

Predicting the response to pre-operative short course radiotherapy in rectal cancer: a potential role for Raman spectroscopy?

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Colorectal cancer is common, affecting around 42,000 people each year in the UK. Currently, neoadjuvant radiotherapy (RT) is frequently given to high risk rectal cancer patients. However, a significant proportion of patients do not respond yet unnecessarily endure the side-effects of RT. Raman spectroscopy is a highly sensitive, non-destructive form of vibrational spectroscopy that can determine the chemical fingerprint of cells and tissues, prior to any morphological changes. Using Raman spectroscopy, we aimed to identify novel biomarkers capable of predicting the response to pre-operative RT in rectal cancer.

4 rectal cancer patients who underwent short course RT were identified. Response to RT was determined by calculating the percentage reduction in tumour cell density (TCD) following RT by comparing the biopsy and resection. Tumour rich and stromal rich regions of interest were annotated onto digitalised H&E stained sections and an inVia Raman confocal inverted microscope was used to collect the spectra of these areas.

The good responders had a TCD reduction of 92% and 98%, and the bad responders a reduction of 6% and 30%. Preliminary results suggest that Principal Component Analysis, a form of non-supervised multi-variate analysis, was able to accurately classify the spectra obtained, showing clear differentiation between tumour and stroma, when correlated with the H&E. Further analysis to investigate the differences between good and poor responders is ongoing.

There are currently no reliable predictors of response to radiotherapy in rectal cancer. Pilot work from our study has shown that Raman spectroscopy can be used to differentially identify tumour and stroma after short course radiotherapy. Further work is currently being performed to interrogate the spectra and identify novel predictors of response.