# Improving Impressions and Tooth Preps with Intraoral Scanning

Gordon's Clinical Observations: In-office scanning is showing significant growth and acceptance by practitioners despite the clinical success of conventional vinyl, polyether, and alginate impressions. It appears that this concept is the future. Cost, physical characteristics, speed of scanning, and overall performance of these devices varies considerably among brands, but clinical acceptance is very high after a period of accommodation by practitioners. *In this issue, CR clinicians and scientists provide an update on intraoral scanning.*
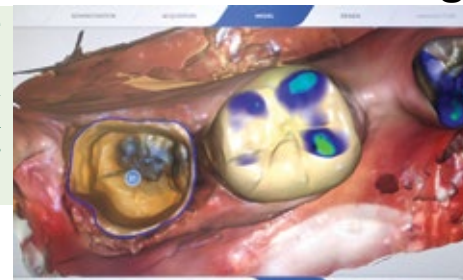
Example impression *(CEREC Primescan by Dentsply Sirona)* showing such digital tools as occlusal contact strength, margin marking, and labels.

Digital design and fabrication of dental prostheses and devices is increasing. Today, almost all labs scan conventional impressions or casts to digitize them for computerized workflows. For clinicians, an intraoral scanner is the portal to the digital realm and can actually improve the quality of impressions and tooth preparations. Pioneering devices have been available for decades, and the recent proliferation of scanner brands suggests that this concept is gaining acceptance. **The following report provides guidance on changing from conventional to digital impressions; examines the current status of scanning; and reviews features of three current intraoral scanners.**

Guidance on Changing from Conventional to Digital Impressions

The sad reality, as reported by dental laboratories, is that many conventional *(and digital)* impressions are of poor quality and need better soft tissue management. Clinicians and patients are reticent to repeat tedious and uncomfortable elastomeric impressions. **Digital impressions, however, are viewed live and enlarged on a computer screen for instantaneous feedback.** Immediate action can be taken to correct such defects as inadequate reduction, poor margin definition, undercuts, or soft tissue and moisture management issues. Open review by the entire dental team has been shown to improve treatment and refine clinical techniques.

The key requirement for successful digital impressions is clear visualization of all margins.
- Excellent soft-tissue management
- Dry field, with no blood or fluid seepage

Challenging clinical situations *(deeply subgingival margins, moisture problems, etc.)* where the above requirements cannot be met require conventional materials. Clinical cases by CR and others have shown that scanning equals or exceeds conventional impressions.

▶ **Example Workflow for Digital Impressions**

1. **Clinical assistant** welcomes and seats patient, and reviews planned treatment.
2. **Dentist** greets patient, answers questions, evaluates occlusion, and anesthesia is administered by dentist *(or hygienist, where legal)*.
3. **Clinical assistant** makes a quick-set occlusal impression for fabrication of temporary *(if sending case to lab)* and obtains maxillary, mandibular, and buccal bite *(interocclusal)* intraoral scans while anesthesia takes effect.
4. **Dentist** prepares teeth using conventional methods, including adequate soft-tissue management.
5. **Dentist** *(or clinical assistant, where legal)* scans the prepared teeth.
6. **Clinical assistant** fabricates temporary restoration, which is seated and adjusted.
7. **Clinical assistant or technician** either includes scans with email case submission to lab, or designs and mills the restoration using an in-office CAD/CAM system, such as CEREC.

Digital impression scan in progress *(Emerald S by Planmeca)*

Intraoral scanning is an exciting opportunity for staff to be more involved in restorative treatment and use high-tech equipment. With a well-trained assistant, it is not unusual for the dentist to spend less than 15 minutes chairside for a single crown procedure.
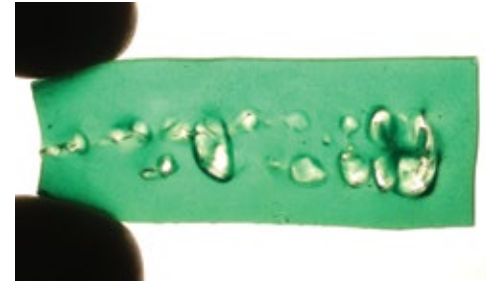
▶ **Clinical Tips**
- **Put patient needs first:** Avoid overtreatment or temptation to turn a small restoration into a crown to better suit the scanning or milling process.
- **Patient motivation:** Patients generally prefer digital over elastomeric impressions to avoid the long wait for set, possible gag reflex, objectionable taste, and mess. They also show enthusiasm for new technology and restorative material options.
- **Rapid turnaround time:** Digital impressions eliminate processing steps in the lab. A turnaround time of 2–3 days is possible and may include a discounted lab fee.

Improving Impressions and Tooth Preps with Intraoral Scanning *(Continued from page 1)*

Guidance on Changing from Conventional to Digital Impressions *(Continued)*

▶ **Clinical Tips** *(Continued)*

- **Restoration fit:** Communicate with lab to refine the settings for contact strength and cement space. *Currently, many crowns are purposely milled out of occlusion (up to 0.5 mm or 500 µm) to minimize need for chairside occlusal adjustment. This negates the capabilities of the technology, compromises clinical performance, and can cause patient breakage of adjacent teeth due to occlusal forces.*

- **Cost:** Initial cost is high, but most users reported good to excellent return on investment. *Before purchase, clarify additional costs, including data plan and maintenance plan fees.* Detailed cost analyses indicate that digital impressions range in cost from $14–$204, while elastomeric impressions range from $17–$130 *(depending on numerous variables)*. Increasing the number of crown cases per month was the most significant factor for improving profitability.

Occlusal Indicator Wax *(KaVo Kerr)* **reveals that a newly seated crown has light occlusion, causing accentuated occlusal stress on both adjacent teeth.**

- **Technical challenges:** Computerized equipment is expensive and can be frustrating for some to learn. Use motivated staff to learn and operate digital equipment and files.

Current Status of Intraoral Scanning: CR Survey

It is estimated that 10–15% of North American dentists currently use intraoral scanners. A recent survey of CR subscribers revealed the following trends (n=1,011).

- **Scanner use among CR subscribers:** Approximately **36%** *(much higher than national average)*
- **Clinical results compared to conventional impressions:** **54%** better; **33%** similar; **11%** mixed results; **3%** worse
- **Cost effectiveness:** **30%** excellent; **42%** good; **23%** fair; **5%** poor
- **Overall satisfaction:** **55%** excellent; **36%** good; **8%** fair; **1%** poor
- **Brands in use:** **44%** CEREC models *Dentsply Sirona*; **19%** iTero models *Align Technology*; **14%** TRIOS models *3Shape*; **8%** CS models *Carestream*; **7%** Planscan models *Planmeca*; **5%** True Definition models *Midmark*; **1%** Medit i500; **1%** Heron IOS *3DISC*
- **Main uses:** **95%** single units; **55%** multiple units; **40%** ortho; **31%** occlusal splints; **26%** implants; **26%** digital record; **26%** study model; **25% or less:** patient education, surgical guides, removable prostheses, interocclusal record, sleep appliances, bleaching trays, dentures, waxups, etc.
- **Main advantages:** **83%** preferred by patients; **67%** fast case turnaround time; **63%** accurate fit; **56%** digital record storage; **52%** easier; **50%** improved quality of treatment
- **Main limitations:** **51%** high cost; **37%** soft tissue management; **35%** learning curve; **34%** intraoral access; **29%** moisture management

> *CR Survey Summary:* The majority of clinicians making digital impressions indicated that clinical results are similar to or better than conventional impressions, and their overall satisfaction was good or excellent. Patients prefer digital impressions and clinicians appreciate the fast case turnaround time. Challenges continue to be high cost, soft-tissue management, and technical complexity. It is hoped that increasing competition and innovation will improve these issues.

Features of Three Representative Intraoral Scanners

More than 20 different intraoral scanners are now on the market. The CR science and clinical team recently evaluated three current models, listed below in alphabetical order. *(See Clinicians Report April 2017, August 2016, and March 2014 for previous evaluations.)*

- **Updated CEREC** *(Dentsply Sirona)* **and Planscan** *(Planmeca)* **models** offer improved speed, convenience features, and future expansion into in-office CAD/CAM systems, if desired.
- **New WOW** *(Denterprise International)* **model** offers lower initial cost and no fees for a lower cost entry into scanning.

▶ **CEREC Primescan** *(Dentsply Sirona)*

$44,995

- **System evaluated:** Stand-alone cart with touch-screen and touch-pad
- **Major improvements over previous Omnicam model:** Wider scan area *(but with a larger handpiece)* and greater depth of field for improved speed of scanning; improved user interface; heated anti-fog handpiece
- **Features:** Color images; high resolution; disposable handpiece sleeves; exports in open STL format
- *CR Findings:* Clinical users noted significant improvement in smoothness and speed of scanning over previous Omnicam model despite larger handpiece; intuitive software; and large touchscreen interface.

Improving Impressions and Tooth Preps with Intraoral Scanning *(Continued from page 2)*

Features of Three Representative Intraoral Scanners

▶ **Emerald S** *(Planmeca)*

$32,000
- **System evaluated:** Laptop-based system with mouse
- **Major improvements over previous Emerald model:** Improved speed and ease of scanning; improved color and shade-assist technology; higher resolution detail; updated intuitive software
- **Features:** Color images; autoclavable anti-fog tips; optional smaller SlimLine tip; exports in open STL and PLY formats; no scan, click, or subscription fees
- *CR Findings:* Users noted significant improvement over Emerald with faster and smoother scanning, and significantly less loss of tracking. Size and shape of handpiece remain similar.

▶ **WOW** *(Denterprise International)*

$17,995
- **System evaluated:** Laptop-based system with mouse
- **Technology:** Two video cameras *(stereophotogrammetry)* in a slim, lightweight, USB handpiece with relatively low cost; 3D data created by software processing
- **Features:** Color images; powderless; direct view *(no mirror tips);* snap-on guides in three sizes to help maintain proper distance during scanning; Linux-based software exports in open STL or PLY file formats
- *CR Findings:* Video-based 3D scanning was slower and less detailed than other scanning technologies evaluated, but once acclimated to technique, scanning was simple and effective. Distance guides improved ease of use by allowing tip to rest directly on dentition, but made overall size of tip similar to other scanners. Slim, lightweight handpiece had best ergonomics and handling.

CR CONCLUSIONS:
- The digital workflows of today's advanced materials could logically start in the clinic with intraoral scanning for digital impressions.
- Scanning allows clinician to review tooth preparation and captured details, permitting refinement and improvement of prep and impression.
- Scanning technology is well proven and in a state of rapid evolution with more than 20 models now on the market.
- High cost and complexity remain the main limitations, and conventional impressions are still required for challenging clinical situations.
- Clinicians should ensure good soft-tissue management and moisture control for optimum impressions, whether using elastomeric materials or digital impression scanners.
- WOW *(Denterprise International)* scanner has low initial cost and no fees. Slim, lightweight handpiece utilizes dual video camera technology. Scans were acceptable after initial learning period. Unit offers a relatively low-cost option for initial scanner purchase.
- CEREC Primescan *(Dentsply Sirona)* and Emerald S *(Planmeca)* scanners are improved models with faster, smoother scanning, and enhanced software. Importantly, both can later be upgraded to in-office CAD/CAM systems, if desired.

What is CR?

WHY CR?

CR was founded in 1976 by clinicians who believed practitioners could confirm efficacy and clinical usefulness of new products and avoid both the experimentation on patients and failures in the closet. With this purpose in mind, CR was organized as a unique volunteer purpose of testing all types of dental products and disseminating results to colleagues throughout the world.

WHO FUNDS CR?

Research funds come from subscriptions to the Gordon J. Christensen Clinicians Report®. Revenue from CR's "Dentistry Update®" courses support payroll for non-clinical staff. All Clinical Evaluators volunteer their time and expertise. CR is a non-profit, educational research institute. It is not owned in whole or in part by any individual, family, or group of investors. This system, free of outside funding, was designed to keep CR's research objective and candid.

HOW DOES CR FUNCTION?

Each year, CR tests in excess of 750 different product brands, performing about 20,000 field evaluations. CR tests all types of dental products, including materials, devices, and equipment, plus techniques. Worldwide, products are purchased from distributors, secured from companies, and sent to CR by clinicians, inventors, and patients. There is no charge to companies for product evaluations. Testing combines the efforts of 450 clinicians in 19 countries who volunteer their time and expertise, and 40 on-site scientists, engineers, and support staff. Products are subjected to at least two levels of CR's unique three-tiered evaluation process that consists of:

1. Clinical field trials where new products are incorporated into routine use in a variety of dental practices and compared by clinicians to products and methods they use routinely.

2. Controlled clinical tests where new products are used and compared under rigorously controlled conditions, and patients are paid for their time as study participants.

3. Laboratory tests where physical and chemical properties of new products are compared to standard products.

Clinical Success is the Final Test

Clinicians Report® a Publication of CR Foundation®
3707 N Canyon Road, Building 7, Provo UT 84604
Phone: 801-226-2121 • Fax: 801-226-4726
CR@CliniciansReport.org • www.CliniciansReport.org

CRA Foundation® changed its name to CR Foundation® in 2008.

This team is testing resin curing lights to determine their ability to cure a variety of resin-based composites.

Every month several new projects are completed.

THE PROBLEM WITH NEW DENTAL PRODUCTS.

New dental products have always presented a challenge to clinicians because, with little more than promotional information to guide them, they must judge between those that are new and better, and those that are just new. Because of the industry's keen competition and rush to be first on the market, clinicians and their patients often become test data for new products.

Every clinician has, at one time or another, become a victim of this system. All own new products that did not meet expectations, but are stored in hope of some unknown future use, or thrown away at a considerable loss. **To help clinicians make educated product purchases, CR tests new dental products and reports the results to the profession.**