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# Effects and image evaluation of high-resolution scintillators on digital X-ray detector for intra-oral radiography

In recent years, digital X-ray imaging sensors with indirect detection method have been widely used in many dental imaging applications 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 different scintillating materials such as CsI, GOS. Currently, a CMOS-based indirect X-ray imaging sensor with low dose and high spatial resolution has been widely utilized for dental intra-oral radiography.
In this work, we have designed and developed the CMOS APS image sensor with high-resolution and high-sensitivity for dental imaging tasks. A prototype sensor consists of CMOS array with a 24mm x 33mm active area with high-definition mode (10um pixel pitch) and normal-definition mode (20um pixel pitch) respectively. Different high-resolution scintillation materials such as FOS (fiber optic scintillator) with columnar CsI:Tl and Gd2O2S:Tb(GOS) with various thickness were used to investigate the imaging performance. The used FOS screen is a highly X-ray absorption material that minimizes the X-ray induced noise. The used scintillator's design parameters were optimized for excellent image quality at low X-ray exposure condition.
For evaluation and optimization of the X-ray image sensor characterization, different scintillating screen materials were directly coupled on the prototype CMOS photodiode array. The typical imaging performance such as the light response to X-ray exposure dose, signal-to-noise-ratio (SNR) and modulation transfer function (MTF), low-contrast detail resolution was measured under practical dental imaging systems with 60-70kVp tube voltage and 2-5mA tube current. The experimental results with CMOS image sensor using FOS scintillators, about 16.6lp/mm spatial frequency could be seen.

**Authors:** Dr CHA, Bo Kyung (KERI); Dr JEON, Sungchae (KERI); Prof. SEO, Chang-Woo (Yonsei University)

**Presenter:** Dr CHA, Bo Kyung (KERI)

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