Abstract

Oral cancer often precedes by precursor lesions (pre-cancers) having differential malignant potentiality. Histopathological evaluation is the major diagnostic gold standard for malignant potentiality assessment but it suffers from subjectivity, ambiguity and fails to predict oral lesion susceptibility too. These diagnostic limitations may be dealt with logical corroboration and meaningful analysis of multimodal oral pathology information. Present study evaluated oral pre-cancers (*viz.* leukoplakia, oral sub-mucous fibrosis) and cancer using attributes from clinico-epidemiology, exfoliative cytology, IR spectroscopy, optical biopsy, immuno-histochemistry and histopathology. In accomplishing classification tasks, appropriate analytical measures including supervised machine learning classifiers are implemented. In oral pre-cancer and cancer susceptibility assessment including classification, clinico-epidemiological attributes were statistically analyzed and fuzzy '*If-Then*' rule-base as well as machine learning approaches was executed. The oral liquid based exfoliative cytology microphotographs are scrutinized for diagnostic segregation of these pathosis through analyzing photometric and morphometric features. In the context of label-free marker identification for oral pre-cancer and cancer Fourier Transform Infrared (FTIR) spectroscopy was employed on biopsy sections and glycogen, collagen and keratin expression associated changes were elucidated. The preprocessing, multivariate analysis and specific feature subset selection of FTIR spectra were effective for optimal diagnostic differentiation of oral lesions. Further the optical coherence tomographic attributes (photometric) became effective to delineate oral pre-cancers/cancer and the findings were corroborative with the observation from FTIR, histochemistry and immuno-histochemistry (viz. cytokeratin 10 and collagen I). Considering importance of comparative functional stratification of oral lesions and pathological discrimination, gene and microRNA sub-set selection was accomplished. The substantiation of multi-layered and multimodal information obtained in this study indeed augmented the understanding of precise characteristic signatures for oral pre-malignancy and malignancy in correlation to the existing diagnostic approaches and essentially demonstrated utility of computer assisted analysis for pathobiological variables in robust oral lesion classification.

Key words: Oral pre-cancer, Multimodal attributes, Epidemiology, FT-IR Spectroscopy, Optical Coherence Tomography, Computational Analysis