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Perspective

Recent Advancements in Biosensors used in Oral Cancer Diagnosis

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DESCRIPTION

Oral Cancer (OC) is a growth of malignant tissue in the mouth that usually affects the tongue, floor of the mouth, cheeks, gums, lips, and palate. OC accounts for one-third of all cancer cases worldwide, and India accounts for approximately 30% of all cases. The most common symptoms of OC are pain in the mouth that does not heal and discomfort that is difficult to alleviate. Other symptoms include lumps and swelling of the cheeks. White or red patches on the gums, tongue, and other areas of the oral cavity; persistent sore throat and difficulty eating and swallowing. OC can be avoided by reducing risk factors such as tobacco use (both smokeless and chewing tobacco) and alcohol and increasing awareness of these issues.

All these variables contribute to the development of Oral Squamous Cell Carcinoma (OSCC) by inducing genetic and epigenetic alterations. Oral ethology begins with a burning sensation in the mouth, some restriction in opening the mouth, and red or white lesions in the oral cavity. However, lesion histology may show features of dysplasia. Such conditions are classified as oral occult malignancy. If undetected in the very early stages of Oral Potentially Malignant Disorders (OPMD), which can be life-threatening and associated with increased morbidity, early detection is critical for disease prognosis and individual survival.

In addition to high mortality, OC is a leading cause of lost productivity in developing countries due to premature death. Visual inspection and biopsy are the most common methods used to diagnose OC and premalignant lesions. Currently, OC is diagnosed using invasive methods such as tissue biopsy of the infected area, followed by costly and time-consuming non-invasive medical imaging. Conventional methods to distinguish Oral Squamous Cell Carcinoma (OSCC) from normal oral mucosa have been used individually or in combination with adjuvant screening strategies. These approaches are cumbersome, time consuming, costly, labour intensive and dependent on researcher competence. Due to the presence of low levels of biomarkers in exfoliated cells, tissue samples, or biological fluids, this condition may go unnoticed until specific diagnostic tests are performed. The abundance of these markers is minimal in healthy people but increases as the disease progresses.

Requirement of biosensors in diagnostics

The development of biosensors is important for studying the causative biomarkers of these malignancies and diagnosing OC at an early stage. Early detection of cancer improves a patient's prognosis and chances of survival. This requires immediate consideration of the availability of minimally or completely non-invasive, non-invasive and patient-friendly diagnostic techniques. Biosensors can accurately determine the number of biomarkers, thus helping in proper diagnosis of OSCC development. Therefore, early diagnosis of OSCC is essential for disease management and improved health status. Advances in new biosensor-based diagnostic and screening devices have paved the way for rapid, simple, accurate, and robust OC or OSCC detection assays.

Biosensors that are used to detect cancer

Biosensors to identify cancer markers are designed and developed by researchers and scientists to detect cancer in its early stages. OC can be effectively and early detected using biosensors. DNA, RNA, and protein biosensors have all been clinically proven to be efficient in detecting OC and provide useful information to enable non-invasive OC detection.

Electrochemical biosensors have been used to detect cancer markers. Surface Plasmon Resonance (SPR) sensors based on surface plasmon spectroscopy are used for label-free detection of cancer markers. Piezoelectric biosensors have also been used to detect cancer markers due to their light weight, high sensitivity, and low power requirements.

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