Purpose: To establish a practical methodology to quantify the performance of different automatic exposure controls (AEC) options in digital mammography in terms of dose efficiency.

Methods: A Hologic Selenia digital mammography system was used in the study. A figure of merit (FOM), defined as the squared signal difference to noise ratio normalized by the mean glandular dose (MGD), was utilized to delineate the AEC performance. The measurements and analyses were conducted under different AEC options on a realistically shaped tissue equivalent phantom (CIRS 18-222). The phantom consists of simulated masses, fibers, and microcalcifications. Slabs of BR12 were added to reach different thicknesses. Based on the results, a computer simulation was performed for lesions on the images of an anthropomorphic breast phantom (Gammex, Rachel) acquired under the same AEC options. The pathological findings from the resulted images were compared.

Results: For the mammography system used in the experiment, it was found that as compared with the default AEC, the lower kVp and Mo/Mo target-filter AEC table results in a FOM improvement on low contrast by 11% to 20%, except for 7 cm thickness where the FOM is reduced by 17%. The FOM improves negligibly on high contrast details for the thicknesses of 4.5 - 6 cm and decreases by 18% for the thickness of 7 cm. The simulated lesions on the Rachel phantom showed enhanced contrast with the lower kVp and Mo/Mo option, but the enhancement gradually decreases for the thicker breast.

Conclusions: A methodology was established to quantify the performance of different AEC options using the figure-of-merit and the commercially available phantoms. For the tested mammography system, the lower kVp and Mo/Mo option is preferred if the breast thickness ranges 4.5 - 6 cm, whereas the default AEC is recommended if the breast thickness is 7 cm and above.

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NONE