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### Assessment of Entrance Surface Skin Dose (ESD) and Mean Glandular dose (MGD) in a Digital Mammographic Unit Comparing the TL and OSL Techniques

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The digital mammography is the most important and simple tool in the diagnosis of breast diseases in women. Despite the innumerable advantages of this technique, such as an accurate diagnosis for women with dense breast, it was noticed an increase of radiation doses to obtain the images by this system. To guarantee proper conditions of protection for patients, the radiation dose should be as low as reasonably achievable possible and simultaneously compatible with image quality requirements<sup>(1)</sup>. Thus, this work proposes the use of the thermoluminescent (TL) CaSO<sub>4</sub>:Dy sintered discs, produced at IPEN and Al<sub>2</sub>O<sub>3</sub>:C optically stimulated luminescence (OSL) 'dot' dosimeters, manufactured by Landauer Inc., as dosimeters to evaluate the entrance skin doses (ESD) delivered to patients, the half value layer (HVL) and the mean glandular doses (MGD) in a mammographic digital unit, comparing these two techniques with the results obtained using an All-in-one QC meter.

The repeatability response for both materials was evaluated using a <sup>137</sup>Cs gamma source. The energy dependence responses were evaluated to X radiation beams and with gamma radiation from <sup>60</sup>Co and <sup>137</sup>Cs gamma sources. A breast phantom *Nuclear Associates*, model 18-220, was placed under the compressor tray and an X-ray image was acquired using the fully automatic exposure control of the LORAD M-IV digital unit. Then, knowing the beam quality that the acquisition system was calibrated for imaging the phantom, the TL and OSL dosimeters were calibrated in a dose range of 3 to 25 mGy of this quality using a *PTW DIAVOLT UNIVERSAL All-in-one QC Meter*, placing them in the centre of the radiation field. The half-value layer was estimated using the QC meter and the dosimetric materials. To evaluate the ESD and the MGD, with the QC meter and the dosimetric materials, they were exposed to the same conditions selected by the mammographic unit in a standard mammogram exam positioning.

The repeatability of the CaSO<sub>4</sub>:Dy and Al<sub>2</sub>O<sub>3</sub>:C dosimeters is better than  $\pm 3.0\%$  after 10 times of repeated and standard annealing procedures. The dose response curves for both dosimeters vary linearly with the radiation in the dose range studied. The energy dependence response of the TL and OSL dosimeters was obtained in order to evaluate the ESD. The results obtained for ESD for 27kV in the Lorad M-IV unit were (10.45  $\pm$  0.10) mGy for QC meter, (10.25  $\pm$  0.57) mGy for TL dosimeters and (10.50  $\pm$  0.03) mGy for OSL dosimeters. For HVL estimative, the results are (0.31  $\pm$  0.01) mmAl for QC meter, (0.32  $\pm$  0.01) mmAl for TL pellets and (0.32  $\pm$  0.01) mmAl for OSL dosimeters. The MGD results are 1,80mGy with QC meter, 1,81mGy with TL pellets and 1,81mGy with OSL dosimeters for the 4,5cm thickness breast phantom. The ESD and HVL results met with Brazilian national requirements<sup>(1)</sup>. The results obtained for MGD are according with international recommendations.

The results obtained demonstrated that the TL and OSL dosimetry systems used are able to evaluate the entrance skin dose as well as mean glandular doses in a digital mammographic unit accurately within the requirements, and they can be considered a practical and simple tools for verification of these items in a Quality Assurance Program.

- Agência Nacional de Vigilância Sanitária. Portaria nº 453. Diretrizes Básicas de Proteção Radiológica em Radiodiagnóstico Médico e Odontológico. Jun, 1, 1998. (ANVISA, Portaria nº 453).