A research team led by A/Prof Chamindie Punnyadeera has developed two saliva based tests for detection of Head and Neck Squamous Cell Carcinoma (HNSCC) at an early stage.

1 - A micro RNA expression panel of nine biomarkers in saliva identifies potentially malignant pre-cancerous lesions.

2 - A salivary DNA methylation panel of five biomarkers for screening asymptomatic high risk individuals (e.g., smokers over the age of 50) when visiting a dentist or their GP.

HNSCC has high morbidity with a five-year survival rate of less than 50%. There is also evidence that the 5-year survival rate for oral cancer detected early is 70% compared to 37% for late diagnosis. At present, diagnosis relies on histological assessment of tissue biopsy samples (invasive) and the presence of lymph node metastasis.

Pre-cancerous lesions such as Leukoplasia and Erythroplakia, require regular inspection at specialist oral medicine clinics. Some lesions at the back of the mouth are difficult to identify and adequately review even when found. These red or white spots can remain benign for years before either resolving or progressing towards malignancy and there is “no reliable correlation between clinical appearance and the histopathologic presence of dysplastic changes except that the possibility of epithelial dysplasia increases in leukoplakic lesions with interspersed red areas.”


Head and Neck Cancers:
Head and neck squamous cell carcinoma (HNSCC) includes malignancies in five major anatomic sites, namely, oral cavity, oropharynx, nasopharynx, hypopharynx and larynx. HNSCC is the sixth most common malignancy with an estimated annual incidence of approximately 900,000 and 300,000 deaths worldwide. Tobacco smoking and alcohol consumption are major risk factors (others include diet, betel nut chewing and mouth wash use) for developing HNSCC.

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Hence there is a significant need for a tool to screen oral lesions prior to malignant transformation.

A panel of nine miRNA markers has demonstrated a sensitivity of 95% and a specificity of 93% (AUC = 0.98) when discriminating saliva collected from patients (n=100) vs saliva collected from precancer lesions (n=30).

Furthermore, expression levels of three miRNAs are able to distinguish patients with Human Papilloma Virus infections (HPV) from HPV-negative patients. The HPV virus usually resides in the tonsillar crypts as well as in the pockets at the back of the mouth, hence confirmation of infection can suggest that a specialist should place additional focus in their visual examination on the more difficult to observe regions of the mouth.

2 - Salivary DNA Methylation Biomarkers:
Aberrant epigenetic changes (e.g., DNA methylation) is a hallmark of cancer. Tumour suppressor gene activity is significantly reduced in cancer. Promoters of these genes can be over- or under-methylated, resulting in the inhibition of protein production. MethDNA-Oral Test™ test detects the aberrant methylation of the five markers using Methylation-Specific PCR (MSP) technology.

Diagnostic capabilities: The five biomarker leads in a combined assay demonstrate a specificity of 90% and a sensitivity of 90% with an area under curve (AUC) of 0.96.

Screening capabilities: This panel can also differentiate healthy non-smokers from at risk individuals, e.g., smokers, with a specificity of 90% and a sensitivity of 94% with AUC of 0.97.

Figure 1: Receiver operator characteristics for MethDNA-Oral Test™.

Commercial Potential:
We are seeking a partner to commercialise the MethDNA-Oral Test™ Kit to detect HNSCC. One application would be regular post-resection recurrence testing where the second primary rate in ex-smokers is 2 to 7% per year. Monitoring patients through GP accessed testing, rather than a clinical examination by a surgeon would save substantial costs.

Intellectual Property and Publications:
Both MED 15 markers, the five marker panel and MethDNA-Oral Test™ Kit are protected by PCT patent application PCT/AU2014/050261.

The nine miRNA panel have been protected by an Australian provisional application.