Use of Digital Impressions in Orthodontic Appliance Fabrication

by Matthew Hendrickson

There's a prevailing thought in orthodontics surrounding the use of intraoral scanners; this thought is that scanners are primarily used for clear-aligner therapy. In fact, when many orthodontists look into scanner technology, their main concern is how often they will use it to make clear aligners. However, the biggest advantages of using digital-impression scanners have nothing to do with clear aligners.

As I speak with orthodontists around the country, I find that the average orthodontic practice treats approximately five percent to eight percent of their cases through clear-aligner therapy. Of course, there are extreme exceptions in both directions—with some offices that do not offer clear aligner treatment at all and others that treat a much larger portion of patients using clear aligners—but the five percent to eight percent average is a reliable estimate.

Yet when it comes to digital-impression scanners, almost all orthodontists have a tendency to focus only on how they can use the scanner for their clear-aligner cases. I think this disproportional focus on clear-aligner cases is causing orthodontic practices to miss out on the real advantages of digital impressions and their ability to streamline and improve every case. Digital impressions can offer higher accuracy, increased patient comfort, fewer treatment appointments, better fitting appliances (of all types, not just clear aligners) and a standardized impression method for all applications.

Improved accuracy through digital impressions

There are a number of opportunities for errors when taking a conventional impression. Some of the errors are visible while the patient is still present, but unfortunately, many of the potential errors happen after the patient has left the office. Bubbles in the alginate or Polyvinyl Siloxane (PVS) materials, poor capture of the molars and torn impression material are common during actual impression capture and may require additional impression attempts. Accuracy can also be compromised during the transfer of the impression to the lab. Damaged or distorted impression material, improper pouring technique and even lost impressions introduce the risk that an appliance may have a poor fit.

Digital impressions eliminate all of these issues and streamline appliance fabrication. Digitally captured impressions display on screen as they are acquired, making it easy to see if there is any missing data before the patient leaves the chair. Once the scan is complete, it is stored electronically as part of the patient record and can be sent directly to the lab without the possibility of the impression quality degrading.

Andrea Cook, an orthodontic clinical consultant who has worked with practices nationwide, is a strong advocate for making the switch to digital impressions.

"The introduction of digital scanning has increased the accuracy of appliance fabrication and fit in the office," Cook said. "This, in turn, decreases our retake rate, improves the fit and decreases—or even eliminates—the number of appointments necessary to ensure a proper fit."

This consistency of the impression is a boon to busy dental practices. Knowing that the digital file is accurate means less time retaking impressions, remaking appliances and improving overall patient care.

photo courtesy of Andrea Cook

Standardization of digital impression files

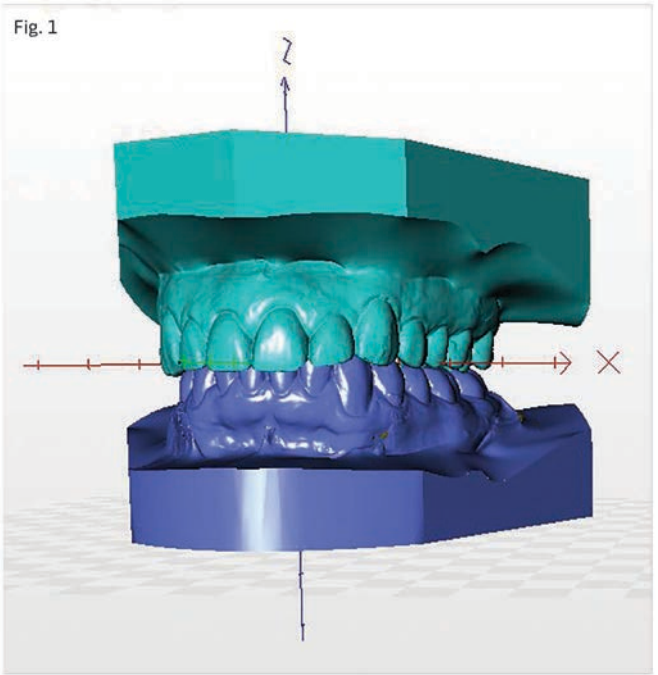
STL, or stereolithography (also known as Standard Tessellation Language), is the most commonly used file format to communicate three-dimensional images. STL files are essentially the 3D version of a JPEG, in that they are universal file formats that can be opened by anyone with a 3D viewing application. Capturing a digital impression with a system that allows storage as an STL file means that orthodontic practices can send the data to the lab of their choice for appliance fabrication. There are even free software applications available to view STL files. Fig. 1 shows an STL file of a digital impression captured with a CS 3500 scanner viewed through a free application called ModelWorks STL. Advanced viewing programs also provide simplified tools to virtually view, measure and present each orthodontic case. Fig. 2 shows the same digital impression viewed in the CS Model software provided with each CS 3500 scanner.

As you evaluate scanners for your practice, it is important to note that most scanners capture the initial digital impression in their own proprietary file format. Images saved in this proprietary format can only be opened by specialized programs. Some scanners provide a simple "one click" interface to share the impression as an STL file, while others make the process of sharing an STL file very difficult. If sharing an STL file is difficult, it limits practices to working with only a select group of labs that can open the files. This is because they must take additional steps to convert the file to an STL. Some of the scanners even charge a monthly, yearly or per-scan fee in order to have the ability to convert the files into STL file format. Make sure you understand the steps and fees associated with sharing STL files when you evaluate potential scanners for your office.

Digital impression scanners also standardize impression methods used by the staff. Traditional methods require staff training on two primary systems: alginate and PVS. Techniques used for each method are very different. This creates challenges for staff, specifically when using PVS. The staff only needs to learn one technique to acquire digital scans. This standardization in the process further streamlines the efficiency and accuracy of the impressions.

"When taking impressions, an assistant has to learn different techniques for alginate and PVS impressions, including moisture sensitivity, mixing, loading trays, and placement methods," said Dr. Robert Waugh, of Waugh and Allen Orthodontics in Athens, Georgia.

"With the CS 3500 a scan is a scan, one technique covers all appliances, from simple study models to the Herbst appliance or palatal expanders," he added.



Working with the digital lab

The evolution of technology being utilized in digital labs is moving at an astonishing rate. Labs can use specialized programs on digital impressions to quickly fabricate orthodontic appliances in ways that weren't possible just a few years ago. Communication with digital labs has become so easy and quick that many orthodontic practices are starting to send all appliances for fabrication by digital labs instead of making them in house. Using a digital lab can also reduce the number of patient visits and the amount of chair time required to plan each appliance.

Let's take the example of a rapid palatal expander. Traditional workflow requires:

Visit 1: Place spacers

Visit 2: Follow-up appointment to remove spacers, capture traditional impression, fit bands, replace spacers, pour model, transfer bands and begin construction of appliance or ship model for appliance fabrication (all other bands used during trial fit must also be sterilized and re-inventoried for future use).

Visit 3: Remove spacers and seat the appliance

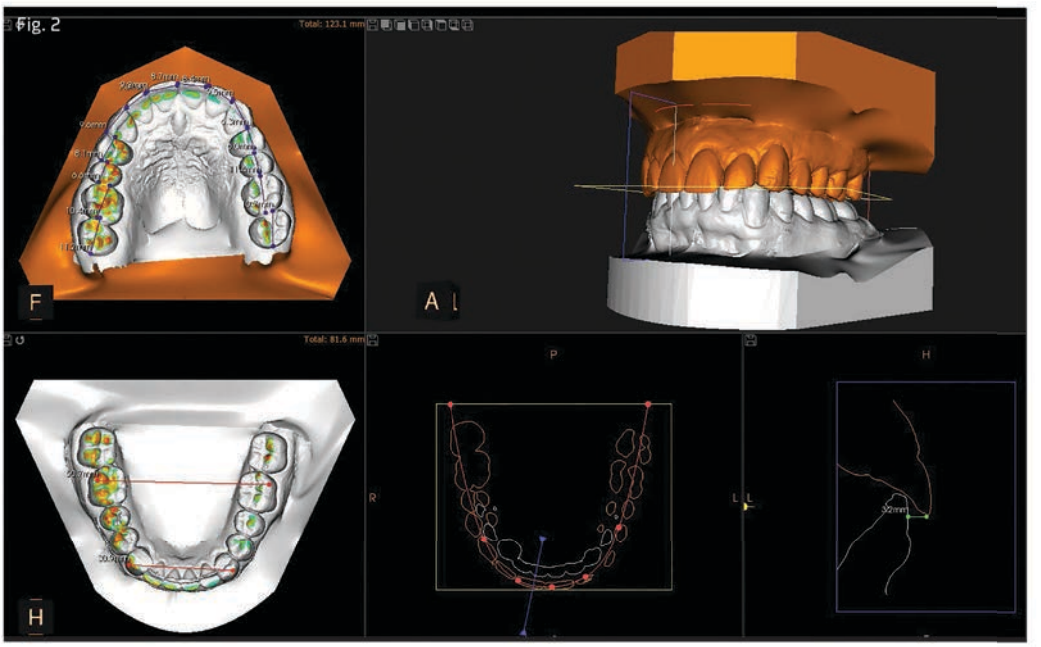
The protocol when using a digital impression system is:

Visit 1: Take a digital impression, place spacers and submit the case to a digital lab. Within 24 hours, the lab can digitally separate teeth, fit bands and begin appliance fabrication.

Visit 2: Remove spacers and seat appliance

The result is a great fit with less doctor time and fewer visits. It is even possible to eliminate the need to inventory bands and crowns.

Similar workflows can be applied to most orthodontic appliances. Dr. Waugh has implemented digital impressions as a means of improving his patients' retention process. During one of the patient's last appointments, he will scan his patient's mouth—even while the braces are still on—and send the digital impression to the lab for fabrication of the retainer. The lab will digitally



remove the brackets and send back the completed retainer so it's ready at the patient's debanding appointment.

Since Dr. Waugh has a digital impression of the completed case on file, he can produce an unlimited number of retainers from the stored digital impression. In the event of a lost or damaged retainer, the patient can call and request a new retainer without needing an appointment for a new impression. As long as there has not been significant tooth movement, a new impression is not necessary.

Dr. Waugh's staff members simply use his digital impression to create (or have the lab create) a new retainer that can either be shipped directly to the patient or picked up at the patient's convenience. Since most offices charge for replacement retainers, this increases the profitability on each retainer because there is no chair time required.

As you can see, intraoral scanners aren't just for clear aligners. Incorporating digital impressions into the orthodontic practice means that you have a more standardized process that yields greater flexibility than ever before, such as appliance fabrication and record storage. ■

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Author Bio

Matt Hendrickson is the U.S. orthodontic director for Carestream Dental, and has spent more than 25 years in the dental industry. Prior to joining Carestream Dental, Hendrickson founded and served as president of Integrated Dental Solutions, and held a variety of roles in dental practices.

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