

To Assess the Feasibility and Accuracy of Using Optical Surface Monitoring System (OSMS) in Tattoo-less Breast Radiotherapy

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INTRODUCTION

Radiotherapy set up during CT Simulation requires permanent tattoos on patient skin for reproducibility and daily setup. Several studies report that these marks can cause anxiety and body confidence issues and needle prick incidence might be occurred.

The purpose of this study to assess the feasibility and accuracy of using Optical Surface Monitoring System (OSMS, Vision RT) as an surface guided radiotherapy. OSMS is a technique that using non-ionizing camera technology to track patients' surface in 3D for both daily setup and motion management during radiotherapy treatment delivery.

MATERIAL & METHOD

The study was conduct on Jan-June 2019. Each patient underwent CT Simulation in the supine position on a breast board with hands up. The first group of patients received standard method of having permanent tattoos and were aligned based on the tattoos and with the breast board scale level using treatment machine laser (**Diagram 1**). The second group of patients had no tattoo and just recorded simple landmark to align with breast board scale level and OSMS was the primary setup modality to position the patient.



Diagram 1:

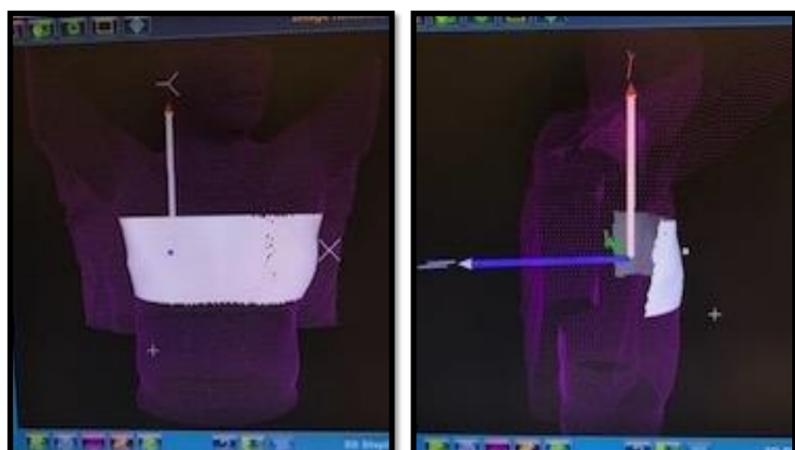


Diagram 2 & 3

CT datasets was then exported to OSMS workstation where the reference surfaces were generated in DICOM file. (**Diagram 2 & 3**)



Diagram 3 & 4

When patients were positioned on couch, real time surface images were automatically aligned with the reference surface (**Diagram 3 & 4**)

Which the reference MV and KV Imaging for the first three days was obtained for both groups, then the vertical(z), longitudinal(y), lateral(x), pitch, roll and rotation shift were recorded and analyzed.

RESULTS

23 patients were set up using tattoo and another 24 patients using OSMS. The results is per table below:

| Axis | z (cm) | y (cm) | x (cm) | Pitch (°) | Roll (°) | Rotation (°) |
|---------------|--------|--------|--------|-----------|----------|--------------|
| Mean | 0.148 | 0.068 | -0.004 | -0.161 | -0.08 | 0.025 |
| Std Deviation | 0.234 | 0.365 | 0.263 | 0.811 | 0.618 | 0.772 |

Table 1: Data for 23 patients that set up using tattoos

| Axis | Z (cm) | y (cm) | x (cm) | Pitch (°) | Roll (°) | Rotation (°) |
|---------------|--------|--------|--------|-----------|----------|--------------|
| Mean | 0.056 | 0.042 | 0.015 | -0.088 | 0.00 | 0.017 |
| Std Deviation | 0.166 | 0.157 | 0.155 | 0.530 | 0.128 | 0.325 |

Table 2: Data for 24 patients that set up using OSMS

DISCUSSION

External beam Radiotherapy needs precise patient positioning, reproducible and continuous monitoring throughout the whole treatment. This study has shown set up using no tattoo with OSMS is comparable with using tattoo. From this study, we found out some limitations of SGRT such as greater errors in verify and positioning for deeper target area (e.g., posterior axillary field) and blind angle (e.g., neck area for SCF field). However daily MV and KV imaging still as our main verification procedure after all steps of positioning. When doing verification with CT reference images the shift was apply, then the images of the patient surface was captured by the OSMS as a new reference images for the subsequent treatment. For this study the data shift was collected and analyzed from the first three days only, normally on the following treatment days the shift will be better due to follow the **new reference image** that captured by OSMS (shift more than 0.5cm) or follow CT based data **DICOM** (shift less than 0.5cm).

The results above indicates that no tattoos together with SGRT, the set up accuracy is clinically acceptable and therefore has led to offering no tattoos to all breast patients in our Centre. Beside of having unnecessary skin marks on patient the importance of this OSMS to avoid frequent repositioning of patient and reduced rejected imaging during verification procedure.

CONCLUSION

Surface Guided Radiotherapy can be considered as alternative method besides having permanent tattoo on patient's body. Tattoo-less method with OSMS improves in patient positioning for breast cancer treatment. With our current medical imaging technology for verification, it shows that tattoo-less is appropriate and safe for patients and staffs and also improves patient experiences having radiotherapy treatment without having permanent marks on their skin.

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