Hyperspectral Transmission Microscopy for Oral Cancer Diagnosis

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Over the past decade, the incidence of oral cancer has been one of the fastest increasing of all cancers, with the statistics for oropharyngeal cancer being particularly concerning [1]. It is often detected late due to reliance on self-referral, and metastasis is found at first inspection in 32.5% of cases [2] meaning that prognosis tends to be poor. The diagnosis gold standard is biopsy followed by histopathological examination which has poor repeatability, particularly in marginal cases such as precancers [3, 4]. The poor repeatability is due, in part, to the qualitative nature of the diagnostic techniques used. A quantitative technique for a second "opinion" in difficult cases could lead to improved repeatability. In time it could also be used to generate personalised treatment ameliorating the difficult balance between treatment which is aggressive enough to be effective without causing unnecessary detriment to the patients' quality of life.

Raman spectroscopy has been identified as a highly accurate diagnostic tool [5], however it is too time consuming to be viable as a histopathological diagnostic aid on whole tissue sections as it scans the full area point-by-point. Therefore, a spectral scanning hyperspectral transmission microscope has been developed and is being tested for use as a rapid pre-screening technique to locate small regions of clinical interest for further investigation with vibrational spectroscopy, or for complete diagnostic imaging alone.

Unstained human oral tissue is very complex, therefore data from simpler biological samples have also been collected for this work, including saliva droplets and mouse tissue. Analysis was carried out using in-house cluster analysis software as well as texture analysis software, which is currently under development.

References

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