

Cine films

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Cinefluorography is a professional motion-picture process. To obtain high-quality motion pictures for medical diagnosis, we must understand and apply the techniques that produce high-quality motion pictures for the entertainment industry. These techniques include film selection, processing of cine films, and quality assurance of the final product.

Historically, films for cinefluorography were selected from films developed for other purposes and were available at a given moment. Early image intensifiers had low gains of the order of 1000 to 3000 times. Adequate motion-picture processors, at a cost compatible with cardiology department funds, were not available. The first film requirement was a high-speed film of at least medium contrast. Such a film was in use in the motion-picture industry—Eastman double-X negative film. This film became widely used in cinefluorography. Unfortunately, it did not meet the requirements of every laboratory or diagnostician. What was an acceptable film result in one laboratory did not always give the same result when used in another laboratory. Consequently, other cine films were tried and selected by trial and error.

Cine film is the recording media and repository of the final permanent image needed for diagnosis.

Many factors besides the film affect the quality of the image the film records. The usual approach to choosing a film for photographic application is to match the application against film characteristics as established a film's characteristic curve. This approach is not suitable in cinefluorography. A number of "system" factors affect the final contrast recorded on the film. Unfortunately, these factors cannot be measured by the sensitometric procedure that is used to obtain the characteristic curve of a film.

Film selection is affected by the following seven "system" contrast factors: the patient, radiation quality, image intensifier, processor characteristics, viewing equipment, subjective diagnostic judgment, and film. The first factor affecting the "system" contrast is the patient whose biological configuration influences the amount of x-ray absorption that may occur, the degree of x-ray penetration required, and the amount of secondary radiation that will be produced. Second, the radiation quality, which refers to the wavelength of the kilovoltage selected, controls the subject contrast of the image. It is affected not only by the patient configuration but also by the limitations of the x-ray generating equipment. The third factor is the inherent contrast of the image intensifier tube. The tubes now available range in contrast from 1:6 (low) to 1:20 (high). Even higher contrast tubes are beginning to appear. Fourth, the processing cycle and the processors used may

vary in their operating parameters. The single processing factor that has the greatest effect on "system" contrast is the degree of agitation a particular processor provides. Fifth, the viewing equipment and viewing conditions can increase or decrease the "system" contrast. Sixth, the nature of the human perception process results in individual value judgments of the contrast and brilliance of a projected image. Consequently, identifying the contrast desired by the diagnostician is vital to choosing the proper cine film. The final factor is the film contrast, which is determined by the film manufacturer.

Choosing a film for cinefluorography is more complicated than looking only at the characteristic curves of films. It requires assessing all the factors listed that influence the final recorded image contrast.

Cine films should be handled carefully to avoid physical strains such as pressure, creasing, or buckling. Since the majority of cine films are panchromatic (sensitized from the blue through the red portion of the electromagnetic spectrum), they should be handled in total darkness. Such films should be stored in a cool, dry place, properly shielded from gamma rays, x-rays, and other penetrating radiation. If film is stored in a refrigerator, it should be removed 12 hours before use. The exposed film should be kept cool and dry and processed promptly.