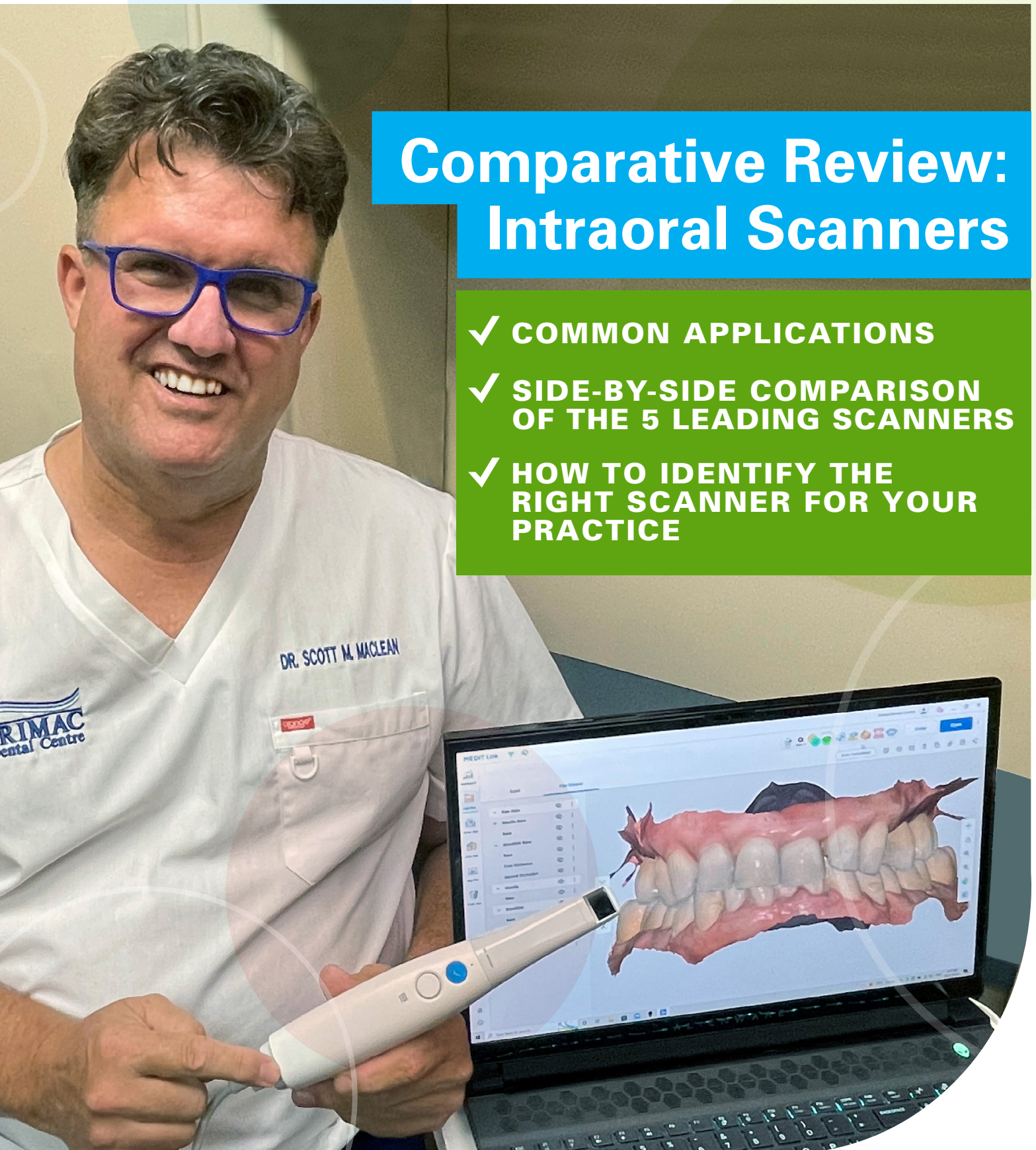


Comparative Review: Intraoral Scanners

- ✓ COMMON APPLICATIONS
- ✓ SIDE-BY-SIDE COMPARISON OF THE 5 LEADING SCANNERS
- ✓ HOW TO IDENTIFY THE RIGHT SCANNER FOR YOUR PRACTICE



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DENTAL

The advent of digital health care devices has transformed the dental profession. In fact, technological advances — such as 3D intraoral scanners — have completely enhanced the experience for dental practitioners and their patients, helping to improve and elevate clinical services and care like never before.

Intraoral scanners are devices for capturing the oral environment, offering the ability to perform complete hard and soft tissue digital impressions in full color — replacing conventional, traditional impressions. They can be used in a wide range of applications, from fabricating restorations to simulated smile design.

DIGITAL VS. CONVENTIONAL IMPRESSIONS

Traditionally, dentistry has depended on conventional impressions to capture a “negative” of the intraoral environment, requiring a dental laboratory professional to either pour up the impression in stone for a “positive,” or scan the impression with a benchtop scanner. Unfortunately, taking conventional impressions can be time-consuming and uncomfortable for patients, and cannot be easily corrected beyond making another impression. Most impression materials also tend to shrink — while the stone expands — leading to variability on accuracy and technique sensitivity.

With digital impressions, however, dental professionals are now saving time, improving efficiency and obtaining an accurate means of recording dental structures when compared to traditional impressions.¹

SAVES TIME

Studies have shown that taking a digital impression saves time compared to making a traditional

impression — particularly when it comes to the number of steps involved in the model-making process.²

With digital impressions, there is no need to wait for a stone model. A dental professional can send the digital file directly into a variety of software applications to diagnose, treatment plan or design — or can send the file to a laboratory, specialist or manufacturing process for milling or printing — all of which eliminates any shipping costs and saves time.

For dental practices with the capability to scan, design and fabricate chairside restorations, the resulting 3D files are imported into computer-aided design (CAD) software. When the restoration design is complete, the resulting files may be transferred to computer-aided manufacturing (CAM) software and sent to a mill or printer where the provisional and/or final restoration is created.

OFFERS SIMILAR ACCURACY TO CONVENTIONAL IMPRESSIONS

Intraoral scanning systems offer many advantages, including a reliable and accurate means for recording dental structures — comparable to traditional impressions.³ In addition, digital images are made with live feedback, so retaking or modifying a scan is much easier than retaking a conventional material-and-tray impression.

ENHANCES EFFICIENCY

Perhaps the greatest advantage to CAD/CAM in intraoral scanning is its ability to simplify patient workflow. With intraoral scanning, digital scans are converted to virtual patient records, which improve efficiency and workflow.

Interestingly, a study evaluated patients’ perception of digital and conventional impression techniques, analyzing treatment comfort, effectiveness and clinical outcomes. Ultimately, digital impressions resulted in a more time-efficient technique that the patients preferred over conventional impressions.⁴

COMMON INTRAORAL SCANNING APPLICATIONS

- Diagnosing and treatment planning
- Recording digital images and files of patients’ teeth
- Monitoring patients’ tooth wear and changes over time
- Merging intraoral images with cone beam computed tomography (CBCT) scans for more precise implant planning and placement⁵
- Fabricating restorations, such as inlays/onlays, single crowns and fixed partial dentures, as well as removable partial and full prostheses
- Fabricating aligners and other orthodontic devices
- Increasing case acceptance with simulated smile design
- Collaborating with specialists through digital images and files

1. [https://jada.ada.org/article/S0002-8177\(21\)00312-3/fulltext](https://jada.ada.org/article/S0002-8177(21)00312-3/fulltext)

2. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5727697/>

3. <https://www.sciencedirect.com/science/article/pii/S1532338222000331>

4. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3913616/>

5. <https://pubmed.ncbi.nlm.nih.gov/34085497/>



“If you’re looking to incorporate a digital workflow into your practice, often dentists ask what they should do. The first step, in my opinion, is to buy an intraoral scanner. When you have an intraoral scanner, it opens doors for you. Not just in implant placement but in crown and bridge impressions.”

- Dr. MacLean



A CLINICIAN’S THOUGHTS AND RECOMMENDATIONS

To learn more about the benefits of intraoral scanning, we interviewed Scott MacLean, D.D.S., a private practitioner and fellow of the Academy of Dentistry International, the American College of Dentists, the International College of Dentists and the Pierre Fauchard Academy, about his experiences with digital dentistry. Dr. MacLean purchased his first intraoral scanner in 2005 and routinely performs restorative and implant dentistry with the help of an intraoral scanner.

Dr. MacLean owns Trimac Dental Centre in Halifax, Nova Scotia, where he focuses on implant and esthetic dentistry. He graduated from Dalhousie University’s Faculty of Dentistry in 1991 with a Doctor of Dental Surgery degree.

Before purchasing his first intraoral scanner, he had been looking for a more efficient way to manufacture crowns and decided it was time to take the leap into digital dentistry.

“I currently own four scanners, one of which is the Medit i700,” he explains. “The reason I purchased my first intraoral scanner was because I was searching for more accuracy and speed, and a way to make the procedure more convenient for my patients. I like that the patient can have a procedure done in one day. And, my patients like not having what they call, ‘all that goop’ in their mouth.”

When asked if intraoral scanning has made a

positive impact on his practice, Dr. MacLean says, “Absolutely. I wouldn’t want to go back to conventional impressions because scanning is more accurate and convenient. Also, it’s something the patients love. Intraoral scanning definitely speeds up my workflow from start to finish.”

Dr. MacLean noted that intraoral scanning is a great “first step” into digital dentistry. “If you’re looking to incorporate a digital workflow into your practice, often dentists ask what they should do. The first step, in my opinion, is to buy an intraoral scanner.

When you have an intraoral scanner, it opens doors for you. Not just in implant placement but in crown and bridge impressions.”

He explains, “Beyond crowns and bridges, you can facilitate implant placement. You can record patients’ soft and hard tissue. You can use it to teach students anatomy. It makes a great teaching tool for dental schools. You can take the file and synchronize structures that lie below the bone with CBCT. Intraoral scanning improves the quality of care and the quality of life, which is very important to me as a dentist. Everything is pointing to digital rather than analog. My goal is all-digital — that’s where I want to go.”

IMPROVES CASE ACCEPTANCE

With conventional impressions, the material can be uncomfortable for some patients — especially children and adults with an active gag reflex. For these patients, replacing materials with digital scanning is an advantage. In fact, patients prefer digital scanning to traditional impressions because the procedure is significantly more comfortable.⁶

Most intraoral scanners are connected to a laptop or to a computer cart with a monitor that can be positioned for preferred viewing level. The patient can see what the dentist sees while they explain suggested treatments. Simulated procedures that show the final result to patients pre-treatment can enhance patient communication and increase the likelihood of case acceptance.



Dr. MacLean with his Medit i700 intraoral scanner in action.

6. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5727697/>

A scanner that comes with a lightweight, ergonomically-designed handpiece and user-friendly software is best. A digital interface that is too complex may be difficult to use chairside. Ask yourself: Does it fit comfortably in the patient's mouth? Is it simple and easy to use?

SELECTING THE RIGHT INTRAORAL SCANNER FOR YOUR PRACTICE

When asked which features are most important to look for when buying an intraoral scanner, Dr. MacLean advises, "The most critical feature is the accuracy of the scanner. You want technology that improves the accuracy of your current method."

Beyond accuracy, other factors that every dental professional should consider when buying an intraoral scanner include ease of use, software capability and price.⁷

1 | ACCURACY

Accuracy is important because an exact fit ensures proper function and prevents further diminishing of the remaining tooth structure. Fixed partial dentures, in particular, require an exact fit for supporting structures such as prepared teeth or implants. In addition, the quality of the scan will determine the accuracy of the final product. The intraoral scanner you choose should be able to capture fine details of both hard and soft tissues.

Intraoral scanners accurately replicate a patient's dental arches through the use of technology, generating a set of data points in space. Each data point is then linked to create a 3D model. A study concluded that the resulting high-resolution STL files are often considered a universally-accepted choice for dentists who wish to engage in a digital workflow.⁸

2 | EASE OF USE

A scanner that comes with a lightweight, ergonomically-designed handpiece and user-friendly software is best. A digital interface that is too complex may be difficult to use chairside. Ask yourself: Does it fit comfortably in the patient's mouth? Is it simple and easy to use?

Some scanners also offer wireless technology, which eliminates the cord to the laptop, enabling easy maneuverability. Keep in mind, however, that this requires further research into the scanner's battery life.

Additionally, it's important to consider the learning curve when taking digital impressions. An in vivo study was conducted in 2020 to determine the ease of use of an intraoral scanner. Ten dental students from Semmelweis University, with no prior intraoral scanning experience, worked in pairs, taking 10 digital impressions of the upper and lower arches using a 3Shape TRIOS® 3 intraoral scanning device.⁹

The result? The difference in scanning time between the first and last digital impression was significant, associating a decrease in time with the students' repeated use of the intraoral scanner.

3 | SOFTWARE CAPABILITY

The software powers the scanner, affects how it performs and determines how fast you can scan. Software speed and capability may differ widely between brands, so it's an important consideration when determining a scanner's usability. Ideally, there should be no lag time between scanning and the images appearing on the screen.

In addition, you should expect regular software upgrades to keep your system up to date with the latest technology.



Look for an intraoral scanner that captures fine details in high definition.

7. <https://www.dentaleconomics.com/science-tech/intraoral-scanning-and-photography/article/14213400/a-quick-guide-to-choosing-an-intraoral-scanner>

8. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8740072/>

9. <https://bmcoralhealth.biomedcentral.com/articles/10.1186/s12903-020-01278-1>

“Ultimately, you should purchase from a company that has the capability to support the equipment and the digital ecosystem, as well as provide education and support for your entire team.”

- Dr. MacLean



Left: The 3Shape TRIOS 4 intraoral scanner. Right: The Dentsply Sirona CEREC Primescan intraoral scanner.

4 | PRICE

In the past, intraoral scanners were considered too expensive for most practices. Now, high-quality scanners are available at attractive price points. When choosing an intraoral scanner, consider the additional costs that may be involved, including a software subscription, additional equipment, equipment upgrades, training and support.

“When I talk to dentists, my goal is to say, ‘This is something you need to jump into, but you also need to consider how you are buying,’” explains Dr. MacLean. “Your initial cost will be the equipment, but there may also be subscription fees and replacement costs. Some companies are now offering laptops that have a smaller footprint.”

With that in mind, Dr. MacLean recommends new users buy a portable intraoral scanner: laptop, cart or battery-operated. “In other versions, you may have to eventually replace the entire scanner and cart rather than just the handpiece. With a laptop version, for example, you only have to upgrade the handpiece, which can save you money in the long run,” he says.

In addition, it’s important to buy an intraoral scanner supported by the manufacturer, long-term. It’s best to choose a full-service distributor like Henry Schein that offers a support network and training. Dr. MacLean adds, “Ultimately, you should purchase from a company that has the capability to support the equipment and the digital ecosystem, as well as provide education and support for your entire team.”

A COMPARISON OF POPULAR INTRAORAL SCANNER BRANDS

Scanning for dental restorations requires the right equipment to precisely capture hard and soft tissue, interproximal and most distal areas. Each brand listed below offers intraoral scanners that can help you increase patient comfort, save treatment time, increase case acceptance and boost the overall patient experience. In addition, all will perform well for applications ranging from clear aligners to crowns and bridges.

3SHAPE

3Shape A/S, based in Copenhagen, Denmark, with its U.S. headquarters located in New Providence, New Jersey, is a developer and manufacturer of 3D scanners and CAD/CAM software solutions for the dental and audio industries. Their **TRIOS® 4** intraoral scanner is fast, reliable and easy to use, with a user interface that is simple and intuitive. The company states that a full arch scan is completed in high-definition and realistic color, thanks to the accompanying TRIOS software.

The TRIOS 4 has a smaller scanner head compared to most other brands on the market and weighs approximately three-quarters of a pound, with both wired (345 grams) and wireless (375 grams) options available in one device. Other features include a long battery life and fog-free mirrors.

3Shape offers support through their online user platform: 3Shape Community. The 3Shape platform

hosts 3Shape product experts and users who provide answers to common questions 24/7. 3Shape also offers how-to guides and product training, along with training videos for future users.

DENTSPLY SIRONA

Dentsply Sirona, with its global headquarters located in Charlotte, North Carolina, is the world’s largest manufacturer of professional dental products and technologies. Their product range includes the **CEREC Primescan®**, which is capable of processing more than one million 3D points per second at depths of up to 20 mm. The company states that users can easily digitize hard-to-reach areas with the Primescan. This intraoral scanner comes with a variety of sleeves to ensure hygienic handling.

An integrated touch screen and touchpad make for easy operation. The accompanying software provides a processing speed of up to 50,000 images per second, creating a fully automated workflow.

The Primescan weighs between 457 grams to 524 grams, depending on the scanner sleeve used (disposable plastic or metal).

Dentsply Sirona also offers clinical accelerator advanced training, which is included with a qualifying equipment purchase.



The DEXIS CS 3600 intraoral scanner.

DEXIS

Carestream Dental's intraoral scanner (IOS) business has recently joined the DEXIS™ Imaging and Envista family. With its U.S. headquarters located in Brea, California, Envista Holdings Corporation is an independent, public company launched in the second half of 2019. It is one of the largest global dental products companies, offering a differentiated portfolio, which includes dental implants, orthodontics and digital imaging technologies. Envista currently offers three wireless intraoral scanners.

Their **DEXIS CS 3600** wireless intraoral scanner weighs 325 grams (excluding the scanner cable and power box), and scans in a smooth, uninterrupted pattern to easily acquire dual-arch or quadrant scans. It also has a short 14 mm tip height, which improves patient comfort, simplifies distal molar surface scanning and allows better access for patients with limited bite openings, trauma or temporomandibular joint (TMJ) disorders.

One of their more lightweight options, the **DEXIS CS 3700** wireless intraoral scanner, weighing 316 grams (excluding the scanner cable and power box), provides high-speed scanning and processing, excellent touch screen capabilities and smart-shade matching technology, which detects up to three matched shade values to ensure beautiful, esthetic restorations.

And finally, the lightest of the three, weighing 240 grams (with battery), the **DEXIS CS 3800's** deep field-of-view (16 mm x 14 mm) provides a fast and smooth scanning experience, with a proven scanning time of 25 seconds for a single arch. Its significantly larger field of capture (21 mm depth) offers high-quality detail — even in interproximal areas and subgingival

margins. In addition, its embedded sensor offers gesture motion control, allowing practitioners to orient the on-screen digital model by simply rotating the scanner.

Dexis offers product support by phone and e-mail, including remote assistance, along with dedicated courses and webinars.

MEDIT

Medit is a South Korea-based company, with its U.S. headquarters located in Long Beach, California, that is a global provider of 3D scanning solutions for dental clinics and labs, including intraoral scanners. The company's mission is to provide innovative technology and the highest quality products to assist dental professionals in the adoption of digital dentistry.

Their **Medit i700 wireless** intraoral scanner, the newest to the Medit lineup, weighs slightly over half a pound (328 grams). Ergonomically designed and comfortable to hold, it comes with a handle grip option, as well as UV-C LED disinfection, which allows the dentist to scan and disinfect at the same time.

The Medit i700 wireless comes with three batteries. Each battery provides approximately one hour of continuous scan time. For beginners, the Medit Scan for Clinics software comes with AI-assisted scanning support.



The Medit trio of intraoral scanners.

The non-wireless version, the **Medit i700**, weighs a little over half a pound (245 grams), offering double the speed and a deeper scanning depth compared to its predecessor, the Medit i500.

In addition, Medit offers the **Medit i600**, which has similar features and functionality as the Medit i700, with a splash of color and a lower price point, making it ideal for dental professionals who are new to scanning.

For all models, local dealers provide training and assistance, as well as the Medit Help Center Knowledge Base, Medit Academy (YouTube) and the Medit Users Group (Facebook).



The Planmeca Emerald S intraoral scanner.

PLANMECA

Planmeca is a Finnish-based dental equipment manufacturer, with its U.S. headquarters located near Chicago, Illinois, that offers 3D scanners, CAD solutions and software. Their **Planmeca Emerald® S**, which is manufactured in the U.S., is compact and lightweight, weighing a little over half a pound (229 grams) — making it one of the lightest scanners currently available.

The Planmeca Emerald S has an ergonomic design and fits comfortably in the user's hand. This intraoral scanner captures images in realistic colors and, according to the manufacturer, will scan a full arch in less than a minute.

The Planmeca Emerald S comes with additional tips including the SlimLine tip and the Cariosity™ transillumination tip.

Planmeca also offers digital dentistry courses and training for dental professionals. In addition to hands-on training, they offer webinars and tutorial videos to support their products.

“It’s important for dentists to invest in something that will help them improve the quality of care so that the patient is getting better treatment. In my opinion, treatment is better with digital scanning.”
- Dr. MacLean

NEW DEVELOPMENTS IN INTRAORAL SCANNING

With the increasing demand for restorations, partially attributed to an increase in the geriatric population, intraoral scanners are gaining in popularity and becoming an essential part of a clinician’s armamentarium.¹⁰

Recent developments and technological advances mean new and innovative features are constantly being added to digital scanning technology, driving interest into the future.

Interestingly, the COVID-19 pandemic has made a positive impact on intraoral scanner sales due to a need for reduced chair time and a reduction in the physical components being sent to a dental laboratory. Social distancing requirements and government-mandated lockdowns have also contributed to the growing popularity of intraoral scanners.¹¹

Although the initial cost of an intraoral scanner may make some clinicians hesitate, Dr. MacLean mentions, “It’s important for dentists to invest in something that will help them improve the quality of care so that the patient

is getting better treatment. In my opinion, treatment is better with digital scanning.”

Dr. MacLean adds, “With digital scanning, it’s easier to see when a patient needs to be referred to a specialist. Improving the quality of care and quality of life is what I’m most passionate about as a dentist.”

While many dental practices may not yet embrace new technology, it’s clear that digital dentistry is the wave of the future. There are now more choices for fabricating in-office restorations than ever before. Intraoral scanning is much faster and more comfortable for the patient. Overall, digital dentistry delivers cutting-edge, seamless care to patients and saves clinicians time, money and resources.

Scott MacLean, D.D.S., FADI, FACD, FICD, FPFA

Dr. Scott MacLean (Instagram handle: @drscottmaclean) currently has over 13,000 subscribers on his dental YouTube channel (smmaclean) with more than 4 million views. He is a global speaker and has often been on the mainstage podium for many international symposiums. He has taught dentistry students for more than 15 years on the topics of dental implants and restorative dentistry.

Dr. MacLean is currently a director with the Seattle Study Club. He enjoys discussing how to use digital technology to “wow” patients and to improve accuracy of the digital workflow. He currently has four intraoral scanners, two digital printers (SLA and DLP) and one desktop lab scanner in his office.

Dr. MacLean is proud to be a fellow of the Greater New York Academy of Prosthodontics (GNYAP). He is also a fellow of the

American College of Dentists (FACD), the International College of Dentists (FICD), the Pierre Faucard Academy (FPFA) and the Academy of Dentistry International (FADI).

Dr. MacLean has taught “dental technology” around the globe, including most U.S. states and all 10 Canadian provinces. In addition, he has been an invited guest speaker at the Harvard School of Dental Medicine on the topics of implant dentistry, as well as digital smile design.



TO LEARN MORE ABOUT ADDING INTRAORAL SCANNING TO YOUR PRACTICE — [SCAN HERE](#)



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10. <https://www.globenewswire.com/news-release/2022/04/13/2421872/0/en/Intraoral-Scanners-Market-Trends-and-Forecast-to-2027-with-Key-Players-Align-Technologies-Sirona-3Shape-Carestream-Planmeca-Recent-Publication.html>

11. <https://www.mordorintelligence.com/industry-reports/intraoral-scanners-market>