AbstractID: 10831 Title: Impact of respiratory biofeedback on adaptively sampled 4D-CBCT image quality: Initial experiences

Purpose: Linac-mounted 4D-Cone Beam CT (CBCT) imaging is an important tool for IGRT. Our protocol uses an in-house built audio-video (AV) biofeedback device to regularize patient respiration during 4D-CBCT data acquisition. In this study, the impact of the respiratory stabilization on phase-correlated 4D-CBCT image quality is evaluated in our full field-of-view (FOV) 4D-CBCT procedure using the Varian OBI and RPM respiratory monitoring system.

Materials and methods: We have implemented a 4D-CBCT imaging procedure with a 450.0 mm diameter FOV using adaptive acquisition time and projection sampling frequency. An AV respiratory biofeedback device consisting of a LCD visual and audio feedback channels was used. It provides the patient with a real-time visual and auditory cues whenever the RPM deviates from the selected reference breathing trace. During the 8~10 minute data acquisition, the patient was instructed to duplicate the reference trace as closely as possible both in terms of displacement and time. The acquired projections were sorted into 10 groups by the associated phase recorded by the RPM system.

The effects of the AV biofeedback on the respiratory regularity were studied in terms of average cycle length, baseline variation and displacement. Subsequently, the corresponding 4D-CBCT images were compared with different acquisition AV modes, such as free breathing, audio only and AV regularization.

Results: The patient respiratory track presents larger variation in the free-breathing data acquisition. The auditory instruction to the patient exhibits control of the displacement but a noticeable baseline drift through the time. The AV biofeedback device improves the reproducibility of respiratory pattern.

Conclusion: Our results demonstrated that the AV biofeedback device improved the reproducibility of patient respiratory pattern in our 4D-CBCT data acquisition. The image quality benefits from the improved projection consistency within an extended time span in every phase bin.

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