

Dual-screen CR imaging is the technique of simultaneously exposing two screens and digitally superimposing the resultant images into an image of better signal-to-noise ratio. Because X-ray absorption is effectively improved, it is also possible to use one or two HR screens to achieve higher resolution without compromising on the signal-to-noise ratio. A theoretical model for dual-screen CR imaging has been derived to relate the DQE of the superimposed image to the MTFs and noise power spectra of the front and back images. The model showed that for best DQE the front and back images should be weighted in proportion to their DQE and in inverse proportion to their MTF. The optimized DQE is equal to the sum of the DQEs in the front and back images. In order to achieve best DQE over the entire frequency range, the optimal weighting factors must be determined as a function of the frequency and used to filter the front and back images prior to superimposition. MTF and NPS were measured and used to estimate DQEs for various screen combinations used in dual-screen CR chest imaging. It was found that the use of one or two HR screens in dual-screen CR imaging results in substantially improved DQE at high frequencies without significantly affecting the DQEs at low frequencies. For asymmetric screen combinations, it is necessary to use frequency dependent weighting factors to optimize image superimposition for best DQE.

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