OC-0077

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Published in:
Radiotherapy and Oncology

DOI:
10.1016/s0167-8140(17)30521-2

Publication date:
2017

Document Version
Publisher's PDF, also known as Version of record

and is pictorially presented for the potential replacement of thermoplastic masks.

Material and Methods

A radiographer nurtured a concept with robotics engineers and consulted with physicists regarding materials. A 3D head position tracking device – the MCP (Fig. 1) was designed and tested by robotics engineers in a limited user study. The pillow is a biologically-inspired sensing device based upon the deformation of the epidermal layers of the human skin. Deformation of MCP-head interaction is measured optically by tracking the movement of internal artificial papillae pins on the inside of the pillow skin(Fig.1). These papillae pins create an image with a matrix of dots captured by a single camera inside the pillow. The head position image on the pillow has been matched with an absolute head position captured by an optical infrared system (Polararis NDI,™) with a tracking tool attached to the person's mouth. The aim of the study was to validate accuracy of the MCP by measuring its resolution (smallest detectable input) and repeatability (the maximum deviation of output for the same input) (Fig. 2).

Results

Five basic movements of the head were detected 1. two translations across the MCP – laterally (Tx, x-axis) longitudinally (Ty, y axis) and one translation n vertical to the pillow (Tz, z axis) and 2. two rotations of the head: roll (α) and pitch (β). A graphic user interface was created in Matlab™ to view and analyse the two sets of data – Polaris ™(Tx, Ty, Tz, α, β) and MCP data. A minimum detectable deformation of the MCP in translation is 1mm, and in rotation is 0.3° (α) and 0.6° (β). The repeatability test showed a maximum of one pixel output deviation for the same position.

Conclusion

The prototype MCP has been patented (1609040.9) and proof of concept has shown potential for consideration in clinical practice. The sensing resolution of the MCP can be improved by a larger number of dots per area or adaptations to the software algorithm. There is a small ambiguity between lateral translation and yaw rotations that can be resolved by an initial MCP calibration. The current challenge and future work is to develop a clinical system that will cause limited radiation attenuation, preserve some skin sparing, and is non-ferrous when considering magnetic resonance imaging. The preliminary prototype data calls for further investigations in the laboratory, including how to reduce jaw and cranium movement prior to being investigated in clinical practice.

OC-0077 Comparison of setup accuracy, intrafractionmovement and comfort for two stereotactic masks

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Purpose or Objective

Intracranial stereotactic radiosurgery (SRS) requires high precision for setup and during treatment. On Brainlab Novalis system, noninvasive repositioning with dedicated proprietary thermoplastic mask is as accurate as with the invasive ring. Macromedics developed a new full head mask dedicated to SRS, fully compatible with the Brainlab couch and localization system, named the Double Shell Positioning System (DSPS) with documented submillimetric and subdegree intrafraction accuracy. The aim is to prospectively compare both fixation systems in a randomized trial for setup and intrafraction accuracy, as well as patient reported comfort.

Material and Methods

Study was approved by the Ethics Committee of CHU-UCL-Namur. All patients approved written informed consent. Sixty patients with various pathologies (metastases, vestibular schwannoma, meningioma or pituitary adenoma) had to be recruited. Randomization between Brainlab and DSPS masks was stratified according to disease and fractionation (one *vs* multiple fractions). For each treatment session, initial setup accuracy was measured and corrected with Brainlab exactrac system and 6 degrees of freedom (6DoF) values (tx, ty, tz, rx, ry, rz) were recorded in mm or degree and resultant vectors for translations were calculated. The same was made at the end of the session (intrafraction movement). Patient reported comfort with a Visual Analog Scale (VAS) at the end of confection time and for treatment (for fractionated treatments average value of all scores was considered). VAS went from 0 (most uncomfortable) to 10 (very comfortable). Comparisons for accuracy and comfort were made with mixed model linear regression (R 3.0.1, package *nlme*). Regarding accuracy, the variable was the mean movement (resultant vector) for each patient.

Results

We report the results for 58 patients, two patients are not treated yet. Among the 28 patients of the DSPS group, seven received a fractionated treatment (either 3 or 28 fractions). In the Brainlab group, it was the case for six of the 30 patients. Setup accuracy and intrafraction motion are recorded in Table 1. Initial setup accuracy was significantly better with the DSPS mask ($P < 0.01$), particularly in the y direction (longitudinal) and around the x rotation (head tilt) where it showed less variability. There was no significant difference for intrafraction motion ($P = 0.88$), both masks showing submillimiter and subdegree accuracy on average. During confection, both masks were rated as comfortable (average VAS scores 8.7 and 8.4 for DSPS and Brainlab, $P = 0.53$). For treatment, DSPS was scored as more comfortable than Brainlab (average VAS scores 7.2 and 6.0, $P = 0.04$).

Table 1: setup positioning and intra fraction accuracy for DSPS and Brainlab masks. Mean translation error (x, y and z directions) in mm, mean resultant vector in mm +/- SD and mean rotation error (around x, y and z rotation axes) in °.

TIME	MASK	TRANSLATIONS (mm)			VECTOR (mm ± SD)	ROTATIONS (°)		
		x	y	z		x	y	z
positioning	DSPS	-1.1	0.7	-0.6	2.5 ± 1.1	-0.3	0.9	0.8
	BRAINLAB	-1.8	2.3	-0.4	3.6 ± 1.8	-0.7	0.3	0.8
intrafraction	DSPS	-0.1	0.2	0.1	0.5 ± 0.2	0.0	-0.1	0.0
	BRAINLAB	-0.2	0.1	0.1	0.5 ± 0.3	0.0	0.0	-0.1

Conclusion

We could demonstrate that DSPS and Brainlab dedicated masks are both viable alternatives to invasive head frame for SRS, showing submillimeter and subdegree intrafraction motion. Initial setup accuracy was significantly better with DSPS, maybe due to the higher comfort reported by the patients.

Symposium with Proffered Papers: Novel approaches in gut matters

SP-0078 Best of both worlds: can novel pathways be targeted for reduced gut toxicity but improved tumour response?

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Radiotherapy is an effective treatment strategy for cancer, but a significant proportion of patients still