AbstractID: 11067 Title: Quantitative image quality assessment of high-dose CT images simulated by averaging multiple low-dose CT images for prospective CT dose reduction studies

Purpose: To quantify image quality differences between the average of *n* low-dose images and a single high-dose image of equivalent effective dose. **Method and Materials:** An electron density phantom (CIRS) was scanned on a 16-slice CT scanner 25 times each at 12, 24, 48, 72, and 144 mAs (130 kVp, 5 mm slices, standard-body filter). Low-mAs scans were averaged to simulate 25 realizations of 9 high-mAs scans: 24mAs=2x12mAs, 48mAs=2x24mAs=4x12mAs, 72mAs=3x24mAs=6x12mAs, 144mAs=2x72mAs=3x48mAs=6x24mAs=12x12mAs. Mean and standard deviation (SD) were calculated for 18 ROIs over a range of materials (-790 to 235 HU) on matched pairs of simulated and acquired images. The Welch's *t*-test was used to evaluate differences in mean and SD between images. Similar experiments were performed on a Catphan$^{(R)}$ and anthropomorphic-body phantom (ATOM, CIRS). Catphan images were visually scored for spatial and low-contrast resolution. Profiles through selected ATOM images from the head, shoulder, and thorax were compared. **Results:** For every simulation, the average (range) difference in mean CT number between simulated and acquired images over all ROIs was <1 HU (-0.1±0.4 to 0.7±1.1 HU); no statistically significant difference was observed for any one material ($p \geq 0.27$). For every simulation, the average (range) relative difference in SD over all ROIs was ≤4% (-4.0% ±4.9% to 3.6%±3.1%); no statistically significant difference was observed for any one material ($p \geq 0.56$). Spatial resolution of simulated images was ± 1 lp/cm of acquired images and low-contrast resolution was ± 1 disc at all contrast levels. ATOM images profiles showed excellent agreement in all slices. **Conclusion:** Image quality of the average of *n* low-mAs CT images is equivalent to a high-mAs (*n*xlow-mAs) image for the dose range studied; suggesting prospective CT dose-reduction studies may be feasible using multiple low-dose CT image acquisitions in place of the single high-dose diagnostic scan.