

The State of Chairside 3D Printing

Q&A With Michael Scherer, DMD

Inside Dentistry interviews Michael Scherer, DMD, an assistant clinical professor at Loma Linda University and a private practitioner in Sonora, California, who focuses on prosthodontics and implant dentistry

INSIDE DENTISTRY (ID): How would you describe the state of 3D printing for chairside applications in dentistry?

MICHAEL SCHERER, DMD (MS): Dentistry is perfect for 3D printing. A large part of the genesis of the adoption of 3D printing is that so many dental offices are equipped not only with devices and equipment that aid in the development of 3D printing applications, such as optical scanners and cone-beam computed tomography units, but also with miniature laboratories that include cast grinders, sinks, steamers, grinding tools, polishing tools, ultrasonic instruments, etc. We have a need for the ability to produce products that are being used either intraorally or as part of our workflows. In addition, with the advent of biocompatible resins, the ability to use additive manufacturing to directly fabricate patients' occlusal guards, temporary bridges, and dentures, as well as countless other applications, is hugely impactful.

ID: Currently, what are some of the most impactful of those 3D printing applications?

MS: This can be highly variable from clinician to clinician, but generally, the easiest

products for dentists to fabricate, implement, and benefit from are occlusal guards, orthodontic clear aligners, and surgical guides. You can literally buy a printer, place it on a countertop, and immediately start printing occlusal guards that are biocompatible and strong. Orthodontic models can be printed to fabricate your own clear aligners with a high level of predictability. Similarly, surgical guides can be printed very predictably, and a model is no longer necessary. Producing occlusal guards and surgical guides is very simple and straightforward for most clinicians. The biggest challenge is in using the design software, but that should not be a limitation because that step can be outsourced to a laboratory or design center. Dentists can simply scan a patient, send the file out, and within 24 hours, have a design for an occlusal guard, surgical guide, or orthodontic model that can be popped right into the 3D printer.

ID: What are the most exciting current developments in 3D printing?

MS: Everything in 3D printing is exciting. Digital protocols have changed everything that I do without actually changing my dentistry. Globally, we really need to start pushing more for even better materials, biocompatibility, strength, optical color properties, etc. The printers are so well developed, and the hardware has been proven. We just need more development of materials, but it is going slowly because that is a very extensive process.

ID: The next applications that all manufacturers seem to be pursuing are directly printed clear aligners and permanent restorations. What would it mean to be able to print those?

MS: For many, many years, the proverbial holy

grail of dental 3D printing has unquestionably been the direct printing of clear aligner devices for orthodontic treatment workflows. A vacuum-formed appliance is very pliable, elastomeric, and forgiving, whereas a directly printed device is often very rigid and brittle, which poses a significant challenge for manufacturers. Once the technology to directly print clear aligners is developed, it will be incredibly impactful. Regarding permanent restorations, I genuinely expect a resurgence in polymer jetting technology in dentistry because you can essentially control gradient layers, color mapping, and shades. There is no question in my mind that we will eventually see the direct printing of ceramic restorations at the same level of quality, or better, that we see with traditional manufacturing. That is absolutely on the horizon. There are a lot of hoops to jump through, and certainly, the regulatory issues pose significant obstacles, as do the technological requirements. At the 2019 International Dental Show, I heard chatter from three different 3D printing companies that claimed to be developing a process for printing zirconia restorations. In the future, we will see rapid growth in the development of direct additive manufacturing of definitive restorations, and although it is hard to say what form it will take, I would not be surprised if it takes the form that we are accustomed to with everyday manufacturing.

ID: What do you expect in the more long-term future?

MS: Predicting what things will look like in 10 to 15 years is always difficult. I anticipate that we will see continued growth of the development of applications of 3D printing technology. Certainly, costs will either continue to stabilize or decrease, depending on the market. As



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dentists and providers, we have certain goals and tasks that we need to achieve. If we are looking at the future, we need to consider everything that we do in our practices from seeing new patients to providing restorations to following up with those patients. As 3D printing is adapted to support everyday clinical procedures, the technology will either improve the quality of care or facilitate the delivery of the same quality care that we are providing right now but in a more efficient, expedited, and affordable fashion. We may even reach totally new horizons. No one knows where the next horizon is, but I do anticipate exciting developments for the technology.

ID: Do you believe that the adoption of 3D printing among dentists will be more widespread than milling?

MS: Technology improves and systems get better, but what does not necessarily change that quickly is human nature. Some dentists want to do laboratory work or do not mind doing a little bit; however, quite a few dentists just want to send impressions to a laboratory.

Will 3D printing have a higher rate of penetration than milling? I genuinely do believe that. Will it be 75%, 85%, or 90%? I do not think so. Compared with milling, 3D printing is a bit easier to implement. Most importantly, the cost of entry is much lower. You can buy a 3D printer that is ready to go for dentistry for \$3,000 to \$5,000, depending on the applications and materials needed. Splints, clear

“Orthodontic models can be printed to fabricate your own clear aligners with a high level of predictability.”

aligners, and surgical guides are a big part of dentistry, but if you do not provide many occlusal guards, utilize clear aligner workflows, or place many implants, and you focus your practice more on hygiene, Class 1 and Class 2 composite restorations, and single-unit

crowns, 3D printing might not be the best for you. For others, however, 3D printing is an amazing adjunct, whether you are utilizing it at a high level or just as a novice.

ID: What advice would you offer to a dentist implementing 3D printing for the first time?

MS: The first thing that I tell anyone who is getting into 3D printing is to make sure that you reach out to colleagues and friends. Connect with us on social media. Read magazines, journals, eBooks, and all of the other great resources that are available to help guide you. In addition, know when to get training. Look at online courses. Finally, the most important thing that I tell anyone who is getting involved with 3D printing is to make sure that you have fun doing it. If you think it will be drudgery, then don't do it. But if you have a sparkle in your eye, then you are ready for 3D printing. There is no question in my mind that it has been a huge benefit to my clinical practice. I have patients who are coming to me from across the country so that I can print their teeth. It drives growth in my practice.



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