

Radiodermatitis Quantification through Image Processing: A Simulated Study

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Radiodermatitis is an acute skin reaction caused by ionizing radiation. The lesion presents a red visual appearance known as erythema, and is caused by increased blood volume in the subpapillary vascular plexus. Currently the rating is done qualitatively, where the physician uses the “RTOG / EORTC Late Radiation Morbidity Scoring Schema”. Nowadays, there is no quantitative method to assess the degree of injury that is affecting the skin throughout Head & Neck and Breast Cancer therapy. The objective of this work is to develop a metric for the evaluation of radiodermatitis using digital images with polarized light.

We simulated radiodermatitis by exposing the ventral region of a left forearm to solar radiation for two hours without the use of sunscreen, where different regions of said forearm were exposed to the sun for different time intervals (0 hours (reference), 30 minutes, 1 hour and 2 hours). The three images were obtained in a dark room, 24 hours after exposure with the forearm being illuminated only by an RGB LED light source. The three images were, one without filter, one with polarizing filter oriented parallel to the polarization of the illumination; and one with a filter oriented perpendicularly. Each image was analysed in different color spaces (RGB, HSV and $L^*a^*b^*$). The mean intensity in each region of the skin was calculated. For each region, the percentile of the pixels with intensity greater than 99.9

After the analysis of each channel in the 3 color spaces, the ones that represented a greater variation with light exposure time were the channel R for the parallel and perpendicular settings. The imaging done with crossed polarizers was marginally better than the image obtained with non-polarized light.

We have shown that RGB imaging can be used to quantify time of exposure to the sun. The proposed methodology can potentially be used for quantification of skin erythema.