The design and construction of a Simulated Linac Control Area (SLCA) for Radiation Therapy

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Purpose

Required knowledge and skills for radiation therapists (therapeutic radiographers) are wide ranging – combining patient care with technical/ medical skills. UK pre-registration training happens in both university and clinical departments. Increasing pressures in the clinic means training time is limited; so extending training into simulated environments has proven to be highly effective in our university, giving students more time to learn and develop in a safe, non-clinical environment, with the same equipment, methods and discipline of the real clinic. This project aims to extend our present simulation facilities to include a Linac control area, to complement students' skills to safely and effectively ensure accurate and precise patient set-up and delivery of treatment. This poster describes the design, construction and initial student experience of the SLCA.

Materials and Methods

The SLCA was created with hardware and software components for patient selection, set-up, on-treatment imaging and radiation delivery. Using true-to-life components was a high priority; so the SLCA was designed around Eclipse/ARIA software (Varian/Siemens Healthcare, USA), our Virtual Environment for RT (VERT) (Vertual, UK), a motorised couch, a doorframe and screens creating a treatment 'bunker', CCTV system, a Linac function keypad (from a decommissioned Elekta Linac (Elekta, Sweden)), a uniquely designed MU counter/sound module (programmable with fault interruptions), real radiation-on lighting panels and a simulated door interlock system (fig 1).

Fig 1. Combined design schematic and real components of the SLCA

Results and Discussion: Design and Construction

All electronic components were built or assembled with documented specifications and design briefs. A wall-mounted, swinging door-frame and screens create a 'bunker' so students enter through the door-frame, set-up a patient in front of/using the VERT system and exit, as in a real bunker (fig 2). Patient and room are visible continually through the CCTV system (fig 3). Patient treatment plan and beam delivery can be selected on separate Eclipse/ARIA monitors. CBCT acquisition and image registration is possible through the VERT system. The function keypad is interfaced to the MU counter and radiation-on light. MU (and, if desired, no. of random machine faults) are programmed into the counter and verified, before simulated 'beam-on'; which then starts the MU counter, radiation-on sound (at realistic doserates) and radiation-on light.

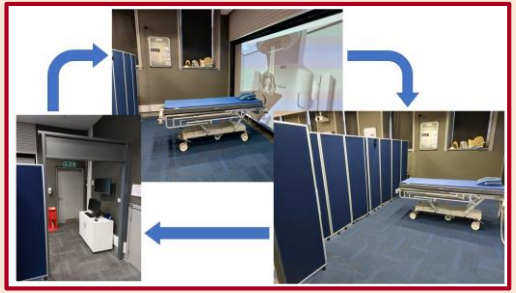

Fig 2. The simulated 'bunker' created with a room door frame and screens

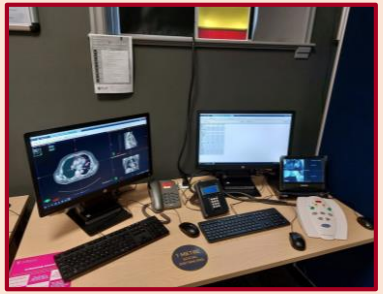

Fig 3. SLCA control desk with Eclipse/Aria monitors, Elekta function keypad, CCTV, radiation-on light and MU counter

Results and Discussion: Initial Student Experience

Initial student experience came from a 2nd year Undergraduate class simulation session, using expert and peer-to-peer blended learning; one group performing patient set-up, the other working with the SLCA and their own testing scenarios (fig4). Initial evaluation through anonymous feedback is also shown in fig 4.

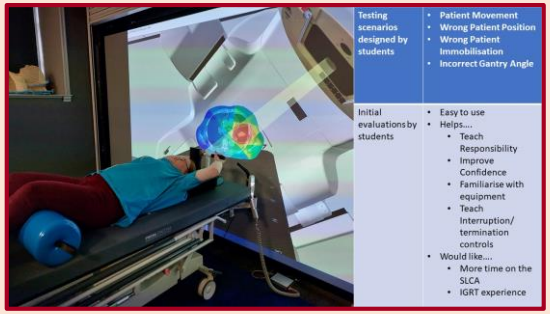

Fig 4. The SLCA in use; simulated patient set-up; testing scenarios created by the students and their initial evaluation

Conclusions

All components work well together as per design specification, enabling true-to-life patient set-up, patient selection and plan check, on-treatment CBCT verification and radiation-on simulation with doserate sound and radiation-on light. If desired, machine fault scenarios can be simulated through the MU counter, occurring randomly within an exposure. Initial student experience shows that highly creative scenarios can be designed by the students themselves, inspired by the SLCA; with very favourable feedback. Work is on-going for the door interlock, which will enable inhibition of simulated radiation when 'open', and interrupt radiation if opened during simulated exposures. Evaluation continues with clinical and university staff and UG/PG Radiation Therapy students.

Acknowledgments

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