P3-11

An Exposure System for In-vitro 3D Tumour HIFU Studies

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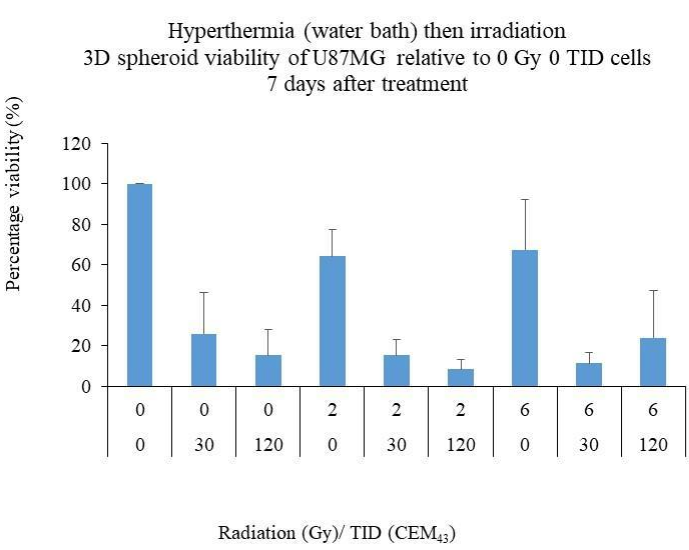
A system for targeting, delivering and quantifying thermal exposure of 3D tumour spheroids for application in hyperthermia ± radiation studies was developed and tested

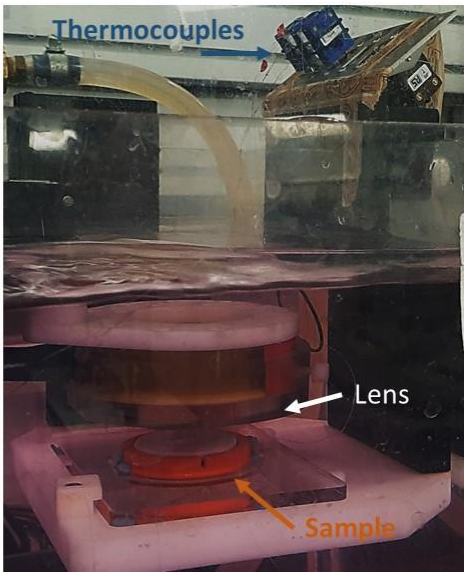
An acoustic holography designed lens was used to broaden a focused ultrasound beam. A gel phantom (IEC standard tissue mimic with 25 mg/100ml of Phenol red to improve visualization of spheroids) was used. One layer had 3 100um diameter T-type thermocouples set 0.5mm below a 0.7mm deep, 1mm diameter well. One spheroid per well was covered with a drop of Matrigel. A flat gel lid was placed on top, with culture medium as acoustic coupling.

The lens design convert a 12 x 1.5mm ellipsoidal focus into a region 10mm long, by 8 and 6mm (6dB) lateral widths. Sham exposed spheroids survived being mounted in the phantom, submerged in degassed tap water (pH neutral) pre-heated to 38oC and removed again. The system allowed ultrasound exposure of 3 spheroids at once e.g. to 35, 120 and 90 CEM43. Real-time logging of temperature and thermal dose allowed alignment to within 0.5 mm and dosimetry control to within 1 CEM43 in one well, and within a range of < 1 5% in 2 other wells.

Preliminary experiments demonstrate the system is fit for purpose. It is being used to compare ultrasound hyperthermia exposed spheroids with water bath heating experiments. Spheroid exposures have been completed (see figure) and the results of viability studies and comparison with water bath heat spheroids will be presented at the meeting.

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Hyperthermia (water bath) then irradiation
3D spheroid viability of U87MG relative to 0 Gy 0 TID cells
7 days after treatment
Percentage viability (%)
120
100
80
60
40
20
0
0 0 0 2 2 2 6 6 6
0 30 120 0 30 120 0 30 120
Radiation (Gy)/ TID (CEM43)


Thermocouples
Lens
Sample