

By David Avery, AS, CDT, TE

Indirect Digital Workflow for Fixed Prosthodontics: A More Cost-Effective Approach

The adaptation of digital technologies in dentistry has been quickly embraced by the laboratory segment; fueled by the need to maximize labor efficiency in a shrinking labor pool of qualified technicians.

A digital model may be designed and printed or milled as a tool for complex cases or any veneered restoration.

The clinical community however, has not been as receptive. A number of factors contribute to this slow adaptation of superior technology. Chief among them is cost followed by resistance to change from what has been familiar and successful for many years with seasoned professionals. Or, as the saying goes, if it isn't broken.....

It is well-documented that the internal adaptation of fixed restorations is superior when a digital workflow is utilized. The reduction of material transfers associated with gypsum casts developed from impressions and hand-developed wax patterns cast or pressed into copings and crowns leads to more consistently fitting restorations.

Intra-oral scanning technology is not the only pathway to digital incorporation. A less expensive alternative is impression scanning. This approach allows the clinician to continue with a clinical technique that is familiar and predictable for them. The in-office scanning of the impression and

occlusal record is possible at a significant reduction in technology cost, as much as 75 percent less when compared to chairside direct scanning.

The additional benefit of time savings due to immediate "delivery" of the STL file to the laboratory versus conventional case transport reduces the average turnaround time by one to three days. This is significant in this era of immediate gratification that patients demand and results in an improvement in customer service at all levels.

Upon receipt of the file in the laboratory the technician has the opportunity to manage the case as needed. A digital model may be designed and printed or milled as a tool for complex cases or any veneered restoration.

In the case of simple monolithic restorations, ie., full contour zirconia, lithium disilicate, lithium silicate or milled alloy, the STL design data is sent to the appropriate in-house or sub-contract fabrication technology for processing.

Case study

For this study, we developed two restorations for a blind clinical comparison.

One crown was developed directly from The Cara Scan 4.0i impression capture through the laboratory digital process to completion.

A second restoration was fabricated by pouring the original analogue impression that was scanned in gypsum. The resulting model was scanned for production of a digital restoration following the exact technique for both restorations.

The same technicians performed the steps for both cases in tandem to provide the greatest possible consistency in the clinical results.

Our patient presented in need of a restoration of #18.

The tooth was prepared for a monolithic milled zirconia crown. The clinician utilized the Fast and Scan impression material from Kulzer. It includes a titanium oxide component allowing optimized scan properties for the highest accuracy available. This was enhanced by the elimination of powder improving accuracy at the interface level. Kulzer's scannable impression material supports CAD/CAM manufacturing of prosthetic restorations and offers optimal workflow integration with dentists and laboratories. Impressions scanned directly without the need for powder provided greater accuracy and improved efficiency than a model scan.

The impression was scanned by a staff member with the cara Scan 4.0i impression scanner from Kulzer Dental. This option represented an improved work flow for the staff compared to packaging the case materials for pick up. The completed STL file was sent to the laboratory with a digital prescription for case fabrication (Fig. 1).

The cara Scan impression scanner is a low-cost scanner that allowed the laboratory to boost customer loyalty. The cara Scan 4.0i scanning solution was designed to be the easiest way for clinicians to transition to digital dentistry and create an automated workflow. With its touchscreen semi-automatic operation, anyone on the dental team is able to digitize traditional impressions. The unit is self-contained with a touch screen integrated into the scanner, with no keyboard, monitor or mouse needed.

Laboratory Procedures

The laboratory downloaded the STL file for design of the printed model. The design was sent to the cara Print 4.0i for fabrication of the model (Fig. 2).

The crown design was uploaded to the CAM software and milling machine for fabrication of the full contour zirconia restoration (Figs. 3 - 4).



1

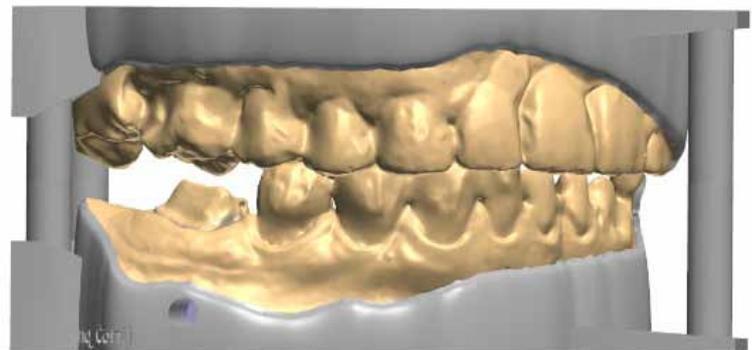
Figure 1
cara Scan 4.0i

Figure 2
Model design from
doctor's impression
scan STL

Figure 3
Crown with Model

Figure 4
Model-less crown

2



3



4

After milling, the “green” restorations were pre-stained for optimal esthetic results. Upon successful sintering, the restorations were refined with rotary instruments and stained to the final desired shade.

To ensure an impartial “blind” clinical evaluation, the two restorations were placed in separate crown boxes labeled A and B (Figs. 5 - 6).

Clinical Delivery

The clinician tried in the two restorations. The results illustrated the technical superiority of the digital workflow compared to the analogue working cast approach. This improved result is directly attributed to the elimination of the gypsum transfer of materials associated with the dental stone cast fabrication step.

Clinician Notes

“Crown “A” (Scanned impression) went better than crown “B” with this case as well as the other four,

and exhibited good margins which were closed and being in good contour with the prep edge. Contacts needed slight adjustment and the occlusion was very close and only required very slight adjustment to have the patient happy with results. All in all, I was impressed by the general fit and occlusion from doing full digital and see it as an improved alternative to analog processing” (Figs. 7 - 8).

Conclusion

A great deal of emphasis in the manufacturing community is focused on digital workflow. This is driving the rapid transition from conventional analogue hand fabrication of indirect dental restorations to the improved clinical results exhibited in this discussion.

As we have historically witnessed firsthand, technology improvements and cost reductions occur through the dedicated involvement of the technical community. Increased adaptation of technology will occur as a result of consistently bringing improved results to our patients. **JDT**

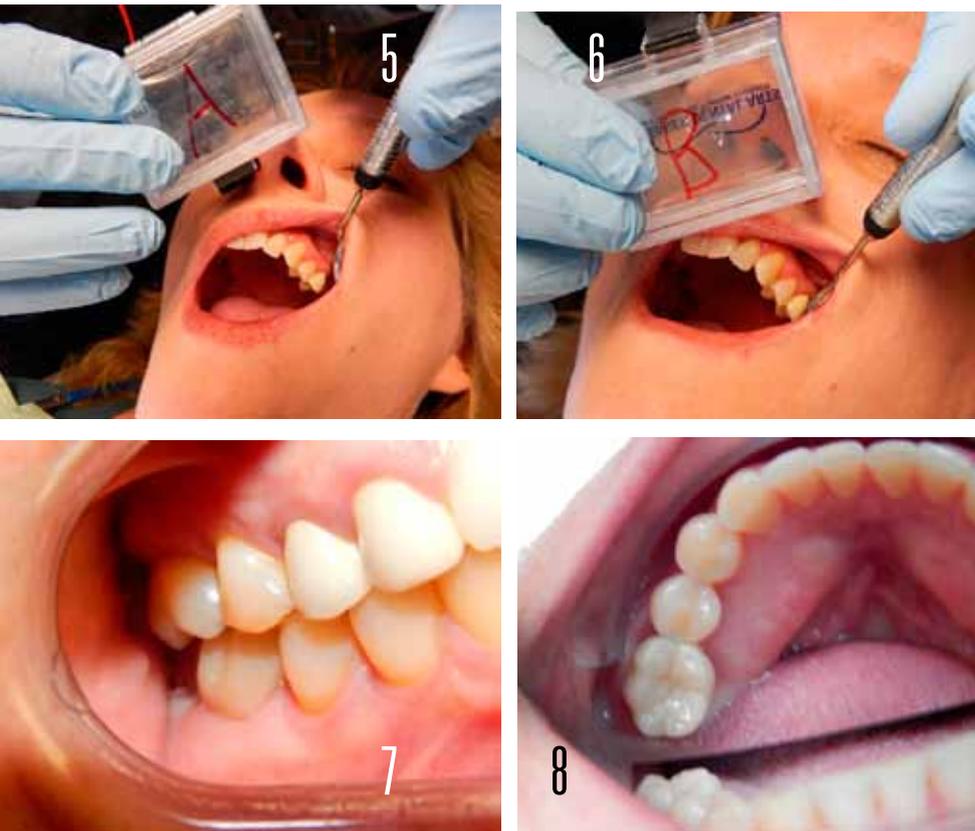
About the Author

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Figures 5 - 6
A and B Crowns in boxes

Figures 7 - 8
Crown A at delivery



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