AbstractID: 5857 Title: Evaluation of respiration-correlated digital tomosynthesis for soft tissue visualization

Purpose: To find optimal parameters for digital tomosynthesis (DTS) image acquisition, assess DTS imaging for soft tissue visualization and patient positioning, and determine if DTS can be acquired fast enough to avoid blur caused by the respiratory motion

Methods and Materials: We have used Varian gantry-mounted kV on-board imaging system to acquire DTS images as well as reference cone-beam CT (CBCT) scans. An external respiratory monitor system recorded patient respiration together with the x-ray on/off signal during imaging for retrospective sorting of projections based on respiration phase. DTS reconstruction used backprojection followed by a deblur. For a lung tumor subject to the respiratory motion we also reconstructed DTS images during a short time interval (~ 1 s = 6° arc at 1 rpm) around the end-exhalation.

Results: Phantom studies indicate that image quality increases with DTS arc length; however, longer arc lengths cause image blur and degradation. Optimal DTS arc length is 10-20.° Patient studies also indicate that at approximately 15° arc length image quality, as judged visually, is the best. For longer arcs image blur increases, while for shorter arcs out of plane objects become more pronounced. For all arc lengths tumor visualization was possible.

Both manual and automatic 2D registrations of DTS and CBCT were possible in most cases. For short (6°) or long (30°) arc lengths manual registration became more challenging and automatic registration less precise, but still possible. Registration of a respiratory correlated DTS image over a 6,° non-optimal arc, was possible.

Conclusions: DTS is capable of soft tissue and bone visualization and can be an efficient imaging modality for image-guided radiotherapy. DTS can be acquired, with some tradeoff in image quality, during a ~1s time interval, allowing reduction of respiratory motion artefacts.

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