

Pilot study – Using a surface tracking system for initial positioning of patients before radiotherapy treatment

Mikkel Skaarup¹ | Bettina Roche¹ | Vibeke Nordmark Hansen¹ | Nikolaj Kylling Gyldenløve Jensen¹

¹Department of Oncology, Centre for Cancer and Organ Diseases, Copenhagen University Hospital – Rigshospitalet, Copenhagen, Denmark

Purpose

We investigated the accuracy and reproducibility of a surface monitoring system for surface guided initial setup compared to the laser/tattoo method.

Materials and Methods

A surface guiding system (ExacTrac Dynamic, v1.1) was tested for surface guided initial setup of 7 patients. The system’s surface cameras detect and compare the outline of the patient with the body contour from the planning CT and moves the patient to estimated treatment position based on differences between these. All patients were prepositioned every second week with surface guided setup and the alternate second weeks with laser/tattoo setup. With both methods, x-ray imaging was used to confirm the position of the target and perform the final shift to the treatment isocentre.

The two setup methods were compared in terms of time needed to perform the initial positioning, the number of x-ray verification images needed for each fraction and the final couch movements to treatment isocentre after image acquisition.

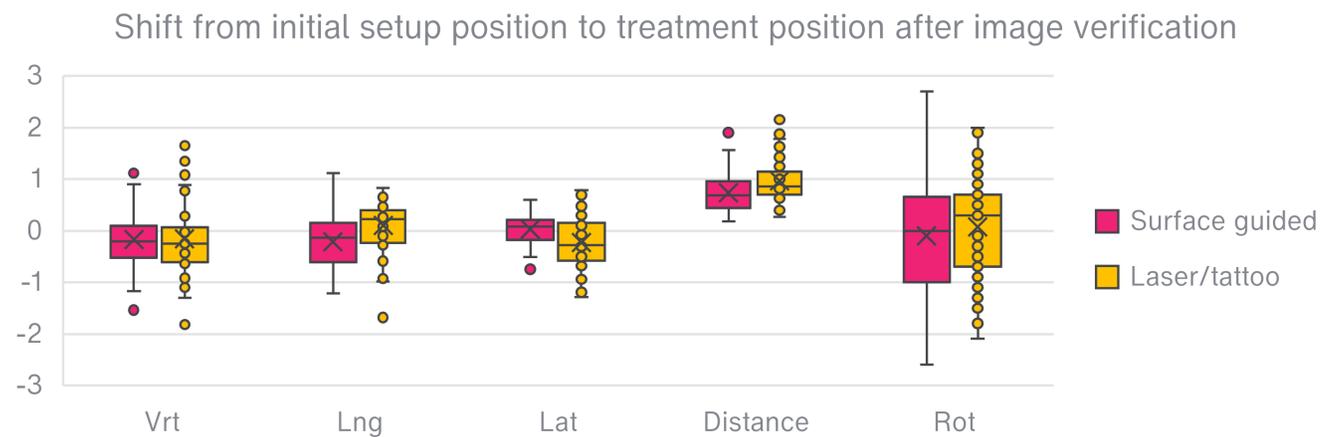


Figure 1. Boxplot of couch shifts for all fractions from initial setup to treatment isocentre (as determined with x-ray images) in the vertical (vrt), longitudinal (lng) and the lateral (lat) direction for both surface guided (pink) and laser/tattoo setup (yellow). The total distance and couch rotation (rot) is also shown

Time spent on initial setup as a function of time during the pilot study

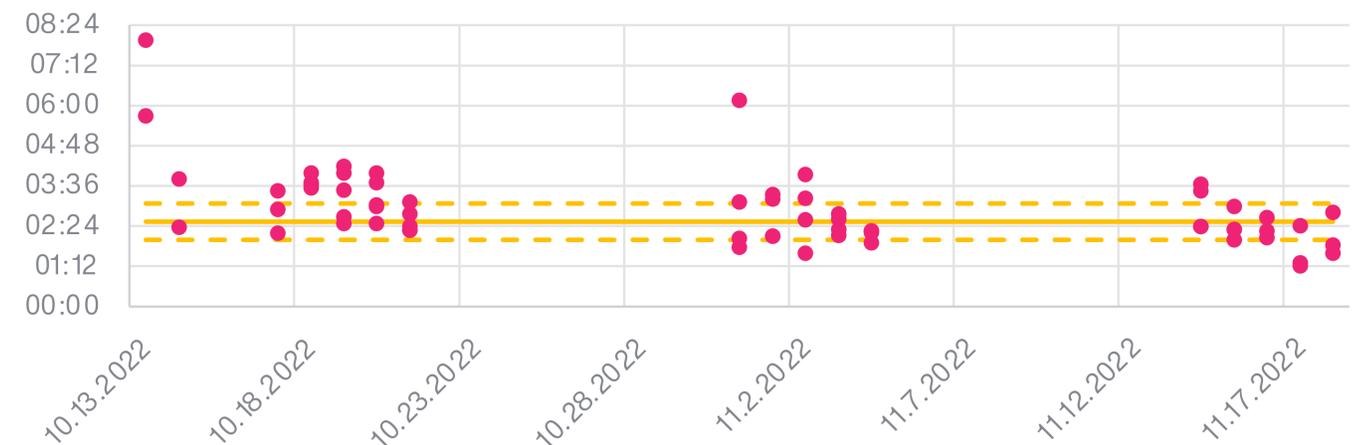


Figure 2. The time spent on surface guided setup over the course of the pilot study for all fractions using ExacTrac (pink dots). For comparison, the average laser/tattoo setup time is also shown (yellow, full=average, dashed=+/- 1 standard deviation)

Results

The laser/tattoo setup method was, on average, 22 seconds faster than the surface guided setup. 5 out of the 64 surface guided setup fractions required two or more x-ray verification images compared to none for the laser/tattoo setup fractions. The average shifts in the vertical, lateral, longitudinal, and rotational directions were comparable to the laser/tattoo setup. The surface guided setup method had, on average, lower combined distance shifts to treatment isocentre than the laser/tattoo setup (0,73 vs 0,96 cm) (Fig 1).

Conclusion

On average, the laser/tattoo setup was faster, however, when considering surface guided setup times during each week of the pilot study, we saw this setup method approach and overtake the laser/tattoo average by the last week of the study (Fig 2, the average time for surface guided setup in the last week of the study was 12 seconds faster than the laser/tattoo setup). We attribute this to a learning period for the treatment personnel. Overall, we conclude that, for this cohort, surface setup is as accurate and fast as laser/tattoo setup, and it is therefore feasible to attempt to verify this conclusion in a larger cohort.