A new view of SGRT

SGRT for
EVERY step
of the RT workflow:
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THE 2023 ANNUAL MEETING OF THE SGRT COMMUNITY

etc.venues
County Hall (London, UK)

Nov 30th - Dec 1st 2023

SGRT COMMUNITY
SURFACE GUIDED RADIATION THERAPY

www.sgrt.org

A new view of SGRT

THE 2023 ANNUAL MEETING OF THE SGRT COMMUNITY

SGRT COMMUNITY

Welcome

This is the seventh annual European meeting of the SGRT Community, and even after all these years, we keep discovering that there is still so much we have to learn from each other, particularly as Surface Guided Radiation Therapy continues to evolve and improve.

Unlike some previous years, this meeting is not going to be fully live-streamed. Although virtual meetings definitely have their advantages (and all of the content from this event will eventually be made available on-demand on sgrt.org), we've found that there really is no substitute for direct, face-to-face learning and collaboration.

So we are very pleased to welcome you to this in-person event, here in the heart of London, where you will get the opportunity to take part in dozens of peer presentations, as well as countless opportunities to catch up, and collaborate with, colleagues from around the world. The theme of this year's event is "A New View of SGRT," and it's an apt one, as Surface Guidance has grown from a motion management solution to an extra pair of eyes that offers benefits to help the entire radiation therapy workflow: Simulation, Planning, Treatment and Dose visualisation.

This is an opportunity to learn from experts using Surface Guidance in active clinical settings for everything from 4D and breath hold CT, to planning noncoplanar treatments, tattooless treatments and even for dose visualization – using SGRT to help stop dose delivery errors in real time. And of course, much, much more. We've got presentations highlighting practical usage of SGRT across every conceivable indication and clinical context: from using SGRT to drive efficiency improvements in Dallas, Texas, to head and neck SGRT implementation tips from a clinic in Ireland.

Whatever your context or SGRT needs, we are confident you will get a new view of SGRT, one that will ultimately benefit your clinic and your patients.

Menna Creed
Head of SGRT Development

Once again, this year, we will be awarding a prize to the best presentation. The winner will receive a trip to the USA SGRT meeting in Arizona, 6-7 June 2024

Use this QR code to cast your vote, at the end of the event.

Criteria:

- Quality and originality of the research
- Visual quality of the presentation
- Ability to answer questions effectively

SCAN HERE
to cast your vote

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*This document includes examples of the clinical use and performance of Vision RT products by independent users, which include customer quotes in advertisements. These have not been validated by Vision RT and thus are not endorsed by Vision RT. Users of Vision RT's products should develop and validate their own workflows consistent with clinical practice within their facility.

LEARNING OBJECTIVES

The European 2023 Surface Guided Radiation Therapy (SGRT) Annual Meeting 'A New View of SGRT' is an educational event providing users with the opportunity to network, discuss best practice and exchange latest clinical research.

Speakers have been selected based on the acceptance of a submitted abstract. The speakers will present their latest research, in addition to knowledge sharing in the more informal workshops. Attendees will receive digital certificates proving their attendance at the SGRT Annual Meeting 2023, which they can then pass on to self-certifying credit boards as applicable.

THE MEETING AIMS TO COVER A VARIETY OF APPLICATIONS FOR SGRT & AFTER THIS MEETING PARTICIPANTS SHOULD BE ABLE TO:

- Recognize SGRT as an important tool that can benefit every step of the RT workflow: Sim, Plan, Treat and Dose
- Understand the potential clinical outcomes and efficiency benefits of SGRT across a range of indications.
- Demonstrate knowledge of current clinical practices of SGRT for SRS, SBRT, breast, head and neck, metastases and, deep inspiration breath hold.
- Understand the latest novel research in the use of SGRT.
- Learn best practice for commissioning and implementing SGRT into your department.
- Understand the benefits of tattoo and mark-free treatments and understand how this can be achieved from go-live with SGRT.
- Understand how SGRT is used across the entire radiotherapy pathway supporting the safe planning and delivery of Radiation Therapy.
- Appreciate the positive impact SGRT has on the patient experience of Radiation Therapy.
- Learn about current opinion and future ambitions for SGRT.

This meeting is endorsed by SOR CPD Now

SGRT EUROPE: A NEW VIEW OF SGRT
December 1

A new view of SGRT
THE 2023 ANNUAL MEETING OF THE SGRT COMMUNITY

08:00 – 08:30	**Registration and refreshments**	Room: **Knight's Lounge**
	Welcome & Plenary sessions	Room: **Waterloo**
08:30 – 08:35	**MEETING CHAIR:** ***Heidi Probst PhD, MA, BSc(HONS), DCR(T), FCR, Hon.FIPEM*** Professor of Radiotherapy and Oncology, Sheffield Hallam University, UK	
08:35 – 08:45	• The positive impact of SGRT – The Berkshire Cancer Centre experience ***Victoria Hammond-Turner*** Technical and Development Lead Therapeutic Radiographer Royal Berkshire NHS Foundation Trust, UK	
08:45 – 09:05	• Successful implementation of SGRT: patient benefits and staff satisfaction from a radiographer's perspective ***Lisa Laws*** Principal Radiographer, Rosemere Cancer Centre, UK ***Lisa Telford*** Team Lead, Rosemere Cancer Centre, UK	
09:05 – 09:25	• Patient movement and millimetre accurate positioning with SGRT ***Rayk Nachtigall*** Medical Physicist, Strahlenzentrum Hamburg MVZ, Germany	
09:25 – 09:45	• Big data analysis for setup margin personalization derived from intra-fraction motion: a proof of concept ***Mathieu Gonod*** Medical Physicist, Centre G. F. Leclerc, France	
09:45 – 10:00	• Feasibility of frameless and maskless stereotactic cerebral radiotherapy with AlignRT InBore guidance on HALCYON v3.0: preliminary results ***Daniel Nguyen*** Medical Physicist, Orlam Group, France	
10:00 – 10:30	**Refreshment Break**	Room: **Knight's Lounge**
10:30 – 10:50	• Improving efficiencies with MapRT ***David Parsons, PhD*** Associate Director of Medical Physics Residency Program, University of Texas Southwestern, Dallas, Texas, USA	
10:50 – 11:10	• Use of MapRT to optimise noncoplanar planning for head and neck patients ***Helen Convery*** Senior Dosimetrist (Development and Clinical Trials), Raigmore Hospital Inverness, UK	
11:10 – 11:30	• Dosimetric planning advantages of surface guided planning ***Adi Robinson, Ph.D DABR*** Medical Physicist, AdventHealth Celebration, USA	
11:30 – 11:45	**Short Break**	Room: **Knight's Lounge**

11:45 – 12:45 **STREAMS – Choose 1 of 4**

STREAM 1
Head and neck
Room: **Baron**
Chaired by: **Lisa Laws**

- The feasibility of maskless radiation therapy for head and neck cancer by using surface guided radiation therapy (SGRT)

Abbey Adams
Radiation Therapy Treatment Unit Leader
Genesis Care North Shore/Mater, Australia

- Introducing AlignRT for head and neck IMRT treatments

Samantha Ryan
Radiation Therapy Research Fellow and Clinical Specialist Radiation Therapist,
St Luke's Radiation Oncology Network, Ireland

- Comparison of patients treated with conventional head and neck mask versus open mask using SGRT setup

Ragul T
Medical Physicist, Kalyan Singh Super Specialty Cancer Institue, Lucknow, India

- Head and neck SGRT: our experiences at Lincoln

Jacob Curran
IGRT Specialist Radiographer,
Lincoln County Hospital, UK

Ryan Fry
Senior Radiographer
Lincoln County Hospital, UK

STREAM 2
Breast
Room: **Waterloo**
Chaired by: **Rayk Natchtigall**

- Surface guided deep inspiration breath hold (SG-DIBH) in ultra-hypofractionated radiotherapy for early stage left breast cancer (BC): a single-centre analysis

Cynthia Aristei
Professor, University of Perugia and Perugia General Hospital, Italy

- Implementing a novel breast workflow utilising 6DoF through AlignRT surface guidance radiotherapy

Alya Qadi
Radiation Therapist, Genesiscare Northshore &
The Mater Hospital, Australia

- Clinical implementation of tattooless treatment for breast cancer patients using SGRT

Kimm Fremeijer
RTT, Erasmus MC Rotterdam, Netherlands

STREAM 3
Metastatic Treatments
Room: **Earl**
Chaired by: **Josh Naylor**

- Clinical implementation of Surface Guided Radiotherapy (SGRT) for palliative patients

Jack Hannant
Senior Radiographer,
The Christie at Oldham NHS Foundation Trust, UK

Helen Squibbs
Superintendent Radiographer,
The Christie at Oldham NHS Foundation Trust, UK

- Breath-hold for hearing-impaired patients

Yasmine Tate
Lead Therapy Radiographer,
GenesisCare, Cambridge, UK

- Utilizing SGRT in the treatment of oligometastatic hypopharyngeal cancer: case study of a complete remission

Grzegorz Chmielewski, MD
Radiation Oncology Resident,
Holycross Cancer Center, Poland

- Using SGRT for faster, safer and accurate extremity patient positioning

Magnolia Rincón Pérez
Físico Adjunto, Fundación Jiménez Díaz, Spain

STREAM 4
SRS
Room: **Duke**
Chaired by: **David Parsons**

- Surface Imaging for SRS: Insights from St Louis Radiotherapy Center

Gunther Rucka
Medical Physicist, Croix-Rouge Française / Centre de Radiothérapie St Louis, France

- Surface image monitoring for automated stereotactic radiosurgery treatment: efficiency, accuracy, and patient comfort

Edward Clouser, Jr., M.S.
Medical Physicist, Mayo Clinic in Arizona, USA

- Comparison of SGRT to MV isocentre position for two SGRT systems for use with SRS

Mark Wanklyn
Senior Medical Physics Specialist,
GenesisCare NSW, Australia

- Introducing setup of SRS treatment of patients with open-face mask using SGRT and head adjuster in our clinic

Marlon van den Broek
RTT, Radboudumc, Netherlands

12:45 – 13:45 Lunch break Room: **Knight's Lounge**

13:45 – 14:45 **STREAMS REPEAT AFTER LUNCH BREAK** **STREAMS – Choose 1 of 4**

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14:45 – 15:00	**Refreshment Break**	Room: **Knight's Lounge**
15:00 – 15:20	• SG-SFRT: The use of surface imaging for spatially fractionated radiotherapy ***Yi Rong, PhD, DABR, FAAPM*** Professor and Photon Lead Physicist, Mayo Clinic in Arizona, USA	Room: **Waterloo**
15:20 – 15:35	• Correlation between surface motion and heart-breast distance for breast cancer patients treated in DIBH ***Lisa Dietrich, MSc*** Medical Physicist in training and PhD candidate, Universitätsklinikum Erlangen, Germany	Room: **Waterloo**
15:35 – 15:50	• Patient-specific bolus positioning with AlignRT ***Laurence Delombaerde, PhD*** Medical Physicist, University Hospitals Leuven, Belgium	Room: **Waterloo**
15:50 – 16:10	• Quantification of beam latency using AlignRT ***Philip Yeo*** Radiotherapy Engineer, University Hospital Southampton, UK ***Rachel Barlow*** Deputy Head of Radiotherapy Physics, University Hospital Southampton, UK	Room: **Waterloo**
16:10 – 16:30	• First experiences with DoseRT ***Mike Tallhamer*** Chief Physics, AdventHealth, Colorado, USA	Room: **Waterloo**
16:30 – 16:45	**Wrap up – best presentation vote**	Room: **Waterloo**
16:45	**Depart**	

SCAN HERE
to submit questions for the Q&A sessions

Professor Heidi Probst PhD, MA, BSc(HONS), DCR(T), FCR, Hon.FIPEM
Professor of Radiotherapy and Oncology
Sheffield Hallam University, UK

MEETING CHAIR:

Welcome message

I am delighted to welcome delegates to the seventh annual European SGRT community meeting appropriately titled 'A New view for SGRT'. For twenty years I have been conducting research into setup accuracy, patient positioning and patient alignment in breast cancer radiotherapy with a particular focus on patient centred approaches and methods to improve patient experiences of radiotherapy. I have been particularly concerned about the impact and use of permanent tattoos for those receiving radiotherapy following a breast cancer diagnosis and have campaigned to see greater use of tattooless options such as SGRT available for patients. I am therefore particularly excited to see further discussion of tattooless setups within the programme this year.

In our research at Sheffield Hallam, we are interested in technology that can enhance patient experiences and patient empowerment during the radiotherapy pathway. I am excited by the possibilities that surface imaging can offer for example in improving efficiencies in set-up thereby reducing the time patients need to be on the linear accelerator bed, opportunities to improve experiences through maskless head and neck setups and how SGRT may facilitate set-ups for sub-groups of patients with specific needs (such as those with hearing impairments needing to undertake breath hold techniques). Yet I have a sense there are untapped possibilities for SGRT, and while you listen to the excellent programme of speakers lined up for the 2023 annual event, I hope you feel inspired to consider other novel ways that SGRT may improve both patient alignment and the overall patient experience of the radiotherapy pathway.

The positive impact of SGRT – The Berkshire Cancer Centre experience

Victoria Hammond-Turner
Technical and Development Lead
Therapeutic Radiographer
Royal Berkshire NHS Foundation Trust, UK

It is well documented that Surface Guided Radiation Therapy (SGRT) significantly enhances the patient experience in radiotherapy. It can reduce treatment setup time, as well as minimise uncomfortable immobilization devices traditionally used. Moreover, SGRT continuously monitors a patient's surface anatomy throughout treatment, allowing for real-time adjustments.

SGRT has been in clinical use at the Berkshire Cancer Centre since early 2019 and we are lucky to have this technology across all 4 of our linacs as well as on two CT scanners.
We are a completely tattoo less centre but more importantly SGRT has allowed us to implement techniques not feasible before, increase our capacity whilst developing and enhancing the service we provide for our patients.

The adoption of SGRT in our centre has been overwhelmingly positive. In this presentation we will highlight some of those benefits in more detail through some specific clinical case studies including one which enabled radiotherapy for a patient that otherwise would not have successfully managed to tolerate the treatment.

Conflicts of Interest: Berkshire Cancer Centre is a reference site for Vision RT

Successful implementation of SGRT: patient benefits and staff satisfaction from a radiographer's perspective

Lisa Laws
Principal Radiographer
Rosemere Cancer Centre, UK

Lisa Telford
Team Lead
Rosemere Cancer Centre, UK

Author List:
Jayne Fletcher | Lisa Laws | Lisa Telford
Rosemere Cancer Centre

Introduction: An analysis of the experience of implementing and roll out of SGRT.

Objectives:
- Successful implementation of multiple systems: AlignRT and SimRT.
- Streamlining the complexity of workflows.
- Robust staff training program- encourage all staff involvement to increase momentum and engagement.
- Patient results: improved treatment and treatment experience.
- Staff satisfaction.

Methods and Materials: A qualitative and quantitative methodology has been employed to evidence the benefits and success of implementation of SGRT. Audit data collated on timings, imaging displacements and repeat imaging. Quantitative data was collected to gain staff feedback on user experience via a survey comprised of multiple response tick box question and free text.

Results: The robust training program and staged role out of SGRT across the 7 breast techniques allowed a short period (4 months) from go live to all breast tattooless. Techniques have been streamlined, timings reduced and image verification has improved. The majority of the results from staff were positive for training, benefits to patients and staff and experience.100% of the clinical staff feeling confident using the system within a short period of time irrespective of experience.

Conclusion: Implementation of SGRT has been a straightforward process that has shown benefits for patient treatment and patient experience. It has impacted on the service and the staff experience of the implementation. Training and use of SGRT has been extremely positive. Implementation of SGRT has raised profile of the department and has enabled us to provide better options and choices for our patients.

Conflicts of Interest: None

Patient movement and millimetre accurate positioning with SGRT

Rayk Nachtigall
Medical Physicist
Strahlenzentrum Hamburg MVZ, Germany

Author List:
Rayk Nachtigal | Sebastian Exner | Oliver Bislich | Felix Behrens | Nicholas Seeto | Fabian Fehlauer
Strahlenzentrum Hamburg MVZ

Introduction: The SGRT system AlignRT from Vision RT gives us a unique possibility to evaluate patient movement and positioning during treatment fractions and during therapy as a whole. Furthermore, it offers direct feedback of the achievable accuracy for head, chest, and pelvis treatments.

Methods and Materials: Finished treatments of the head, chest, and pelvis regions were analysed independently of their prescriptions. In total 339 patients (20 head, 279 chest, 40 pelvis) were analysed and evaluated. The head treatments were performed with an open mask where the face was not covered. In the chest analysis, treatments were distinguished between free-breathing and DIBH. The focus was set to the three translation dimensions: anterior-posterior, left-right, and superior-inferior.

Results:
The mean deviations per region are mσ_head(vert./lat./long.)=0.5mm/0.48mm/0.51mm, mσ_FB(vert./lat./long.)=1.2mm/0.7mm/1.1mm, mσ_DIBH(vert./lat./long.)=0.7mm/0.8mm/1.3mm, and mσ_pelvis(vert./lat./long.)=0.93mm/0.63mm/1.29mm. As measure for the whole patient stability the 3D magnitude of the deviations is taken in to account (mag=sqrt(vert^2+lat^2+long^2), which leads to mag_head=0.86mm, mag_FB=1.8mm, mag_DIBH=1.6mm, and mag_pelvis=1.71mm.

Conclusion: The AlignRT system supports open-mask treatments with a comparable accuracy to closed masks but with the benefit of an uncovered face. In the chest region it offers a millimetre-accurate tracking of the patient, allowing not only breath-gating but also the reduction of the safety margins of the PTV. Therefore, DIBH is always considerable with chest treatments of compliant patients. The analysis of the pelvic region supports safety margins of 2mm, but it has to be taken into account that the influence of the fillings of hollow organs and abdominal motion are not specified yet.

Conflicts of Interest: None

Mathieu Gonod
Medical Physicist
Centre G. F. Leclerc, France

Big data analysis for setup margin personalization derived from intra-fraction motion: a proof of concept

Author List:
Laurent Delcoudert, Centre G. F. Leclerc | Igor Bessieres,, Centre G. F. Leclerc | Stéphane Morisset, Independent Biostatistician | Victor Robineau,, Centre G. F. Leclerc | Jad Farah, Vision RT | Léone Aubignac, Centre G. F. Leclerc | Mathieu Gonod, Centre G. F. Leclerc

Introduction: Nowadays, and despite the efforts in performing personalized radiation therapy, standardized PTV margins are still applied according to the treatment technique and the localization. Meanwhile, Surface Guided Radiation Therapy (SGRT) tracks and records patient movement throughout treatment delivery, but this data is not often analysed and remains under-exploited.

Objectives: In this context, we aimed to use big data tools to correlate intra-fraction motion to various clinical (site, age, gender, etc.) and technical (immobilisation device) data, in order to define motion groups used to identify possible personalization of PTV margins.

Methods and Materials: The motion amplitude of 5,599 sessions related to 379 patients were extracted from AlignRT reports. In parallel, a total of 50 clinical/technical data were collected with a Python script. For patients with the same PTV margin, Conditional Inference Trees (CIT) were used to generate motion groups with significant correlation between clinical/technical data and motion amplitude. Then different maximum movement sub-groups were identified with a potential margin optimization and personalization.

Results: For PTV margins of 10mm, 7-8mm and 5mm, the CIT algorithm helped identifying 10, 5 and 2 different motion groups respectively. For treatments with a typical 10 mm PTV margin, a possible gain of 1mm, 2mm, 3mm and 4mm were identified for 6.8%, 57.2%, 10% and 3.2% of patients respectively. For 7-8mm typical PTV margins, 44.4% of the patients could have benefited from a 2mm margin reduction.

Conclusion: A correlation between clinical/technical data and intra fraction motion amplitude was identified allowing for personalization of PTV margin.

Conflicts of Interest: Vision RT provided financial support for the statistical analysis and are a member of the SGRT Community clearance mapping consortium.

Daniel Nguyen
Medical Physicist
Orlam Group, France

Feasibility of frameless and maskless stereotactic cerebral radiotherapy with AlignRT InBore guidance on HALCYON v3.0: preliminary results

Introduction and aim of the study: Cerebral stereotactic radiotherapy (SRS) is usually performed with a thermoformed mask to secure the patient's head in place, but this method can be difficult to tolerate for some patients. We report the experience of treating without a thermoformed mask and in SRS conditions, a claustrophobic patient with 5 brain metastases using a Halcyon v 3.0 (Varian, Paolo Alto, USA) and AlignRT InBore (Vision RT Ltd., London, UK).

Material and methods: A mask-free dosimetric scan was performed with a head and neck restraint using a ball mattress system. The dose delivered was 33 Gy in 3 fractions of 11 Gy to each metastasis considering 2mm PTV margins. Treatment was performed on a HALCYON v3.0 accelerator (Varian Medical Systems, Palo Alto, USA), using arc therapy intensity modulation with 4 to 6 partial arcs of 6 MV FFF photons. The patient was repositioned using the AlignRT InBore V7.2 surface imaging system (Vision RT Ltd., London, UK) pre-calibrated to the treatment isocenter using the dedicated SRS package including the cube. kV-CBCT cone imaging was performed before and after each treatment. Two to three target sites were treated per day. AlignRT InBore was used to monitor the patient throughout the treatment process (CBCT acquisition, analysis of control imaging and treatment). Once the table offsets was applied, a session-only reference capture was acquired and intra-fraction monitoring continues with tolerances of +/-1 mm or degree.

Results and statistical analysis: AlignRT InBore allowed reproducible and accurate patient setup, especially with respect to head rotations, thereby compensating for the 3 degrees of freedom Halcyon couch. Indeed, maximum shifts between the first kV-CBCT and the dosimetric scanner remained below 2mm in each direction (vert/long/lat). Additionally, no offset was observed between the treatment position and the second/control CBCT performed at the end of treatment for all 3 sessions. No significant intra-fraction motion (values below the set RTD tolerances of 1 mm/°) during beam delivery continuous monitoring which would have required treatment to be interrupted.

Conclusion: This preliminary study suggests the feasibility of frameless and maskless SRS delivery on Halcyon with AlignRT InBore guidance. Studies are underway to confirm this conclusion and assess the safety and efficacy of this method.

Conflicts of Interest: Orlam group is a reference site for Vision RT.

Improving efficiencies with MapRT

David Parsons, PhD
Associate Director of Medical Physics Residency Program
University of Texas Southwestern, Dallas, Texas, USA

Introduction: Incorporating noncoplanar beams into radiation therapy can significantly enhance the precision and success of cancer treatment, however planning requires advanced technology and expertise, in order to maximise plan quality whilst producing a plan that is deliverable without collisions at the treatment machine. When using noncoplanar beams it is commonplace for departments to implement a manual dry run process, to check that the plan is deliverable. This is a time-consuming process, demanding therapist and machine time to undertake this process whilst at the same time impacts treatment planning time if a re-plan is required whilst adding stress and anxiety to the patient as treatment start dates are delayed. A new technology, MapRT, applies the principles of SGRT to the planning process and aims to address these limitations.

Objectives:

- Understand the role of clearance mapping in modern radiotherapy, in particular in the development of noncoplanar treatment protocols.
- Investigate if the implementation of MapRT can eliminate the need for physical dry runs and quantify the efficiencies in the clinic.

Methods and Materials: We audited existing data to evaluate the typical time it takes to perform manual dry runs and calculated the mean impact in hours on the clinic. We then evaluated the new MapRT software to establish if the system is providing accurate enough data to eliminate the need for the manual dry run.

Results & Conclusion: MapRT is a novel SGRT clearance mapping software and our studies have found it is more accurate than manual clearance checks, greatly reduces planning time and, in short, enables confidence in noncoplanar treatments.

Conflicts of Interest: Member of the SGRT community clearance mapping consortium.

Use of MapRT to optimise noncoplanar planning for head and neck patients

Helen Convery
Senior Dosimetrist
(Development and Clinical Trials)
Raigmore Hospital Inverness, UK

Introduction: Treatment of head and neck patients can be complex and affected by variations in setup, especially around the shoulder area, due to extreme mobility and difficulty in immobilisation. Planning with noncoplanar treatments to avoid entrance dose through the shoulders can improve the reproducibility of the treatment but has an impact on resources, especially 'dummy runs' to check for any collision on set. The use of MapRT can eliminate this.

Objectives:

- Produce a class solution for noncoplanar head and neck planning.
- Improve the overall reproducibility and dosimetry of these plans.
- Integrate this study with the introduction of shoulder-less masks.
- Have no significant impact on department resources.
- Further develop our use of MapRT.

Methods and Materials: Ten patients will be retrospectively planned with couch angles to avoid the treatment arcs entering through the shoulders. Both these plans and the plans used for treatment will be calculated on CBCT to show the effects on the dosimetry.

Results: This work is an ongoing study so final results will be presented at the conference but will include any problems encountered during planning and treatment and any class solution achieved.

Conclusion: Full conclusion will be presented at the conference, but I aim to show a class solution that produces higher, or similar, quality plans to the current standard; is more accurate on delivery and has no significant impact on resources.

Conflicts of Interest: We are a test centre for MapRT and member of the SGRT community clearance mapping consortium.

Dosimetric planning advantages of surface guided planning

Adi Robinson, Ph.D DABR
Medical Physicist
AdventHealth Celebration, USA

Introduction: The objectives and challenges of treatment planning in radiation therapy are well-documented and accepted within the radiation therapy community. All hospitals strive to maximise the therapeutic effect on cancer cells, whilst minimizing the impact on the surrounding healthy tissues, achieving a high dose within the target volume with a steep dose gradient at the margins, with the aim to maximise successful treatment whilst minimising long term toxicity. However, the trade-off between tumor control and minimizing healthy tissue damage may not always be easily attainable and the potential for long-term side effects or secondary cancers is a crucial consideration in treatment planning. Various technological advances aim to address this problem, with SGRT being a new innovation within this area. This abstract aims to look at how surface guided planning (MapRT) could contribute in this area.

Objectives: Report on the evaluation of the dosimetric impact of MapRT as a treatment planning tool to improve quality treatment plan.

Method and Materials: Using planning data from UTSW evaluated the impact of MapRT across a number of different body sites. MapRT was used to evaluate if improvements could be made to the standard plan.

Results & Conclusion: Initial data looks promising and gives in an insight on how mapRT opens up different planning possibilities. Full results and conclusions will be presented at the SGRT meeting.

Conflicts of Interest: Member of the SGRT community clearance mapping consortium.

The feasibility of maskless radiation therapy for head and neck cancer by using surface guided radiation therapy (SGRT)

CHAIRED BY: Lisa Laws
Principal Radiographer
Rosemere Cancer Centre, UK

Abbey Adams
Radiation Therapy Treatment Unit Leader
GenesisCare North Shore/Mater, Australia

Introduction: : Patients suffering from claustrophobia have presented as challenging cases when treating the head and neck (H&N) area due to being confined in a thermoplastic mask without a desirable alternative. The feasibility of maskless radiation therapy for head and neck cancers by using surface guided radiation therapy (SGRT) has been assessed through this case study.

Background: Patient is a 50-year-old male diagnosed with T2N1MX SCC of the left tonsil. The patient was planned to a radical dose of 70Gy/35# to the oropharynx and lymph nodes using a VMAT technique. The plan included using 3 full arcs and 6FFF energy. After extensive peer reviews, a 0.5cm PTV margin was decided upon.

Workflow: Patient attended simulation appointment and was immobilised using H&N mould care cushion-only and was scanned with the CT room door open. The patient also attended a 'day 0' appointment which included the patient lying in their simulated position in the treatment room with the AlignRT camera turned on. The gantry was moved from 179-181 around the patient while they were asked to move their head very slightly in all directions to determine the system's sensitivity to movement. It was decided to have two treatment ROIs and tight treatment tolerances were set at 0.15mm and 1.5 degrees. Treatment consisted of aligning the patient using the ROIs and postural alignment function to be within tolerance. The treatment staff would then take a pre CBCT and post mV/kV image and record the shifts along with the daily treatment times.

Imaging: Patient was imaged daily by taking a pre-CBCT image where a bones match was priority along with assessing soft tissue to be within PTV margins. Jaw and shoulder position were assessed along with contour changes. Shifts were recorded and assessed to determine an accurate in room setup. A post mV/kV image was also taken and matched to bones. Shifts were recorded to determine the accuracy of AlignRT in detecting intrafraction motion. If AlignRT detected motion outside of tolerances, the imaging process was repeated.

Challenges: There were various challenges and complications throughout this procedure. One of which included noting a jaw drop on the post mV/kV image that was not detected by AlignRT. This issue was rectified by trialling a new ROI that included an additional region around the chin and jaw. Another challenge included a neck flexion issue. It was noted on the CBCT that the patient's neck was more flexed due to being less anxious as the treatments progressed. This issue was rectified by the patient having a rescan after #12. Contour change was an anticipated issue that caused AlignRT to produce inaccurate setup results. This was rectified by created an SGRT reference capture that was saved for future sessions in the peak of this patient's contour change.

Results: The average shifts from the CBCT were 0.28cm VRT, 0.23cm LNG and 0.16cm LAT shifts. The average shifts from the mV/kV pair were 0.06cm VRT, 0.09cm LNG and 0.03cm LAT and the average daily treatment time was 17 minutes.

Summary and Impact: The results indicated the in-room setup was accurate and intrafraction motion was minimal throughout treatment making SGRT a feasible option to treat H&N patients without a mask. This is an area of continued development, however, is a viable option for patients who previously had limited treatment opportunities.

Conflicts of Interest: None

Introducing AlignRT for head and neck IMRT treatments

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Introduction: Immobilisation of patients during radiotherapy treatment is imperative to ensure accuracy. However, conventional masks are associated with significant treatment related distress and the well-documented phenomenon called "mask anxiety". Many patients experience difficulty swallowing and breathing which makes a conventional facemask even less tolerable, this in turn causes disruption to linac schedules.

Objectives: In order to improve patients' radiotherapy treatment experience, we piloted a three-point, faceless, open mask. We used SGRT in our department to investigate whether such masks could reduce patients' distress without impacting on treatment accuracy - by comparing setup data for full, versus open masks, combined with SGRT.

Method and Materials: A feasibility study with three patients was first carried out to establish the most appropriate ROI to use, assigning a setup and isocentric ROI to the face and thorax. The feasibility study assessed three-point open facemask and five-point open facemask.

Over an 18-month period, all head and neck cancer patients undergoing radical radiotherapy, were offered open masks. Once 30 patients had completed radiotherapy treatment with the open mask and SGRT, an analysis of the setup data was completed by comparing this consecutive cohort of patients, to patients in standard closed masks treated during the same time period. Imaging for the pilot consisted of daily CBCT before treatment, and also after treatment, to analyse intrafraction motion. The one-dimensional standard deviations (SD) of the systematic and random set-up errors were calculated for all three orthogonal directions (x, y, z). Mann-Whitney U and independent t-test were used to determine any significant differences between rotational set up data for open and closed masks.

Analysis of data is still ongoing, and results are not ready to report as of yet. It is projected that results will be available before the conference in December.

Conflicts of Interest: None

Comparison of patients treated with conventional head and neck mask versus open mask using SGRT setup

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Introduction: In radiation therapy, patient immobilization and positioning are crucial for accurate treatment delivery. Surface Guided Radiation Therapy (SGRT) has emerged as a promising technique, offering real-time tracking and motion monitoring. This study aims to compare the efficacy between conventional mask (CM) for head and neck and open-face masks (OM) in radiation therapy.

Objectives:
- To analyze the benefit of SGRT in head and neck patients treated using conventional and open mask.
- Assess the consistency of the immobilization device.
- Explore the Practical Implications of Mask Performance based on data.

Method and Materials: This study was conducted on TrueBeam SVC with six-dimension couch. Two groups, each comprising 20 patients, were formed: one used CM and other OM. The setup accuracy was assessed by measuring the deviation between planned and actual treatment positions (Vertical, Long, Lateral, Pitch, Roll and Rotation). The deviation was collected for the fraction number 1st, 11th and 21st. To analyze the data statistically paired t test with 5 % significance level was performed between the two groups.

Results: Based on the statistical analysis, the results as follows: Vertical Axis: Open Face Masks (OM) is marginally superior then Closed Face Masks (CM), demonstrating lower mean deviations at all treatment fractions (1st, 11th, 21st). The paired t-tests also showed no statistically significant differences in setup accuracy between the two masks for this axis. Longitudinal, Lateral, Pitch, Roll, and Rotation Axes: For these axes, there were no statistically significant differences in mean setup accuracy between OM and CM across all treatment fractions.

Conclusion: Both immobilization device exhibited comparable performance in all axes, except in the Vertical axis where the OM slightly outperformed CM. These findings underscore the clinical adaptability of the open-face mask in radiation therapy, emphasizing its potential to enhance patient comfort and provide personalized care.

Conflicts of Interest: None

Head and neck SGRT: our experiences at Lincoln

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Objectives:

- To summarise how we have implemented tattooless breast, thorax, DIBH lung SABR and head and neck SGRT in Lincoln.
- A focus on H&N SGRT, VMAT DIBH Breast and DIBH lung SABR.
- Outline our plans regarding tattooless pelvis, head and neck SGRT and using SGRT for extremities.

Method and Materials: A timeline to show key moments in our SGRT journey. Graphs with data from surveys of staff at various points of implementation. Tools utilised for training – ROI Workshops, online and offline training tools. Data showing impact on treatment time and patient satisfaction. A showcase of ROIs we have used. Positioning 3D printed bolus with AlignRT. Data to show how H&N SGRT has benefited rotations on images.

Results: Data from surveys of staff and patients to demonstrate how successful all SGRT implementations have been. All breast and thorax patients are now tattooless. Successfully treated lung SABR patients, some of which were DIBH. 25% of head and neck patients are now scanned with an open mask with SGRT being utilised for setup and monitoring.

Conclusion: Outlining our future goals for SGRT; tattooless pelvis implementation beginning in the third quarter of 2023. Plans to trial SGRT for all head and neck patients to investigate if we can improve accuracy and reduce the need for reimaging. Plans to utilise SGRT for extremities.

Conflicts of Interest: None

Surface guided deep inspiration breath hold (SG-DIBH) in ultra-hypofractionated radiotherapy for early stage left breast cancer (BC): a single-centre analysis

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Introduction: In left-sided BC patients treated with ultra-hypofractionated WBI SG-DIBH has been implemented at our Institution.

Objectives: To evaluate SG-DIBH-WBI delivered with AlignRT® System in terms of dosimetric parameters, treatment delivery and patient compliance in the first ten patients treated.

Method and Materials: Two CT scans were acquired: the first in free breath (FB) for surface reference and tattoos alignment and the second in DIBH. Dose-volume specifications were: D95%≥95%, V105%<5%, V107%<2%, Dmax<110% for breast-PTV, V8Gy<15% for the left lung, V1.5Gy<30%and V7Gy<5% and for the heart and LADA Dmean<6Gy. Comparison between DIBH and FB plans was performed.

Results: Left lung V8Gy: 11.7%±1.6 (mean±SD) vs 13.6%±1.5; Heart V1.5Gy: 6.6%±5.4 vs 12.8%±7.3; Heart V7Gy: 0.5% ±0.5 vs 3.1%±2.1; LADA Dmean: 2.9Gy±1.5 vs 7.3Gy±4.2Gy for DIBH and FB, respectively. Regarding treatment delivery the average of the maximum shift value in all directions, calculated after co-registration of DRR with 2D kV-portal images, was <0.5mm for all patients. All patients completed RT and patient compliance was high.

Conclusion: SG-DIBH with AlignRT® System resulted feasible and reproducible. The "learning curve" for radiation oncologists, medical physicist and radiation therapy technicians was fast. At present SG-DIBH is the standard treatment for the left-sided BC patients in our Institution, within a well-defined pathway of care. Regarding treatment plans doses to the left lung, heart and LADA were lower than with FB-WBI reaching a reduction of 84% for the heart V7Gy.

Conflicts of Interest: None

Implementing a novel breast workflow utilising 6DoF through AlignRT surface guidance radiotherapy

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Introduction: Breast cancer is one of the most treated cancers in radiation therapy, but it has been marred by various challenges during its technological evolution (Li, 2022). Breast treatments have been historically set up using tattoos, followed by IGRT for positioning verification. During these processes, several variations that can affect the treatment accuracy may occur. Inter & intra-fractional errors such as setup errors and respiratory motion can be considered as contributing factors (Li,2022). With evolving technology and the emergence of SGRT, physical tattoos and the emotional distress of tattoos have been eliminated. As breast techniques begin to be more volumetric based, new techniques such as VMAT have been implemented, as the technology changes so does the treatment setup (Al-Hallaq, 2022). Our centre has introduced a novel setup workflow using Align RT that utilises "Send to Couch" feature that applies 3Dof & 6Dof when setting up breast patients which has reduced treatment times, improved accuracy and overall patient care as no tattoos are required.

Objectives:
- Enhancing workflow efficiency and reducing treatment time for breast patients
- Increasing accuracy for image guided radiotherapy for breast treatment setups
- Minimising manual handling for radiation therapists by limiting physical manipulation when positioning patients

Method and Materials: The intent of the case study is to enhance department breast treatment workflow. It started On November 2022 by applying ***"Send to Couch"*** on patients diagnosed with breast, supraclavicular and axilla treatment setups. Patient age group ranged between 30 - 90 years old. The breast treatment techniques that have been targeted during this case study were free-breathing & deep inspiration breath hold breast. 3DoF & 6DoF Align RT function has been utilised as part of the ***"Send to Couch"*** in order to minimize user errors.

Results: Finding suggests that ***"Send to Couch"*** function in AlignRT software has reduced department breast treatment time by 20% and increased treatment accuracy by applying smaller shifts during image matching when compared to the original department breast treatment procedure.

Conclusion: AlignRT ***"Send to Couch"*** function is an excellent and far superior function that helped to enhance department breast treatment by reducing treatment times and increasing setup accuracy.

Conflicts of Interest: GenesisCare has a global reference site agreement with Vision RT.

Clinical implementation of tattooless treatment for breast cancer patients using SGRT

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Introduction: Since 2018, our clinic has used SGRT for monitoring Deep Inspiration Breath-Hold for left-sided breast cancer patients. From early 2021, we started using the system for positioning the patients as well, but tattoos were still used, mainly to align the patient correctly on the breast board. As a next logical step, we recently implemented a tattooless workflow.

Objectives:
- Increase patient satisfaction
- Maintain similar setup accuracy
- Workflow efficiency / RTT experience

Method and Materials: To allow tattooless treatments, fixed reference points, suitable for all breast/thoracic wall cancer patients were defined for patient setup. A risk analysis was done to evaluate potential hazards, a protocol on how to handle in case of technical failure of the SGRT system was made. A 5-minute presentation was prepared to inform the RTTs. Clinical implementation started in July 2023 at our site in Dordrecht.

Results: So far, more than 50 breast patients have been scanned tattooless. The RTTs are very positive; they now have a uniform workflow for positioning all breast/thoracic wall cancer patients. In addition, the entire CT procedure is finished in a shorter time. The patients react positively surprised; they no longer will experience the cosmetic and psychological impact of tattoos. Analysis of the accuracy of patient setup is ongoing.

Conclusion: Based on the positive results, a similar procedure will be implemented on the linacs of in our main location in Rotterdam before the end of 2023. In addition, extension of tattooless treatments to other treatment sites will start.

Conflicts of Interest: None

Clinical implementation of Surface Guided Radiotherapy (SGRT) for palliative patients

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Introduction: SGRT has been used as standard for all patients undergoing radical radiotherapy to breast/chest wall at The Christie at Oldham since 2021. In order to extend the use of this system, patients receiving virtual simulation (vsim) for palliative treatments were selected.

Jack Hannant
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The Christie at Oldham NHS Foundation Trust, UK

Objectives:
Compare SGRT positioning to current departmental workflow.
Appropriate region of interest (ROI).
Establish appropriate gating thresholds.

Method and Materials: Clinical validation of the SGRT system's application to palliative vsim planned treatments was conducted:

Helen Squibbs
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Phase 1: Patients positioned as protocol with the addition of SGRT. Differences in setup position were documented and verified with KV imaging.

Phase 2: Patients positioned using SGRT and verified with KV imaging. Patients were then monitored during treatment. The data analysis demonstrates differences between SGRT & imaging placement and establishes appropriate gating thresholds for phase 3.

Phase 3: Patients positioned using SGRT treatment, gating activated and correction to verified treatment position if required. The data gathered will confirm the setting of appropriate thresholds for gating activation.

Following data analysis, the aim is to transfer to SGRT workflow for this cohort of patients.

Results: Preliminary results suggest accurate setup using SGRT. Further results pending.

Conclusion: Perceived advantages are improved speed and accuracy of treatment with reduction in imaging. This will be confirmed with data analysis. Palliative SGRT highlights the importance of appropriate ROI's to achieve an accurate tracking surface.

Conflicts of Interest: None

Breath-hold for hearing-impaired patients

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Introduction: A right-sided breast patient presented with a metastatic lesion in the sternum. Planning and treatment delivery was complicated by previous radiotherapy to the left side.

Considerations: A VMAT plan was required with the patient in breath hold. The patient was hearing impaired, which presented further challenges in communicating breath-hold commands.

Results: In this presentation we will discuss how using AlignRT and modifications to the Real Time Coach we were able to support this treatment and challenges were overcome. Feedback was positive from the patient and staff and moreover the patient was able to receive a high standard of treatment.

Conflicts of interest: GenesisCare has a global reference site agreement with Vision RT.

Utilizing SGRT in the treatment of oligometastatic hypopharyngeal cancer: case study of a complete remission

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Introduction/context: A 45-year-old woman was diagnosed with hypopharyngeal (pyriform sinus) cancer in October 2021. Her initial evaluation comprised an endoscopic ENT examination with tumor biopsy, positron emission tomography with FDG, and MRI of head, neck, and liver. The disease was classified as cT1N2cM1 (clinical stage IVC) according to 8th edition of AJCC TNM staging system. The patient was found to have a single liver metastasis and two bone metastases, in the 3rd left rib and sacral bone.
Considering the patient's relatively young age and overall good health, she was qualified for non-standard treatment regimen, including:

- Induction chemotherapy with 3 cycles of cisplatin and 5-fluorouracil,
- SBRT for the metastatic sites,
- Locoregional treatment (radiotherapy with concurrent low-dose, weekly administered cisplatin).

Metastatic lesion in the liver was treated with SBRT, using SGRT system for deep breath-hold technique. A dose of 45 Gy in 3 fractions was delivered. Both bone metastases were treated with SBRT with doses of 50 Gy in 5 fractions, using SGRT system for intra-fraction motion control.

For locoregional treatment, 70 Gy was delivered in 35 fractions, concurrently with three cycles of cisplatin at 40 mg per square meter. Follow-up CT imaging and ENT examinations detected no signs of disease recurrence or progression. PET scans performed six months post-treatment indicated a complete remission of the disease. The patient remains disease-free.

Conclusion: This case displays a great potential of SGRT technique in SBRT treatment across various sites. It increases both precision and safety of the treatment. It allows for a consistent delivery of high doses without notable adverse events.

Conflicts of interest: None

Using SGRT for faster, safer and accurate extremity patient positioning

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Introduction: The aim of this retrospective study is to quantify the reliability and accuracy of SGRT in positioning extremity patients compared to conventional methods. Secondary objectives include investigating improvement of workflow efficiency, reducing number of CBCTs and reducing repeat positioning with SGRT.

Method: 30 patients treated for upper or lower extremities September - July 2023 were analysed retrospectively (Group A). These patients were immobilised with vacuum bags, Moldcare, polystyrene or excluding immobilisation. For daily positioning AlignRT software (Vision RT Ltd.) used with 0.5mm and 1° tolerance.
30 patients treated September -August 2023 using traditional setup (lasers and skin marks): 15 were immobilised with thermoplastic masks (Group B), 15 patients were immobilized with other devices (Group C). Data collected included percentages of translational distribution shifts-based surface shifts versus CBCT shifts, setup timing and systematic and random translational setup errors.

Results:
- AlignRT setup for extremity patients is more precise (89%,76%,77% x, y, z shifts < 3mm) than conventional setup (72%, 62%, 67%) but similar with Group B (86%,70%,77%)
- In 90% of cases, weekly CBCT (shifts < 5mm) is possible with AlignRT as opposed to traditional setup, unless immobilised with thermoplastic mask.
- AlignRT setup times (6±1 min) are similar to group B (7±2 min) but superior to group C (5±1min)
- Reduction in magnitude of the random translational errors were seen in vertical, longitudinal, and lateral directions (≤2mm vs 3-5mm)
- AlignRT improved treatment efficiency which could be possibly attributed to reduction of repeat imaging and elimination of repositioning.

Conclusions: SGRT improved the accuracy and reproducibility of patient setup and treatment efficiency of extremity radiotherapy and reduced the frequency of routine IGRT. Monitoring extremity patients during treatment was also useful.

Conflicts of interest: None

Surface Imaging for SRS: Insights from St Louis Radiotherapy Center

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Introduction: SGRT offers ergonomic advantages, precision, and avoids ionizing radiation, enhancing positioning and monitoring. This study assesses the effectiveness, precision and reproducibility of SGRT, recently adopted by the St Louis center for SRS treatments.

Objectives: Evaluate SGRT's precision, reproducibility, and application in SRS

Method and Materials: An anthropomorphic phantom quantified positioning errors, using an in-house End-to-End control with the AlignRT–VersaHD system, analyzing margins between GTV and PTV. The Head Adjuster fine-tunes patient position up to 0.1mm/0.1°. A decision tree guides treatment delivery through six arcs at multiple couch angles, ensuring continuous sub-millimeter oversight. Since April 2022, 68 plans have been executed on patients.

Results: Phantom tests showed AlignRT's reproducibility and alignment with XVI, as well as sub-millimeter isocenter accuracy. Consequently, a 2mm GTV-PTV margin was set. The decision tree enables patient positioning within 10 minutes, achieving 0.5mm/0.5° precision on the CBCT. During CBCT validation, monitoring maintains 1mm/1° precision. Occasional tolerance exceedances arise when the LINAC arm obscures a camera. Sessions average under 30 minutes. Monitoring is satisfactory but varies with the distance from isocenter to ROI.

Conclusion: SGRT facilitates SRS treatments with a 2mm GTV-PTV margin on a VersaHD in under 30 minutes. Its infra-millimeter monitoring ensures consistent operator confidence.

Conflicts of interest: None

Surface image monitoring for automated stereotactic radiosurgery treatment: efficiency, accuracy, and patient comfort

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Introduction: Intracranial stereotactic radiosurgery (SRS) and fractionated stereotactic radiotherapy (SRT) require a high level of precision. The linac-based HyperArc includes delivery efficiency through automation. However, traditional delivery of linac-based SRS requires the acquisition of ExacTrac kV imaging between SRS arcs to ensure delivery accuracy with couch rotations, which breaks the delivery automation, and therefore hinders the benefits of HyperArc. A more efficient workflow incorporating the use of surface imaging is explored to ensure treatment delivery efficiency, accuracy, and patient comfort.

Objectives: The goals of the study are:
Evaluate surface imaging monitoring accuracy compared to ExacTrac imaging
Establish spatial tolerances for surface imaging real-time deltas during SRS/SRT treatments
Evaluate positioning uncertainty for PTV margins to account for SGRT monitoring capability

Method and Materials: The first 24 patients (46 total fractions) who received SRS/SRT with HyperArc were evaluated. Patient treatment workflow starts with surface guided initial positioning of the patient in the mask, then surface guided positioning of the patient into treatment position. A Cone Beam CT and subsequent IGRT table shifts to refine the alignment of the patient to treatment isocenter and this position was used to baseline additional surface monitoring. MV portals were taken at all 4 table angle positions before each table angle's treatment began for initial verification and were discontinued as the team gained more confidence using the surface imaging only. Images were visually inspected at the time of acquisition to monitor for any gross errors and evaluated after treatment for quantitative analysis.

Results: Two out of 24 patients had motion detected during the treatment and additional image guidance confirmed the need to re-position the patient. Data analysis of the 184 MV images taken across the 46 treatment sessions revelled no more than 1mm of discrepancy between Vision RT and MV imaging on any image. A 1mm PTV margin on targets within 10cm of isocenter and 2mm on targets further away is sufficient to account for positional uncertainty with SGRT monitoring.

Conclusion: Patient monitoring with IGRT during SRS is sufficient to replace ExacTrac imaging as a means of ensuring a patient has not moved away from the intended treatment isocenter during a HyperArc automated treatment.

Conflicts of Interest: None

Comparison of SGRT to MV isocentre position for two SGRT systems for use with SRS

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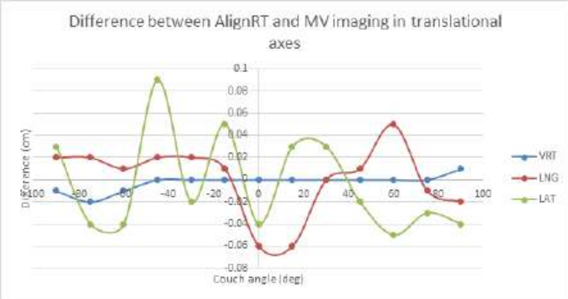
Introduction: In order to be able to use SGRT for intrafraction monitoring of patient position in SRS, it is important to quantify the agreement between the MV isocentre and the SGRT isocentre at non-zero couch angles. With the different SGRT systems available on the market this study was designed to evaluate the performance of two of those systems in accurately determining the position of a phantom at non-zero couch angles.

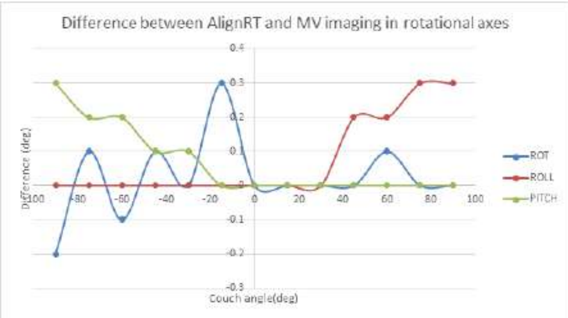
Objectives:

- Quantify the difference between the position of a hidden target phantom determined using MV imaging and SGRT.
- Performance of AlignRT was compared to the performance of ExacTrac Dynamic in determining the position of a phantom at non-zero couch angles with respect to MV isocentre.
- Determine whether SGRT, when used for SRS intrafraction monitoring, was a suitable alternative to internal imaging for position verification at non-zero couch angles.

Method and Materials: The AlignRT cube - which has 5 ball bearings hidden inside - was aligned to isocentre at couch zero using CBCT and applying 6DoF corrections. An A/P MV image was taken once the phantom was in position. The SGRT position was measured. The couch was rotated in 15-degree increments from 270 to 90. At each couch position an MV image was taken, shifts from MV and SGRT noted but not applied.

Results:





Due to being unable to decouple the SGRT and X-ray components of ExacTrac dynamic the results could not be collected in the same manner to make meaningful comparison between SGRT systems.

Conclusion: There is good agreement between the shifts observed by AlignRT and MV imaging for all translational and rotational axes when using a hidden target phantom. This would make AlignRT a suitable alternative for position verification at non-zero couch angles for SRS treatments.

Conflicts of Interest: GenesisCare has a global reference site agreement with Vision RT.

Introducing setup of SRS treatment of patients with open-face mask using SGRT and head adjuster in our clinic

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Introduction: In April 2023 we started treatment of SRS patients using SGRT system AlignRT with head adjuster (Vision RT Inc, UK) and open-face masks (Orfit Industries, Belgium). PTV margins are 2 mm and rotations are corrected with the head adjuster, which make it possible to treat multiple PTVs with a single isocenter.

Objectives: We tested the hypothesis that correcting the rotations with the head adjuster in combination with the SGRT during patient setup, will show smaller residual error in the CBCT match results.

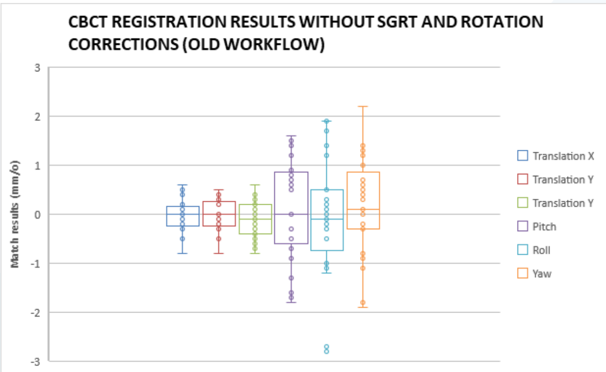
Method and Materials: In this study we show our results of the first 10 patients treated with this new workflow. For the SGRT system we use tolerances of 1-degree rotations and 1.5 mm for translations and a 2 mm tolerance for the 3D vector. During the treatment, patients will be monitored with the SGRT system using the tolerances.

Results: Figure 1 shows the results of the CBCT registration results after patient setup and couch shift for new SGRT- and the old (each PTV has an isocenter, no SGRT is used and no rotation correction) workflow. The patient setup with SGRT in combination with head adjuster shows significant less variance for rotations residues (see Figure 1). Patients lay stable during the treatment and deviations monitored are within tolerance.

Conclusion: The open-face mask gives the patients comfort. Rotations can be easily corrected with the head adjuster within subdegree before CBCT is made. Treatment time is reduced by treating multiple PTVs with single isocenter (less CBCTs and single patient setup for multiple PTVs). Patients can be treated within the applied tolerances, because they lay stable and deviations are small enough for different couch angles. Patient position can be monitored during treatment and movement out of tolerance can be detected.

Conflicts of Interest: None

Figure 1: CBCT registration results after patient setup using SGRT and head adjuster (upper panel) versus clinical workflow before (lower panel)



SG-SFRT: The use of surface imaging for spatially fractionated radiotherapy

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Introduction: Spatially Fractionated Radiotherapy (SFRT) is a radiotherapy technique that uses radiation fields to create a highly non-uniform and spatially oscillating dose distribution with "peaks" and "valleys" within the treatment volume[1]. Commonly used treatment regimen for the SFRT technique, also known as the Grid or Lattice therapy, ranges from 15-20 Gy in one fraction, based on early clinical studies for bulky malignant tumors[2, 3].

Objectives: The goal of the study is to commission and establish clinical workflows, involving various imaging capability including surface guidance, for accurate delivery of SFRT (or Grid) using volumetric modulated arc therapy (VMAT) or Brass aperture.

Method and Materials: VMAT Grid uses 4-arc plans to deliver 20 Gy to all 1.5cm diameter spheres distributed within the bulky tumor based on distance rules for constructing dosimetric peaks and valleys. Brass Grid relies on a brass aperture to deliver a lattice pattern of dose. Surface imaging is utilized for patient's initial setup, and during treatment. The dosimetric robustness study was performed to evaluate patient's positioning variation impact.

Results: A total of 10 patients treated with either VMAT or Brass Grid were evaluated. Based on the positional variation study, a threshold of 3mm was determined for the delta shifts along the x, y, z direction for surface imaging monitoring during the VMAT Grid treatment. For Brass Grid, surface imaging was used for patient setup followed by cone beam CT prior to placing the aperture. Surface imaging with 5mm threshold was used for treatment delivery monitoring after placing the aperture.

Conclusion: Our experience of both VMAT and Brass Grid using surface guidance is presented. Surfacing imaging plays an important role to ensure high positional accuracy during the SFRT one-fraction high dose treatment.

Conflicts of Interest: None

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Correlation between surface motion and heart-breast distance for breast cancer patients treated in DIBH

Lisa Dietrich, MSc
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Universitätsklinikum Erlangen, Germany

Author List:
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Universitätsklinikum Erlangen

Introduction: The introduction of the SimRT (Vision RT) system at the planning CT raised the issue whether the measured surface motion correlates to the increase of distance between heart and breast due to DIBH. The influence of the SimRT patch position is also investigated.

Objectives: Estimate the benefit of a DIBH treatment before performing the planning CT, determine the optimal placement of the SimRT patch, and optimize the patient selection for DIBH treatment.

Method and Materials: DIBH and free-breathing (FB) CTs along with SimRT data of currently 33 patients were analysed. Distances FB vs. DIBH measured by SimRT were compared to those of the corresponding CTs. In these CTs the centre-of-mass for structures of breast, heart, and three surface patch options were analysed.

Results: The results show that the heart motion due to respiration has a stronger influence on the heart-breast distance than the breast motion. The distance measured in surface patches has no direct correlation with the heart-breast distance. However, in 97% of all studied cases the heart-breast distance is smaller than the maximal measured surface distance of the three surface patches.

Conclusion: Measuring the surface motion in DIBH treatment in patches along the mid-sagittal plane allows a prediction of the heart-breast distance increase. This can be used to predict the profit of a DIBH treatment for each patient before performing a CT. Dosimetric implications need to be studied.

Conflicts of Interest: None

Patient-specific bolus positioning with AlignRT

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Medical Physicist
University Hospitals Leuven, Belgium

Author List:
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Department of Radiation-Oncology, UZ Leuven, Belgium

Introduction: Conventional gel-based bolus flaps can be difficult to mould around the patients' anatomy resulting in the appearance of air pockets in between the bolus and the skin, possibly compromising dose deposition. The translucent and reflective nature of gel-based boluses can also impact the tracking accuracy of optical surface scanning systems.

Objective: To counteract these issues, we have designed a workflow to design flexible patient-specific boluses which are manufactured using 3D-printing and which can be positioned with AlignRT.

Method and Materials: Plan preparation: Patients receive a CT-simulation without the use of bolus, giving the treatment planner total freedom to choose the extent and thickness of bolus. An inhouse C# script was created in Eclipse (Varian Medical Systems) which generates a mould from this 'digital' bolus structure, figure 1. This mould also contains the patient ID and volume of the bolus. A two-component silicone (Eurosil 8 Transparent, Schouten SynTec), with added skintone pigment, is mixed and poured into the mould, see figure 2.

After 2 hours, the silicone has solidified and is removed from the mould. After plan approval and verification by the physician and physicist, the RTPlan and RTStruct are sent to the AlignRT system.

Preparation in AlignRT: During import in AlignRT, both the body contour and the bolus structure are imported. As the body contour does not contain any bolus material, a conventional region-of-interest (ROI) is drawn which will be used for patient positioning. On the bolus structure an ROI is delineated encompassing the complete structure.

Treatment delivery: Patients are positioned using the body structure and ROI in AlignRT. After positioning, RTTs switch to the bolus structure/surface and turn on the option 'Postural Video' which displays the outlines of the bolus. These outlines are then used to position the bolus in case if the body location contains little topography (e.g. chest wall), or as a validation if there is a lot of definition in the location (e.g. nose), see figure 3. The position of the bolus is verified during online matching on CBCT, see figure 4.

Results and Conclusion: Combining both additive manufacturing technologies such as 3D printing and optical surface tracking such as AlignRT, we have created an easy-to-use workflow for patient-specific bolus positioning.

Conflicts of Interest: UZ Leuven is a reference site for Vision RT.

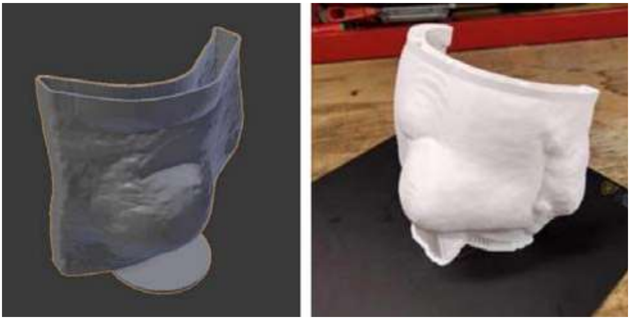

Figure 1:
(left) Output of the script, a 3D model, wich is then 3D-printed.
(right) The final mould.

Figure 2:
Two patient-specific boluses for a left and right chest wall of the same patient.

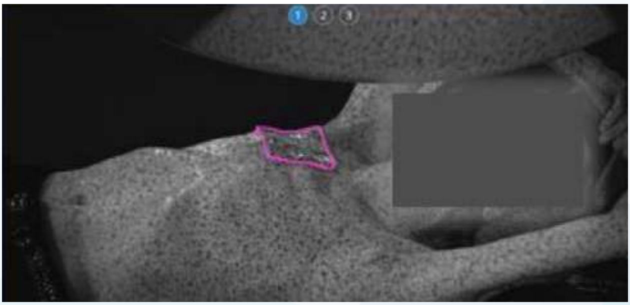

Figure 3:
Postural video screenshot showing the outlines of the bolus structure.

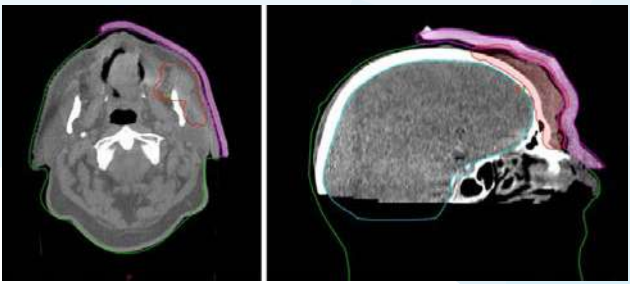

Figure 4:
CBCT acquisition of a head and neck (left) and cranial skin treatment (right). The pink outline indicates the digital bolus structure. During online matching, RTT's verify the bolus position, which is excellent in both cases.

Quantification of beam latency using AlignRT

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Southampton, UK

Rachel Barlow
Deputy Head of Radiotherapy Physics
University Hospital
Southampton, UK

Introduction: Beam latency can be characterised as 'beam hold latency' (time period from patient motion to beam hold), and 'beam start up latency' (time period between the patient moving into tolerance and the beam starting). This should be measured to ensure the latency is negligible to treatment delivery accuracy.

Objectives:
- To develop and compare two methods to characterise gating latency to find the most suitable method for gathering data for commissioning and routine QA to share with the SGRT community.
- Measure latency and compare to published guidance.

Further work:
- Measure latency on multiple Elekta VersaHD and Varian Truebeam Linacs using both developed methods.

Method and Materials:
Method 1: A CIRS Dynamic Thorax Phantom was used to provide a moving target with a high-density marker and the software was programmed with a range of velocities. A reference surface capture was acquired of the phantom at its zero position and the Vertical Realtime Delta was set to +/- 10 mm. Reference EPID images were taken. Several exposures were then taken. The marker moved with a range of velocities both into and out of the gating window. Matlab was used for image analysis. The moving target deviation from reference was plotted against target velocity, to calculate end-to-end latency.

Method 2: An electronics method combining a solenoid to move a region of interest vertically between the gating window and a magnetron current detection circuit. Time stamps were created on a microcontroller when the solenoid moves and every time the magnetron is pulsed (radiation on). Beam hold and beam on latencies could be characterised by calculating the difference between the two time stamps.

Results: Results from method 1, measured on four Elekta linacs gave an average beam hold latency of 156 ms with a range of 36 ms. Results from method 2 are pending.

Conclusion: Method 1 for measuring end-to-end latency using AlignRT for gating is simple and accessible to most centres. Results measured at four different linacs are consistent and within published tolerances and show that the AlignRT system can be used to gate the radiation beam and deliver clinically acceptable treatments.

Conflicts of interest: University Hospital Southampton is a reference site for Vision RT.

First experiences with DoseRT

Mike Tallhamer
Chief Physics
AdventHealth, Colorado, USA

Introduction: During radiation therapy, Cherenkov light is emitted from the patient's skin where the radiation beam enters or exits the body. Cherenkov Imaging uses highly sensitive cameras, synchronized with both the linac and SGRT, to visualize this light from the patient's skin and the first commercial system DoseRT, has recently been installed in our clinic. Early evidence and Published data by Jarvis LA et al, suggests that approximately 10% of patients have errors in their treatment that can be detected[1] by Cherenkov imaging. DoseRT has recently been installed in our clinic and we aim to report on our early findings.

Objectives: Report on our early experiences of DoseRT from installation, commissioning, early clinical testing and to establish where current practise can be improved.

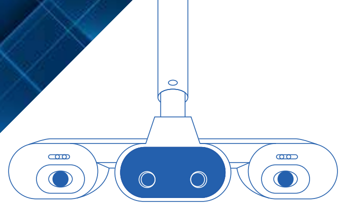
Results & Conclusion: We will present our early findings on this novel technology and discuss areas of clinical research for the future.

References:

Jarvis LA et al. Initial Clinical Experience of Cherenkov Imaging in External Beam Radiation Therapy Identifies Opportunities to Improve Treatment Delivery. Int J Radiat Oncol Biol Phys. 2021 Apr 1;109(5):1627-1637

Conflicts of Interest: AdventHealth, Colorado is a test site for new Vision RT products

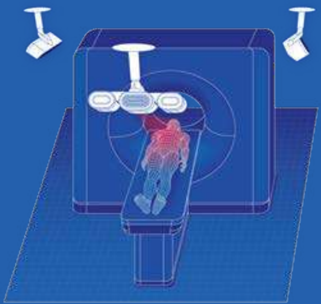
SGRT | Surface Guided Radiation Therapy



Use of surface guidance to help improve the safety, effectiveness and efficiency of the entire radiation therapy workflow.

visionrt | Guiding Radiation Therapy

SIM

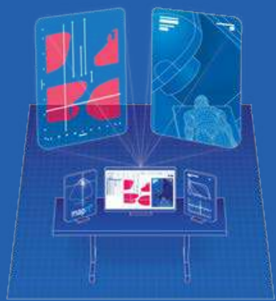


4D AND BREATH HOLD CT

simrt™

Non-contact **4D and breath hold CT** with a simple workflow, no hardware setups and no surrogates.

PLAN

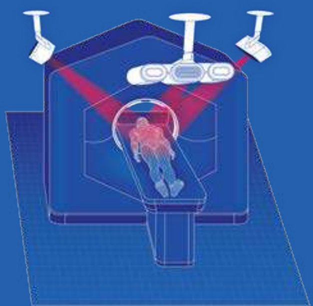


CLEARANCE MAPPING

maprt®

Clearance Mapping of entire patient and all equipment to assist planning without fear of collision, eliminating dry runs and replans.

TREAT

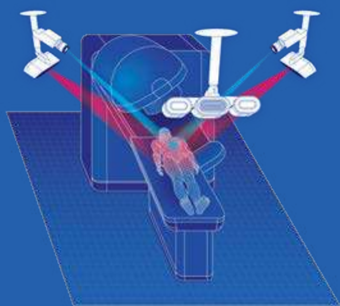


MOTION MANAGEMENT

alignrt®

Contactless pre-treatment **patient ID**. Demonstrated rapid tattoo-free **patient setup**. TG302/ESTRO-ACROP compliant **motion monitoring** accuracy at all couch / gantry angle and skin tones.

DOSE



DOSE VISUALIZATION

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Dose visualization to help stop dose delivery errors in real time.

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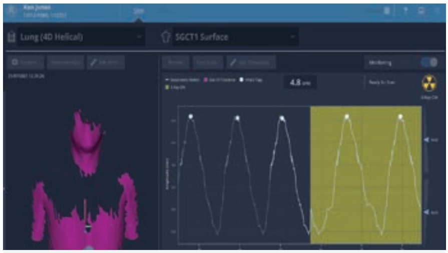
SIMPLE WORKFLOW WITH NO HARDWARE SETUPS AND NO SURROGATES

TRACKING POINT SELECTION FROM CONTROL ROOM:
- Rapid optimization of tracking point, for faster workflow
- Minimal patient distraction pre-scan, so breathing is undisturbed

CEILING-MOUNTED CAMERA:
- No physical marker, block or belt needed - no physical distraction for patients
- No tracking equipment for the user to set up
- Completely non-invasive, non-ionizing motion monitoring

REAL TIME COACH™ DISPLAY:
- Coaches patient on breath-hold level
- No patient contact for minimal infection risk
- Simple and intuitive visual feedback for patients



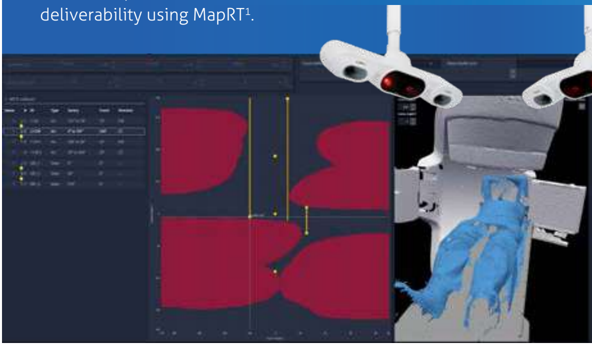
4DCT scan

Breath-Hold scan

SGRT FOR
CLEARANCE MAPPING

maprt®

A five-center planning study recently showed improved assessment of deliverability using MapRT[1].

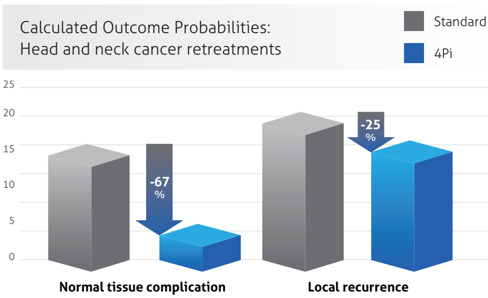


- Check treatment clearances before sim.
- Improve dose plan using clearance map beam options.
- Avoid dry runs and replans for non-deliverable plans. [1]

Two lateral wide-field cameras in simulation deliver a 3D surface of patient and accessories. This surface is used to calculate a clearance map for all couch (x axis) and gantry (y axis) angles. Plans can be imported automatically to check beams, arcs and transition clearance.

	# Fields assessed	Correct responses without MapRT	Correct responses with MapRT
Non-Deliverable	66	89%	100%*
Deliverable	284	64%	100%**

* 3% of responses for non-deliverable fields stated that based on MapRT they would make small adjustments to the patient position in the treatment room to make the gantry clear, thus justifying approving a field that was non-deliverable.
** 12% of responses for deliverable fields stated that based on MapRT they would reject the deliverable field as too uncomfortable due to machine proximity to patient's face.



"4Pi plans may allow dose escalation with significant and consistent improvements in critical organ sparing, tumor control, and coverage."[2]

NOW AVAILABLE FOR SALE

1. Surface guided clearance mapping: see more, do more and achieve more. SGRT Community USA 2022.
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SGRT FOR
MOTION MANAGEMENT

alignrt®

The market-leading SGRT system for tracking a patient's position before and during radiation therapy, to help ensure a streamlined workflow for accurate treatment delivery.

The most rigorous of the ESTRO-ACROP/AAPM-TG302 SGRT guidelines for SRS require a tracking accuracy of ≤0.5mm / ≤0.5° in phantoms, including potential camera occlusions. AlignRT delivers a tracking accuracy of ≤0.5mm / ≤0.2° at all couch and gantry angles. AlignRT's accuracy is not affected by skin tone.

AlignRT is available with a range of innovative add ons to further enhance your workflow:

Patient ID Module:

Our patient identification module adds automated safeguards for improving patient safety by using facial recognition to ensure the right patient gets the right treatment, every time.

Postural Video™:

Gain clear positional guidance from multiple angles during setup and monitoring.
In an independent head-to-head trial, Postural Video **further reduced setup time by 29%** vs. standard SGRT, increasing the linac capacity by one patient per 36 patients treated.[1]

Respiratory Module:

A comprehensive solution designed to expand clinical options in motion management. This cutting-edge module is fully integrated with AlignRT, offering unparalleled support for phase, amplitude and back up gating, as well as real-time monitoring in six degrees of freedom.

1. "Efficiency, Standardisation and Clinical Excellence: One Goal Across a Large Network" SGRT Community Meeting 2022 Presentation by Kira-Lee Oliver, Genesis Care Florida, June 2022.

alignrt® *InBore*™

AN SGRT SOLUTION FOR USE WITH **HALCYON® AND ETHOS™ LINEAR ACCELERATORS**

SET UP OUTSIDE. TRACK INSIDE.

+100 SYSTEMS IN ROUTINE CLINICAL USE

for DIBH, free breath breast, prostate, pelvis, abdomen, thorax / lung

ESTRO-ACROP / AAAPM TG302 COMPLIANT

with ≤0.5mm / ≤0.2° accuracy at all couch angles and skin tones

PUBLISHED CLINICAL DATA

showing faster total treatment time[1,2], accurate and reproducible DIBH[3,4]

1. Flores-Martinez E, et al. Assessment of the use of different imaging and delivery techniques for cranial treatments on the halcyon linac. Journal of Applied Clinical Medical Physics 2020;21 (1):53-61.
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4. Nguyen D, et al. Reproducibility of surface-based deep inspiration breath-hold technique for lung stereotactic body radiotherapy on a closed-bore gantry linac. Phys Imaging Radiat Oncol 2023; 26:100448

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Visualize Dose Delivery & Monitor Patient Positioning in Real Time

DoseRT is a treatment verification tool that provides real time in vivo images of dose delivery while monitoring patient positioning to ensure treatment quality.

DoseRT brings together Cherenkov imaging with AlignRT and Horizon cameras.

Dose Visualization

Can help prevent treatment errors in real time.

Published data suggests approximately **10%** of patients received sub-optimal treatment that can be detected by Cherenkov imaging.[1]

- **Stray Radiation to the Contralateral Breast**
  Clinical evidence suggests that **2.6%** of breast cancer patients had secondary contralateral cancer attributable to radiation.[2]
- **Bolus Misplacement**
  Currently no real-time verification tool exists.
- **Radiation to unintended areas**
  Due to treatment plan errors, exit dose radiation, or patient positioning.

Dose Visualization + SGRT

Can help improve treatment quality.

21% of Preventable Reported Events could be prevented with SGRT.[3]

- **43%** due to wrong isocenter
- **34%** due to wrong accessory

What is Cherenkov Imaging?

During radiation therapy, Cherenkov light is emitted from the patient's skin where the radiation beam enters or exits the body.

Cherenkov Imaging uses highly sensitive cameras, synchronized with both the linac and SGRT, to visualize this light from the patient's skin.

DoseRT not currently available for sale in the US. SimRT, MapRT, AlignRT and DoseRT are Trademarks of Vision RT. BeamSite is a trademark of DoseOptics LLC.

1. Jarvis LA et al. Initial Clinical Experience of Cherenkov Imaging in External Beam Radiation Therapy Identifies Opportunities to Improve Treatment Delivery. Int J Radiat Oncol Biol Phys. 2021 Apr 1;109(5):1627-1637
2. Burt, Lindsay M.; Ying, Jian; Poppe, Matthew M.; Suneja, Gita; Gaffney, David K. (2017): Risk of secondary malignancies after radiation therapy for breast cancer: Comprehensive results. In Breast (Edinburgh, Scotland) 35, pp. 122–129. DOI: 10.1016/j.breast.2017.07.004.
3. Hania Al-Hallaq et al. The role of surace-guided radiation therapy improving patient safety. Radiotherapy and Oncology. 2021 August 26: 163(2021) 229-236.

DEMO STATIONS

Live demos of Vision RT systems, including AlignRT®, DoseRT and SimRT, as well as a non-working demo of AlignRT® InBore, will be available during session breaks. These demos will be led by Clinical Applications Specialists who can answer any questions you might have about the technologies or workflows.

SIM

SimRT™ is a standalone surface tracking platform for CT sim, which allows regions of a patient's surface to be tracked in real-time, using a centrally positioned 3D camera. It is a simple non-contact motion monitoring system for 4D and breath hold CTs with no hardware setups or surrogates. SimRT has been shown to reduce the incidence of repeat scans.

PLAN

MapRT® introduces SGRT for clearance mapping. It is intended to make non-coplanar treatments fast, easy and safe. It uses SGRT to deliver a "clearance map", which planners use to check which beams are deliverable during plan creation.
MapRT images the entire surface of the patient and accessories to detect collisions in the most frequent problem areas such as elbows. In addition, the clearance map checks safety for all couch and gantry angles, so planners have guidance to increase couch kicks and lengthen arcs – for better plans with confidence in delivery.

TREAT

AlignRT®* is the market-leading Surface Guided Radiation Therapy (SGRT) system for tracking a patient's position before and during radiation therapy, to help ensure a streamlined workflow for accurate treatment delivery. AlignRT makes treatment safer by using a contact-free technique to track a patient's skin surface in real-time with sub-millimetric accuracy and ensures radiation is only delivered when the patient is correctly positioned. If a patient moves, AlignRT can automatically signal the treatment delivery system to pause radiation. AlignRT also benefits patient comfort, as it can eliminate the need for tattoos or other permanent marks, avoid the use of traditional closed mask or frame-based SRS, and reduce the need for paediatric anaesthesia.

AlignRT® InBore™ is an SGRT solution for use with Halcyon® and Ethos™ linear accelerators**, enabling 6DoF intrafraction patient monitoring for enhanced treatment accuracy, safety, and M workflow. InBore combines the benefits of ceiling mounted AlignRT camera pods for patient setup, with an innovative, miniaturized SGRT ring camera system mounted within the bore for 6DoF intra-fraction monitoring, including DIBH and stereotactic treatments. This novel CM approach provides a comprehensive end-to-end SGRT solution for patients undergoing treatment on bore based treatment platforms, without the physical design of the bore-based system compromising the SGRT benefits.

DOSE

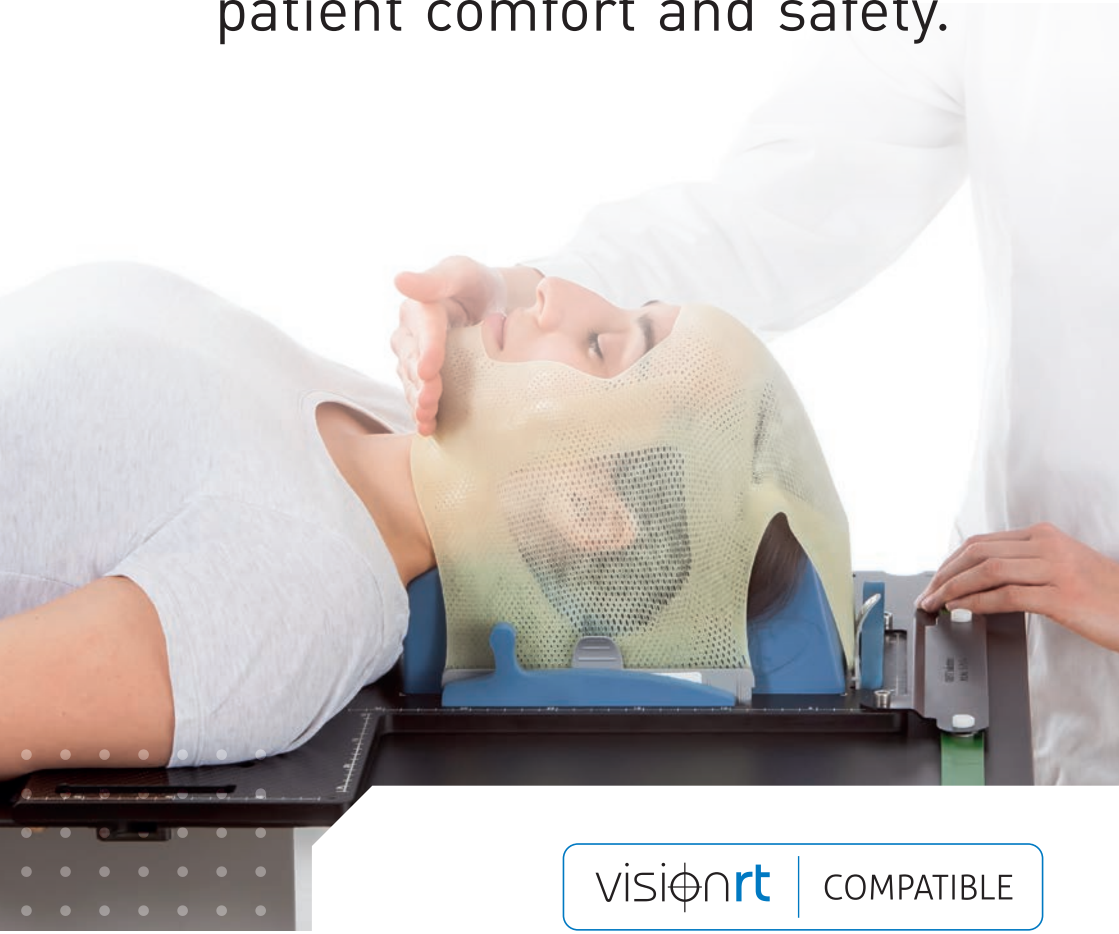
DoseRT™ - Revolutionize Treatment with Real-Time Dose Visualization & Patient Position Monitoring. DoseRT offers - for the first time ever - the ability to monitor the beam and position in real time, using Cherenkov Imaging. During radiation therapy, Cherenkov light is emitted from the K patient's skin where the radiation beam enters or exits the body. Cherenkov Imaging uses highly sensitive cameras, synchronized with both the linac and SGRT, to visualize the Cherenkov light. Published data suggests that approximately 10% of patients have errors in their treatment that can be detected*** by Cherenkov Imaging.

* All VisionRT products are available with the latest HorizonTM cameras, providing new possibilities in radiotherapy through 8MP wide field of view capability and Cherenkov Imaging compatibility.

** Halcyon® & Ethos™ are registered trademarks of Varian Medical Systems. The use of Halcyon® & Ethos™ herein is for identification purposes only. Use of these marks does not indicate sponsorship, affiliation, endorsement, or approval by Varian

*** Jarvis LA et al. Initial Clinical Experience of Cherenkov Imaging in External Beam Radiation Therapy Identifies Opportunities to Improve Treatment Delivery. Int J Radiat Oncol Biol Phys. 2021 Apr 1;109(5):1627-1637.

High Precision double layer open face masks for enhanced patient comfort and safety.



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They are easy to mould and use and can be shaped very closely to the patient's anatomy, providing excellent reproducibility and patient comfort. This results in a high precision and comfortable patient immobilization mask. These thermoplastic pre-cuts have an innovative non-stick surface coating with antibacterial properties. The coating is applied on both sides of the mask surface and contains nano-silver particles that stop bacteria from growing on the plastic material. As such the masks have an inherent property that can play an important role in reducing the spread of harmful microbes in a hospital environment.

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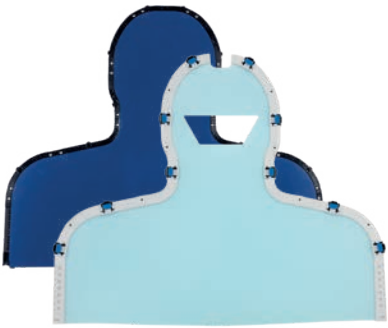

DSPS-*Prominent*® is the latest advancement in the renowned Double Shell Positioning system (DSPS®) product line. With its unique cantilevered frame and expansion of the treatment area to the full head, neck and shoulder region, DSPS-*Prominent*® offers personalized comfort and high treatment accuracy.

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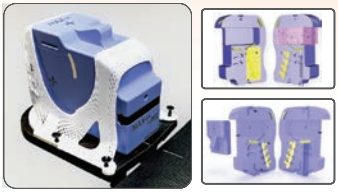

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WHAT IS THE SGRT COMMUNITY?

The SGRT Community is a peer-to-peer network of radiation oncology professionals, working together to share knowledge, research and best practice about the use of Surface Guided Radiation Therapy.

We are free to join and facilitate a number of collaboration opportunities and learning events throughout the year.

If you are interested in attending educational events, webinars or annual meetings, please visit the Upcoming Meetings page on our website.

We hope you've enjoyed this SGRT Community meeting. As you have registered and attended, you will be added to our mailing list and will receive clinical and educational updates from the SGRT Community*.

If you have any questions or if you'd like further information, **email: secretary@sgrt.org**

Share your expertise on our **forums: sgrt.org/forums**

** Vision RT is proud to be the financial sponsor, administrator and editor of the SGRT Community. Users and potential users of all SGRT systems can join the community, attend events and post messages on our forum. Clinical content is provided by users of SGRT and their views, workflows, clinical results etc are not endorsed or validated by Vision RT.*

NOTES

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The SGRT Community Annual USA Meeting
is taking place June 6 - 7 2024
at the Scottsdale Plaza Resort,
Phoenix, AZ, USA
SAVE THE DATE
Abstract submissions
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