

***In Vivo* Examination of the Upper and Lower Gastrointestinal Tract Using a Fluorescence Confocal Endomicroscope**

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Background & Aims: Confocal microscopy is an optical imaging technique that enables microscopic examination of cellular structure in living tissue. Using fibre-optic technology and miniaturised scanning mechanisms, a confocal endomicroscope was fully integrated into the tip of a Pentax endoscope (Model EC3870FK) suitable for flexible endoscopy of the upper and lower GI tract. This study assessed the confocal image data of the confocal endomicroscope for *in vivo* detection of gastrointestinal (GI) pathology. **Methods:** Patients undergoing surveillance examination for indications including routine screening, inflammatory bowel disease (IBD), familial adenomatous polyposis (FAP) and Barrett's esophagus (BE) were recruited for examination. The instrument was used for both white-light endoscopy and microscopic imaging. Fluorescein sodium (10ml of a 10% solution) was administered intravenously to enable fluorescent staining of the upper and lower GI tract. During lower endoscopy, images were collected from the rectum to the caecum and the terminal ileum. For upper endoscopy, images were collected from the lower esophagus, gastric antrum, body and cardia. Images were collected from regions of pathology and normal mucosa. In some instances, chromoendoscopy using 0.1% methylene blue was used to target regions of abnormality. Biopsies were collected from the confocal image sites for comparison with histopathology. **Results:** Confocal endomicroscopy enabled visualisation of colonic crypts and gastric pits of the GI mucosa. The image contrast and resolution was sufficient to distinguish pit pattern architecture as observed with chromoendoscopy as well as cellular and some sub-cellular structures at patient examination. Intravenous fluorescein sodium also resulted in strong contrast in the lamina propria and the subsurface microvasculature. IBD and/or pathology resulted in loss of the normal mucosal architecture and altered staining patterns that correlated with the findings of histopathology. **Conclusions:** This study demonstrates that confocal endomicroscopy can be used to examine key histological features of normal and diseased mucosa during otherwise conventional endoscopy. Microscopic imaging is in real time and not surgically invasive. *In vivo* histology with endomicroscopy may lead to significant improvements in the clinical management of patients with large fields of diffuse abnormality (for example, in IBD, BE or hyperplastic polyposis) to minimise or target biopsy collection and to increase diagnostic yield.