

Photobiomodulation Effect on Oral Cancer Prior to Radiation Therapy

An animal study

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Disclosures

- James Carroll is the founder and CEO of Thor Photomedicine LTD
- There are no other conflicts of interest to declare related to this project

Background

- Photobiomodulation (PBM) a.k.a. LLLT has been used in cancer patients to prevent and/or treat therapy-induced mucositis or dermatitis
- Some authors suggested that PBM may protect malignant cells from the effects of cytotoxic treatments
- Our previous data (Barasch et al, JSCC 2016) suggested a dichotomous effect of PBM on normal vs. malignant cells
- There is a dearth of *in vivo* data addressing this hypothesis

Hypothesis

- Based on our *in vitro* study results, we hypothesized that PBM exposure of oral cancer tumors in an animal model will enhance tumor response to radiation therapy
- Null hypothesis: pre-exposure to PBM will have no effect or result in tumor protection from the killing effects of radiation therapy

Methods: Experiment 1

- 5×10^5 Cal-33 human oral cancer cells were injected in the tongue of 20 nude mice and checked with bioluminescence for viability
- Tumors were allowed to grow for 7 days
- Animals were divided randomly into 4 groups: control; PBM only; radiation only; PBM + radiation
- PBM consisted of a single exposure to 650 nm light at a power of 75 mW, fluence of 5.6 J/cm^2 (ThorLX2 Thor Photomedicine LTD);
- Animals were treated with a daily dose of radiation (4Gy/day X 5 consecutive days similar to the clinical protocols; Total= 20Gy)

Methods: Experiment 2

- Animals were divided into groups as in the previous experiment set-up
- PBM consisted of 650 nm light at 5.6 J/cm²
- RT consisted of one single dose of 15Gy delivered 30 min after PBM exposure

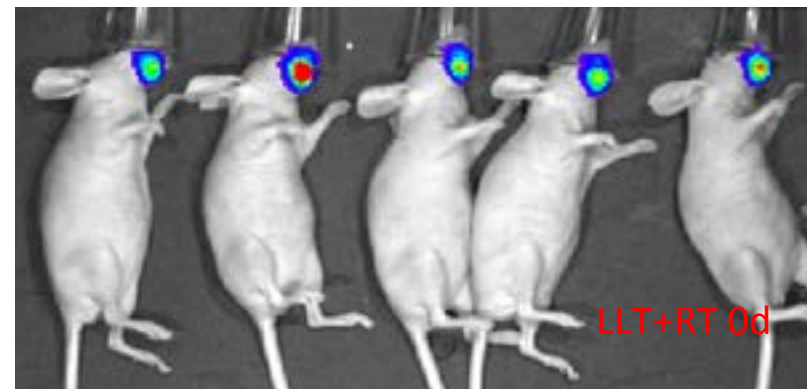
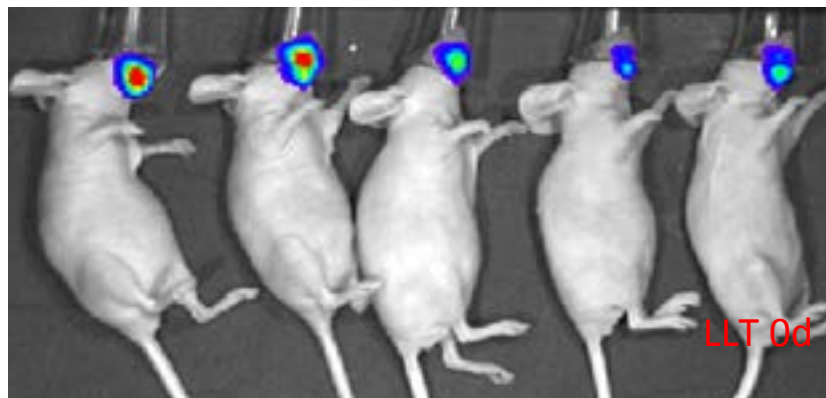
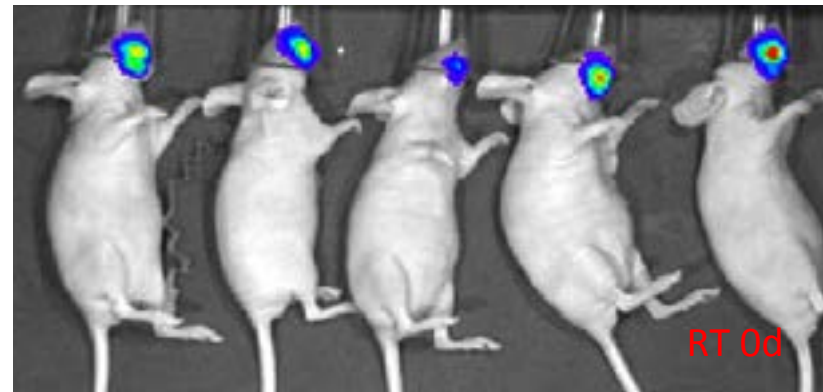
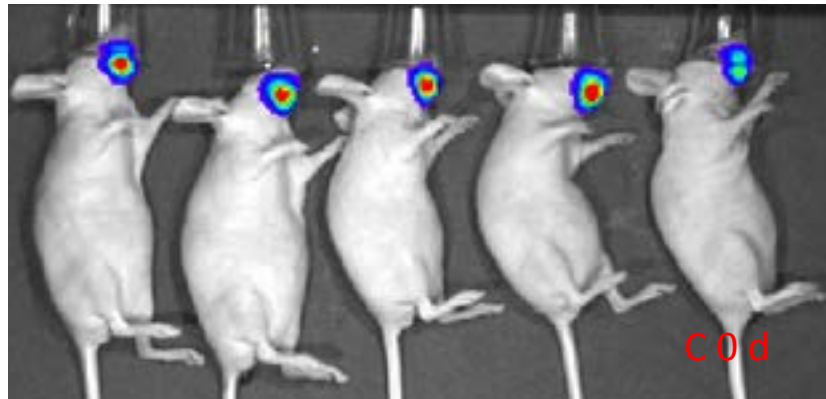
Methods: Experiment 3

- Animals were divided into groups as previously described
- PBM consisted of light at 650 nm and 810 nm at a power of 1874 mW and fluence of 3 J/cm²
- RT consisted of a single 15Gy dose delivered 30 min after PBM exposure
- All animals were weighed daily and tumor behavior was evaluated with TV fluorescence

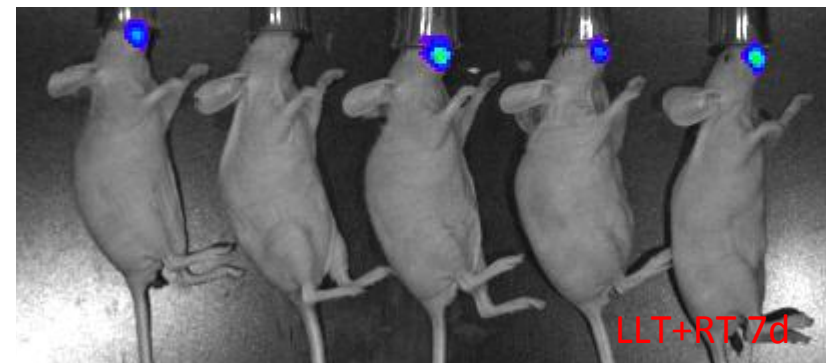
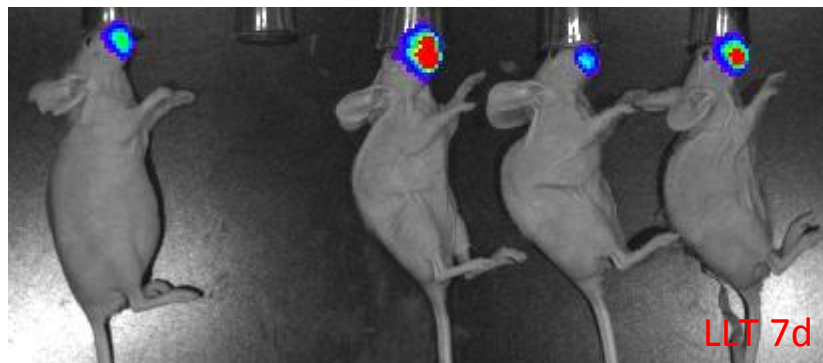
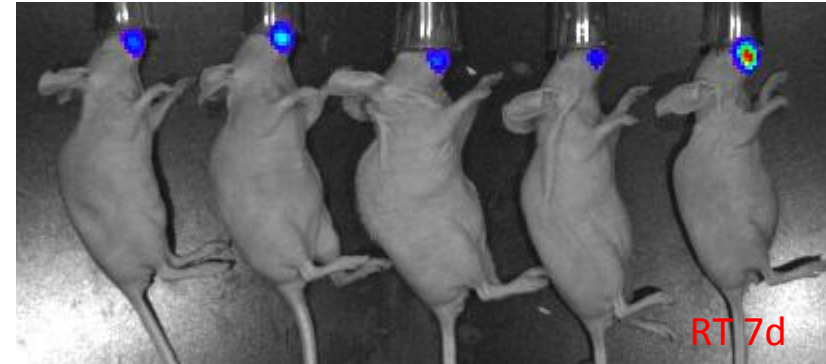
Results:

- There were no differences between control and PBM only animals, suggesting there was no PBM stimulation or inhibition of tumor growth
- Animals exposed to RT had significantly lower TV fluorescence scores and longer survival regardless of exposure to PBM, suggesting there was no interference of PBM with RT
- RT + PBM animals lost less weight than all other groups, suggesting a beneficial effect of PBM on mucositis and pain.

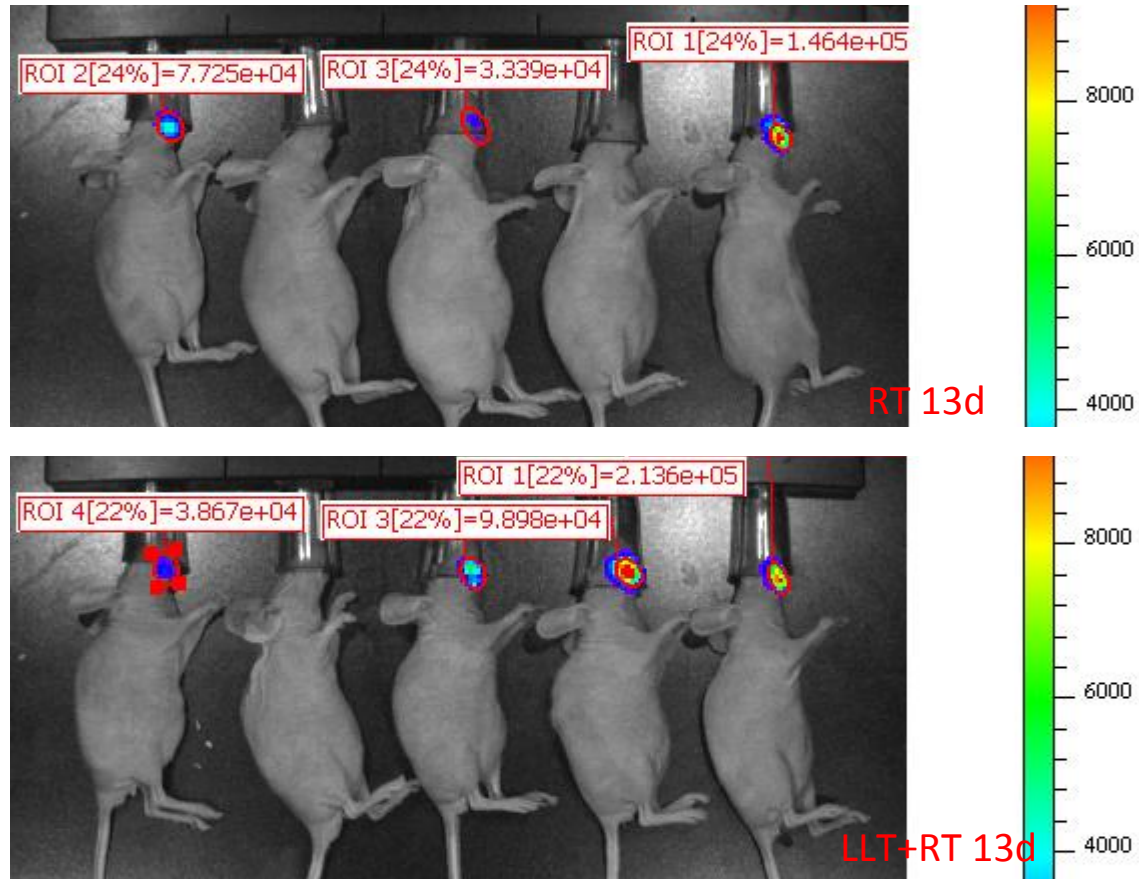
0 days post 15Gy



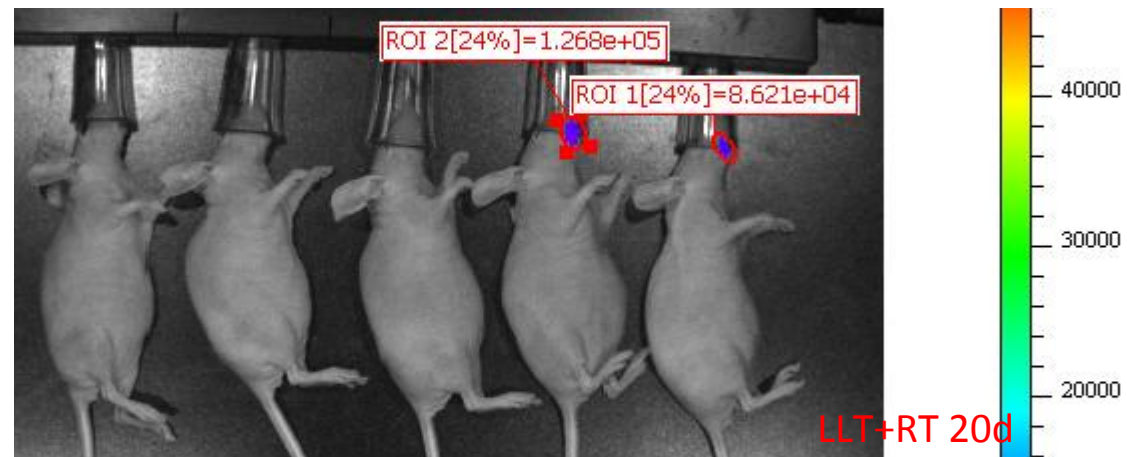
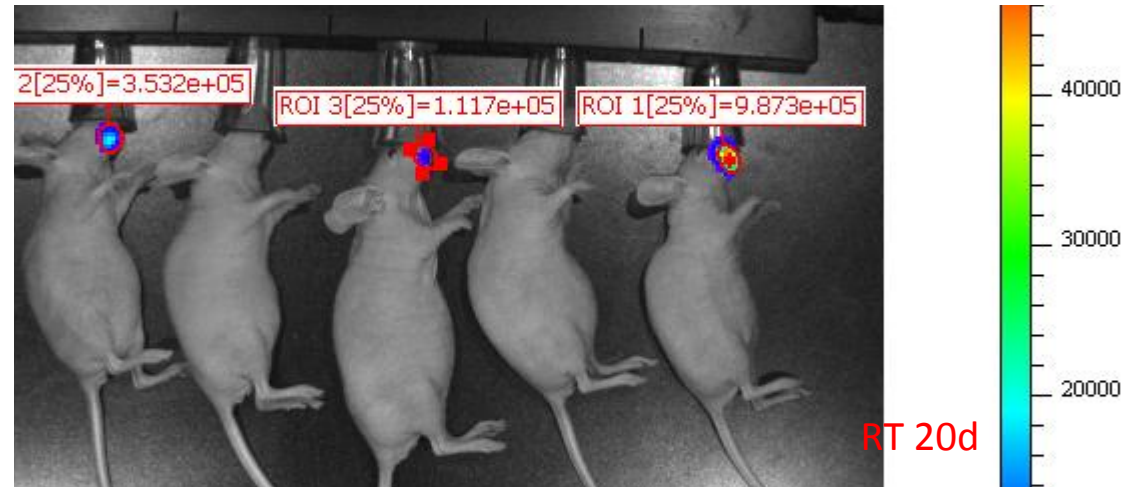
7 days post 15Gy



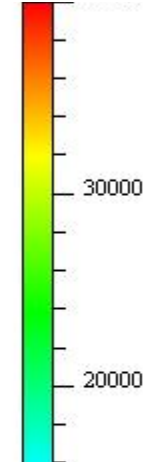
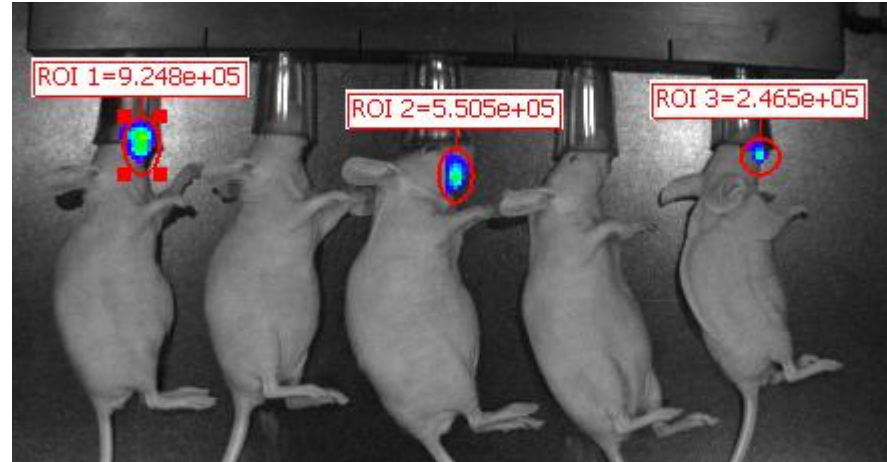
13 days post 15Gy



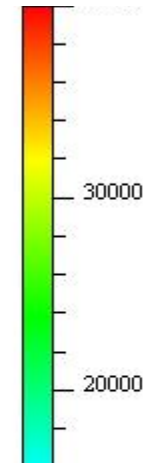
20 days post 15Gy



27 days post 15Gy

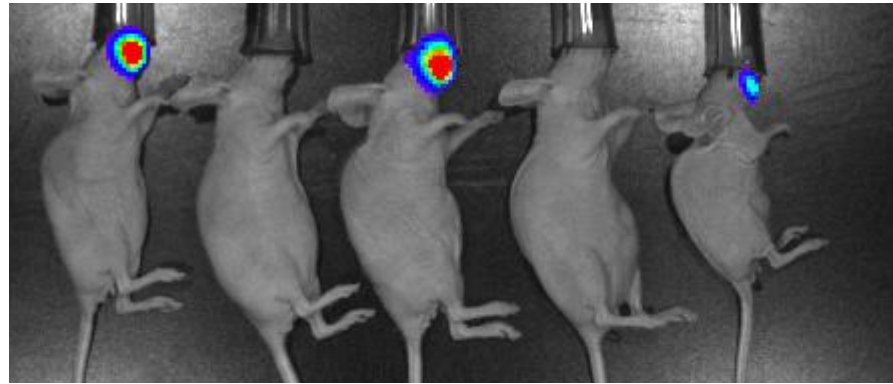


RT 27d

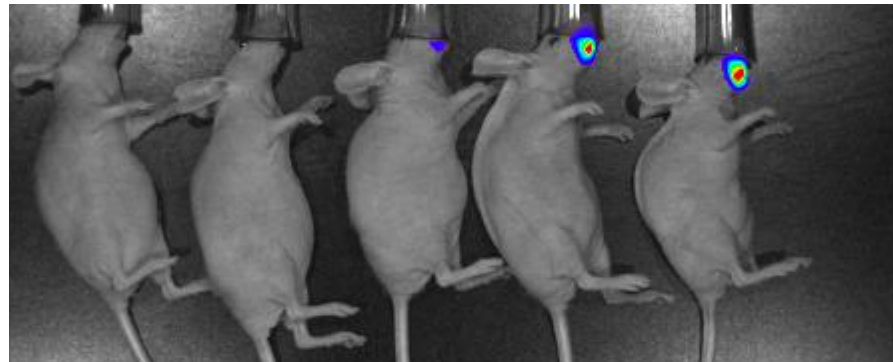


LLT+RT 27d

34 days post 15Gy

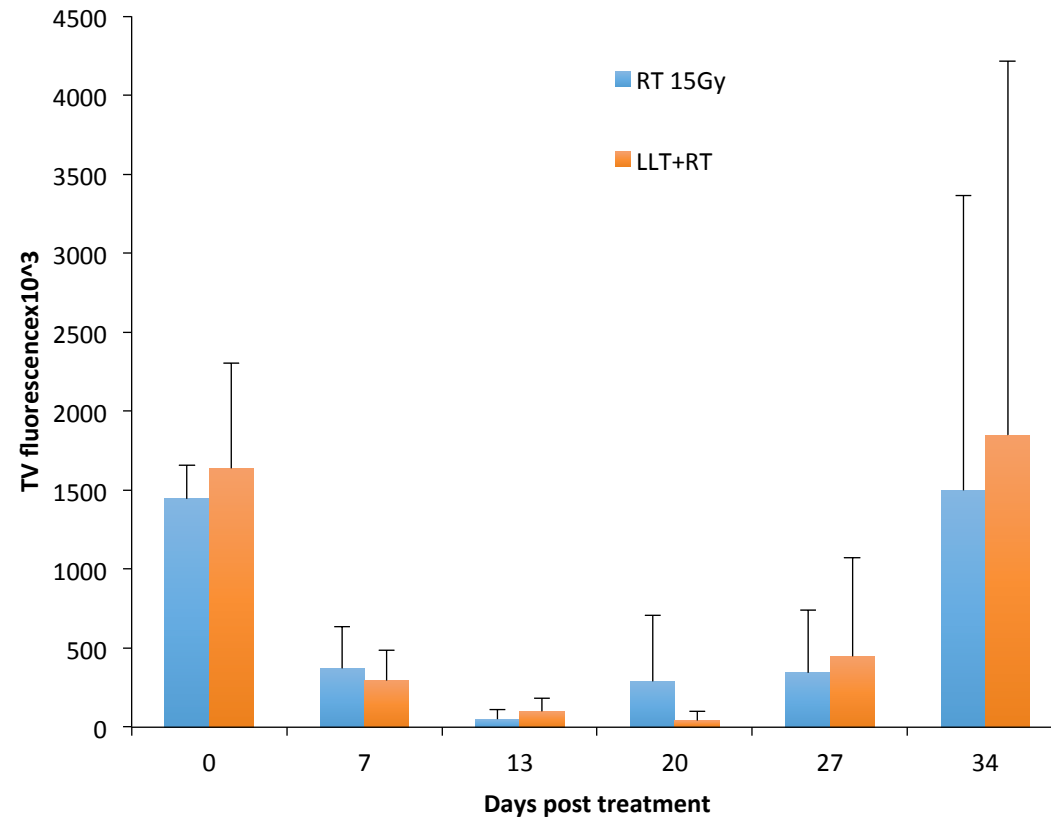


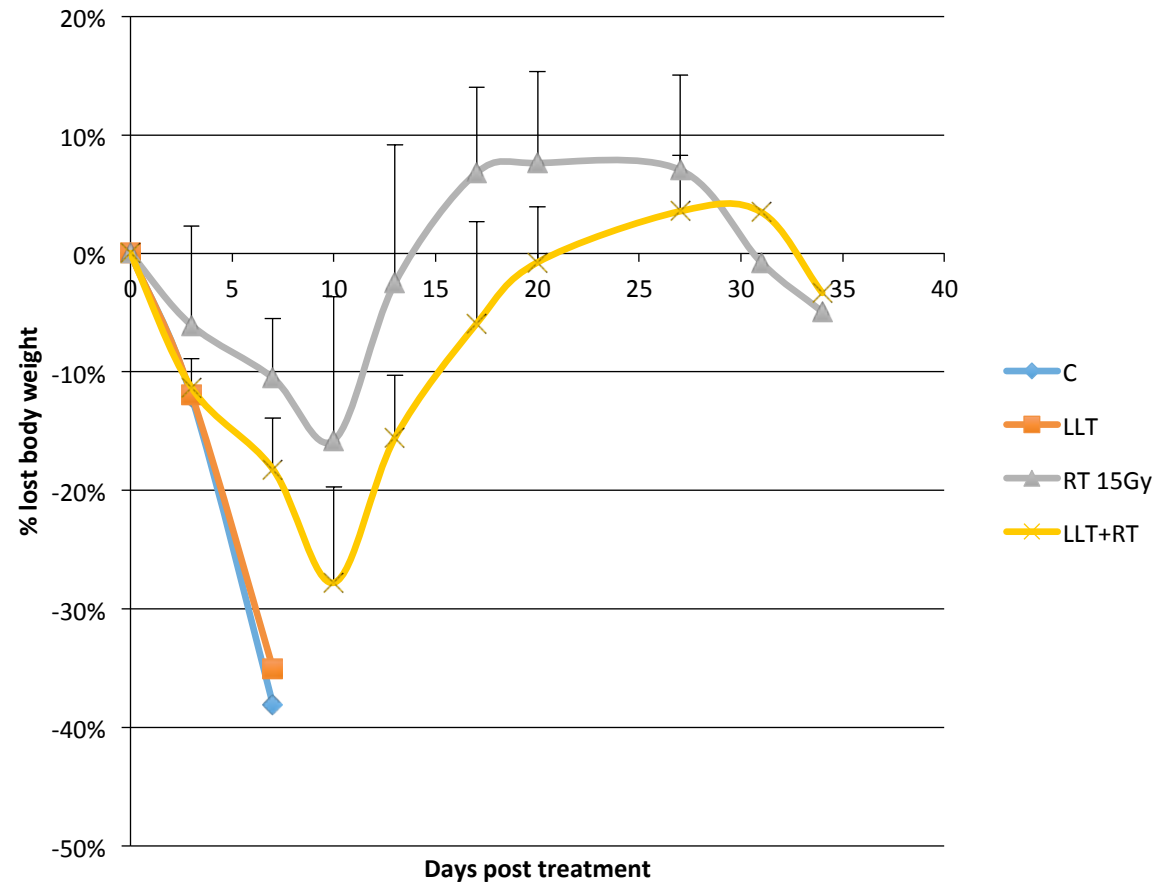
RT 34d



LLT+RT 34d

Tumor volume





Conclusions

- Our experiments strongly suggest that PBM has no proliferative or protective effects on human oral cancer tumors in an H&N orthotopic animal model
- We were unable to show a sensitization effect of PBM on Cal-33 tumors
- Animals exposed to PBM and radiation maintain their weight better than RT alone peers, suggesting protective effects of PBM on normal mucosal cells.