Seminar

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Institute for Plasma Research

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Title: The effect of cold atmospheric plasma jet in Hamster-buccal-pouch carcinogenesis: A Serum Raman spectroscopy study

Speaker: Dr. Poonam Gawali

Institute for Plasma Research, Gandhinagar

Date: 02nd June 2023 (Friday)

Time: 11:00 AM

Venue: Join the talk online:

https://meet.google.com/hrp-bobp-ysg

Abstract

The efficacy of Cold Atmospheric Plasma (CAP) jet in reducing tumors, both *in vitro* and *in vivo*, has been proven in several cancer studies. Raman Spectroscopy (RS), a non-invasive method, is widely explored for screening oral cancer and examining biomedical samples. Serum RS (SRS) has shown potential in detecting cancer. This study explores the application of CAP jet treatment in oral cancer and uses the SRS approach to identify the potential biochemical changes in the treatment and normal control groups. In this study, female Syrian golden hamsters between six and eight weeks old were given a carcinogen, DMBA, for 14 weeks to induce cancer. After exposure to DMBA, they received CAP jet treatment thrice a week for one month. Serum samples were collected from all tumor groups with different experimental times and the experimental control groups before and after the treatment through retro-orbital blood collection. The serum is a systemic biofluid that can offer the advantage of remote diagnosis and reflect the *in-vivo* state while minimally invasive. Both plasma-treated and untreated hamster serum samples were used for the SRS study. The spectral features indicated differences between the normal (NC) tumor control (TC) group, and the normal (NP5, NP10), tumor (TP5, TP10) group treated with plasma. The treatment group included the tumor group treated with plasma for 5 minutes and 10 minutes (TP5 and TP10), and the experimental normal control group also received CAP jet treatment with no tumor growth (NP5 and NP10). After spectral pre-processing, the average spectra were analyzed using multivariate analysis PCA, an unsupervised tool, and supervised PC-LDA. Hamster serum underwent notable biochemical and intensity variations detected by SRS when the tumor group was subjected to plasma treatment. After treatment exposure, biomolecules such as proteins, lipids, and nucleic acids showed altered levels. The LDA model gave a classification efficiency of ~91.67% in TP5 v/s NP5, whereas ~ 90% classification was observed between TP10 and NP10. This suggests the treatment efficacy of CAP jet in the hamster-buccal-pouch oral carcinogenesis model. An increase in Reactive Oxygen Species (ROS) levels in CAP jet treated tumor group leads to DNA damage and, eventually, apoptosis. H_2O_2 is found to play a role in biological processes among the species of ROS. The research suggests that using a cold atmospheric plasma jet can effectively slow down the growth of cancerous cells by optimizing the treatment time and found that the CAP jet successfully suppressed tumor growth in the hamster-buccal-pouch oral carcinogenesis model.