# Implementing AlignRT and MapRT into a Clinical Workflow

Alisha Chlebik

Senior Radiation Therapist

# No Conflicts of Interests to Disclose


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# Objectives:

- Describe the multidisciplinary implementation strategy used at CHLA to successfully integrate AlignRT and MapRT into the clinical workflow.
- Evaluate the positive and negative impacts of introducing new SGRT technologies on the radiation therapy workflow.
- Identify common challenges encountered during implementation, including training, staff buy-in, and timing constraints and describe strategies used to overcome them.
- Compare different implementation approaches and discuss how strategies may vary across clinical settings.


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# Introduction:

- Children's Hospital Los Angeles (CHLA) implemented AlignRT into clinical practice and achieved a completely markless workflow within nine months. Following the introduction of MapRT into the clinical workflow CHLA eliminated the need for physical dry runs and expanded the clinical use of non-coplanar fields for complex treatments.
- The implementation of AlignRT and MapRT at CHLA followed a multidisciplinary, team-based approach. Input and feedback from therapists, physicists, and physicians were incorporated throughout the process, resulting in a more effective and sustainable application of surface-guided radiation therapy (SGRT).

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# MapRT:

- MapRT is installed in the simulation room in a two-camera configuration and uses 3D surface captures of the patient and immobilization devices, along with dedicated software, to identify and avoid unsafe gantry-couch configurations.
  - It is a patient-specific surface data which predicts more accurately than a generic database
- MapRT was implemented into CHLA in 2025 for clinical use.
- CHLA uses MapRT on all cases regardless of complexity.

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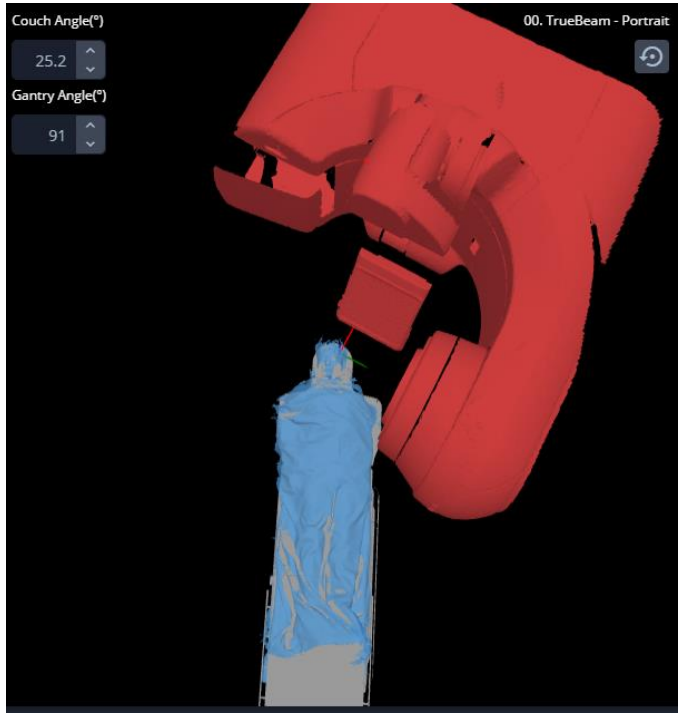
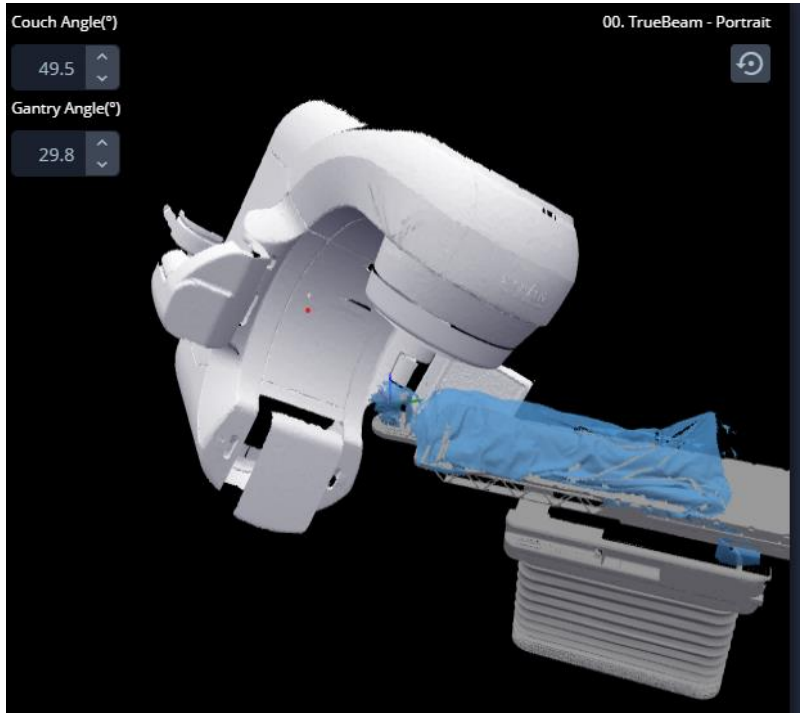
# MapRT:

- The use of MapRT expanded the clinical use of non-coplanar fields for complex treatments by allowing for more complex beam arrangements.
    - MapRT provides a significantly higher confidence during treatment planning and delivery by accurately identifying potential patient and machine collision risks.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# MapRT:

- During simulation, some patients require positioning that falls outside the standard set up due to anatomy, disease location, immobilization devices or comfort considerations.  These atypical positions can increase the risk of gantry, couch or accessory collisions if not evaluated carefully.
  - MapRT provides tools to assess clearance and collision risk at multiple stages of the workflow. Clearance can be evaluated by the therapists prior to scanning using in-room software to ensure the proposed set is safe.
  - MapRT also allows the user to apply a configurable buffer within the software and accounts for expected daily setup shifts and variations in patient positions to ensure collision free treatments.

# MapRT:

- CHLA eliminated the need for physical dry runs required by a therapist prior to treatment.
  - This workflow modification allows therapists to complete New Start Chart QA independent of machine availability.
- Implementation of MapRT had a negligible impact on both therapists and physics/dosimetry workflow.
  - Simulation Process:  Following immobilization device(s) creation and patient positioning, MapRT adds only adds two to three minutes to the workflow.
    - The simulation therapist captures an image (or multiple images as necessary) and merge them into a final surface map by selecting finish.
  - Planning Process: Requires an export to MapRT software to allow for collision checks.
- By shifting collision evaluation to a software-based work, MapRT supports safe planning practices while preserving valuable machine availably for patient care.

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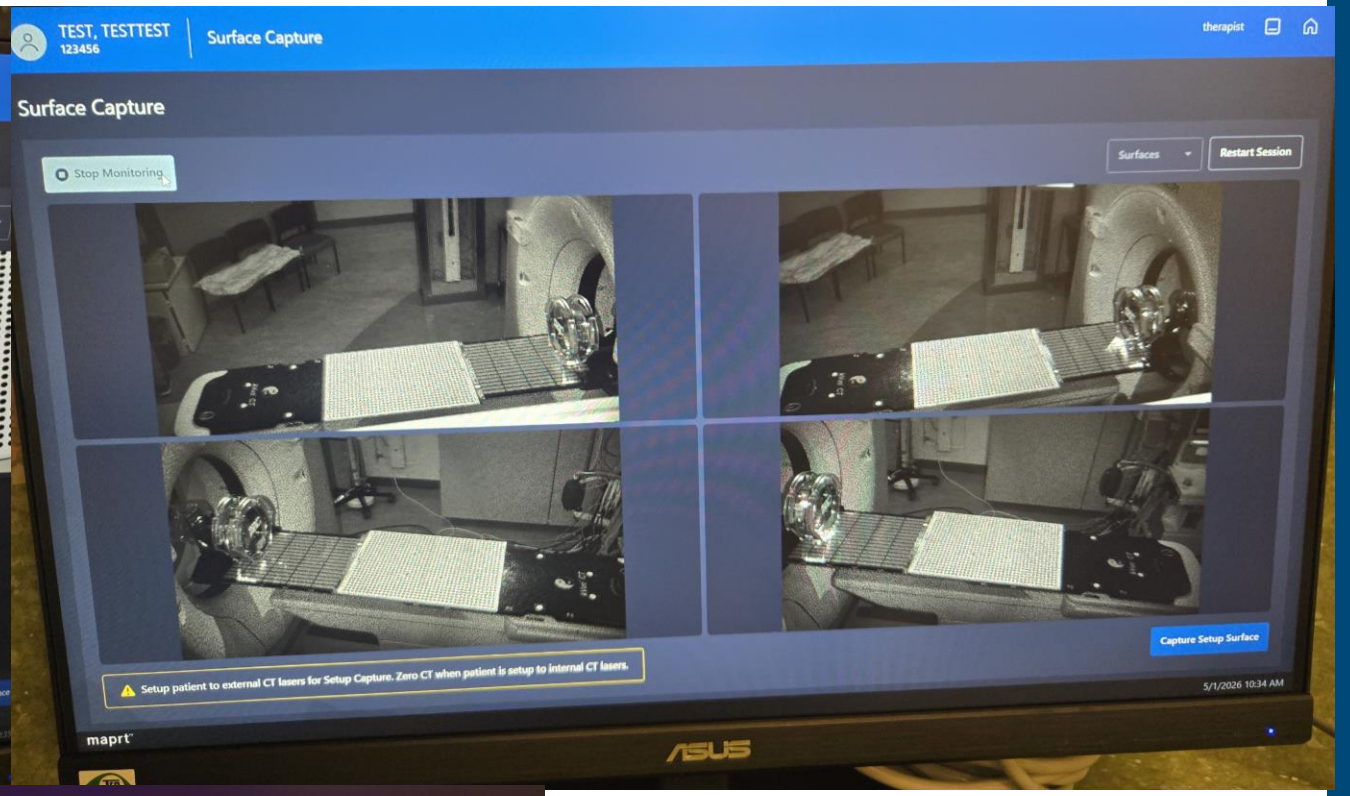
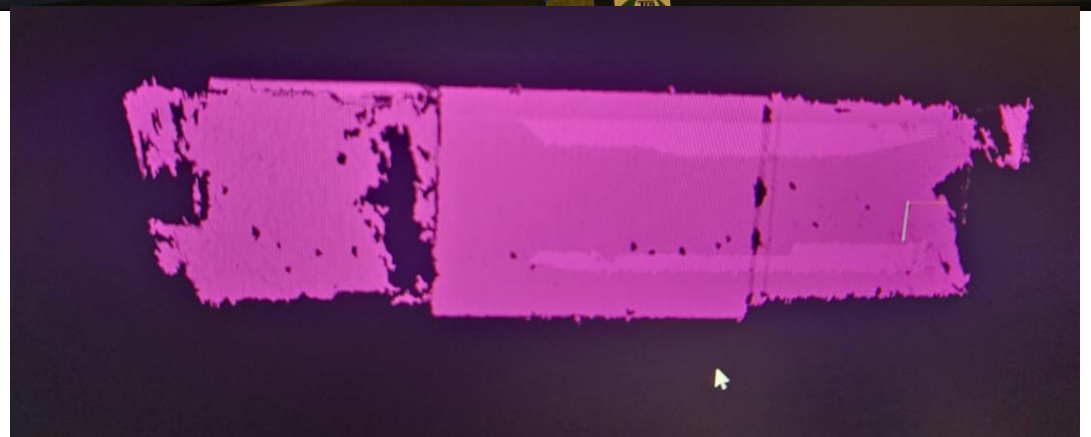
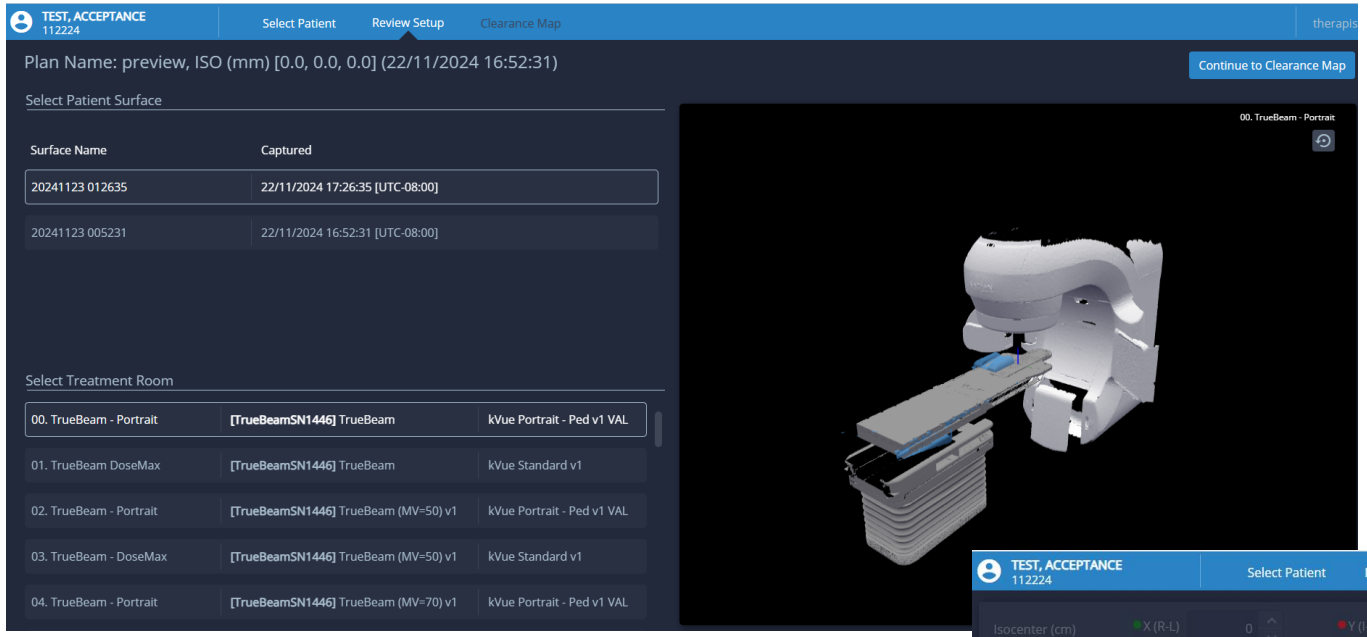
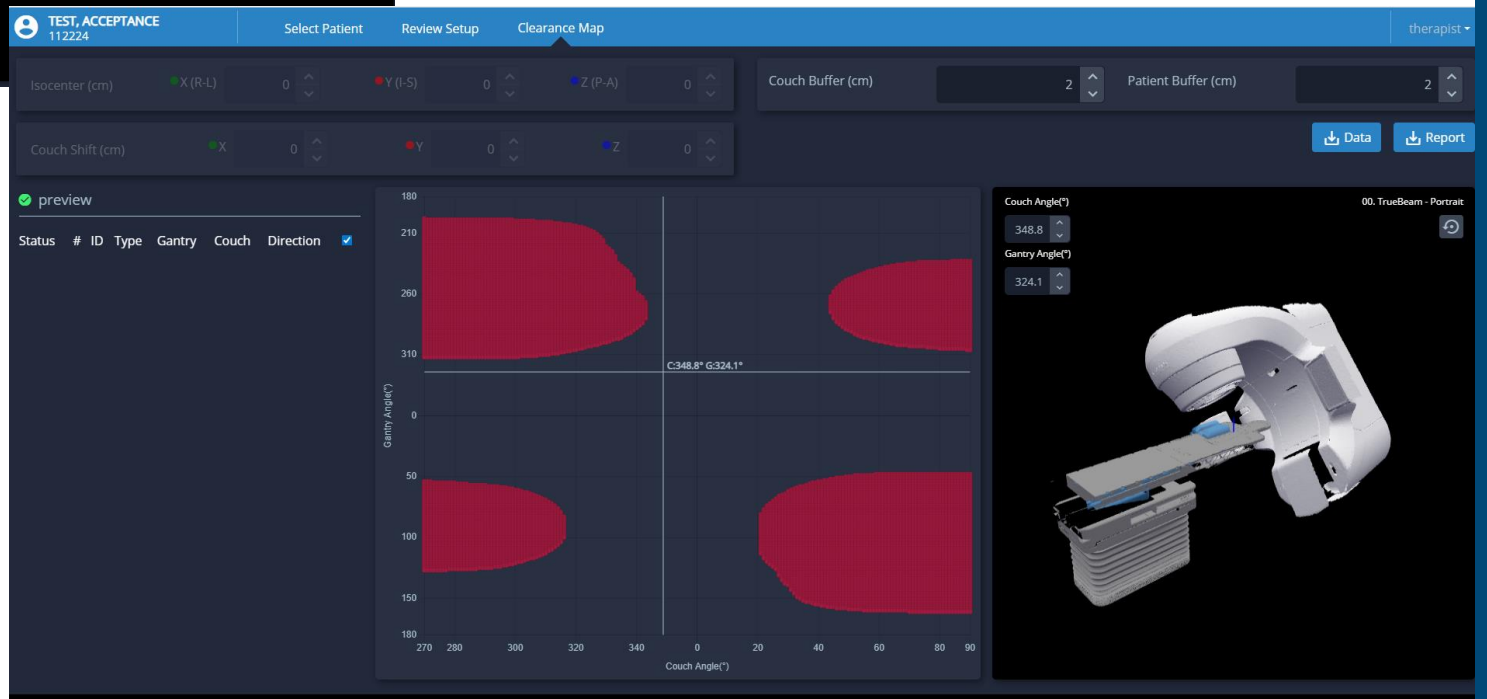
# MapRT: Simulation Captures

# MapRT: Planning Software



# Quick Tips: MapRT

- When merging data sets in MapRT there is an outermost CT table travel limit beyond which the white registration dots are no long visible.
  - A reference line was added at the end of the CT table to indicate the maximum allowable position where the camera can still visualize the white dots for registration.
- Objects and people can block the camera system, always double check prior to taking captures.
- Before taking captures, verify that no blankets or clothing are interfering, as they may be interpreted as collisions by the software.



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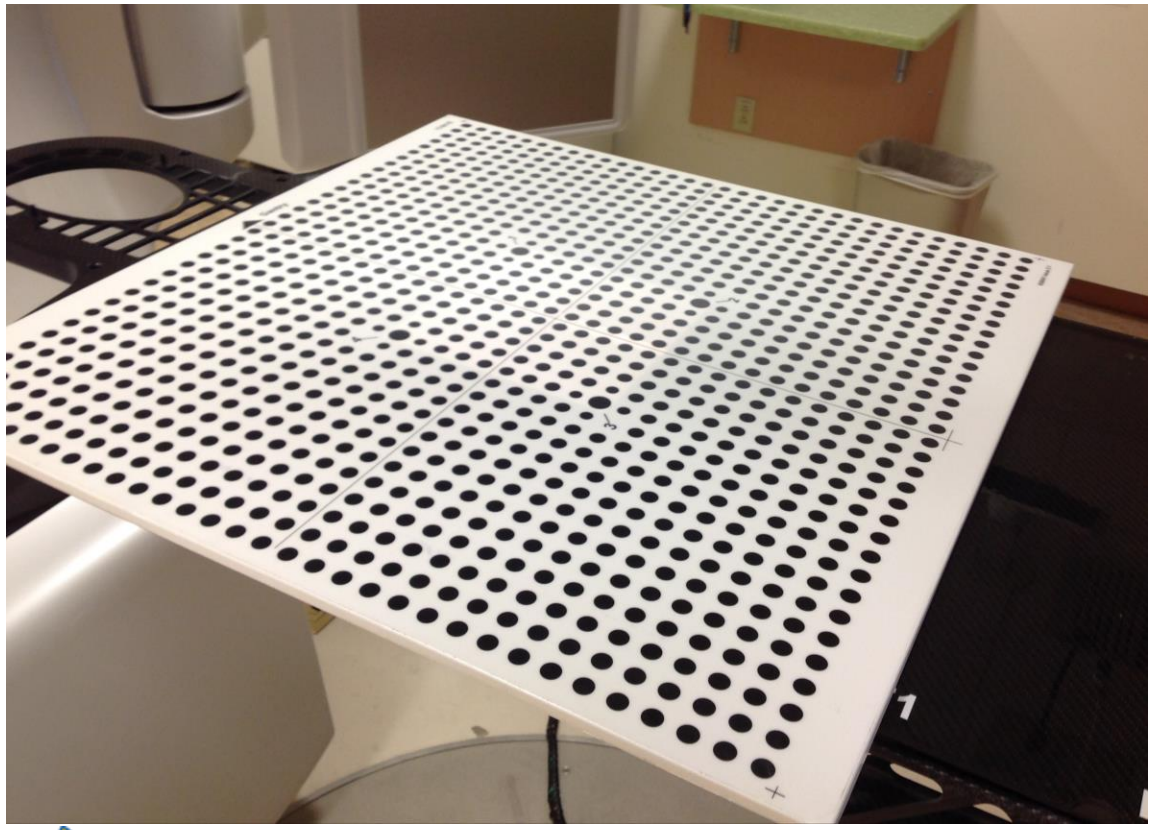
# Warm Up

- AlignRT and MapRT take approximately 3-5 minutes for daily QA
  - AlignRT requires a daily QA with the plate and CHLA implemented an extra test to verify the beam shuts off when out of tolerance.



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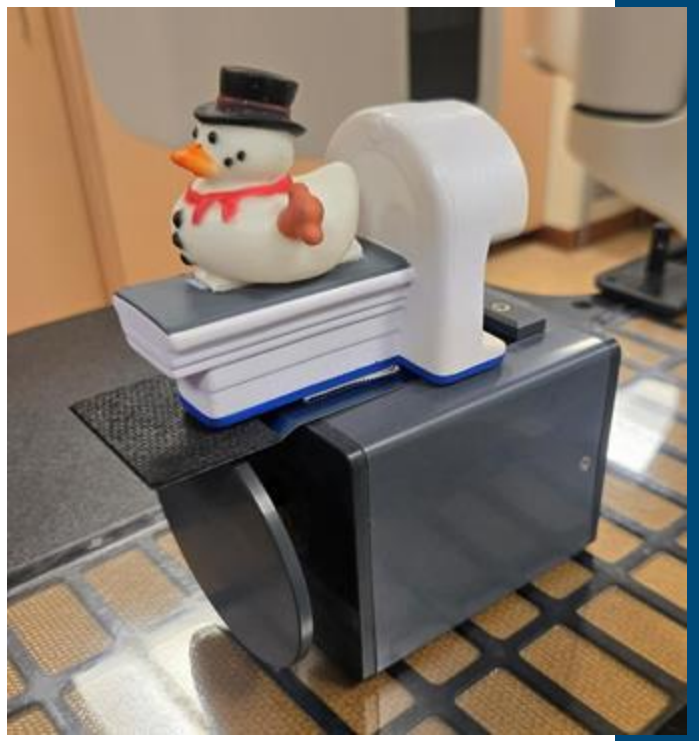
# Warm Up

- AlignRT warm up consists of the required daily plate test as well as one additional test
  - CHLA added an additional test which verifies the functional integration between AlignRT and the linear accelerator, ensuring that motion outside of tolerance correctly triggers the beam-hold interlock, providing an added layer of safety.
    - During daily warm-up, the therapist positions a motion device with a tracking object and delivers a 100 MU verification plan. Motion is introduced to move the object outside the preset AlignRT tolerance to confirm proper beam-hold functionality and automatic beam shut-off.
      - We utilize high-contrast white objects to enhance to surface visibility for AlignRT. These were items we already had at CHLA and did not require any purchases.




# Align RT: Data, Method and Materials:

- During the implementation of AlignRT, CHLA collected clinical data before, during, and after integration of SGRT into our routine practice. Metrics evaluated included patient shift magnitudes, frequency of repeat imaging, and overall patient setup time. This data was used to assess workflow efficiency and clinical impact.
  - The first data collection points included shift deltas for marks vs SGRT
    - Initially we had a printed table (spreadsheet) with the magnitude of shifts from patient marks to films (CBCT/KV) and after applying shifts we would turn on Align RT and record the deltas (giving us the magnitude of shifts from AlignRT to imaging).
      - Example data of shift magnitudes:

| Patient: Test | Shifts from marks to CBCT | Shifts from CBCT to SGRT |
|---|---|---|
| | | |
| Vert | 0.3 | 0.1 |
| Long | 0.4 | 0.2 |
| Lat | 0.1 | 0.1 |
| | | |
| Vert | 0.5 | 0.3 |
| Long | 0.4 | 0.2 |
| Lat | 0.2 | 0.1 |
| | | |
| Vert | 0.2 | 0.1 |
| Long | 0.4 | 0.2 |
| Lat | 0.3 | 0.1 |

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# AlignRT: Data, Method and Materials:

- There was initial reluctance to transition to AlignRT-only setup, leading to continued reliance on standard skin marks. This approach was maintained until it became evident that shifts between CBCT and AlignRT were consistently of smaller magnitude, increasing confidence in the system.
- We subsequently transitioned to AlignRT-only setup, while retaining skin marks as a backup until confidence in the system was established. Shift data continued to be recorded, and once the multidisciplinary team reached consensus, skin marking at simulation was discontinued.
  - Therapists were initially the most hesitant to remove any markings on patients.
    - After positive feedback from patients about not having to keep any marks and minimal shifts after imaging, therapists then felt confident in removing all marks (including isocenter).

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# AlignRT: Data, Method and Materials:

- This process took CHLA approximately 9 months to remove all skin marks.
  - AlignRT was implemented in 2012, when there were no other centers using SGRT in pediatric populations. Consequently, workflows had to be developed and tailored to meet the specific needs of CHLA, which added time and complexity to the implementation process.
    - Although the underlying technology is the same for both adult and pediatric patients, its application in pediatrics presents unique considerations. However, once the initial implementation challenges were overcome, it became clear that SGRT provided a greater range of benefits than originally expected.
      - Example of differences and/or changes include: Region of Interests (ROI) had to be adjusted, patients under anesthesia required minor changes such as not covering with blankets and changing where the monitoring devices went (EKG, temp probe, etc.).
      - Most of our patients were markless after about 6 months, however CSI treatments added an additional 3 months as we only had a limited number of CSI patients as well as the initial learning curve of multiple isocenter set up with AlignRT .

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# AlignData, Method and Materials:

- Concurrent installation and implementation of TrueBeam and AlignRT at CHLA required staff to undergo simultaneous training on two new technologies and proved to be overwhelming and contributed to an overall slower implementation process of SGRT.
  - After gaining confidence with TrueBeam, therapists added AlignRT and began collecting data which included patient shift magnitudes, frequency of repeat imaging, and overall patient setup time.
    - To reduce workflow burden on therapists, data collection was conducted in a phased approach, focusing on one or two agreed-upon parameters at a time before progressing to additional metrics after analysis.
      - After analyzing shift magnitudes, we expanded data collection to include repeat imaging frequency and overall patient setup time comparisons between SGRT and traditional marking.
      - As therapists at CHLA became more familiar with SGRT we saw a decrease in the metrics.

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# Initial Implementation

- Throughout the learning and implementation process, several key factors were identified as critical to successful adoption of new technology such as AlignRT. These included early education prior to product installation, strong staff buy-in, identification of clinical champions, a small incremental rollout rather than broad implementation, and direct observation of positive patient impacts.
  - Early education: If staff members have a basic knowledge of SGRT prior to installation through online learning modules or in person training it will greatly help improve the initial implementation.
  - Staff buy-in: Critical for all team members to have buy-in (including therapists as they will be the only using the technology daily and it can either positively or negatively impact their schedule and workflow).
    - Therapists may be resistant at first to new technology that can impact their workflow as centers have strict schedules without a lot of flexibility.

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# Initial Implementation

- Champion or Super Users: Identifying staff willing to serve as super users to support adoption, training, and troubleshooting.
  - This can greatly help therapists, as it can help identify possible issues prior to implementation and help find solutions when necessary.
  - Identifying knowledgeable, well-respected therapists within the group can help increase buy-in.

- Small incremental rollout: Gives staff time to learn and adjust to new technology.
  - Due to short staffing and strict schedules, implementing a new technology such as SGRT for all patients at once can be challenging. Starting small and expanding as staff confidence grows is effective. We began with chest and abdomen cases and gradually expanded to more complex sites such as pelvis and CSI.
  - A stepwise approach was used, adding new body sites once staff demonstrated confidence with the previous site.

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# Initial Implementation

- Direct observation of positive patient outcomes: It encouraged therapists to continue implementation, playing a key role in early success and improving overall therapist buy-in.
  - We found that patients liked not having to have visible marks on their skin and not having to keep marks in place during treatment.
  - Direct monitoring during treatment made it possible to safely lower the age of patients requiring anesthesia.

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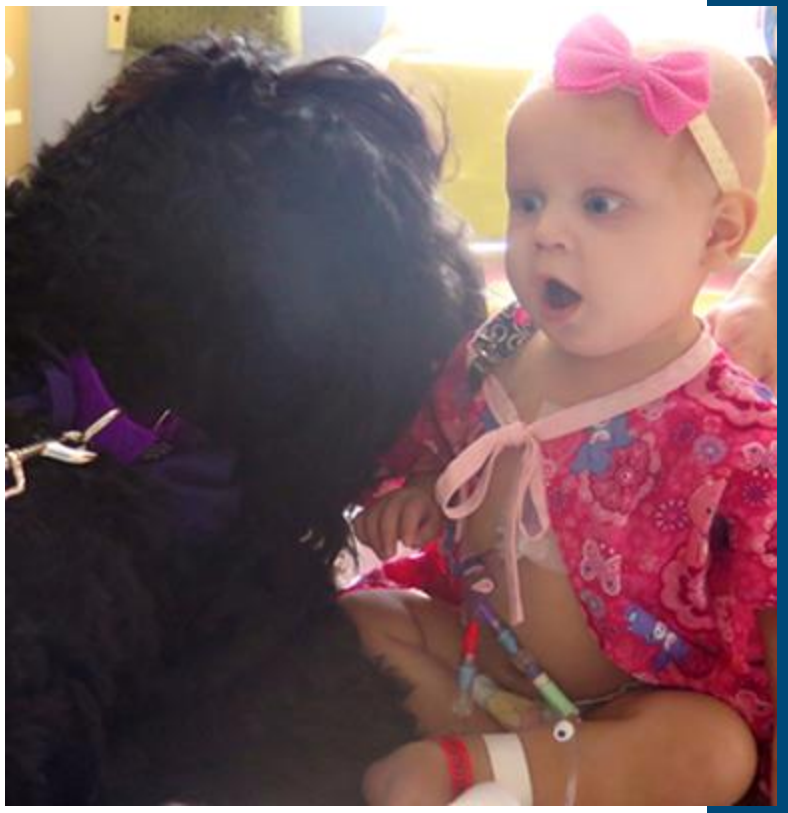
# Challenges:

- Challenges associated with AlignRT and MapRT implementation included initial staff hesitancy, a steep learning curve, and increased setup times during early adoption. Resistance to change and unfamiliarity with surface-guided radiation therapy workflows contributed to slower uptake, while additional training requirements and workflow adjustments temporarily impacted efficiency. However, these challenges typically diminished as staff gained experience and confidence with the systems.



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# Challenges:

- Given an already demanding schedules for treatments, therapists found it difficult to incorporate the additional time required per patient during the early stages of implementation.
  - This challenge was mitigated by selecting a small number of patients and allocating a minimal amount of additional time (as little as 5 minutes), thereby avoiding added stress on therapist workload.
- Initial staff hesitancy was driven by apprehension toward adopting new technology—particularly one that was not widely established in radiation oncology in 2013—as well as concerns about the impact of additional time requirements on an already busy schedule.

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# Quick Tips: AlignRT

- We used Velcro on the side of the TrueBeam to attach the remote making it easier for therapists to utilize AlignRT without having to be near the computer.
  - Therapists can remotely start monitoring while standing next to the patient.  You will need to find where to point the remote as each room may have a different location.
- Have regular trainings (check your contract with VisionRT as you might have yearly training with your purchase contract).
- During initial training and implementation, therapists can practice with phantoms to better understand how AlignRT works without the pressure of patients on the table.

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# Conclusion and Questions:

- CHLA successfully implemented AlignRT and MapRT into the clinical workflow through a collaborative, team-based approach. While challenges were encountered, the multidisciplinary team ultimately developed a workflow that best met the needs of the institution.
- Questions?

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