

# Patient Dose Measurements in Digital Mammography, using Computed Radiography (CR) versus Dose in analog mammograph

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## 1. INTRODUCTION

Protocols have now been published that give guidance on the commissioning and routine testing of full field digital mammography systems. These documents include remedial levels for the mean glandular dose to equivalent breasts for thicknesses of polymethylmethacrylate (PMMA) from 20 -70 mm and acceptable and achievable levels of image quality. For most film/screen mammography systems the automatic exposure control (AEC) is based on the use of a radiation detector placed behind the cassette which terminates the exposure when a certain level of dose is reached, corresponding to the level needed to achieve the required film density. With the introduction of digital mammography with solid state detectors, manufacturers no longer use a single radiation detector to control the AEC exposure; rather each manufacturer may use the signal from the image detector in a different manner in order to determine when to halt the exposure.

## 2. OBJECTIVES

The aim of this work is double: 1- to assess the image quality in clinical practice using the subjective rating scales of the European Guidelines on Quality Criteria for Diagnostic Radiographic Images, and 2- to estimate patient doses for the digital mammography and analog mammography for auditing compliance with the European Diagnostic Reference Levels (DRL).

## 3. MATERIALS AND METHODS

The study sample was constituted by 96 patients randomly chosen, providing a total of 384 images, i.e. 192 images for the cranio-caudal (CC) projection and 192 images for the medium lateral oblique (MLO) projection. Average glandular dose (AGD) was evaluated in computed radiography systems and from the screen-film system. The value of the MGD was obtained from the kerma in the incident air, and the conversion coefficient so that:

$$MGD = K_i \cdot g \cdot c \cdot s$$

where:  $K_i$  = kerma in the incident air on the surface of the breast, measured without backscattering;  $g$  is the conversion factor of the incident kerma on the breast, in a mean glandular dose, for glandularity of 50 %;  $c$  is the correction factor for different compositions of the breast with glandularity other than 50 % and  $s$  is the correction factor for different anode-filter.

## 4. RESULTS AND DISCUSSIONS

European image quality criteria were adopted by the radiologist doctor to accept the image for diagnostic purpose. For breast densities of 50% adipose and 50% glandular tissues the incident air-kerma was measured and the glandular dose calculated considering the x-ray output during the exam. In the study of 96 patients the mean glandular dose varied from 0.49 to 4.08 mGy for CC incidences. For MLO incidences the mean glandular doses ranged from 0.62 to 4.84 mGy. Table 1 shows the variation of the mean glandular dose. Figure 1 and Figure 2 shows the average dose values glandular

Table 1 – comparison between doses to digital systems and screen-film system (mGy)

average value	screen-film system	standard deviation	digital	standard deviation
CC	<b>1.77</b>	<b>0.65</b>	<b>2.37</b>	<b>0.83</b>
MLO	<b>2.13</b>	<b>0.78</b>	<b>2.25</b>	<b>0.94</b>

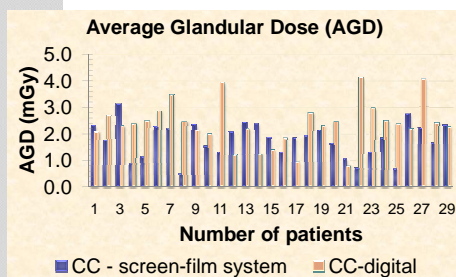


Figure 1 shows results obtained in this study comparing the average glandular dose digital and conventional for CC.

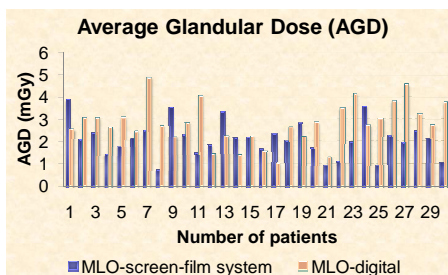


Figure 1 shows results obtained in this study comparing the average glandular dose digital and conventional for MLO.

## 5. CONCLUSIONS

For breast densities of 50% adipose and 50% glandular tissues the incident air-kerma was measured and the glandular dose calculated considering the x-ray output during the exam. In the study of 96 patients the mean glandular dose varied from 0.62 to 3.20 mGy with a mean value of 1.79 mGy for CC incidences. For MLO incidences the mean glandular doses ranged from 0.62 to 3.98 mGy and a mean value of 2.40 mGy. In the evaluation of the MGD, the average doses estimated meet the values established by norms. The dose in the MLO projection is always greater than the dose in the CC projection, it is because in the MLO projection displayed the pectoral muscle, causing the increases in breast thickness and the dose also.

In general the clinic assessed is in conformity, as image quality is concerned and the average dose received by the patients meet the values permitted.

## 5. ACKNOWLEDGMENTS

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