

DIGITAL IMAGING: WHAT ARE YOUR OPTIONS?

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Much discussion has taken place in the medical imaging community as to the virtues of which digital imaging modality is the “right” way to go. A great deal of confusion has arisen because of inconsistency in the use of terminology. Terms such as CR, DR, flat panel and CCD are used without fully understanding what they mean. If a practice is considering making the transition to “digital” it is essential that they understand the differing image acquisition technologies. This is the first of a series of articles exploring the topic of considerations in determining which imaging modality is best for your practice.

PART 1 - CONVENTIONAL ANALOG RADIOGRAPHY

Use of a photographic emulsion to record a radiographic image has been utilized since Roentgen first discovered x-rays in 1895. The technology has evolved from the use of an emulsion coated on glass plates in the early 1900’s to today’s familiar film products.

Conventional film-screen radiography has been a mainstay of diagnostic radiography for many decades. Although the technology has evolved over the years with improvements in the characteristics of both film and screens, the basic principals remain unchanged. An exposure is made with an x-ray machine and the resulting beam is transmitted through the patient. A cassette equipped with intensifying screens causes an exposure on a film that is proportional to the intensity the beam transmitted from the patient. The cassette is then taken to a darkroom where the film is removed and placed in an automatic processor. The processed film is than interpreted using a viewbox.

Analog film-screen radiography offers several benefits. Relatively speaking, the cost of film-screen radiography is low. The systems have the capability of rendering excellent image quality. Since the cassettes are portable, there is a great flexibility in positioning of the image receptor. That being said, analog film-screen radiography has many drawbacks. The following are some of the limitations of conventional analog film-screen imaging that should be taken into consideration when evaluating which imaging modality is best suited for your practice.

1. **Limited Dynamic Range:** Conventional film-screen radiography relies on a combination of exposure factors and characteristics of the film and screen utilized to determine contrast and density levels. This range is limited and all pertinent information in the image may not be displayed.
2. **Image Manipulation:** Once processed, the contrast and density levels present on the film are fixed. The user does not have the ability to adjust these values to display additional diagnostic information

3. **Processing Variations:** Radiographic film is subject to variables in processing conditions. Variations in temperature, chemical activity and transport time will result in inconsistent display of images.
4. **X-Ray Exposure Factors:** Contrast and density on conventional film-screen systems are determined by the mAs and kV factors utilized. Relatively minor variations in these factors may render the radiograph non-diagnostic. The resultant repeat examination increases dose to both patient and operator, increased material cost and inefficient use of technologist time.
5. **Distribution Cost:** Film is bulky and the cost of handling and distributing to areas where needed for diagnosis is high.
6. **Storage Cost:** Archived X-ray film requires a significant amount of space for storage. With construction cost approaching \$150 per square foot for typical office space, the cost of long term storage cost for radiographs is significant.
7. **Clerical/Administrative Cost:** Conventional film-screen systems require the use of ID cards to imprint pertinent patient information on the film, file jackets to store and transport film files, clerical time to file patient jackets and time to retrieve folders when prior images are needed for comparison to a current study. These administrative cost add to the overall total “cost of operation” for a film-screen system
8. **Lost Films:** Typically, studies on film-screen systems only exist as the original study. In many instances, films are lost which may result in substandard patient care if prior studies are not available for comparison and in worst case, may have negative legal implications.
9. **Environmental Impact:** Processing solutions contain chemicals that may be detrimental to the environment.

Although conventional analog film-screen radiography has proved to be a reliable method to record images, the above drawbacks have led the industry to search for alternatives. With the increased use of computers and related equipment in many industries, the transition from film-based imaging to the use of computers was the next logical step in the evolution of diagnostic radiographic imaging.

Next PART 2: CR: A NEW ERA