Biospectroscopy of Cervical Cytology vs. Conventional Screening in Identification of Histology Verified Cervical Intra-epithelial Lesions

K. Gajjar, G. Valasoulis, M. Nasioutziki, A. Loufopoulos, M. Kyrgiou, M. Stasinou, P. Karakitsos, E. Paraskevaidis, P.L. Martin-Hirsch, F.L. Martin.

Department of Obstetrics and Gynaecology, Lancashire Teaching Hospitals NHS Foundation Trust, Preston, United Kingdom. Centre for Biophotonics Lancaster Environment Centre, Lancaster University, Lancaster, United Kingdom.

Objectives
Inter and intra observer variability in assessment of cervical cytology leads to discordance between categorised samples and histology. Biospectroscopy methods have been suggested as sensor-based tools to deliver objective assessments [1]. Categorisation of biological samples based on imperfect conventional screening can reduce the apparent diagnostic accuracy of biospectroscopy [2]. The aim of this study is to analyse the infrared spectra of cytology samples derived using biospectroscopy and compare the accuracy of biospectroscopy *vs.* conventional cytology to identify true atypia in light of the corresponding histology.

Methods
Within a typical clinical setting a total of n=322 cervical cytology specimens were collected immediately before biopsy (n=154). Cytology specimens were categorised according to conventional screening methods and subsequently interrogated employing attenuated total reflection Fourier-transform infrared (ATR-FTIR) spectroscopy with multivariate analysis.

Results
Based on the categorisation derived from conventional screening, infrared (IR) spectroscopy derived from cervical cytology does not appear to discriminate in a diagnostic fashion. Scores plots of IR spectra exhibit marked cross-over of spectral points between different categories. However, when histology based analysis was conducted, conventional screening was deeply flawed. By imposing the histology findings on the biospectroscopy analyses, ATR-FTIR spectroscopy was found to identify underlying disease missed by conventional screening.

Conclusions
Histology demonstrates that ATR-FTIR spectroscopy of LBC specimens identifies the presence of underlying atypia or disease missed in conventional cytology screening. This study points to an urgent need for a future biospectroscopy study where categories are based on such histology. It will allow for the validation of this approach as a novel screening tool.

References:
[1] F.L. Martin, J.G. Kelly, V. Llabjani, P.L. Martin-Hirsch, I.I. Patel, J. Trevisan, N.J. Fullwood, M.J. Walsh, *Nat Protoc* 5(11), 1748-60 (2010).
[2] N.C. Purandare, I.I. Patel, J. Trevisan, N. Bolger, R. Kelehan, G. von Bünau, P.L. Martin-Hirsch, W.J. Prendiville, F.L. Martin Analyst (2013).