Treatment of breast cancer with or without Postural Video

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Background and Purpose

The background for the study were to find out the **neccessaty** of Postural Video compared to traditional AlignRT
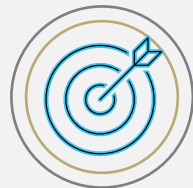
COST EFFICIENCY
The cost of advanced functions

TIME
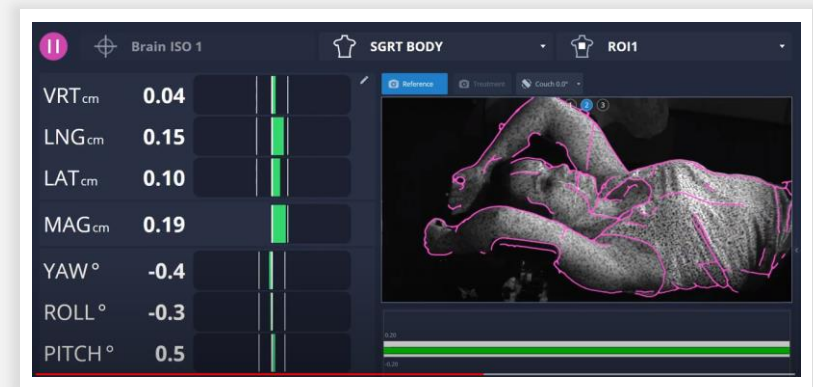Reduction of positioning time

WORKFLOW
Reduce use of treatment capture

PRECISION
Evaluate the precision between methods

WITHOUT
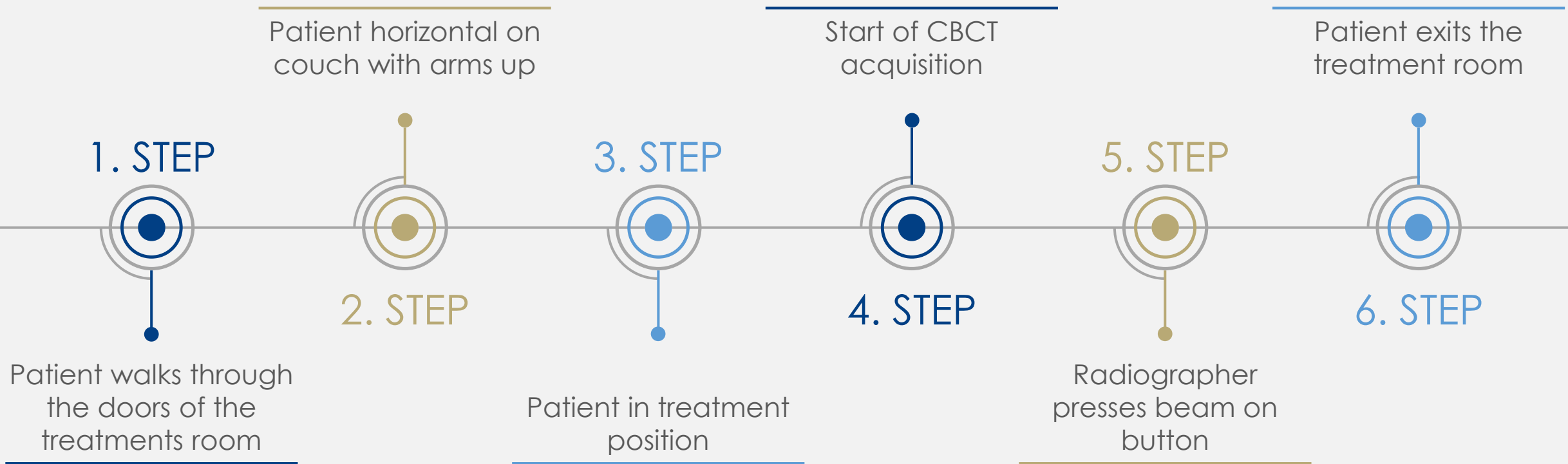
WITH

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Method

A small group of radiation therapists did the **patient setup** and **treatment** for each fraction to minimize effects related to the radiation therapists

- Same TrueBeam linac for all patients

- Highly experienced AlignRT users

- Patient setup with and without Postural Video

- Randomized order

- The first fraction was not included

- Standard ROI for all patients

- Treatment capture when need for fractions without Postural Video

Method

A few dedicated people took the time during each fraction and registered both the total time and several **checkpoints** during the treatment

Patient horizontal on couch with arms up

Start of CBCT acquisition

Patient exits the treatment room

1. STEP

3. STEP

5. STEP

2. STEP

4. STEP

6. STEP

Patient walks through the doors of the treatments room

Patient in treatment position

Radiographer presses beam on button

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Method

To check the precision of the treatment, the **clavicula position** was checked on all CBCT matches for each fraction

- The clavicula was drawn on the plan-CT

- All CBCTs with registration from the online match were imported

- New registrations were made, matching only on the clavicula

- The clavicula was copied from the plan-CT to the CBCT based on this registration

- The clavicula was then copied from the CBCTs back to the planning-CT, but this time based on the registration from the online matched result
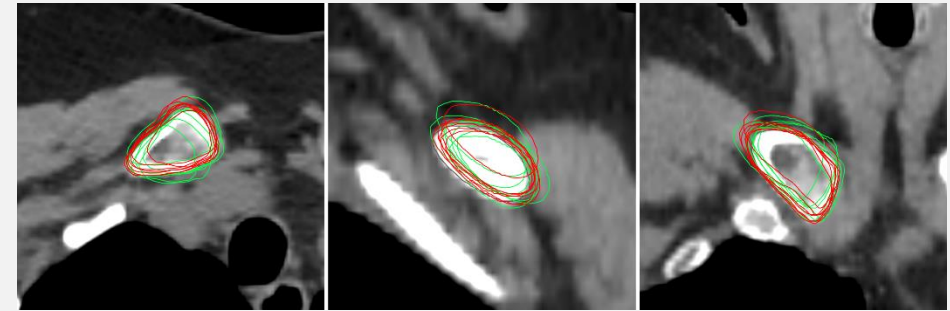
Patient inclusions

25 patients were included in the study, based on the following **inclusion** and **exclusion** criteria

Patients that were **included**

+ Diagnosed with right-sided breast cancer

+ Radiation included lymph nodes

+ Curative treatment with 2.67 Gy x 15 on TrueBeam SB12

+ ≥ 18 years

Patients that were **excluded**

− Radiation of the breast without lymph nodes

− Bolus

− DIBH

Results

CBCT matches from treatments both with and w/o Postural Video. No difference in couch transitions

Table 2: Group mean (M), patient population systematic error (Σ) and patient population random error (σ) for the two procedures calculated from CBCT match results

	Procedure	Vrt (cm)	Lng (cm)	Lat (cm)	Pitch (°)	Roll (°)	Rtn (°)
	A	0.10	0.04	-0.05	0.24	-0.31	-0.19
M	B	0.05	0.02	-0.08	0.12	-0.16	-0.22
	p-value*	0.03	0.41	0.43	0.22	0.07	0.72
	A	0.17	0.23	0.21	1.23	0.76	0.71
Σ	B	0.17	0.21	0.24	1.23	0.78	0.64
	p-value**	0.97	0.73	0.47	0.99	0.93	0.63
	A	0.17	0.19	0.18	0.83	0.62	0.72
σ	B	0.16	0.20	0.23	0.75	0.68	0.73
	p-value*	0.56	0.95	0.28	0.32	0.24	0.97

Procedure A: Set up without Postural Video
Procedure B: Set up with Postural Video
*Paired two-tailed t-test
**Fischer exact test

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Calculations Used
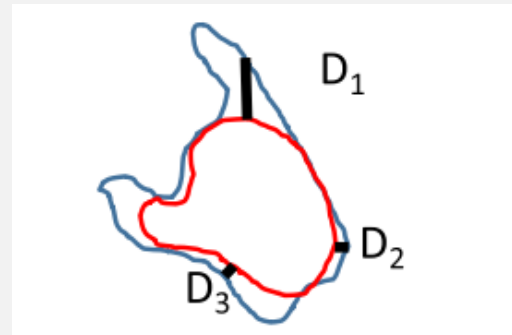
To check the treatment position of the clavicula

Dice Similarity Coefficient (DSC)

$$\frac{2\,(A \cap B)}{A + B}$$

Hausdorff distance (HD)

Calculate the distance from each point in volume 1 to the nearest point in volume 2. Used average and max (95%)

Results

The table shows no difference in treated clavicula position

Table 3: Comparison of planned and treated clavicula position

Procedure	DCE	HD_{mean} (cm)	$HD_{95\%}$ (cm)
A	0.82	0.16	0.33
B	0.82	0.16	0.34
p-value*	0.61	0.63	0.65

DCE: Dice Similarity Coefficient

Hd_{mean}: mean Hausdorff distance

$HD_{95\%}$: 95 percentile Hausdorf Distance

* Paired two-tailed t-test

- No difference in couch transitions
- No difference in treated clavicula position
- Indicates that both positioning methods are equally precise

Results

Treatment time

Table 1: Group means and standard deviations for the three evaluated time intervals for each setup procedure

Procedure	T_1 (sec ± SD)	T_2 (sec ± SD)	T_3 (sec ± SD)
A	115.1 ± 28.2	152.3 ± 25.3	647.5 ± 88.8
B	75.2 ± 17.5	146.1 ± 17.9	611.1 ± 75.8
p-value*	<0.01	0.17	<0.01

Procedure A: Set up without Postural Video

Procedure B: Set up with Postural Video

T_1: Time from patient lies horizontal on couch with arms up to patient in treatment position

T_2: Start of CBCT acquisition to beam on

T_3: Patient walks through the doors of the treatment room to patients exits the treatment room

* Paired two-tailed t-test

- Looking at the total treatment time, there is a 35% difference
- Patient setup with Postural Video is 40 seconds faster
- The difference can be even greater with less trained radiation therapists

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Results

For most patients, the setup times with Postural Video are generaly lower

- The median values for setup times with Postural Video are consistently lower compared to setup without

- There are some outliers and extreme values, indicating variability in the setup times for certain patients

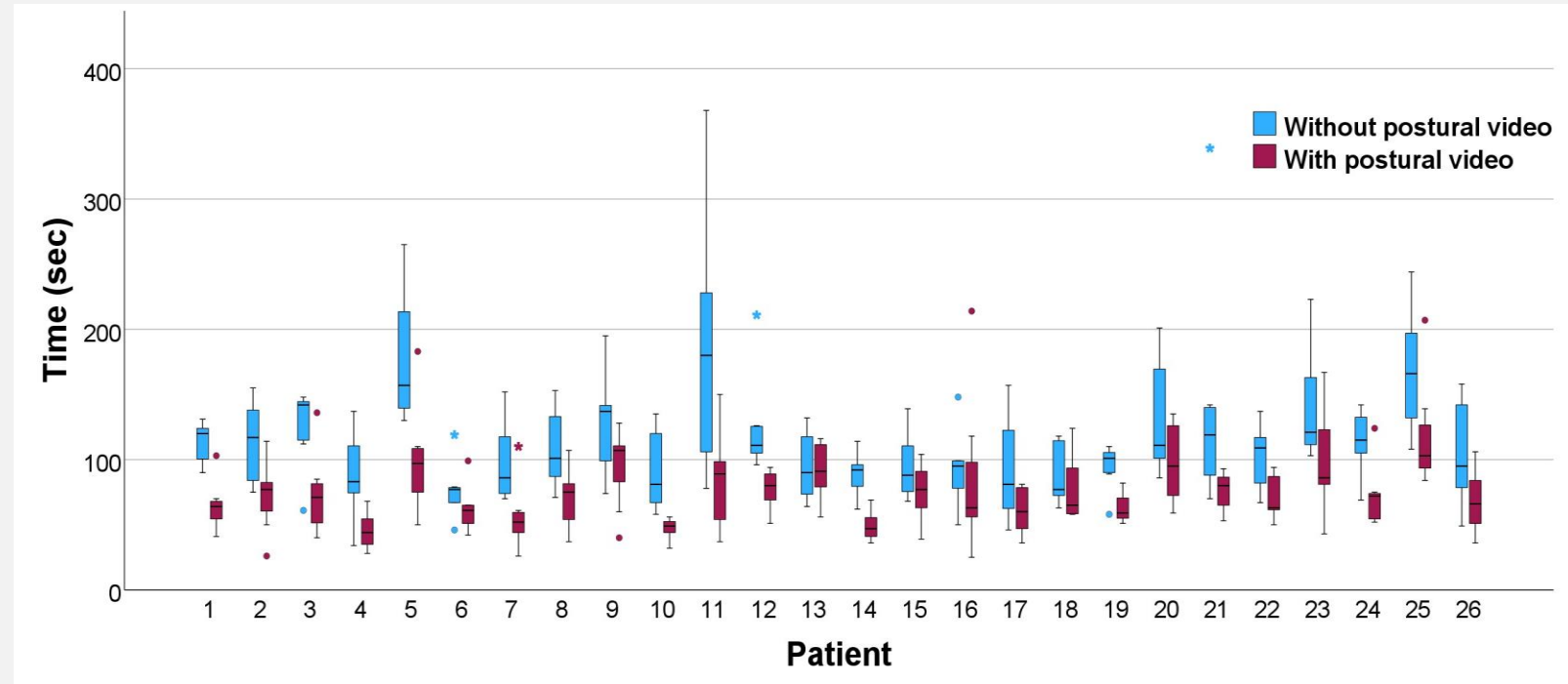- Overall the results show a potential improvement in setup efficiency when using Postural Video

Figure 3. Distrubution of setup times (time point 2 to time point 3) for each individual patient. The boxplots show the minimum value, 1st quartile, median value, 3rd quartile, maximum value, outliers (dots) and extremes (stars).

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Questions?