Feasibility study for application of single grid-based Phase-Contrast Imaging (PCI) technique to Dental Digital Tomosynthesis (DTS)

Hyosung Cho, Hyunwoo Lim and Hunwoo Lee
Yonsei University, South Korea

Since Röntgen discovered X-rays in 1895, X-ray imaging techniques have continuously advanced from two-dimensional (2D) radiography to 3D tomography such as digital tomosynthesis (DTS) and computed tomography (CT), having been a powerful inspection tool in many applications of medicine, industry, material science, etc. Those techniques have in common attenuation-based contrast which arises from differences in elemental composition, thickness and density of the examined object. However, conventional attenuation-based radiography remains limited by low image contrast especially in imaging materials of low atomic number Z. One possible solution to the problem of limited contrast inherent to attenuation-based radiography is the application of phase-contrast imaging (PCI) technique that utilizes the phase shift introduced by the examined object to the transmitted X-rays. Because the variation in phase of X-rays is much larger than that in intensity due to attenuation, it can detect small features and variations in the object that would be invisible in conventional attenuation-based radiography. In this work, in order to overcome this limitation and to further increase the diagnostic value of DTS examinations, we applied the recently proposed PCI method, the so-called single grid-based PCI to DTS (PCI-DTS). We developed a useful simulation platform for single grid-based PCI-DTS and performed a systematic simulation using a three-dimensional numerical head phantom. In the simulation, an X-ray grid having a 200-lines/in strip density was used and the DTS scan comprised 41 projections within an angle range of 0=±40o with an X-ray energy of 50 keV. We successfully reconstructed PCI-DTS images of much improved image contrast, compared to attenuation-based DTS images, which demonstrates the viability of the proposed approach.

Biography

Hyosung Cho has completed his PhD at University of California at Berkeley and Post-doctoral studies at Lawrence Berkeley National Laboratory (LBNL) and Johns Hopkins University. He has published more than 100 papers in reputed journals and has been serving as an Editorial Board Member of repute.

hscho1@yonsei.ac.kr

Notes: