RAMAN AGAINST CANCER: Towards automated detection and imaging of basal cell carcinoma (BCC).

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1. Abstract
An automated method for imaging and diagnosis of the most common skin cancer, basal cell carcinoma (BCC), with Raman micro-spectroscopy (RMS) during surgery has been developed. The RMS images showed extremely high correlation with traditional methods. The introduction of a generalization of the proposed technique into a real clinical scenario will help in a fast and accurate location of the tumour margins and may improve the feasibility and efficacy of the current state of the art treatment for difficult BCCs.

2. Basic concepts

What is Raman micro-spectroscopy (RMS)? Optical technique based on inelastic scattering of monochromatic radiation by atoms or molecules in a sample. It is able to detect the slight biochemical changes within cells associated with the onset of cancer. It does not require sample preparation and does not produce tissue damage. Most common human malignancy and 80% of skin cancers. Rates dramatically increasing annually. What is the state of the art treatment for BCC? For aggressive BCCs, Mohs Micrographic Surgery (MMS). How does MMS work? Sequential layers of tissue are removed until the lesion is clear of cancer cells (BCC). They are stained with hematoxilyn and eosin (H&E) and microscopically examined by expert histopathologists in order to detect the presence of residual tumour. If there is tumour persistence, further tissue removal is performed. How can RMS improve current MMS? RMS enables real time and in situ discrimination of cancerous tissue. In conclusion, this study has demonstrated the potential of RMS for automated diagnosis of BCC during MMS.

3. The equipment:

4. The results:

4.a) Raman spectral database:
A spectral database using 329 Raman spectra from 20 patients, including 127 BCCs, 92 epidermis and 110 dermis. Selected Raman bands corresponding to nucleic acids and collagen type I were used to create the model. BCC was discriminated from healthy tissue with 90±9% sensitivity and 85±9% specificity.

4.b) Raman imaging:
BIOPSIES WITH CANCER

5. The impact:

5.a) Discussion and future work
A model for the spectral database has been developed using 329 Raman spectra from 20 patients, including 127 BCCs, 92 epidermis and 110 dermis. Selected Raman bands corresponding to nucleic acids and collagen type I were used to create the model. BCC was discriminated from healthy tissue with 90±9% sensitivity and 85±9% specificity. How does RMS improve current MMS? RMS enables real time and in situ discrimination of cancerous tissue. In conclusion, this study has demonstrated the potential of RMS for automated diagnosis of BCC during MMS. However, reducing the time employed in generating the images will be the target of our future work.

6. References