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Flexitime Fast & Scan: A Comparison of Impression Scanning vs. Model Scanning

Introduction: Technology in dental offices and dental laboratories offers the opportunity to increase accuracy and efficiency. Despite the proliferation of intraoral scanners for taking digital crown-and-bridge impressions, the majority of dentists still use traditional impressions. They have a history of success, have the advantage of being a familiar procedure and avoid the capital investment of an intraoral scanner. Likewise, dental laboratories can choose to use traditional techniques or integrate technology into their workflow.

An increasing number of dental labs are utilizing computer-aided design and manufacturing (CAD/CAM) for the fabrication of crown and bridge restorations. When a dental lab receives a traditional impression, that information must somehow be digitized as the first step in the CAD/CAM process. The lab has two choices for creating a "virtual model" that can be used with design software: create a stone model from the impression and scan the model, or simply scan the impression.

In order to gain further understanding of these two scanning methods, a dentist and milling center agreed to conduct a comparison for a number of single-unit crowns. The dentist followed normal clinical procedures for crown preparation and impression taking. The lab then produced two crowns, one with each scanning technique. Parameters of lab efficiency and clinical accuracy were recorded. One of these cases is discussed in detail to illustrate the process.

Clinical Presentation

The patient presented for permanent restoration of an endodontically treated maxillary first molar, tooth #14 (Figure 1). For long-term durability, a full-contour zirconia crown was selected, and this dictated the preparation design. A composite core was placed in the tooth, and it was prepared for the crown. Gingival retraction cord was placed in order to reveal the margin for the final impression (Figure 2). **Flexitime Fast & Scan** *(Kulzer)* is a polyvinylsiloxane impression material that is optimized for scanning. The light-body material was placed around the prepared tooth, while the tray material was dispensed from a dynamic mixer into a dual-arch quadrant tray. The tray was placed in the mouth and the patient was guided into occlusion. After the 2:30 setting time, the impression was removed from the mouth and inspected (Figure 3). The tooth was temporized until the final restoration was completed.

Figure 1. Pre-op of tooth #14.

Figure 2. Crown preparation of tooth #14.
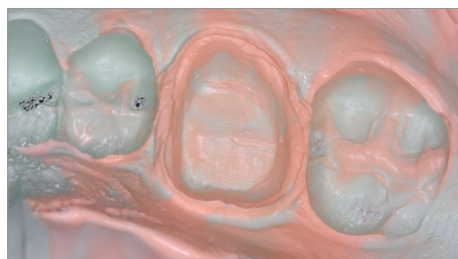

Figure 3. *Flexitime Fast & Scan* impression.

Laboratory

The impression was scanned with an *i-Series (Dental Wings)* impression scanner. Once the impression scan was complete, a model was poured and trimmed from the same impression. The model was scanned with an *Identica Blue (Medit Co., LTD)* scanner. The impression and models are shown in Figure 4. Both scanners were calibrated at standard operating temperature within five days of the impression and model being scanned. The *Dental Wings i-Series* scanner uses a sweeping laser-line light source. The *Identica Blue* scanner is a structured-light scanner with a blue light source. Both scanners have a dual camera configuration for data collection.

Figure 4. Poured model and impression.

The total processing times involved for each workflow are recorded in Tables 1 and 2. The actual time to scan an impression, at over 14.5 minutes is significantly longer than that required to scan a model, just 8.5 minutes. However, the total process time required for an impression scan is significantly less than that required for a model scan.

Table 1. Impression scan and processing times.

	Impression Trim	Impression Scan	Model Builder Time	Total Impression Scan Process Time
Impression	1:05	14:39	5:00	20:44

Table 2. Model scan and processing times.

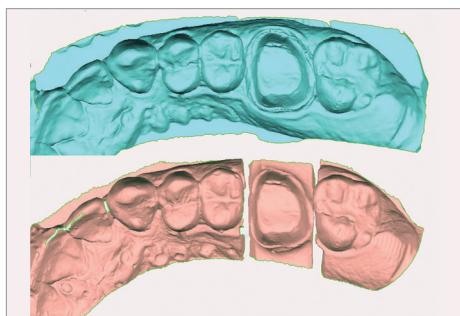|	Impression Trim	Prep Arch Pour	Opposing Arch Pour	Trim	Model Scan	Total Impression Scan Process Time
Model	1:05	3:31	3:25	10:54	8:26	27:21

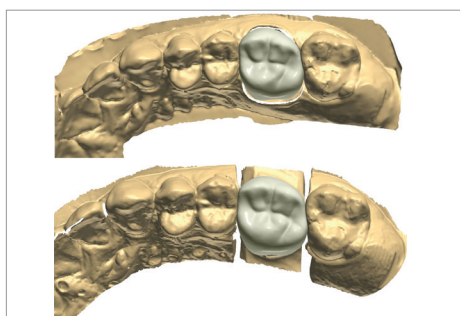**Figure 5.** Impression (top) and Model (bottom) scans.

Figure 6. Designed crowns from impression scan (top) and model scan (bottom).

Figure 5 Shows both the impression scan and model scan of the preparation arch, side-by-side. Note the comparable level of detail in both scans.

After scanning each case, the bite relationship was checked and corrected as needed using the dental CAD or Model Builder software. This is almost always required in cases where impressions are scanned. Both the vertical dimension and anterior/posterior relationship between the arches can be slightly out of position with a typical quadrant impression tray scan. In this particular case, minor correction of the impression scan was necessary.

Crowns were designed from both the impression scan and the model scan. *3Shape Dental Designer 2014* software was used to design both crowns to eliminate variations in CAD software settings (Figure 6). Subtle markings on the intaglio surfaces of the crowns provided identification for the lab related to the type of scan. This identification was not revealed to the dentist. The crowns were milled, finished and sent to the dentist for seating.

Restoration Seating

Upon receiving the case from the milling center, the dentist reported that the two crowns looked virtually identical. Both crowns were tried on the tooth and the following characteristics were evaluated: fit to tooth, rocking of margins, interproximal contacts, and occlusion. Both crowns were clinically acceptable (Table 3). Each crown needed only minor adjustment to interproximal contacts and/or occlusion. Crown #2 was chosen to cement on the tooth because it required slightly less adjustment of the interproximal contacts and no adjustment to the occlusion. After try-in, the internal surface of the crown was cleaned and primed *(Monobond Plus, Ivoclar Vivadent, Inc.)* and seated with a self-adhesive resin cement *(3M ESPE RelyX Unicem 2 Automix Self-Adhesive Resin Cement, 3M ESPE)* (Figure 7).

Table 3. Clinical evaluation of two crowns.

	Crown #1 – Model Scan	Crown #2 – Impression Scan
Fit	Perfect	Perfect
Margins	Perfect	Perfect
Rocking	None	None
Contacts	Tight (moderate)	Tight (slight)
Occlusion	High (slight)	Perfect
Clinically Acceptable	Yes	Yes

Figure 7. Crown cemented on tooth #14.

Conclusions

Dental laboratories utilizing CAD/CAM technology continue to regularly receive traditional impressions from dental offices. Even with the availability of digital impression systems, not every dental office has adopted the technology, and those that have still find in many cases, traditional impressions are necessary or a preferred option. Laboratories spend a substantial amount of time pouring, trimming and articulating models from impressions and then spend even more time scanning the resulting model. Simply scanning the impression saves time, materials and labor compared to the complete model scanning workflow.

The dental lab identified that in the case presented, the crown from the impression scan was seated for the patient. This case illustrates that both methods produced accurate restorations that were clinically acceptable. The slight differences between the two crowns fabricated for this patient may be attributed to minor design variation. The trend observed during the course of the study was that the crowns designed from scans of impressions were selected for placement in the mouth more often that those designed from scans of models.

In digital workflows, dental models or casts are not required for every case. Crown designs from scans of traditional impressions can yield excellent results. The clinical use of an impression material that is easily read by dental scanners, such as **Flexitime Fast & Scan (Kulzer)**, is very important as it can improve or enhance critical scan data detail.