b), and tooth preparations with silicone guides were performed (Figs. 9a–9c). Both conventional impressions with polyvinylsiloxane (Fig. 10) and digital impressions (TRIOS, 3Shape) were taken (Fig. 11). Provisionalisation was executed digitally, using Telio CAD (Ivoclar Vivadent) in the Wieland Select CNC milling machine. The design was performed with the 3Shape DentalDesigner 2015 software (Figs. 12a, 12b). Two sets of final restorations were fabricated. The set of feldspathic veneers was fabricated on a stone model using IPS Style (Ivoclar Vivadent), while IPS Empress CAD Multi (Ivoclar Vivadent) was used for the digital set (Figs. 13, 14). Both sets were examined intraorally with a try-in paste to compare the optical properties of the feldspathic and the CAD/CAM veneers (Figs. 15a–15c).

The subjective decision of the clinician and the patient was to cement the feldspathic veneers, owing to slight differences in the length of the central incisors between the two sets. Adhesive procedures followed (Figs. 16a–16f), and...
final intraoral and extraoral photographs were captured one week later (Figs. 17a-17e).

Results
Intraoral digital scanning is a perfect alternative clinical procedure compared with the conventional impression technique. The digital planning and mock-up procedure is a powerful communication tool for the dentist, although special skills in using computer software are required. Regarding the laboratory workflow, most of the analogue procedures require more time (refractory dies, built-up veneers, adjustments), except the staining/glazing (Figs. 18a, 18b). Although the aesthetic outcome of the feldspathic veneers was subjectively chosen in this case, the analogue workflow is much more demanding. The digital approach, because of the reduced difficulty, speed, complexity and patient discomfort, tends to be preferable (Figs. 18a, 18b).

Conclusion
Knowledge and application of virtual smile design procedures, coupled with innovative dental laboratory technologies, allow dentists to diagnose, plan, create and deliver aesthetically pleasing new dental compositions. Furthermore, advances in CAD/CAM technology have catalysed the development of aesthetic veneer restorations with industrially produced materials possessing superior biomechanical properties and good aesthetics.

Bibliography is available from the publisher.
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