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CBCT

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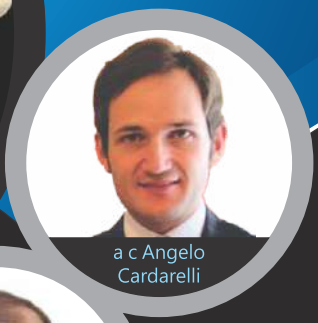
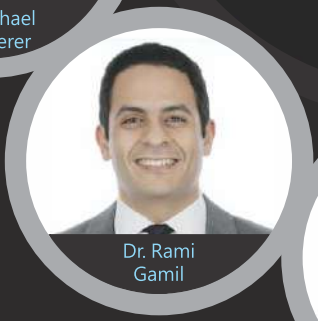
Dr. Michael D. Scherer


a c Angelo Cardarelli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3D Printed Dentures – Is Dentistry Ready?

Dr, Michael D. Scherer
DMD, MS, FACP


Michael D. Scherer, DMD, MS, FACP

Biography

Dr. Michael Scherer is an Assistant Clinical Professor at Loma Linda University, a Clinical Instructor at University of Nevada - Las Vegas, and maintains a practice limited to prosthodontics and implant dentistry in Sonora, California. He is a fellow of the American College of Prosthodontists, has published articles, DVD training series, and in-person and online courses related to implant dentistry, clinical prosthodontics, and digital technology with a special emphasis on full-arch reconstruction. As an avid technology & computer hobbyist, Dr. Scherer's involvement in digital implant dentistry has led him to develop and utilize new technology with CAD/CAM surgical systems, implement interactive CBCT implant planning, and outside of the box radiographic imaging concepts. Dr. Scherer also maintains online education courses at www.FastTrackDentalCE.com and five YouTube channels that teach dentists around the world.

Introduction

Digital technology has rapidly become embraced by dentists and dental technicians since the development of in-office computer aided design and manufacturing (CAD/CAM) technology like CEREC (Dentsply Sirona).1 Intraoral optical scanning systems, such as CEREC, 3Shape, iTero, Medit, Carestream, and 3M, have evolved into a reliable method of replication of the dentition and oral tissues. 2-3 Optical scanning systems like those mentioned began with limited applications including single unit crowns and has slowly evolved into partial coverage restorations, full arches, dental implants. Clinicians and laboratories can utilize optical scans to produce restorations, dental casts, surgical guides, and various other appliances with subtractive or additive manufacturing methods. Subtractive manufacturing, such as milling, has been a reliable and predictable method of manufacturing for years and permits the user to produce a restoration reliably and predictably using a carving like process. Additive manufacturing methods, such as 3-dimensional (3D) printing, permits the user to produce an object using a direct application method, which incrementally builds layers upon each other in a precise dimension. While both methods can reliably produce dental restorations, 3D printing has rapidly become a huge interest of clinicians, technicians, and within the dental industry because it is widely considered a less wasteful, simpler to use technology than milling.

While digital dentistry has been historically limited to tooth or implant borne restorations, recently, a tremendous amount of interest in utilizing CAD/CAM technology, optical scanning, and additive manufacturing methods to produce removable restorations such as complete dentures has emerged.

Clinical Case Report

A patient presented to the author's clinical practice with a history of having two implants with overdenture abutments (LOCATOR, Zest Dental Solutions).(Fig 1) The patient indicated that she had the implants placed and has been wearing a loose interim denture with a soft liner in the intaglio of the prosthesis. Evaluation of the interim prosthesis reveals that the vertical dimension, centric relation, and general appearance appear within clinically acceptable standards and was appropriate for a laboratory hard reline procedure, however, the patient requested new teeth and color. When the patient was advised the number of visits and steps required, she indicated she would want something done much faster as she had a family emergency and couldn't proceed with the number of steps required. As a result, we proposed that a new 3D printed denture could be scanned, designed, and delivered within a single day. The patient ecstatically agreed and wished to proceed with the same-day 3D printed denture.

Fig. 1. A patient presented with two implants and LOCATOR (Zest Dental Solutions) abutments requesting a new denture.

The patient's existing interim denture was adjusted with acrylic burs, adhesive placed (Universal PVS Adhesive, GC America), and a closed mouth reline impression was made with a medium body VPS material (Examix Regular, GC America) with overdenture housings (Denture Attachment Housing, Zest Dental Solutions) on top of the abutments. During the impression procedures, care was given to ensure proper border molding and contours were achieved during the impression. (Fig 2)The denture and impression were scanned using an intraoral scanner (i500, Medit), ensuring 360° capture of the entire denture and reline impression.(Fig 3)The overdenture housings were removed, and the patient dismissed; she was instructed to return later in the day for definitive procedures.

Fig. 2. A medium body VPS reline impression was performed within the denture, ensuring proper borders were captured and the patient closed into centric while the material was setting.

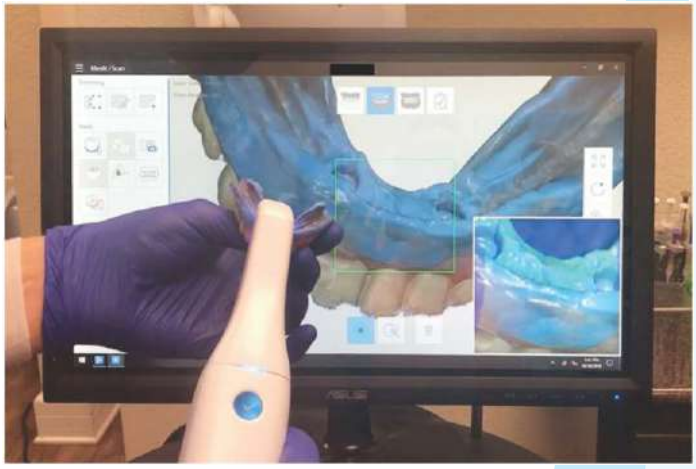

Fig. 3. An intraoral scan (i500, Medit) was made of the denture 360 degrees, capturing the entire denture and reline impression in one scan. The patient's opposing and bite records were also captured within the same scan file.

The optical scan files were exported from the intraoral scanner into a laboratory dental software (Dental Systems, 3Shape) where the scan files were prepared. The teeth were digitally extracted and a dental model base fabricated. Denture teeth (Candulor, Candulor AG) were added, using the existing patient's dentition as a guide for positioning and size of teeth.

(Fig 4) Slight modifications were made per the patient's requests and the denture designed as an arch-form denture, which is a two-part design of one-part teeth and the second part base. Designing in this method allows the clinician or technician maximum flexibility with materials and colors, permitting one to achieve a natural appearing denture without a tremendous amount of manual laboratory procedures. The teeth were printed on a desktop-industrial 3D printer (NextDent 5100, 3D Systems) in a tooth colored resin (C&B MFH, NextDent) and the denture base was printed using a tissue colored resin (Denture Base, NextDent). (Figs 5,6) The prints were washed with alcohol and UV cured in a light curing box (LC-3DPrint Box, NextDent) and were glued together using liquid UV cured denture base resin. Finishing and polishing procedures were completed using pumice and a ragwheel to achieve a high shine and luster.

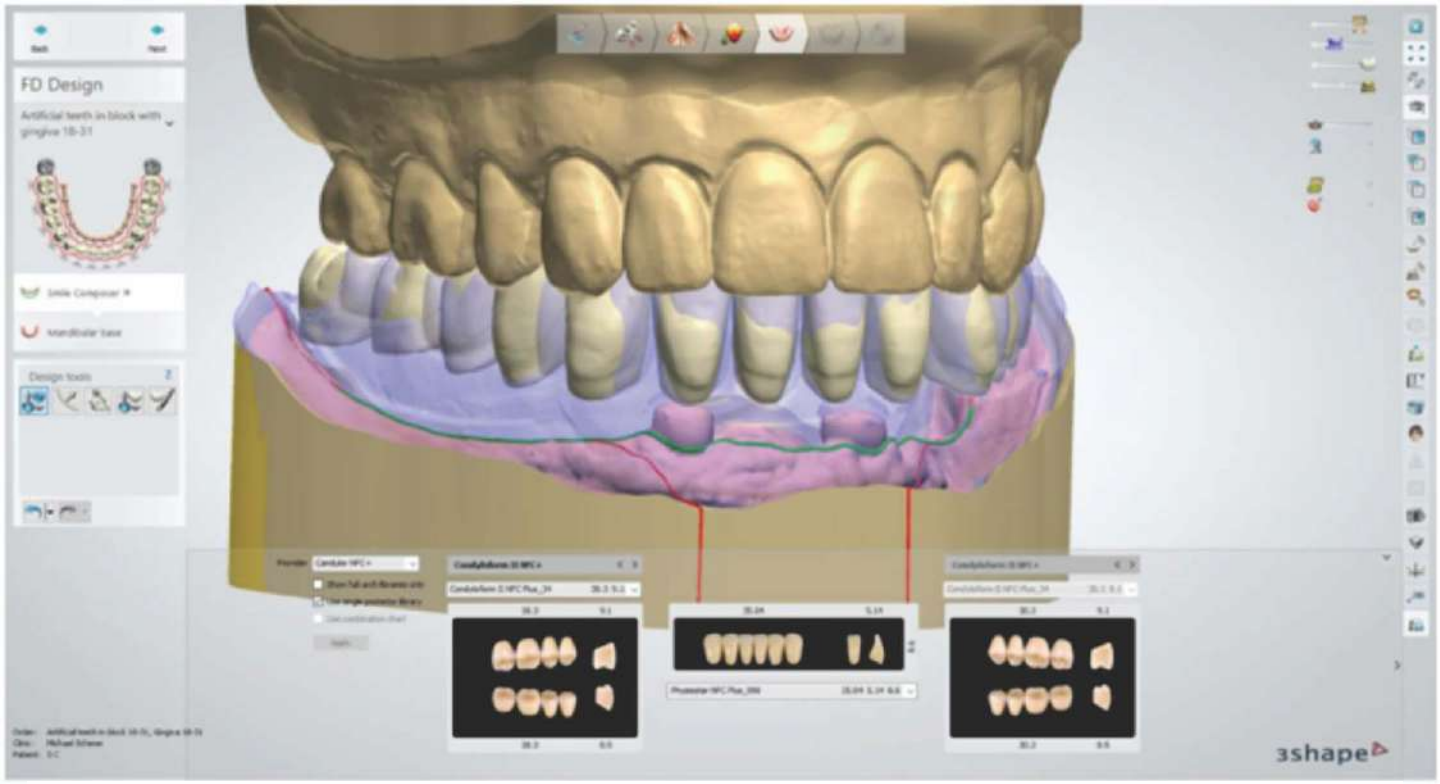

Fig. 4. The optical scan files were imported into dental software (Dental Systems, 3Shape) and the two-part arch-form denture was designed, using the outline of the patient's existing denture for a reference.

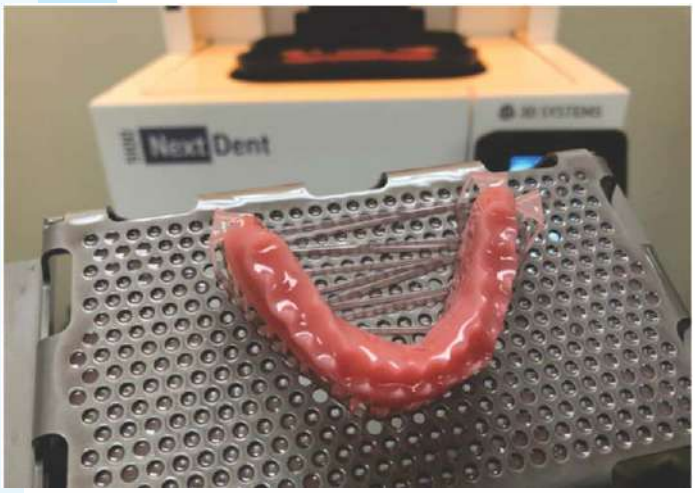

Fig. 5. The intaglio was printed (NextDent 5100, 3D systems) using a pink colored 3D printing resin (Denture Base, NextDent BV)

Fig. 6. The teeth were printed (NextDent 5100, 3D systems) in a single arch configuration using tooth colored 3D printing resin (C&B MFH, NextDent BV)

That same day, the patient returned for definitive procedures. Block-out spacers (Block-out Spacers, Zest Dental Solutions) and overdenture housings (Denture Attachment Housings, Zest Dental Solutions) were placed onto each abutment. The denture was seated onto the edentulous ridge, passive fit was confirmed using a disclosing medium (Pressure Indicating Paste, Keystone Industries), vertical dimension and centric relation confirmed, and the patient approved the esthetics of the teeth. The housings were attached to the denture using composite resin (Chairside Attachment Processing Material, Zest Dental Solutions) and retentive inserts were placed into the housings. Stability and retention were confirmed, and the patient was pleased with the final prosthesis.

Summary

Digital technology within dentistry greatly enhances the ability of the clinician and technician to be able to provide a service that is precise, expedited, and reliable for clinical use. The advent of efficient methods for denture production with optical scanning combined with 3D printing is a paradigm shift that will ultimately result in greater benefit for our patients. This article and case report demonstrated how technology can be leveraged to produce a removable dental restoration in a timeframe conducive to the growing nature of patient demands in clinical practice.

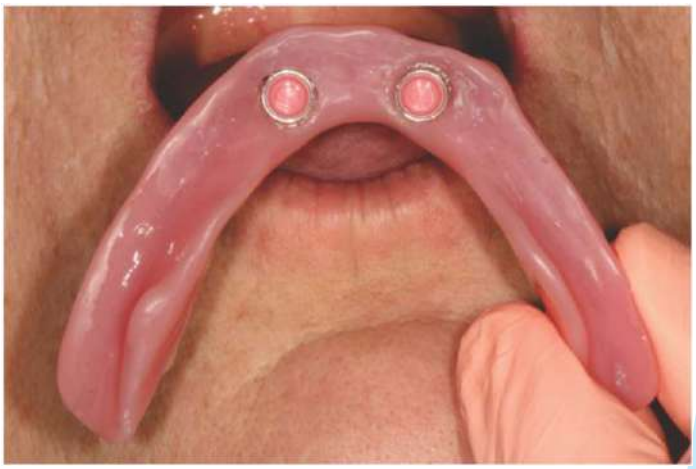

Fig. 7. The denture was finished in the laboratory and placed onto the edentulous ridge. Attachment processing procedures were completed, and the prosthesis inserted.

Fig. 8. Final appearance of the 3D printed denture.

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