CBCT-based Treatment Planning in Veterinary Radiotherapy: Challenges and Practical Solutions

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Introduction

- Cone-beam CT (CBCT) acquired on the linear accelerator is being increasingly used beyond image guidance to support simulation and treatment planning workflows.
- The Elekta Iris™ CBCT incorporates enhanced AI-based scatter correction that substantially improves image quality and Hounsfield unit (HU) accuracy compared with conventional CBCT reconstruction.
- However, whether the Iris™ CBCT can be used for treatment planning for canine and feline patients is still unclear. Moreover, technical challenges associated with limited scan range , AI segmentation, and motion management remains an obstacle to be resolved.

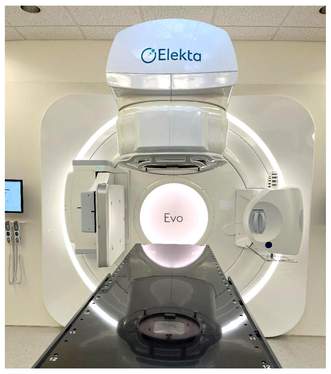
Aims

- Aim 1: To evaluate the image quality and HU accuracy of the IrisTM CBCT for treatment planning.
- Aim 2: To investigate technical challenges associated with CBCT-based treatment planning and to propose practical solutions to these obstacles.

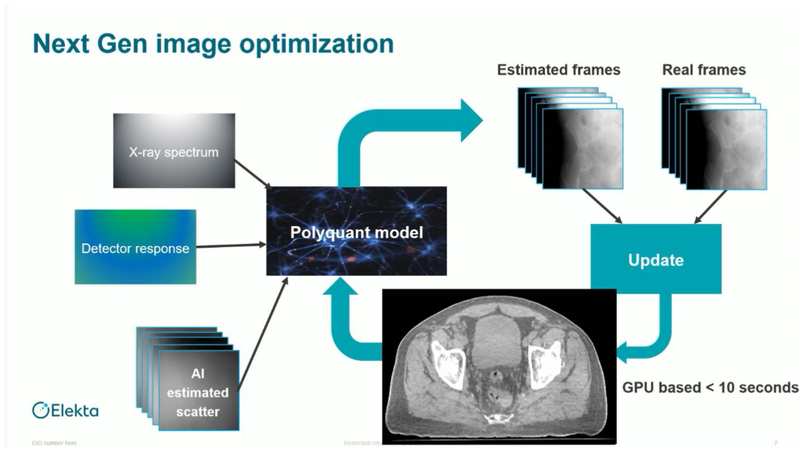
Materials and Methods

Evo: AI-powered Adaptive CT-Linac

- First Elekta Evo linac in the US
- Iris™ high-definition, AI-enhanced CBCT. FDA 510(k) clearance in January 2026!
- Elekta ONE Online for online adaptive RT: CE mark received in Europe and US FDA clearance underway
- 6DOF HexaPod couch



Iris™ CBCT



- AI scatter correction model estimating scatter in real-time during CBCT acquisition
- Iterative polyquant CT (polychromatic + quantitative) reconstruction to improve CBCT image quality
- GPU-based computation, <10s for CBCT reconstruction

Materials and Methods (continued)

Treatment Planning: Image Quality and HU Accuracy Tests

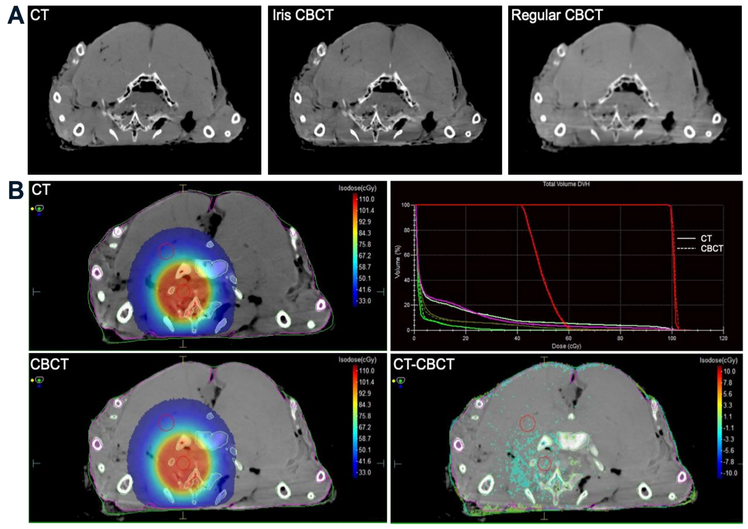
- Frozen duck and turkey scanned with CT, conventional CBCT, and Iris™ CBCT
- Canine and feline patients scanned with conventional and Iris™ CBCT
- Iris™ CBCT HU stability over 6-month tested on CatPhan phantom
- Dose calculation accuracy comparison between CT and Iris™ CBCT using dynamic conformal arc plans

Other Challenges With CBCT-based Planning

- Limited scan range: 27.7 cm for M20 filter setting
- AI segmentation on CBCT: OncoVET (Oncosoft Inc., Korea) exploited for auto-contouring on HN cases
- Motion management with CBCT: Symmetry CBCT preset

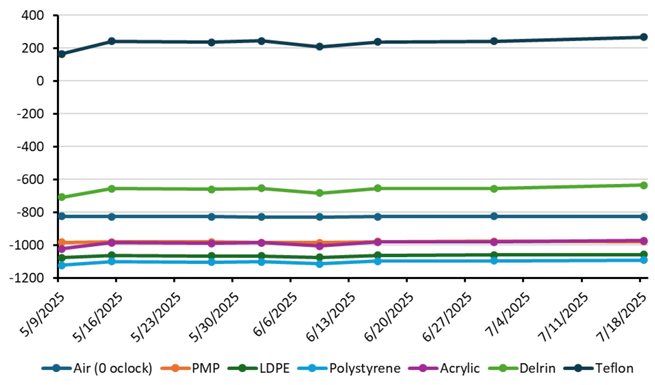
Results

Iris™ CBCT Image Quality and Dose Calculation Accuracy Deemed Satisfactory



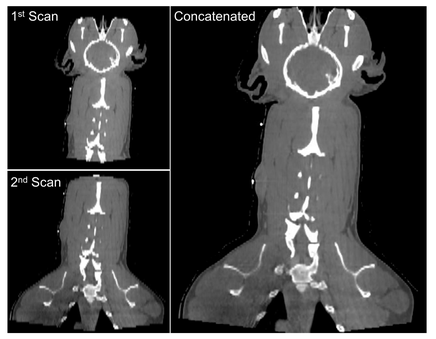
Iris™ CBCT image quality and treatment planning. (**A**) Images of a diagnostic CT scan, Iris™, and conventional CBCT of a turkey phantom, showing the improved image quality of Iris™ CBCT. **(B)** Comparison of dose calculated on the CT scan and on the Iris™ CBCT. A 360-degree dynamic conformal arc plan calculated on the CBCT (lower left) scan shows comparable dose as on the CT (upper left) scan, as also indicated by the overlapping DVH curves (upper right), and small dose differences within ±2% (lower right).

Iris™ CBCT Shows Stable HU on CatPhan Phantom

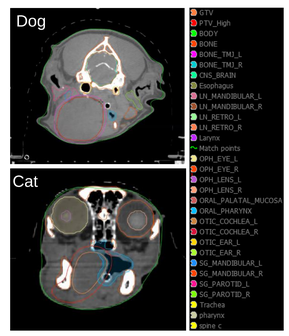


Results (continued)

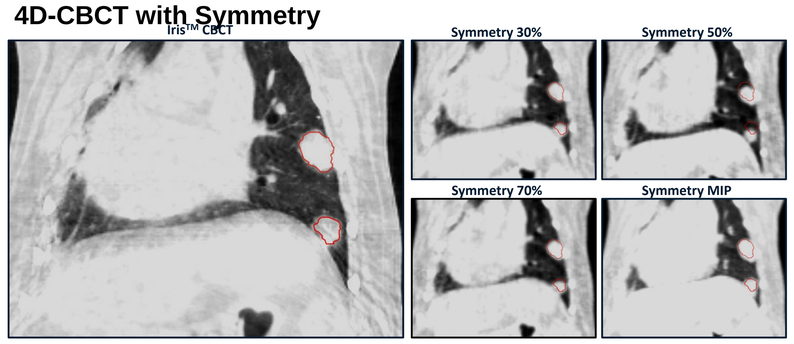
Concatenation with Dicoman™



AI Contours by OncoVET

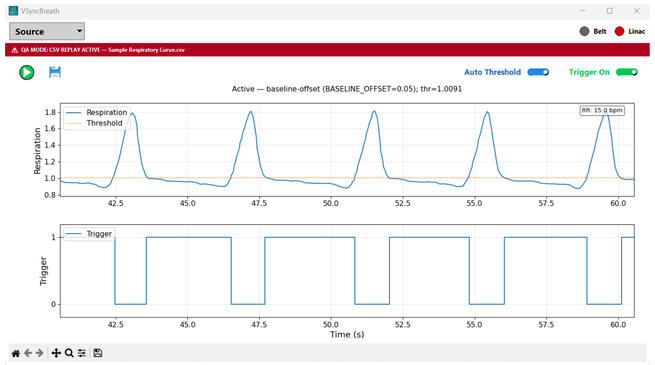


4D-CBCT with Symmetry



Motion assessment by Symmetry CBCT. Shown from left to right are the Iris™ CBCT and Symmetry CBCT phases (30%, 50%, and 70%), and the MIP. Note the two lesions in the right lung delineated by the red contours, with the upper and lower showing a superior-inferior motion of 5 and 10 mm, respectively.

In-house Solution to Respiratory Gating: VSyncBreath



Details about VSyncBreath in abstract 24794

Discussion and Conclusion

- The Elekta Iris™ CBCT incorporates enhanced AI-based scatter correction that substantially improves image quality and Hounsfield unit (HU) accuracy compared with conventional CBCT reconstruction.
- Using a biologically representative turkey phantom, CBCT-based treatment planning demonstrated high dosimetric accuracy, with calculated dose distributions closely matching CT-based reference plans, supporting the feasibility of accurate CBCT-only planning enabled by Iris™ reconstruction.
- CBCT-based treatment planning clinic can be clinically viable in veterinary radiotherapy with the support of AI-enhanced CBCT-based segmentation, tailored workarounds for CBCT acquisition limitations, and integrated motion-management strategies.