Dose evaluation of dental cone beam computed tomography using an anthropomorphic adult head phantom

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Dental cone beam computed tomography (CBCT) can provide high resolution images and has been widely applied in the clinics. Therefore, the radiation dose from CBCT examinations has become an important issue. In this study, we developed an in-house anthropomorphic adult head phantom to evaluate the dose of CBCT.

The anthropomorphic phantom was made of acrylic filled with plaster instead of bone. The contour of the head was extracted from a set of adult CT images. The thermoluminicent dosimeters (TLD) were used to measure the dose at 21 locations within the head and neck region of the phantom. For each location, the measurement was performed three times to obtain the mean dose and standard deviation.

The doses from CBCT with the scanning parameters of 65/75/85 kVp, 5.1/7.1 mm^2 field of view (FOV), and 102 mAs were measured. The results were converted to the effective dose by using the tissue weighting factors from ICRP-103 report, and were compared to the effective dose measured from the standard Rando phantom.

At 5.1 mm^2 FOV, the effective doses of three kVp were 40.31, 67.88 and 90.12 μSv, raspectively. At 7.1 mm^2 FOV, effective doses were 81.23, 133.31 and 188.5 μSv respectively.

The percent error between the dose measured from the proposed phantom and the Rando phantom were lower than 15 % for all scan parameters. We thought that the proposed anthropomorphic adult head phantom can be applied in the dose assessment of clinical CBCT.