Introduction

Are you ready for digital dentistry? The jCD recognizes that you may have many questions regarding the advancing technology in digital impressions. Therefore, we reached out to experienced AACD members and educators Dr. John F. Weston and Mr. Matt Roberts, for their perspectives regarding digital impressions. They both have successfully integrated this technology into their current workflow. The jCD is pleased to offer you both a dentist’s and a laboratory technician’s viewpoints.
Are you ready for digital dentistry?
It is rare to read any dental publication lately without seeing news about digital impression systems. While the majority of dental offices have not yet adopted this technology, digital scanning is gaining in popularity as prices move downward and more dentists come to understand the accuracy and efficiency of these systems. But many misconceptions are still prevalent among the dental community. This is quite understandable, given that the digital impression-taking process is so different from what most dentists are accustomed to. Surveys show most doctors would like to integrate this technology if price and ease of use are demonstrated; this is what drives the market to continue with improvements in hardware and software. Currently, there are eight systems on the market from six different companies, with more on the horizon. This article will attempt to dispel some of the most common myths currently circulating about these systems.

Myth
It is difficult to scan and capture all of the teeth.

Reality
Capturing all the teeth in an arch is dependent upon two things: total time allotted to capture the data and accessibility to all areas of the mouth via the scanning wand. Many of the systems on the market are able to obtain full arch impressions after some experience. Some utilize a scanning contrast medium of powder or liquid and others do not; either way, scanning more teeth obviously takes longer than a typical single crown or “quadrant” digital impression. However, clinicians quickly become more efficient and comfortable the more they use the technology and are better able to scan more difficult cases. Full arch data are required when using digital impressions for fabrication of many dental prosthetics including orthodontic aligners, bite guards, snore guards, removable partial dentures, and larger multi-unit restorative cases. As a result, having the ability to capture all of the teeth will become increasingly important for full digital impression integration (Figs 1 & 2).

Figure 1: Near full-mouth digital case.

Figure 2: Use of powder.
Myth
The scanner is too large to access the entire mouth.

Reality
While many of the scanning wands are considered large and cumbersome to some extent, the trend shows devices are getting smaller and more efficient. It is definitely possible to capture almost all areas of the dental arch, with the exception of the distal surface of second molars, with many of the current wands. It must be noted that this is also a difficult area to impress using traditional analog impressions. Most of the time, a clear occlusal surface with minimal buccal and lingual is sufficient. When the second molar is the tooth to be restored or the distal contour of a second molar is required, wand size becomes a major factor, narrowing the choices available. However, when the second molar is prepared, scanning this area is much easier because the distal contour is now a flat surface and converging toward the occlusal. As wands get smaller and capture technology improves, access to challenging areas of the mouth will improve even more, with digital scanning likely becoming the choice for impressions in difficult areas (Figs 3-5).

Myth
The need for tissue retraction/tissue management is not as important as with conventional impressions.

Reality
Retraction is just as important with digital scanners. In other words, a camera can see only what the clinician can see. If tissue, moisture, or debris is covering a margin, the camera is unable to scan the area. However, the amount of retraction that is required in many cases is less when using digital scanners. If the margin is visible, even slightly, the camera will see it. Most clinicians find that adequate retraction can be achieved using retraction pastes and/or very small diameter retraction cord. Retraction systems used for analog impressions also work well, including lasers and zirconia-tipped high-speed instruments. In addition, subtle differences in tissue and tooth can be visualized using the various imaging tools available on the systems for accurate margin marking and placement. Some systems also employ color-rendering technology for easier distinguishing of tooth structure and tissue. Whether margins are marked in the laboratory or by the clinician, when it comes to accurately distinguishing margins, slight tissue retraction is required (Figs 6-10).
Figure 6: Use of retraction paste.

Figure 7: Zirconia tissue trimmer.

Figure 8: Subtle differences in tissue and tooth shown.

Figure 9: Color rendering used to show differences in teeth and tissue.

Figure 10: Example of cross-sectional margin marking.

Figure 11: Example of an accurately scanned veneer case on an additive stereolithography (SLA) model.
Myth
Digital impressions are not as accurate as conventional impressions.

Reality
Studies show digital data are far superior to traditional polyvinyl silane or rubber base impressions. An optical image will always be more precise than an analog negative. With the added ability to manipulate the images for viewing of margins and preparation details, one can hardly ignore that digital impressions provide the ability to improve the quality of our restorations. We also know that stone plaster distorts as it sets. Traditional impressions can be subtly distorted with no way to absolutely determine this clinically until the restoration is tried in the mouth. Patients swallow and move around, trays can bend, and moisture can silently contaminate the area while we wait for final set. With optical scans, movement is not a factor and moisture is detected easily as it can be seen, cleared away, and an accurate scan completed. Once the data are captured, we know they are accurate. A comparison would be our ability to now easily visualize, manipulate, and diagnose more accurately using digital radiographs over traditional analog films (Fig 11).

Myth
Digital impressions cannot be used for implants.

Reality
All of the systems currently on the market can be used to capture permanently seated custom and stock abutments for any implant system. A handful of the systems are also able to utilize scan bodies for accurate fixture-level impressions and complete digital design of abutments and subsequent restorations. “Model-free” custom abutment and final crowns can be designed at the same time, eliminating steps and improving accuracy. In addition, since implant restorations are inherently unforgiving with regard to fit, the accuracy of digital impressions are well suited for this technology. Either way, recording implant data is an important aspect for digital impressions, and we will see more workflows coming on line with all systems in the very near future (Figs 12-14).
Myth
Digital impressions are not reliably faster than elastomeric impressions.

Reality
Most systems on the market, once fully implemented, save time due to faster impression making. There is a learning curve and one has to look back at the time and training that was required to master analog impressions. In most cases, after a few weeks of consistent use, most clinicians will be faster with digital scans. This is not just due to increased skill level but from a reduction of re-makes. Most digital systems allow you to visualize the impression as it is being made including the ability to go back and “stitch-in” missing pieces of data. This saves time when compared to a complete re-do with analog impressions. Once fully implemented into the office workflow, a typical quadrant scan averages 30 to 60 seconds, with full arch scans inside of a few minutes. When using analog systems, multiple impressions due to voids and distortion are not uncommon and result in more time and increased use of materials. Even experienced clinicians can have occasional re-takes when using analog systems. This is not a factor with digital. Once you have the image on the screen, there is no need for a re-take. The real time savings becomes evident at delivery. Whether using chairside milling or lab-fabricated, restorations made via digital impressions typically show improved fit with minimal adjustments.

Myth
Digital impressions cannot be used for porcelain veneers or cross-arch dentistry due to inaccuracy.

Reality
Most systems on the market were designed for classic single or double tooth quadrant dentistry. Some are specifically designed for model-free in-office milling with the option to connect directly to the clinician’s laboratory for traditional model-based or model-free fabrication. Not all systems on the market have the accuracy or detail to predictably fabricate multiple units and cross-arch dentistry, bridges, or implant bars. Normally these cases require very accurate scanning and models, equivalent to high-density stone models used in precision analog dentistry. Currently, when models are required, they are fabricated primarily using reductive or additive processes. Clinicians should investigate the abilities of digital scanning systems so they purchase the one that best suits their needs. If planning digital workflows for cross-arch and anterior cases, accurate models will most likely be required.
Conclusion
As described here, the rapidly evolving technology of digital scanning systems is opening new doors for dentists. With current scanners that are smaller, faster, and capable of more indications than the first generation of this technology, many dentists are now revisiting their initial assessments of the suitability of these tools for their practices. While a digital scanner is no crutch for poor technique, its use can help dentists quickly identify and correct hard and soft tissue management issues before they become a problem in the model or final restoration. Digital impression systems are likely to reinforce the importance of excellent preparation and tissue retraction while using digital scanners to efficiently create a wide variety of very accurate restorations and other prosthetics.

References

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Disclosure: Dr. Weston receives honoraria from 3M ESPE for teaching courses that use their products.
Although digital impressions have been around for quite a while, and most practitioners are aware of their existence, there seems to be a general lack of information about their advantages. While it appears that a small group of dentists in the U.S. are successfully using digital impressions for their day-to-day dentistry, the vast majority are still sitting on the sidelines using tried-and-true conventional impression techniques. It seems their reasons for not adopting the new impression technology are varied: some are simply reluctant to incur the expense of the new systems, while others are not integrating due to a misunderstanding of what is available or myths about what digital impressions will and will not do. I will try to shed some light on these myths.

### Myth

The need for tissue retraction/tissue management is not as important as with conventional impressions.

### Reality

Digital impressions are not a magic solution to maintaining an isolated field prior to taking an impression. It is equally important to control bleeding, sulcular fluid, and tissue during the impression process when working with digital or conventional impressions. The difference occurs when you are unsuccessful on your first impression attempt. With conventional impression material, you have to retake the entire impression to recover the missing detail on one of two marginal areas; with the newest generation of digital impressions you can simply rescan the area with the problem and add those data to the original digital impression. On cases that are hard to isolate, the digital impression can be taken incrementally as each tooth is isolated, thus eliminating the need to have perfect isolation on an entire arch at one time for the impression. A further benefit in some of the software is that it can be programmed to identify areas of inadequate reduction at the time of the impression, allowing the dentist to go back and reduce further, then rescan just that area and add it to the impression (Figs 1 & 2).

**Figure 1:** iTero digital impression of an inlay preparation on tooth #14.

**Figure 2:** In the iTero system, models are milled from the digital impression at a milling center, and then shipped to the user.
**Myth**
Digital impressions are not as accurate as conventional impressions.

**Reality**
As with many areas of dentistry, there are various studies and opinions relating to accuracy in the digital impressions. I have worked successfully with iTero impressions (Align Technology; Santa Clara, CA) since its introduction in 2005 with very good clinical results. We have used these impressions for both single units and bridgework with equal success. Although not a published study, conventional and digital impressions were taken on many cases, the restorations were fabricated on the digitally generated models, and then fit back to the stone dies from the conventional impressions. We observed no difference in fit between the two impressions techniques.

**Myth**
Digital impressions cannot be used for implants.

**Reality**
This is certainly a myth. Both the CEREC Omnicam (Sirona Dental; Charlotte, NC) and iTero systems are capable of taking implant impressions. A scan abutment is attached to the implant and the digital scan is completed. The software identifies the location of the implant based upon the position of the scan abutment; the models can then be fabricated with an implant abutment in that position. Many of the digital impression companies either already offer this or have working prototypes to solve this need. As with every aspect of new technology, a dentist looking to purchase a digital impression system should be certain that the system being considered offers the features needed for the intended use in practice (Fig 3).

**Myth**
Digital impressions are not reliably faster than elastomeric impressions.

**Reality**
Digital impressions can be faster than conventional impressions. I have seen demonstrations where full-mouth impressions were taken, including bite registrations, in under two minutes with the new color TRIOS system from 3Shape (New Providence, NJ). The CEREC Omnicam is equally fast (Figs 4-6).
Myth
Digital impressions require messy powdering of the mouth.

Reality
Some systems do still require powder and some do not. Many of the lower-cost systems do require powder. The more expensive systems are powder-free.4

Summary
Digital impressions are here to stay. Anyone who questions this should try to remember the last time they loaded a roll of Ektachrome into a camera, or developed x-ray film in their office. When considering purchasing a digital impression system, the consumer should try as many as possible to find one that fits his or her individual needs. Systems range in price from around $15,000 to more than $40,000, and have many significant differences in size and capability. Ease of use in the mouth varies and software options also vary from system to system (Fig 7).

References

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