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Estimation of the absorbed dose in the female phantom lens according to the protocol used in cone beam CT

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In recent years, the cone beam computed tomography (CBCT) has become a common exam for various dental procedures. Besides, recent studies have suggested that the crystalline is more sensitive to radiation than known (Stewart et al, 2012). Thus, the main objective of the present work is to estimate the absorbed dose in the lens for a woman standard phantom during CBCT examination.

For this, a female anthropomorphic simulator was used and thermoluminescent dosimeters (LiF: Mg, Ti) were positioned in the crystalline lens location. The phantom was exposed using 13 protocols of 5 different CBCT equipment manufacturers.

The measured absorbed dose in crystalline were between 0.2 mGy and 2.6 mGy. Considering the different manufactures, the results varied up to 1.7 times for one-arc protocols, up to 8.7 times for two-arc protocols and up to 13 times for localized protocols. Comparing the two techniques used to determine the absorbed dose for protocols with similar Field of View (FOV), it was obtained that the absorbed dose for technique stitched FOV was 2 times higher than dose for the single FOV technique. Depending on the beam geometry, the protocol with asymmetrical beam presented 45% less dose than the symmetrical beam protocol for same image objective.

In this study were observed large variation between the highest and lowest dose absorbed in the crystalline for the different protocols. This results show possibility for reducing dose in the crystalline changing the size of the FOV or the exposure parameters.

Stewart FA, Akleyev AV, Hauer-Jensen M, Hendry JH, Kleiman NJ, Macvittie TJ, et al. ICRP Publication 118: ICRP statement on tissue reactions/early and late effects of radiation in normal tissues and organs — threshold doses for tissue reactions in a radiation protection context. **Ann** ICRP 2012; 41: 1-322.

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Low intensity spatially-resolved luminescence: automated image analysis of arbitrary objects

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Spatial imaging of luminescence phosphors allows the investigation of variations in both sensitivity and dose, but if measurement protocols employ repeated regeneration doses to build dose-response curves it is important to automate the image analysis process. This is relatively straightforward if the phosphor grains are in a known fixed geometry, but is more difficult if the phosphor is of arbitrary shape and spatially-variable sensitivity.

Here we present an automated image analysis program used with the Risø EMCCD camera attachment to construct dose response curves from a variety of OSL and TL phosphors. This software uses 3 reference markers on each image for location; these can be automatically identified, or picked by the user. Arbitrary regular or polygonal regions of interest are then chosen on one image, and the TL or OSL signals integrated on all images to produce the dose response information.

The reliability of the automated identification and location algorithm is discussed, and illustrative TL and OSL images of both natural and artificial phosphors are presented, together with the corresponding optical and elemental analysis (using micro XRF) images. The problems of crosstalk and optical resolution are discussed, and the images used to demonstrate the application of the luminescence imaging system and automated analysis software to investigate the variations in sensitivity and dose distribution across phosphors of arbitrary shape up to ~9 mm across.

We have developed automated image analysis software for arbitrary regions of interest. This allows us to derive spatially-resolved dose-response maps for a range of natural and artificial luminescence phosphor slices or chips.

M. Kook, T. Lapp, A.S. Murray, K.J. Thomsen, M. Jain, A luminescence imaging system for the routine measurement of single-grain OSL dose distributions, Radiat. Meas., 81 (2015), pp. 171-177