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(G*) Cold atmospheric plasma jet diagnostic for tumor growth control and bacteria inactivation

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Cancer incidence is on the rise in Canada, and metastasis is often associated with lowered life expectancy. Bone, especially the spine, is the common site of metastasis for breast, lung and prostate cancers. Treatments for these tumors rely on heavy doses of chemotherapeutic agents and invasive surgical procedures, which usually extend onto healthy tissue. This difficult procedure often requires bone reconstruction and graft, but also leaves high risks of open wound infection. The introduction of a cold plasma treatment promises to be a novel therapy that to aid surgical intervention. While empirical plasma medicine shows promising results, the reaction mechanism between plasma and tissues, proper treatment dosage and reactive species composition to reach hormesis are still unknown at large. Therefore, a plasma-bio interaction platform which combines a 3D-bioprinted tissue model to an automated cold plasma source is proposed. To ensure biocompatibility of the treatment, highly sensitive diagnostic techniques are necessary. By exploiting the thermo-optic effect on a fibre Bragg grating, measurements in the shift of the reflected wavelength exposed to a plasma source was used to estimate the temperature. This technique, coupled to the plasma jet, brings a novel approach for temperature characterization. It accurately shows its capability to attain a maximum temperature up to 40 ℃ inside the effluent while interacting with a dielectric surface. Similarly, colorimetric assays for nitrite and hydrogen peroxide detection have also confirmed that these long-lived species can be tailored through the electric pulse duration, the distance, the duration of treatment and the surrounding conditions. These results, combined with promising 2D *in vitro* treatment of MDA-MB-231 breast cancer cell line, show great potential toward tailoring of the plasma for personalized medicine.

Keyword-1

Cold plasma medicine

Keyword-2

Plasma diagnostic

Keyword-3

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