

By Dr. Andrew Ip

Same-Day 3D Printed Restorations

Taking Chairside 3D Printing to the Next Level

The advancement in hardware, software and material science has now meant that same-day and even same-day chairside 3D printing of dental prostheses is now a predictable reality. What may have taken hours in the past can now be achieved within an hour. As a result, 3D printed restorations have become an increasingly popular restorative option in many situations.



Figure 1:
Pre-operative situation with failing amalgam restorations present

Where 3D printing shines is the production of multiple items simultaneously. With hardware accessories like crown kits, print times can be reduced substantially, allowing for efficient restorative treatment of quadrants in the one appointment. As a result, technology ultimately not only improves the patient's experience as there is no need for a subsequent appointment but also the operator's experience as he or she no longer needs to handle direct restorative matrices in vivo and the anatomy and interproximal contacts of each restoration are produced accurately and precisely using CAD-CAM methodology.

In this case report, we will share how CAD software and 3D printing can predictably produce several restorations for a patient within a single appointment.

Pre-op:

A 35-year-old female attended our practice having not seen a dentist for several years (**Fig. 1**). She was medically fit and healthy but admitted she had not seen a dentist due to needing to look after

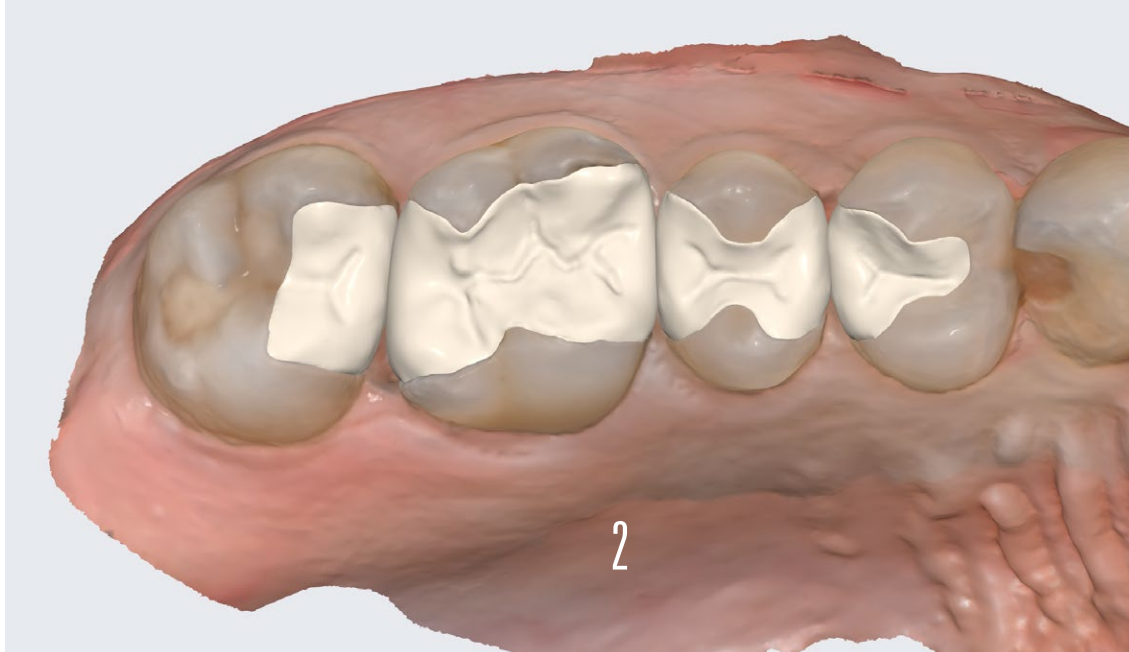


Figure 2:
Chairside design of 3D printed
restorations using Medit
ClinicCAD

her young children. She reported generalized short-lasting cold sensitivity and upon clinical examination, she exhibited several aging amalgam restorations placed in her home country many years ago in her upper right quadrant that were due to be replaced.

More specifically, she had failing amalgam restorations on the mesial-occlusal surfaces of the #17, the mesial-occlusal-distal surfaces of the #16 and #15, and distal-occlusal surfaces of the #14. Due to her time constraints, she wished that all these restorations be replaced at the same appointment.

Treatment plan:

The patient was reappointed to have all four amalgam restorations replaced with indirect 3D printed restorations in the one appointment where the site would be initially anesthetized, the existing failing restorative work removed, followed by an intraoral scan (Medit i700) of the site and chairside design of the restorations. The indirect restorations would be subsequently 3D printed (Bego TriniQ on the Asiga Max 2), manually washed and cured prior to minor characterization (Rodin Palette and N2-Free Glaze), and then definitive cementation (Panavia V5).

Day of procedure:

The patient was sufficiently anesthetized and the amalgam restorations on #17-#14 were removed uneventfully. Following cavity preparation and intraoral scanning, the Medit ClinicCAD application was used to design her restorations chairside. Deliberate use of the sculpting tools was employed to over-emphasize the occlusal anatomy of each restoration. This allowed for easier characterization with staining material (**Fig. 2**).

The restorations were printed on the Asiga Max 2 using the Crown Kit out of Bego TriniQ (shade A3) resin at 100µm layers as this material has been indicated and cleared to produce single-unit indirect restorations (**Fig. 3**). The printing process took around 15 minutes (**Fig. 4**). The restorations were nested with the occlusal surface oriented toward the build plate as this has shown to produce the most accurate result.¹



Figure 3: Asiga Crown Kit



Figure 4: Freshly printed restorations



Figure 5:
Final result with all 3D printed restorations cemented

The printed restorations were manually cleaned with pre-soaked IPA wipes. It is important not to immerse printed hybrid-ceramic material in alcohol as it has been shown to affect bond strength to dental cements when there is exposure for longer than ten minutes.² Characterization was achieved with Voco FinalTouch composite stains, and the restorations were glazed with Rodin N2-Free Glaze prior to final cure. The printed restorations were cured

in an Ackuretta Curie Plus as per the manufacturer's instructions and recommendations. It is important to follow the manufacturer's instructions as failure to do so may affect not just the physical properties of the restoration, but also the biocompatibility.³

The fitting surfaces of the restorations were sandblasted, and they were cemented individually using Panavia V5 resin cement. It is important to bond these restorations, and the application of bonding agents can increase the shear bond strength of 3D printed restorations to resin cements and their underlying substrates.⁴ Following bonding, the occlusion was checked and adjusted as required (Fig. 5).

Conclusion:

It is known that 3D printed restorations are accurate enough to be clinically acceptable for use.^{5,6} The use of 3D printed ceramic-reinforced composites as definitive restorations, however, continues to be a controversial topic due to issues of wear resistance and surface roughness in the first generation of these materials.⁷ There appears to be some merit in their application in partial coverage situations, particularly with advancements in material science. Where 3D printing truly shines is the production of multiple restorations such as this case portrays. Each person needs to evaluate when and if these types of products work in their lab or clinic (Fig. 6).

Overall, we achieved a positive outcome for this patient. Her dental issues were efficiently addressed within her requested one appointment. It will be interesting to see how these restorations present at future follow-up appointments. Developments in



Figure 6:
3D printed restorations fitted on a printed dental model

Figure 7:
Are 3D printed restorations the
future of digital dentistry?

software, hardware and materials mean that this type of dentistry will inevitably become more consistent and reliable (Fig. 7). **JDT**

About the Author:

Dr. Andrew Ip is a Sydney-based private general dentist who presents regularly on dental 3D printing with a special interest in digital dentistry. What started off as a hobby several years ago has now become a full-time passion for Dr. Ip. His passion



has taken him all around the world from the U.S., Europe, Asia and of course across Australia. He also runs an increasingly popular YouTube channel that showcases easy-to-follow dental design tutorials. From simple models to printing zirconia, Dr. Ip has printed almost all printable dental applications available in the global market and is proud to have operated close to 30 different 3D

printers in his career, a number that will inevitably increase. Dr. Ip has been teaching dentists, technicians, and their support staff how to integrate additive technologies into their workplaces for several years and is a speaker for several digital dentistry-related companies. His knowledge is based on true hands-on experience. When he's not designing a surgical guide, printing a splint, or polishing a printed crown, you can find him glued to a screen designing printable table organizers or nesting a helmet for his cats in a slicer.



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