World Academy of Science, Engineering and Technology
International Journal of Biomedical and Biological Engineering
Vol:12, No:05, 2018

Assessment of Cellular Metabolites and Impedance for Early Diagnosis of Oral Cancer among Habitual Smokers

Authors : Ripon Sarkar, Kabita Chaterjee, Ananya Barui

Abstract : Smoking is one of the leading causes of oral cancer. Cigarette smoke affects various cellular parameters and alters molecular metabolism of cells. Epithelial cells losses their cytoskeleton structure, membrane integrity, cellular polarity that subsequently initiates the process of epithelial cells to mesenchymal transition due to long exposure of cigarette smoking. It changes the normal cellular metabolic activity which induces oxidative stress and enhances the reactive oxygen spices (ROS) formation. Excessive ROS and associated oxidative stress are considered to be a driving force in alteration in cellular phenotypes, polarity distribution and mitochondrial metabolism. Noninvasive assessment of such parameters plays essential role in development of routine screening system for early diagnosis of oral cancer. Electrical cell-substrate impedance sensing (ECIS) is one of such method applied for detection of cellular membrane impedance which can be correlated to cell membrane integrity. Present study intends to explore the alteration in cellular impedance along with the expression of cellular polarity molecules and cytoskeleton distributions in oral epithelial cells of habitual smokers and to correlate the outcome to that of clinically diagnosed oral leukoplakia and oral squamous cell carcinoma patients. Total 80 subjects were categorized into four study groups: nonsmoker (NS), cigarette smoker (CS), oral leukoplakia (OLPK) and oral squamous cell carcinoma (OSCC). Cytoskeleton distribution was analyzed by staining of actin filament and generation of ROS was measured using assay kit using standard protocol. Cell impedance was measured through ECIS method at different frequencies. Expression of E-cadherin and protease-activated receptor (PAR) proteins were observed through immune-fluorescence method. Distribution of actin filament is well organized in NS group however; distribution pattern was grossly varied in CS, OLPK and OSCC. Generation of ROS was low in NS which subsequently increased towards OSCC. Expressions of E-cadherin and change in cellular electrical impedance in different study groups indicated the hallmark of cancer progression from NS to OSCC. Expressions of E-cadherin, PAR protein, and cell impedance were decreased from NS to CS and farther OSCC. Generally, the oral epithelial cells exhibit apico-basal polarity however with cancer progression these cells lose their characteristic polarity distribution. In this study expression of polarity molecule and ECIS observation indicates such altered pattern of polarity among smoker group. Overall the present study monitored the alterations in intracellular ROS generation and cell metabolic function, membrane integrity in oral epithelial cells in cigarette smokers. Present study thus has clinical significance, and it may help in developing a noninvasive technique for early diagnosis of oral cancer amongst susceptible individuals.

Keywords : cigarette smoking, early oral cancer detection, electric cell-substrate impedance sensing, noninvasive screening
Conference Title : ICOHMS 2018 : International Conference on Oral Health and Maxillofacial Surgery
Conference Location : Rome, Italy
Conference Dates : May 03-04, 2018