



The Clinical Advantages of Phosphor Plate Digital Radiography

Gordon's Clinical Observations: The change from analog to digital radiography is still not complete in the U.S. despite the many advantages of digital imaging. The principle reason is the high cost involved. Additionally, some have converted to digital and then been dissatisfied with the equipment or results. *The CR scientific staff has surveyed the profession and accomplished significant research to assist you in understanding the distinct strengths and limitations of current digital radiography technology.*



Phosphor plates are thin, flexible, come in many sizes, and are significantly less expensive than hard sensors

The majority of dentists in North America use digital radiography systems with hard sensors (CMOS) that produce immediate images. However, scanned phosphor plate technology (PSP) dominates in many parts of the world and other areas of medicine due to its film-like versatility and lower cost. The unique features of phosphor plate digital radiography make it worth consideration, especially if hard sensors have been problematic in your practice.

The following report provides survey data on current use of digital radiography, a review of the technology, advantages and limitations, and clinical tips.

Survey

CR's survey on intraoral radiography (1,111 respondents) indicated that 70% use hard sensors, 16% use conventional film, 14% use phosphor plates, and a few use a combination of systems.

Key findings from phosphor plate users:

- **Brands in use:** ScanX 67%; Digora 14%; DenOptix 11%; VistaScan 5%; Carestream 7400/7600 1%; Apixia 1%; PSPiX 1%.
- **Satisfaction:** Excellent 44%; Good 47%; Fair or Poor 8%; and 80% felt it was a worthwhile investment.
- **Image quality compared to film:** Better 44%; Similar 42%; Worse 15%.
- **Caries detection:** Excellent 21%; Good 51%; Fair 26%; Poor 2%
- **Problems experienced:** Scratched plates 88%; Bent plates 47%; Patient damaged plates 37%; Achieving proper exposure 25%; Computer hardware/software 16%; Accurate positioning 3%; Sheath 2%.

Hard sensor users reported slightly higher satisfaction with image quality, but more problems with broken cables and connectors (43%), computer hardware or software (34%), and difficulty getting accurate positioning (24%). Although damage to hard sensors was less frequent than phosphor plates, the high cost of repair was frustrating.

Overall, despite having lower resolution than conventional silver halide film, most users felt digital imaging has revolutionized radiography and would never consider going back to wet chemistry and view boxes.

Example Phosphor Plate Systems

Two representative scanners are shown from among numerous systems available. These models are for intraoral plates only, and are small enough to fit within an operatory for chairside use.

FireCR
3DISC Imaging

\$6,990
Intraoral phosphor plate scanner for plate sizes 0, 1, 2, 3, and 4c. Includes 12X size 2 plates, 2X size 0 plates, software, sheaths, and accessories. Replacement size 2 plates cost about \$49 each. QuantorDent, the included stand-alone software, provides patient database and enhancement tools. Images can also be exported to other dental imaging programs.

ScanX Swift
Air Techniques

\$7,999
Intraoral phosphor plate scanner for plate sizes 0, 1, and 2. Includes 8X size 2 plates, 4X size 1 plates, 4X size 0 plates, software, sheaths, and accessories. Replacement size 2 plates cost about \$32 each. Software integrates with most major dental imaging programs and practice management systems.

Example Images of Challenging Areas

Phosphor Plate



Right maxillary premolars
FireCR, size 2 plate
Flexible plate bends to allow accurate positioning

Phosphor Plate



Left maxillary premolars
ScanX Swift, size 2 plate
Flexible plate bends to allow accurate positioning

CMOS Hard Sensor



Right maxillary premolars
Size 2 sensor
Corner of sensor hits front of palate, cutting off canine and forcing a tilt to capture root tips

The Clinical Advantages of Phosphor Plate Digital Radiography *(Continued from page 1)*

Advantages and limitations of phosphor plate radiography systems

Advantages

- **Patient comfort:** Intraoral plates are thin, slightly flexible, with rounded corners, and available in sizes 0, 1, 2, 3, and 4.
- **Positioning:** Film-like flexibility allows accurate positioning in difficult areas such as canines, premolars, shallow palates, third molars, around exostosis, etc.
- **Imaging area:** Plates have larger imaging area than corresponding hard sensors. Without the wire, the bite can be more closed so more bone and supporting structures are captured.
- **Lower cost:** Intraoral plates typically cost \$30–\$50 for a size 2, compared to \$5,000–\$10,000 for hard sensors. Plate scanners typically cost \$7,000–\$20,000, depending on size and capability. Office must already be configured with operatory workstations and dental imaging software.
- **Digital images:** Images can be enlarged, enhanced, reviewed with patient, and printed or emailed to others.

Limitations

- **Scanning:** Images are not immediate for instant diagnosis or correction of alignment. CR clinical testing showed an individual radiograph can be on-screen 10–20 seconds after exposure. Immediate images were most beneficial for endo, implants, impactions, etc.
- **Handling:** Individual plates must be wrapped, exposed, unwrapped, and scanned for each radiograph, requiring significant time and effort compared to hard sensors. Inadvertent exposure to bright ambient light after unwrapping can cause image degradation within a few seconds.
- **Durability:** Scratches and creases in plate produce artifacts in radiograph. CR tests showed that rough handling, not repeated x-ray exposure, caused image degradation. Users indicated most plates required replacing after 1–2 years of use.
- **Image quality:** As with CMOS, filters that sharpen digital radiographs which make them appear more detailed than conventional film can actually obliterate subtle variations in density such as incipient caries.

Clinical Tips

- **Consider adding a phosphor plate scanner** to existing CMOS system for times when hard sensor is inadequate. An entire PSP system can cost less than a single CMOS sensor.
- **View radiographs in both original and enhanced format** to best discern subtle details and caries. Current radiographs rarely show full extent of caries, and clinician must still decide on appropriate intervention.
- **Make only necessary radiographs based on assessment of patient.** Routine full-mouth series are no longer indicated. Current guidelines suggest a pan every few years, and periapicals and bitewings as needed.
- **Use form-fitting barrier sleeves** to minimize patient discomfort and improve use of positioners or stick-on bite tabs.
- **Do not compress radiographs** when electronically transferring images. Use zip files or similar tool to maintain highest image quality.

CR Conclusions:

Phosphor plate digital radiography retains many of the key advantages of film: thin, flexible sensors with large imaging area; better patient comfort and acceptance; ease and accuracy of positioning; image quality comparable to other digital radiography systems; and digital enhancement, display, and storage capabilities. However, increased handling and scanning of individual plates is less convenient than hard sensor radiography. Current phosphor plate systems with thin, flexible plates and lower cost make it feasible to consider using both technologies for their unique advantages.



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.

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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.



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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. Due to 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.