ABSTRACT

The calculation of the detectability index (d') using the model observer (MO) has become a breakthrough in the optimization of CT scanners. However, the exploration of d' calculations in image reconstruction methods—a crucial part of CT image formation—has not been previously conducted. This study aims to explore the calculation of d' on CT images reconstructed using filtered back-projection (FBP) and iterative reconstruction (IR). The research was performed using retrospective images of the ACR 464 phantom, reconstructed with FBP and 50% Adaptive Statistical Iterative Reconstruction (ASIR). The d' calculation was carried out using the IndoQCT v26d software by first determining the Task Transfer Function (TTF) and Noise Power Spectrum (NPS) for each image. After obtaining the 2D profiles of TTF and NPS, synthetic images were generated and evaluated using the Non-Pre-Whitening (NPW) model observer. The NPW model observer calculations were performed with cut-off values of 3, 4, and 5, representing an observer confidence level of 98–100%. The results showed that the synthetic images from IR reconstruction exhibited compressed noise with superior spatial resolution. Furthermore, the d' calculations for both synthetic images revealed that FBP and IR reconstruction methods have similar Contrast-Detail (C-D) curve trends, although the IR curve shifted slightly downward. This minor shift was consistent across all three cut-off values, indicating that the IR reconstruction method produces slightly better contrast detectability compared to FBP. Consequently, IR more optimal for evaluating the detectability of the ACR 464 CT image index using an observer model with an NPW cutoff of 3–5.

Keywords: Optimization, filtered back projection, iterative reconstruction