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Image characterization and optimization of high-resolution scintillators on digital X-ray imaging detector

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In recent years, digital X-ray imaging detectors with indirect detection technology have been widely used in dental digital radiography such as intra-oral, panorama and dental CT. These indirect X-ray imaging detectors are based on the combination of a complementary metal-oxide semiconductor (CMOS) array with various high-resolution scintillating screens such as CsI, GOS materials. Currently, a CMOS panel-based indirect X-ray imaging detector with low radiation dose and excellent spatial resolution has been widely utilized for digital intra-oral radiography.
In this work, different high-resolution scintillation screens such as FOS (fiber optic scintillator) with needle structured CsI:Tl and Gd2O2S:Tb(GOS) materials with different mass density were used to investigate and optimize the imaging characterization. The used different FOS screens are a highly X-ray absorption material that minimizes and removes the direct X-ray induced noise. The used scintillator's configuration parameters were tested and optimized for superior image quality at low X-ray exposure condition.
For image characterization and optimization of the X-ray image device, different scintillating screen were directly combined on the bare high-resolution CMOS photodiode array. The imaging performance such as the light response to X-ray exposure dose, signal-to-noise-ratio (SNR), modulation transfer function (MTF) and low-contrast detail resolution was measured under practical dental system condition with 60-70kVp tube voltage and 2-5mA tube current. The high spatial resolution with 16.6lp/mm could be implemented through the experimental results with a CMOS imaging detector using a CsI scintillator.

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