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P2.63: A novel reconstruction method of angle-limited backprojection (ALBP) for low-dose dental panoramic imaging using a long-rectangular detector

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Dental panoramic imaging is a standard X-ray technique in dentistry that produces a single image of the facial structures, including both maxillary and mandibular arches and their supporting structures. A typical panoramic system consists of a slit-collimated X-ray tube, a linear-array type detector, and predetermined sequences for the panoramic scan motion and signal readout from the detector to focus a specific dental arch. Panoramic image is commonly reconstructed using the shift-and-add (SAA) algorithm [1], where it is gradually built up by adding panoramic projections in a way that stacks the focusing sections of the panoramic projections consecutively. In this study, we propose a new panoramic reconstruction method, the so-called angle-limited backprojection (ALBP) algorithm, for low-dose panoramic imaging [2]. Figure 1 shows the schematics of panoramic reconstruction methods of the SAA and proposed ALBP algorithms. In the ALBP algorithm, rays to be backprojected onto a given spherical voxel, which is established along the dental arch, are selected from the measured panoramic projection data and then backprojected, as in computed tomography reconstruction. To validate the efficacy of the proposed algorithm, we conducted a series of simulations and successfully reconstructed panoramic images using both the SAA and ALBP algorithms. Figure 2 shows the simplified data processing for the proposed ALBP algorithm and the 3D numerical dental arch phantom used in the simulation. Figure 3 shows the resulting panoramic images of the phantom reconstructed using the SAA and ALBP algorithms: (a) with all and (b) with half projection data. The preliminary simulation results showed that the image quality of the panoramic image obtained using the ALBP was better than that of the image obtained using the SAA. In addition, the panoramic image reconstructed using the ALBP with half projection data gave much better image quality than that using the SAA with the same projection data, indicating the potential of low-dose panoramic imaging. More quantitative simulation and experimental results will be presented in the paper.

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