Improving Patient Setup with Postural Video
Commissioning and Clinical Implementation of a Video-Based Interface

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Introduction

Surface Guided RT might be challenging for some users: workflow adaptation, understanding system responses to patient's changes, definition of an adequate Region-of-Interest (ROI), and switch between different ROIs.
The new module *Postural*, allows a clear and simple feedback of the patient setup through a real-time video signal and an overlapped outline .

Aim

1. Validate the Postural module to clinical use
2. Secure a safe implementation process
3. Explore its potential for optimizing workflow and reducing accidents (staff inter-variability, standardization, staff decisions, setup time)

Fig.1. Monitoring of a DIBH Patient using the combined delta-shift and Video-outline information

Commissioning

A. Setup accuracy using Video-Only

1. Set up phantoms with only video
2. Acquire CBCT
3. Set up phantom with RTD
4. Repeat CBCT
5. Repeat all process with diff. TPS contours

(different HUs, $CT_{thickness}$, segmentation algorithm)

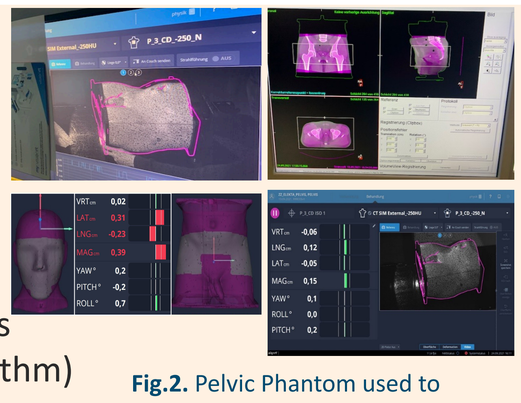


Fig.2. Pelvic Phantom used to compare the information given by the Video-, CBCT-, and RTD-setup

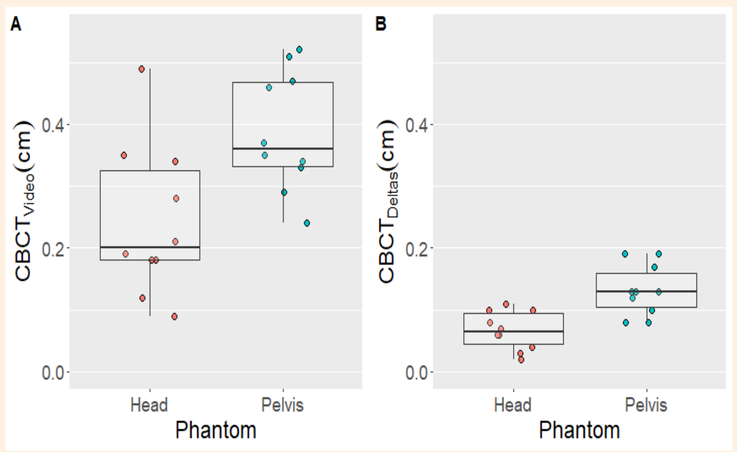
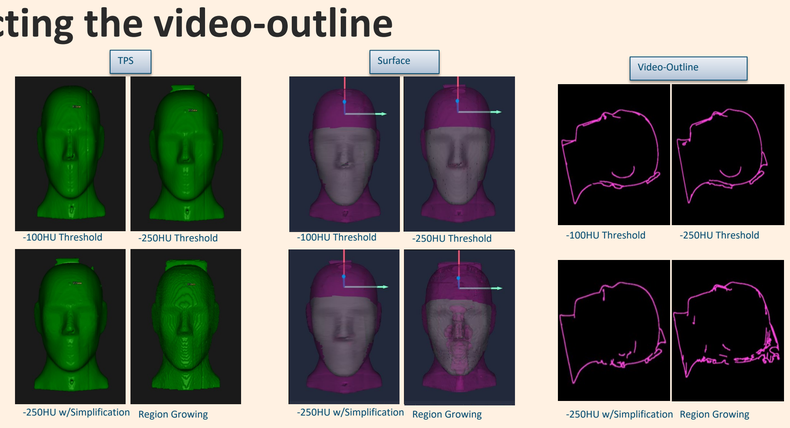


Fig.3.A) Setup with video function only. Median 2mm(Head), 3.5mm(Pelvis)
B) Setup with RTD – higher accuracy (depends on ROI size, CBCT-likeness, statistical surface-quality)

B. Parameters affecting the video-outline

DICOM-Reference
- CT slice thickness
- Segmentation process
  - HU Thresholding
  - Simplification (50pts/slice)
  - Region growing

SGRT-Reference
- Phantom colour
- Skin tone settings
- Room light (max 100lux, min5lux)



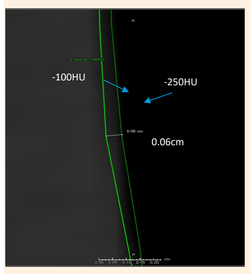


Fig.4. External contour segmented with two different thresholds

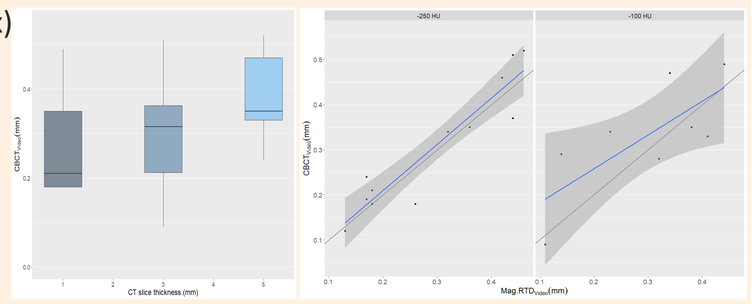


Fig.5. A) Accuracy of the positioning using video-outline of different CT slice thickness **B)** Correlation between RTD and CBCT, setting up the phantom using a video-outline derived from different HU value.

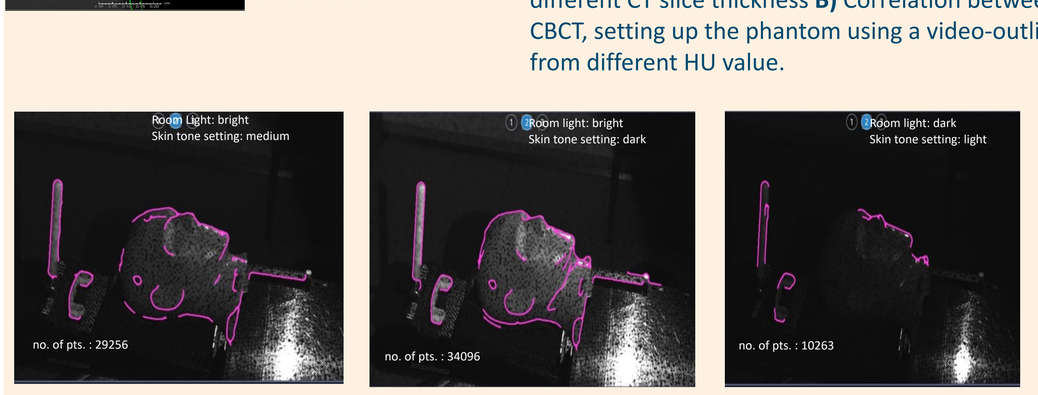


Fig.6. Variation of the among of information of the Video-Outline with the skin tone, system settings and room light.

C. Video outline sensitivity/detectability

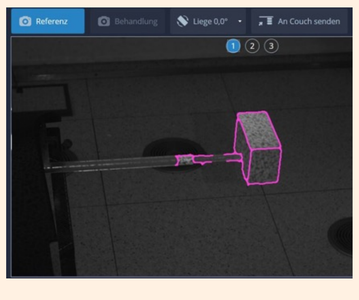


Fig 7. Ball bearing phantom shifted in 3 dimensions. References were made before and after the shift, and compared.

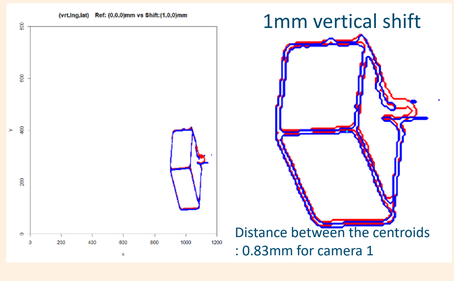


Fig.8. Video outlines exported from AlignRT Raster data converted into 2D Contours (analysis RStudio)

Workflow

§ Failure Modes and Effects Analysis
*Fischer, Batista 2019 SGRT-Usersmeeting

A) Risk assessment

- FMEA§ analysis from 2019 to the AlignRT v5.x detected 15 SGRT-related events (*)
- New version AlignRT Advanced (v6.2) with the Postural Module:
  - Reduced severity or occurrence of 8 events (smaller Risk Priority Number)
  - Added 3 new possible failure events

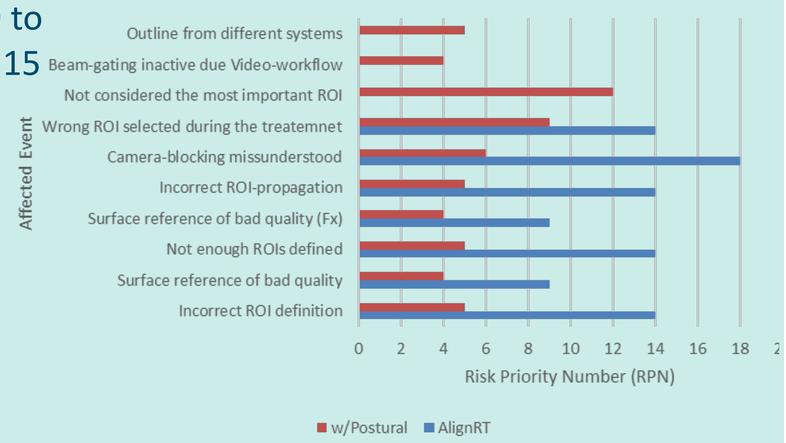


Fig.9. SGRT risk events affected by the introduction of the Video-function

Reduction errors/severity
- Smaller dependence of an inadequate ROI
- Camera-blocking effects and patient-changes are easily distinguished
- One-look to have a full overview of the patient positioning (no need ROI-switch)

New sources of error
- User may center attention in an unnecessary body region
- Not a quantitative information
- Still affected by system/TPS-settings (learning-curve)

B. Workflow changes

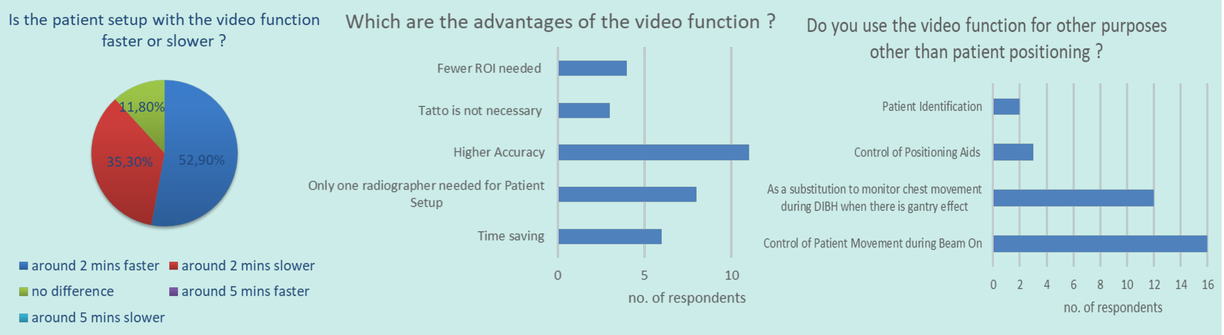
Upgrade (12.2019)
- Entire team training
- No workflow changes performed

6months
- Detected increase number of patients for setup
- Larger staff acceptance

1year
- Reduction of the number of ROI
- Staff reduced the effort to draw optimal ROI

Now
- Only one ROI per patient used
- Used as workaround for camera-blocking-effect
- Replace room-surveillance-system

C. Staff Feedback



Conclusion

- ✓ Accuracy provided from the video-function is enough for patient setup as complementary to IGRT
- ✓ The TPS external contour affects the video-outline quality
- ✓ Suitable settings for room light an skin tone are important to obtain consistent outlines
- ✓ RTTs acceptance and system-understanding improved
- ✓ RPN of events related mainly to ROI-usage reduced but new errors might occur