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

- Pholobiomodulation (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

• $5 \times 10^5$ 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

C 7d

RT 7d

LLT 7d

LLT+RT 7d
13 days post 15Gy
20 days post 15Gy
27 days post 15Gy
34 days post 15Gy
Tumor volume

Days post treatment

RT 15Gy

LLT+RT

TV/fluorescence x10^3

0 7 13 20 27 34
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.