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Absorbed dose distributions in intensity-modulated dental computed tomography

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Dedicated cone-beam computed tomography (CBCT) for dental diagnostics has become popular and nowadays it is not difficult to find CBCT scanners even in private dental clinics. On the other hand, cancer risk with the increasing use of CT has been a great issue in diagnostic radiology [1]. If there was the slice war in the CT industries, the dose war has begun. The tube-current modulation technique in medical CT, which was developed for low-dose imaging while minimizing the loss of image quality, may also be applied to dental CT. This study investigates the feasibility of beam-intensity (kVp and/or mAs) modulation (BIM) technique in dental CBCT. It is a motivation of this study that the BIM technique may avoid severe radiation dose to critical organs, such as eye lens, thereby reducing the effective dose. Various BIM scenarios for a single circular scanning are designed accounting for the cervical spine through which x-ray beam attenuates largely. Using the Monte Carlo (MC) technique, we obtain absorbed dose distributions in a numerical anthropomorphic head/neck phantom for the designed BIM scenarios, and compare the results with that obtained for the conventional scan, as demonstrated in Fig. 1. We implement the BIM scenarios to our laboratory bench-top CBCT system, and investigate image quality (e.g., image noise) of the reconstructed images. This study will determine which BIM scenario can provide less patient dose with image quality comparable to the conventional dental CBCT.

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