IMPROVEMENT OF MEAN GLANDULAR DOSE VERSUS COMPRESSED BREAST THICKNESS RELATIONSHIP FOR MAMMOGRAPHY

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The mean glandular dose (MGD) to compressed breast thickness (CBT) relationship is commonly used for the presentation of mammographic dose survey results and could also be useful for the assessment of individual breast doses retrospectively for situations where dose measurements cannot be provided continuously in house.

However, dose variations at each thickness should be minimum in this relationship for the reliability of the results, but high scattering of the data from the best fit are usually seen. Use of different beam qualities, variations on patient breast compositions at specific breast thickness, fluctuations at tube outputs, compression force uncertainties, and film processing conditions, problems in the performance of automatic exposure control (AEC) performance and in film/screen combinations could be the reasons for these uncertainties.

Main objective of this paper is to investigate the effect of breast composition and beam quality to the MGD versus CBT relationship both for patient examinations and phantom experiments. All measurements were made with a GE Senographe DMR mammography unit. With the anode – filter combinations of Mo-Mo, Mo-Rh, Rh-Rh.

Total of 105 patients have been included in this investigation. One breast was examined with the automatic mode of the system. A manual technique, considering the approximate glandularity content of the breast and its compressed thickness was used for the examination of the second breast. In order to have an initial idea regarding to the glandularity content of the breast before the exposure, a best guess of breast glandularity was tried to be made through the evaluation of X-ray film belong the other breast already examined by the automatic technique. Based upon this decision criteria, patient breasts were divided into three groups according to their glandularity content. Breasts with the glandularities of more than 75% and lower than 25% were categorized as dense and fatty breasts respectively. All the breasts with the glandularities between 25%-75% were collected in the third group. Beam qualities that will be used for the manual exposure technique were selected according to this ratios and compressed breast thickness.

MGD versus CBT relationship for all the patients examined gave a poor correlation. (R^2 =0.28). These relationships were separately obtained for each glandularity group and also for sub groups of specific beam qualities. The best correlation was found for fatty breast group and Mo/Mo combination (R^2 = 0.73). A low correlation (R^2 = 0.34) was found in the case of mid glandularity group due to the inclusion of wide range of glandularities in this group. For the case of dense breast group, although the glandularity range was narrow, there were still high data scattering (R^2 = 0.25). This was probably due to use of Mo/Rh and Mo/Mo combinations. This is validated by obtaining MGD-CBT relationship specific to Mo/Mo combination (R^2 = 0.61).

As a phantom experiment, tissue equivalent materials with a range of simulated relative glandular content (30%, 50% and %70) and thicknesses (20-70mm) were exposed in automatic mode in order to better see the effect of beam quality to MGD versus thickness relationship. High data scattering were noticed at the 4-6 cm of breast thicknesses in these relationships due to the automatic change of target/filter combination

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