Effectiveness of Markerless Surface-Guided Radiation Therapy in Breast Cancer Patients

Kitwadee Saksornchai
Faculty of Medicine , Chulalongkorn University
King Chulalongkorn Memorial Hospital
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King Chulalongkorn Memorial Hospital (KCMH) & Chulalongkorn University , faculty of medicine

Bangkok, Thailand

Radiotherapy machines at KCMH

4 Truebeam

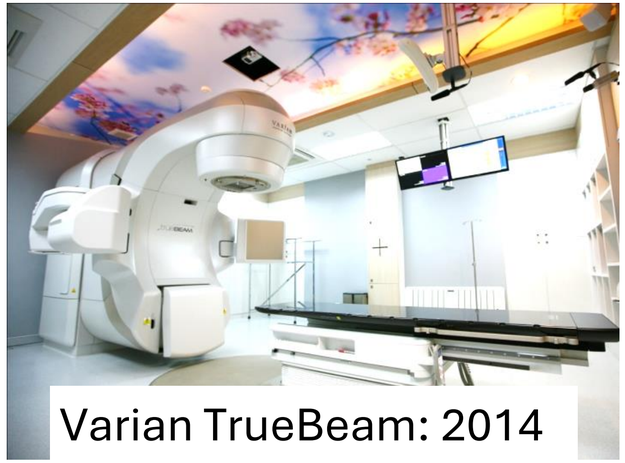
2 Halcyon

1 Linac IX

1 Ethos

1 Proton

SGRT at KCMH



Varian TrueBeam: 2014

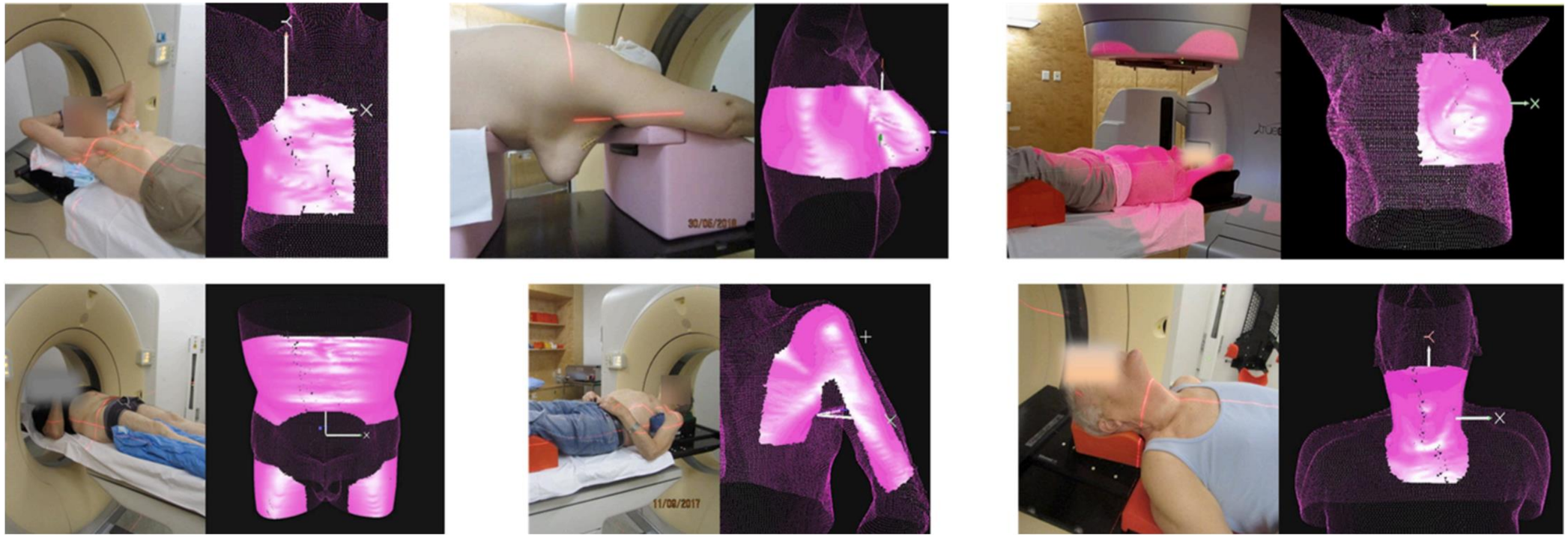
Varian TrueBeam: 2022

Varian Clinac iX: 2018

Varian TrueBeam: 2024

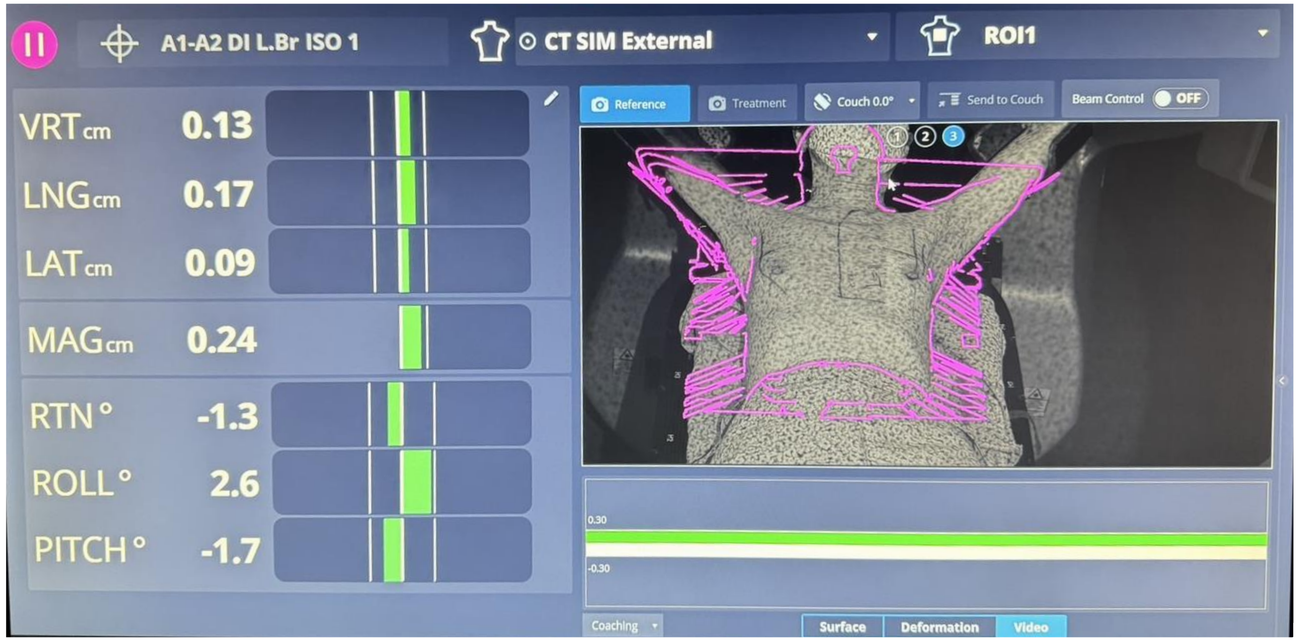
Clinical application

Clinical application of Surface guided radiotherapy



Clinical application of Surface guided radiotherapy

- ***Breast cancer***
  - Deep-inspiration breath hold
  - IMRT/VMAT cases
- ***Lung SBRT***
  - Deep-inspiration breath hold

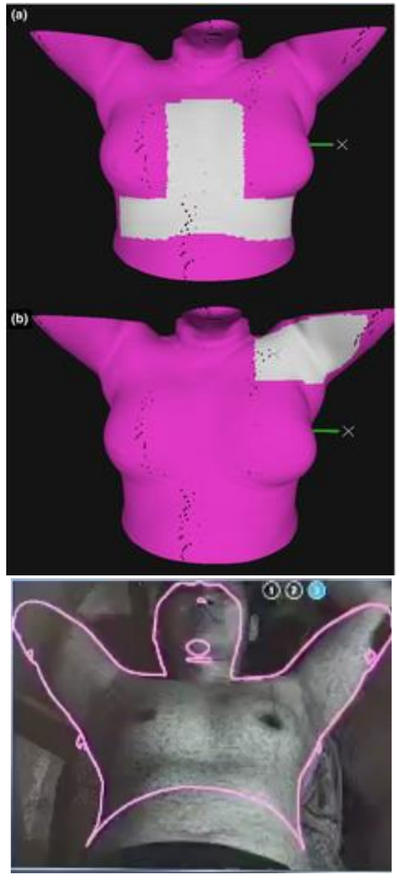


Clinical application of Surface guided radiotherapy

- Accurate breath hold treatment -> ensure patient’s position
- At our center : Implementation of Deep Inspiration Breathhold (DIBH) with Surface Guided Radiotherapy (SGRT)

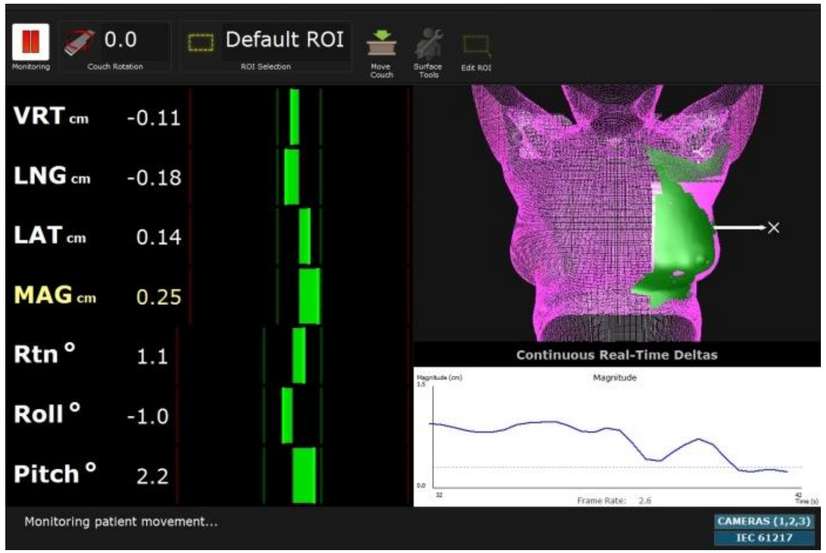
Clinical application of Surface guided radiotherapy

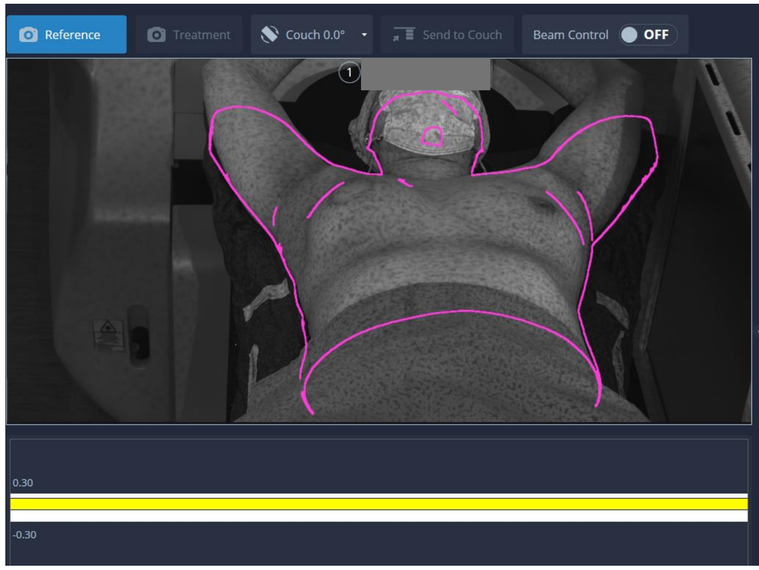
- Correction of patient posture : arm/chin



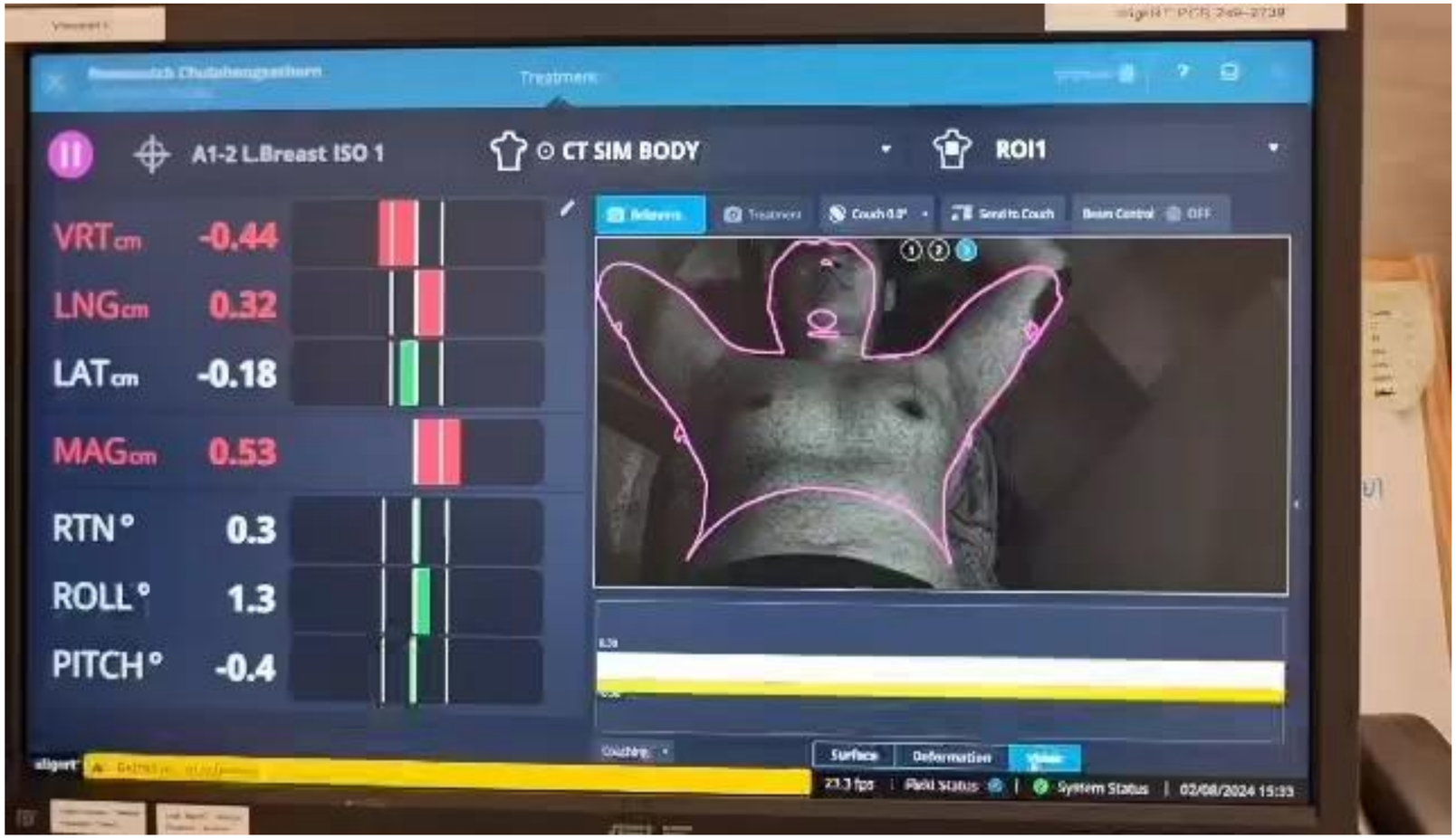
Laaksomaa , J Appl Clin Med Phys. 2019

SGRT as position monitoring





SGRT as position monitoring



A marker/tattoo free SGRT based system

Impact of tattoo/markers

Tattoo

Impact of tattoo/markers

Tattoo

Psychosocial Impacts of Radiation Tattooing For Breast Cancer Patients

A Critical Review

BARBARA CLOW AND JANET ALLEN

Psychosocial Distress – Many patients find radiation tattoos add to the emotional burden of dealing with physical changes from diagnosis and treatment.

Religious Concerns – women may face conflicts, as tattooing is explicitly forbidden by some religious belief.

CANADIAN WOMAN STUDIES/LES CAHIERS DE LA FEMME
VOLUME 28, NUMBERS 2,3

Surface guided radiotherapy (SGRT)

In other special application

- A tattoo-free SGRT-based system

Radiotherapy without tattoos: Could this work?

Breast/Chest wall +/- DIBH

Table 1
Shows the results for right breast patients who were set up and treated free breathing.

	Laser set-up	SGRT set-up
Mean	0.52	0.47
Observations	197	191
Df	370	
t Stat	2.10	
p ($T \leq t$) two-tail	0.04	
t Critical two-tail	1.976	

t-Test: Two-sample assuming unequal variances.

Table 2
Shows the results for left breast patients who were set up in free breathing and treated in DIBH.

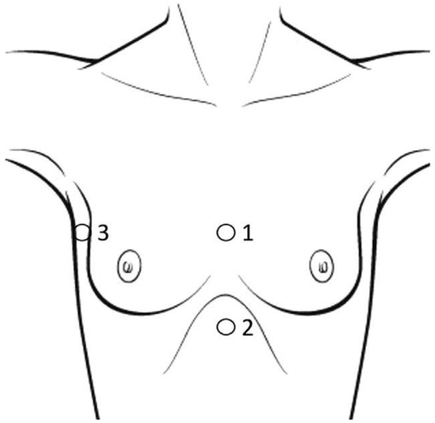
	Laser	SGRT
Mean	0.76	0.45
Observations	201	191
df	262	
t Stat	7.87	
p ($T \leq t$) two-tail	0.001	
t Critical two-tail	1.97	

t-Test: Two-sample assuming unequal variances.

Rigley, Radiagraph 2020

Surface guided radiotherapy (SGRT)

Tattoo-Free Setup for Patients With Breast Cancer Receiving Regional Nodal Irradiation



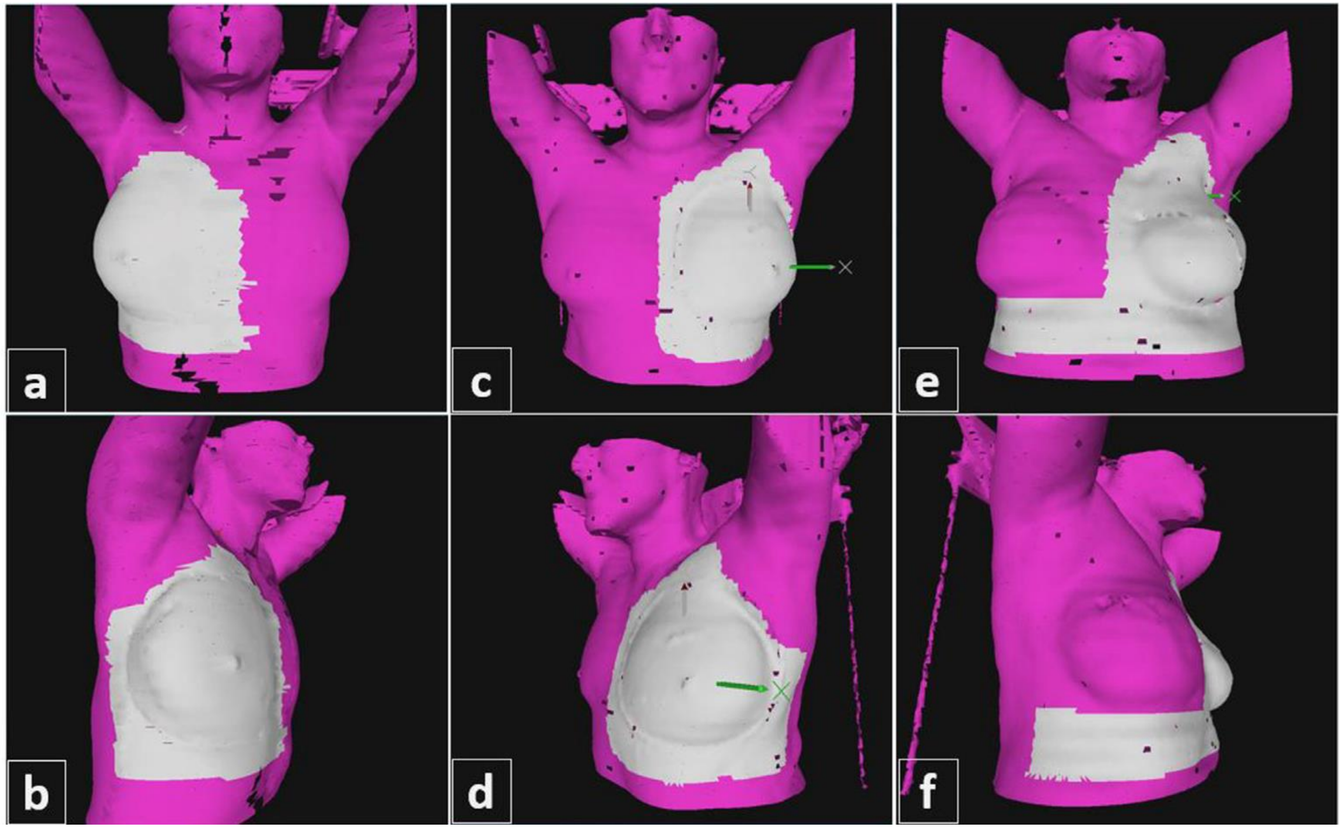
Patients include both 3DCRT and VMAT techniques, left-right breast/chest wall, FB and BH treatment

- tattoo group : setup using tattoos for initial positioning followed by surface and x-ray imaging.

- no tattoo group : positioning using surface imaging followed by x-ray imaging without reference to tattoos

Giantsoudi D,Practical Radiation oncology 2023

Surface guided radiotherapy (SGRT)



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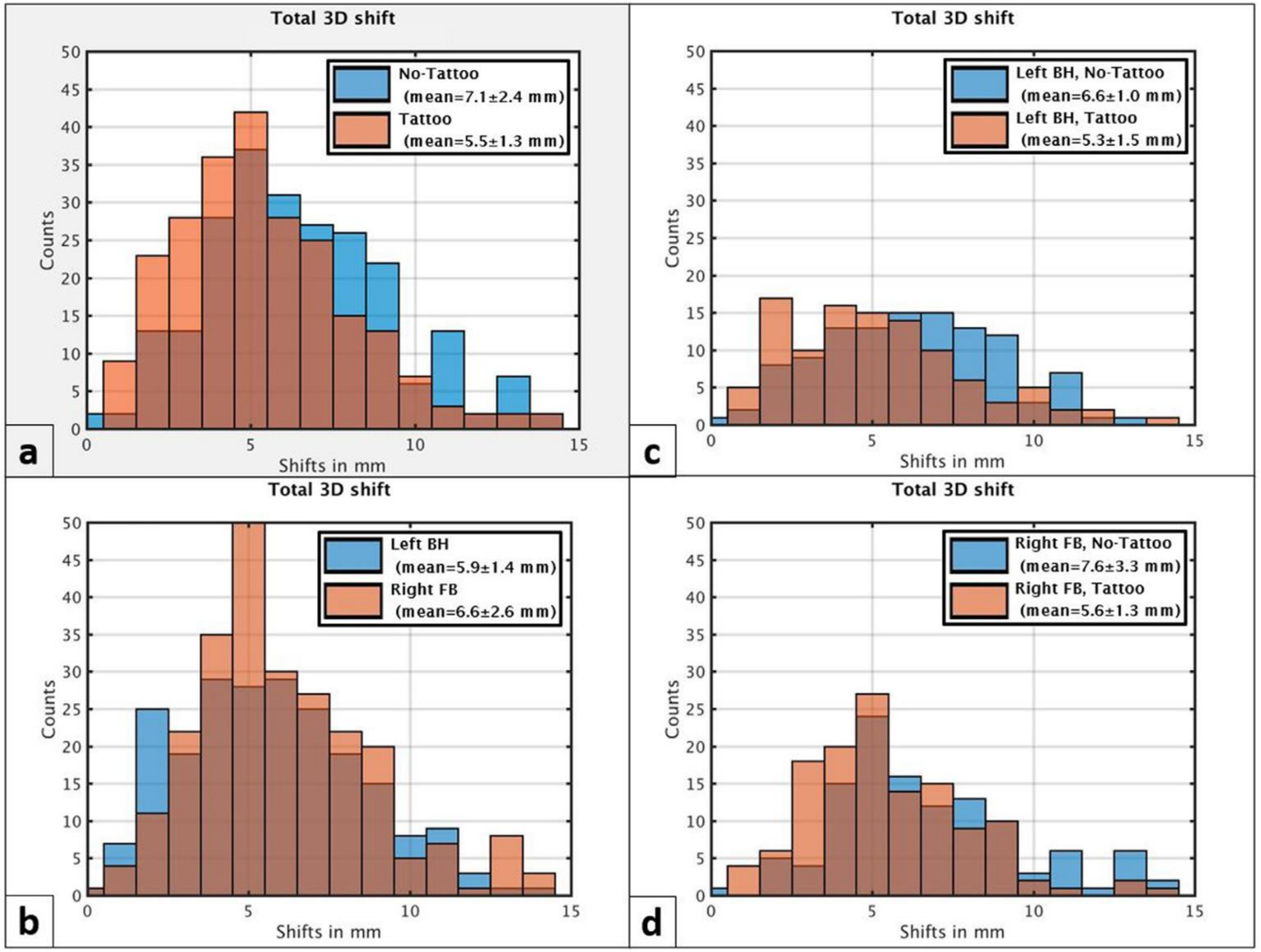
Surface guided radiotherapy (SGRT)



A combination of surface and x-ray imaging ensures high accuracy in alignment and setup verification for RNI in breast cancer

independent of treatment technique, and also reducing treatment time

Giantsoudi D,Practical Radiation oncology 2023

Impact of tattoo/markers

Markers

Impact of tattoo/markers

Markers

Psychological stress associated with skin marking during radiotherapy on breast cancer patients

Ryohei Yamauchi · Ryoko Ito · Tomoko Itazawa · Fumihiro Tomita · Jiro Kawamori

The common sources of stress

-the presence of skin markings (33%)

-bathing (41%)

-clothing selection (25%)

-skincare (30%)

73% reported taking precautions to prevent the skin marks from fading

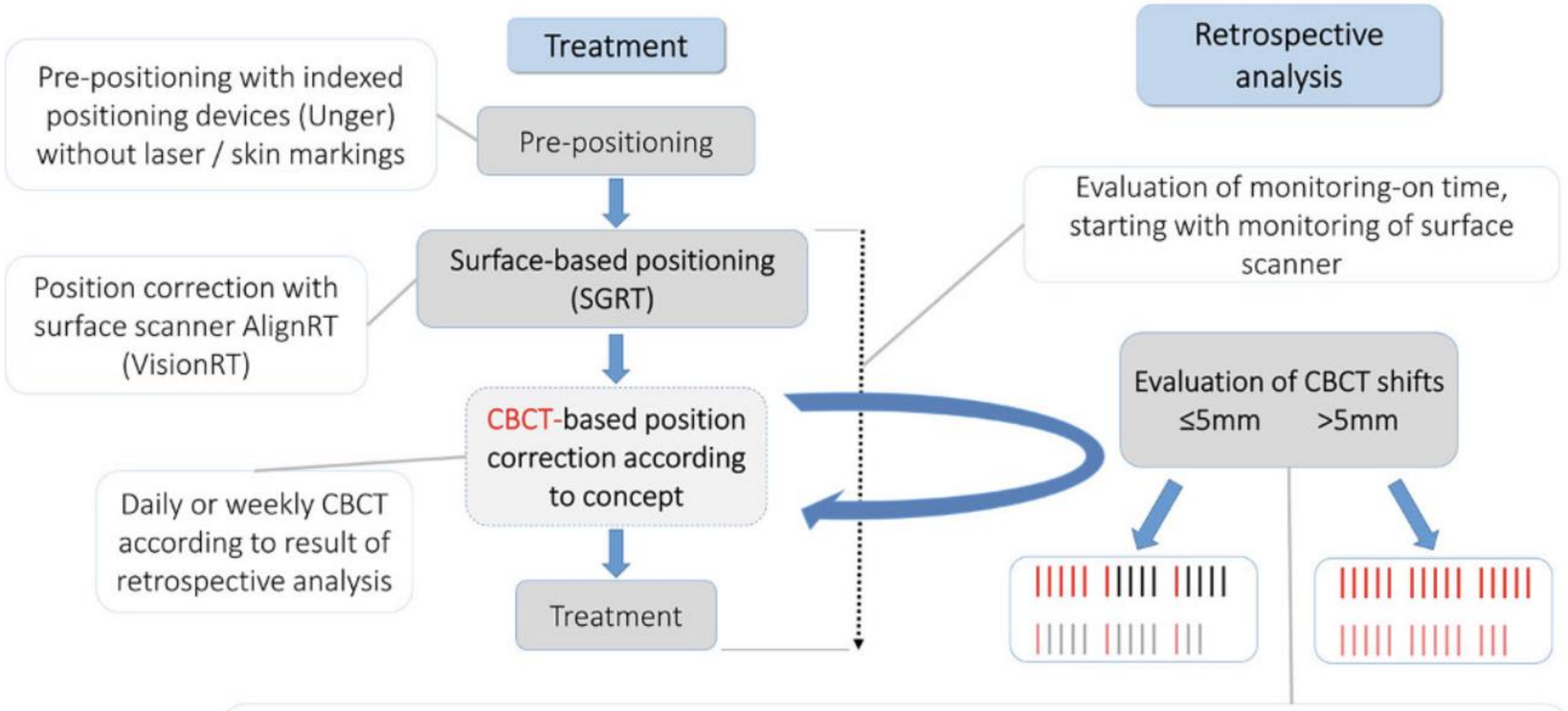
63% expressed preference for a skin mark-free radiotherapy option, with willing to spend extra finances and time

Journal of Medical Imaging and RADIATION SCIENCES,june 2024

Surface guided radiotherapy (SGRT)

In other special application

- A markerless SGRT-based system



Sauer, Strahlenther Onkol 2023

Surface guided radiotherapy (SGRT)

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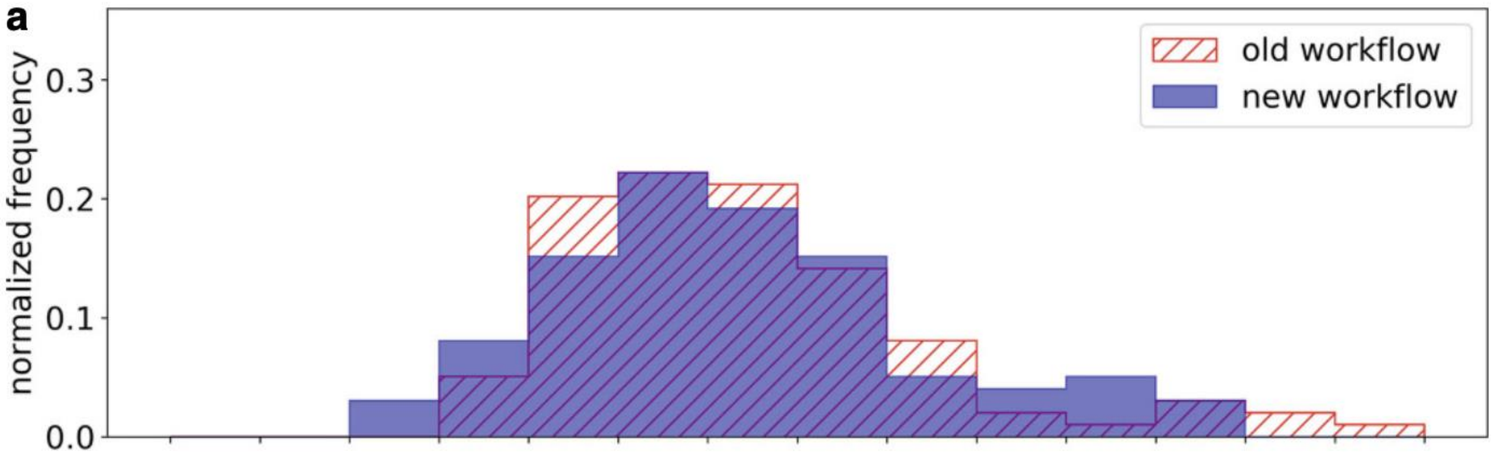
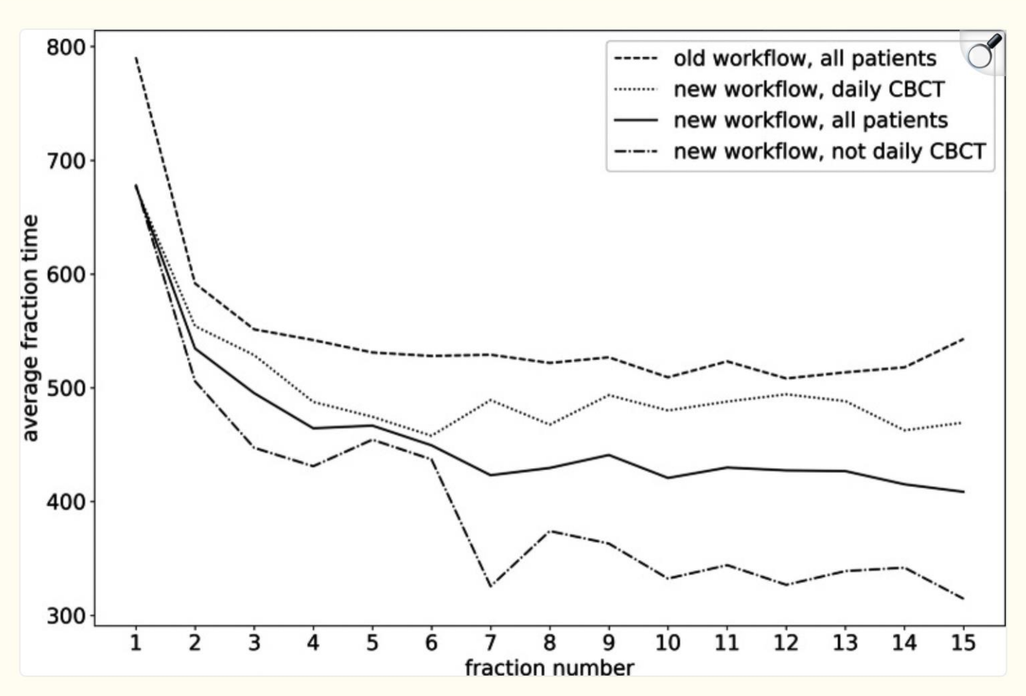


CBCT mean translational magnitude (mm)

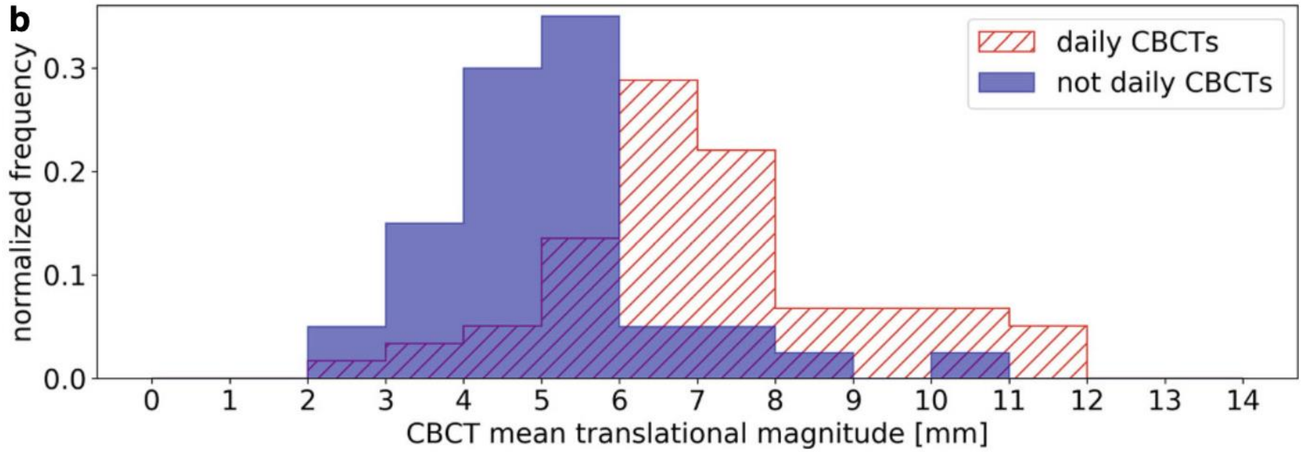
Sauer, Strahlenther Onkol 2023

Surface guided radiotherapy (SGRT)

In other special application



New workflow



Sauer, Strahlenther Onkol 2023

Marker-Free Breast Radiotherapy : KCMH experience

Breast cancer patients

2024

Type	No. Of patients
All	4454
Breast cancer	1212
Head and Neck cancer	543
Cervical cancer	230
Colorectal cancer	312

Reasons for Adopting a Marker-Free Approach

- Patient Concerns
  - Worry about fading markers affecting daily activities (e.g., showering, exercising).
  - Visible marks (e.g., supraclavicular area) may reveal diagnosis unintentionally.
- Radiation Technologist Challenges
  - Extra effort required to educate and maintain marker consistency.
- Practical Limitations
  - Chemical used for markers will no longer be available in the future.

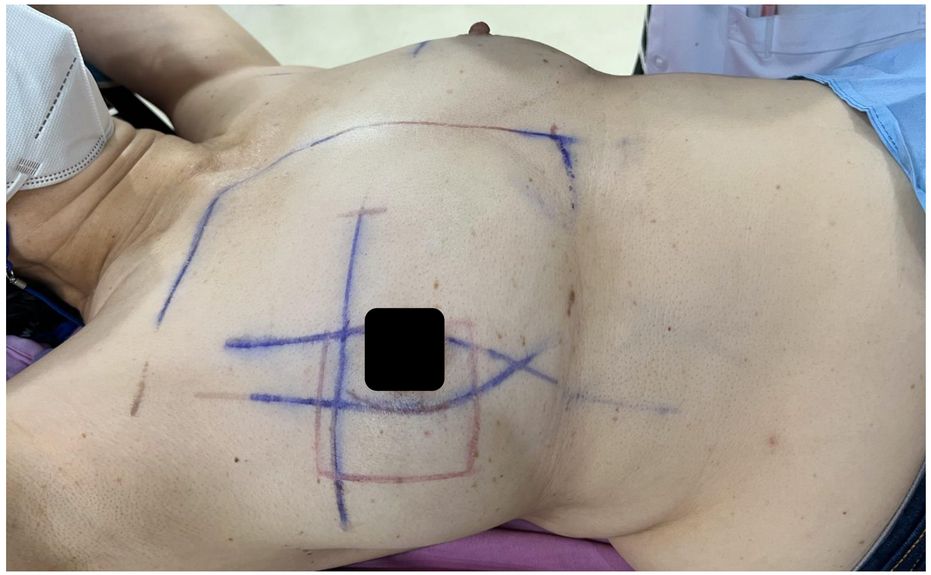
Marker-Free Breast Radiotherapy : KCMH experience

Questionnaire: 69 patients

53% Concerned about the hygiene of treatment area

63% Concerned about marker fading

70% Interest in marker-free approach



Marker-Free Breast Radiotherapy : KCMH experience

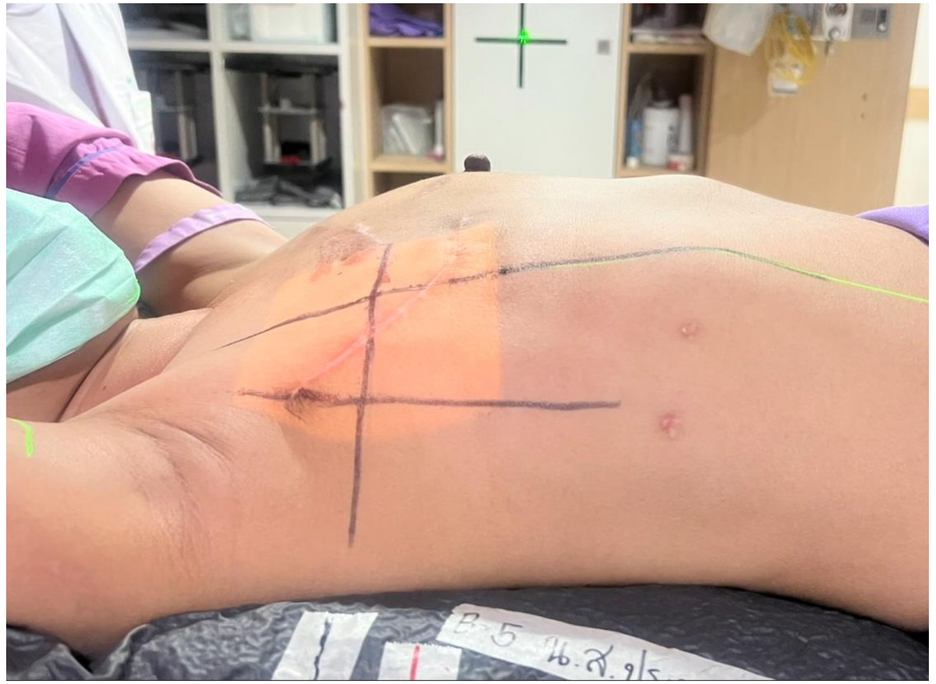
Questionnaire: 29 RTTs

100% Marking need to be redraw multiple times

79% Patients frequently ask about marker care

90% Interest in marker-free approach

Marker-Free Breast Radiotherapy : KCMH experience

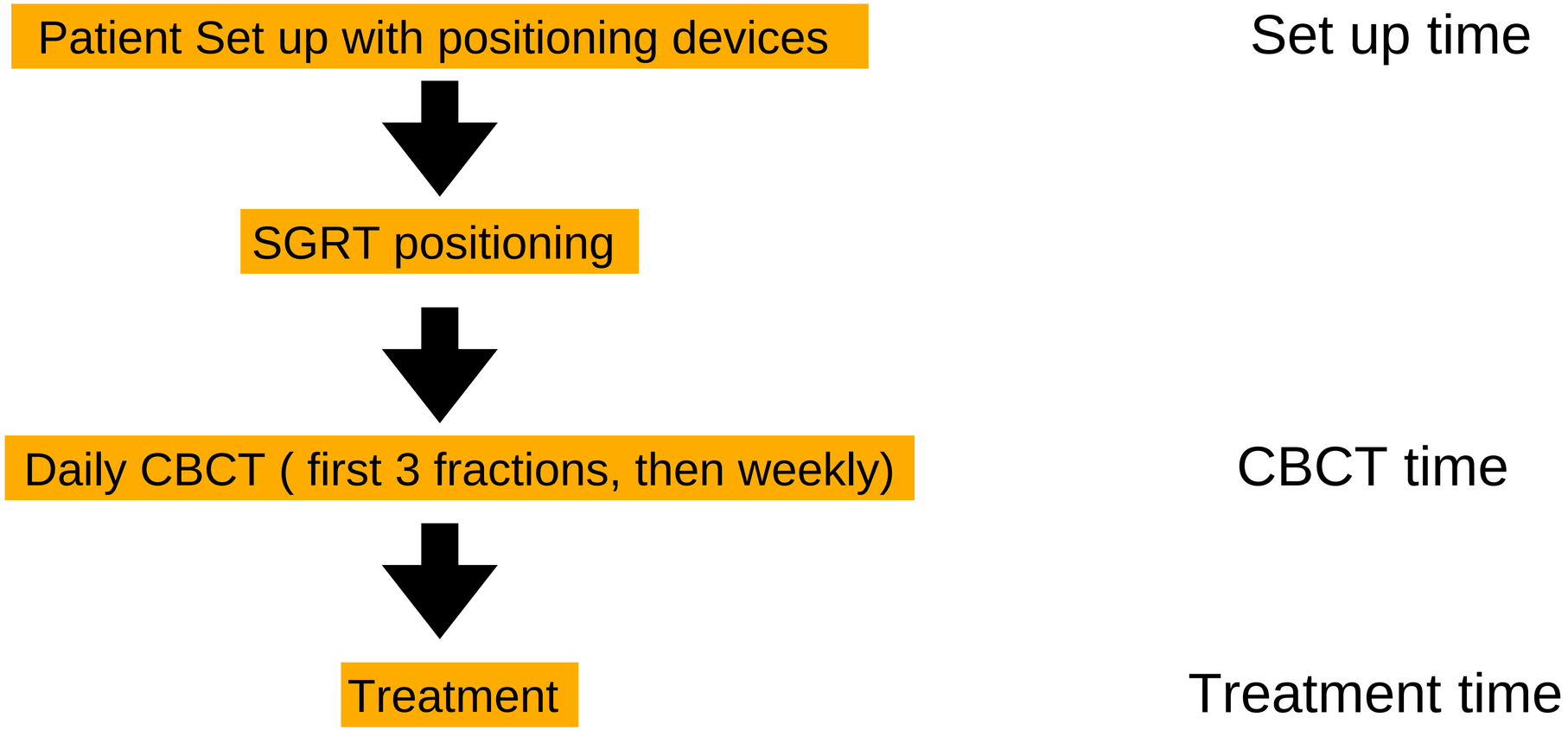


Marker-Free Breast Radiotherapy : KCMH experience

Type of breathing	Target volume (cc)	Bolus (Y/N)	No.Fx	Set up start time	CBCT start time	Treatment start time	Treatment complete time	CBCT shifts (cm)					
								Vrt	Lng	Lat	Rtn	Pitch	Roll

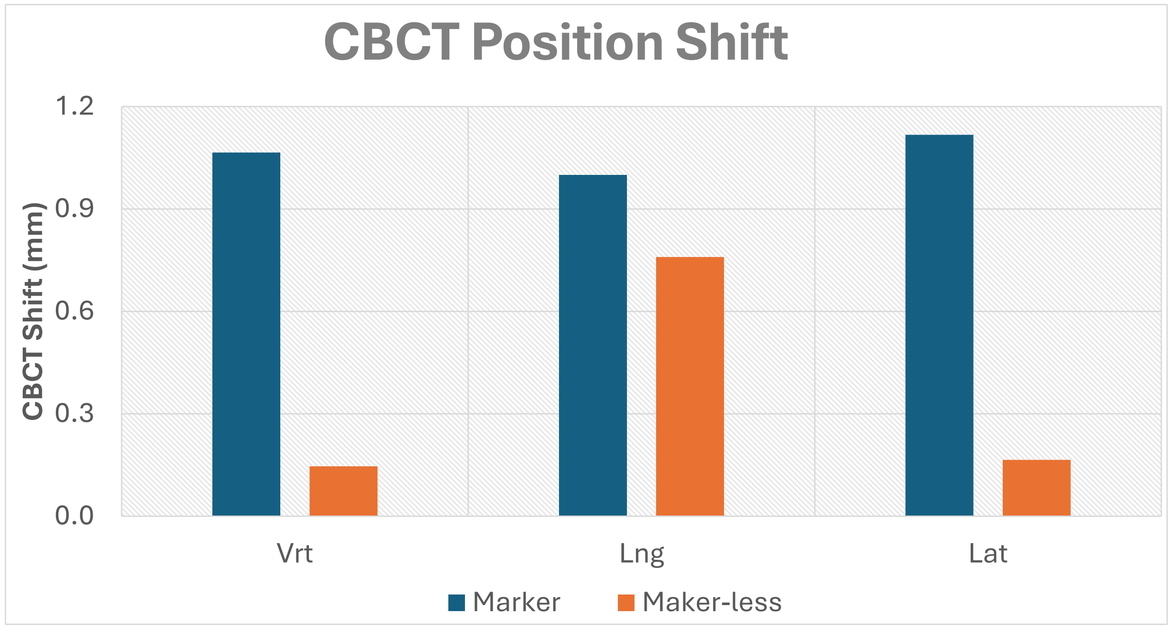
Marker-Free Breast Radiotherapy : KCMH experience

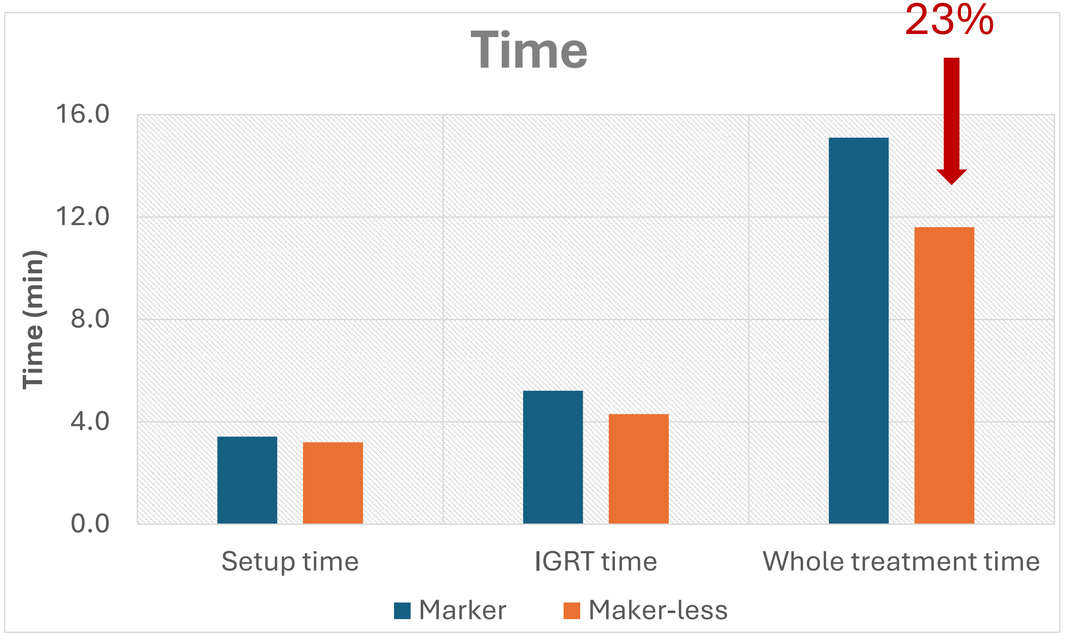
Workflow



Marker-Free Breast Radiotherapy : KCMH experience

Preliminary results





Marker-Free Breast Radiotherapy : KCMH experience

- ***Advantage***
  - High accuracy system and can detect the displacement error
  - Can detect the setup errors sub millimeter level
  - Not harmful to patient -> *non-ionizing radiation*
  - Easy to use

- ***Limitation***
  - Only detected the surface
  - The cameras are sometime unable to gather signals on low reflective surfaces -> *Bolus*

Thank You