Comparison Between CRT and LCD Displays for Full-Field-Digital-Mammography (FFDM) Interpretation

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Abstract. Purpose: To evaluate efficacy and diagnostic accuracy of BARCO LCD 5Mpixel displays, compared to BARCO CRT 5Mpixel displays in full-field-digital-mammography (FFDM) interpretation.

Material and Methods: FFDM mammograms obtained by 100 patients, were analyzed by three independent radiologists experienced in breast imaging, using two different CRT and LCD displays. All cases were selected by a fourth radiologist in order to cover several possible ages and types of breast. Half of cases were negative and half were positive for malignancy, proven by percutaneous biopsy. Readers were blinded to history of patients, ultrasound examination and biopsy results. To minimize recall bias, an interval of at least 30 days between interpretations of each case on two different monitors was chosen. Each reader evaluated cases classifying them according the ACR BIRADS categories. Moreover, they assigned a rate (0-100) corresponding to the Probability of Malignancy (POM) of each case classified into BIRADS categories 3 to 5. Finally, they assigned a rate (0-100) corresponding to reading confidence.

Analysis included ROC curves of POM for each doctor and for pooled data, sensitivity and specificity for the BIRADS≥3 and BIRADS≥4 thresholds for each doctor and for pooled data, and finally main results of "Multireader-Multicase ROC Analysis Of Variance". For each analysis a comparison was made between the two monitors.

Results: No statistical significance was seen between the two displays regarding POM, sensitivity and specificity, nor for single reader either for pooled data.

Conclusions: This study provides a reasonable assurance that the examined CRT and LCD display systems are comparable for FFDM interpretation.

1 Background

Several trials demonstrated that Full-Field Digital Mammography (FFDM) is at least comparable to analogic mammography in the detection rate of cancers (1-3). At the same time, it is well known that the analysis of digital mammograms cannot be performed on printed images but requires high resolution monitors (5 MegaPixels),

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dedicated to mammography (3-5). Actually, two different technologies for monitors are available: the commonly used Cathode Ray Tube (CRT) monitors and the more recently introduced Liquid Crystal Display (LCD) monitors. The two technologies have different characteristics and both present advantage and disadvantage. It is not still clear which of the two should be used in clinical practice (6, 7).

The purpose of our study was to evaluate efficacy and diagnostic accuracy of BARCO LCD 5Mpixel displays, compared to BARCO CRT 5Mpixel displays in full-field-digital-mammography (FFDM) interpretation.

2 Material and Methods

Three radiologists, experienced in breast imaging, with respectively 9, 8 and 3 years of experience, reviewed 100 cases of FFDM, using BARCO CRT monitors (MammoMeDis HD, model V9600123) and BARCO LCD monitors (Coronis 5MP Mammo, Model V9600800). The characteristics of the two different monitors are summarized in Table 1. All digital mammograms were obtained with FFDM unit GIOTTO IMAGE MD (IMS – Bologna, Italy).

Table 1. Characteristics of CRT and LCD Monitors

Characteristics	**CRT**	**LCD**
Dimension	304mm x 380 mm	337mm x 422mm
Contrast	>2000 :1	>700 :1
Matrix	2048 x 2560	2048 x 2560
Refresh Rate (Frequency)	76 Hz	50 Hz
Viewing angle	± 135°	± 25°
Luminance	400 cd/m2	600 cd/m2
Luminance Uniformity	>90%	>90%
Ambient light	< 10 LUX	< 10 LUX

3 Patient's Selection

The 100 cases were selected by a forth radiologist, experienced in breast imaging, in order to cover several possible ages (range 40-83 years, mean 53.5 years) and a great variety of breasts, considering particularly different possible densities. 40% of cases consisted of biopsy-proved malignancies while 60% of cases were negative or with benign findings, with at least one year follow-up. The fourth radiologist anonimized all cases and presented them randomly to the three readers, on CRT monitors and LCD ones. Only the fourth radiologist was aware of the results of histology.

4 Imaging Interpretation

To make the conditions as reproducible as possible, ambient light was always in the limit and the angle with which the doctors were positioned in front of the LCD was into the limits (position of the eyes approximately in the middle of the LCD at a distance of approximately 30/40 cm).