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**COLORECTAL CANCER IDENTIFIED USING OPTICAL SPECTROSCOPY**

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**Aim:** Complete tumor resection is essential to improve the outcome and quality of life after surgery for colorectal cancer. The identification of tumor and healthy surrounding tissue could facilitate complete tumor resection. Optical based techniques can identify tumor and surrounding tissue through a tissue specific “optical fingerprint”. Dual-modality Diffuse Reflectance Spectroscopy–Fluorescence Spectroscopy (DRS-FS) was evaluated for discrimination between healthy and malignant tissue in colon surgery with ultimate application implementation into surgical instruments.

**Methods:** Differences in tissue composition and structure were measured through a fiber-optic needle using dual-modality DRS-FS. Resection specimens of colon cancer patients were investigated immediately after resection. Multiple optical parameters were derived from the measurements, including volume concentration of familiar optical absorbers like hemoglobin, β-carotene, water and lipids. Furthermore, scattering- and absorption coefficients were assessed, as well as sources of intrinsic fluorescence. The optical based parameters were cross-validated with the results of histopathological analysis using a classification and regression tree (CART) algorithm.

**Results:** A total of 1273 measurements was performed on 21 specimens. Spectral characteristics of β-carotene, hemoglobin, lipids and water could be identified in the measured spectra. Differentiation of tumor from surrounding tissue was possible with a sensitivity and specificity of 95% and 88%, respectively. In 10 specimens optical data were collected along a needle path towards the tumor. Both DRS and FS spectra showed significant spectral changes when the needle tip was guided from healthy tissue into tumor.

**Conclusions:** This study demonstrates that dual-modality DRS-FS allows accurate identification of colon cancer based on optical detection of differences in tissue composition and structure. The technique, here demonstrated in a needle like probe, may be incorporated into surgical instruments for optical guided surgery or combined in other devices.

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