Multiphoton diagnostics of skin cancer – the potential and pitfalls using endogenously protoporphyrin IX for tumor contrast

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ABSTRACT
Laser-scanning multiphoton microscopy is making its way into the clinics, particularly translating into non-invasive skin cancer diagnostics. Two-photon excitation (2PE) of tissue autofluorescence has demonstrated to be a powerful tool for visualizing cell morphology of tissue in a non-invasive fashion [1,2], launched as multiphoton tomography. It has been suggested that endogenously formed protoporphyrin IX (PpIX) induced by aminolevulinic acid or methylaminolevulinate (MAL) can be applied to improve tumor contrast [3]. When MAL is applied to living tissue, it metabolizes to form protoporphyrin IX (PpIX), but detailed studies of 2PE of endogenously formed PpIX are scarce.

We here report on an investigative study [4] exploring multiphoton microscopy of nonmelanoma skin cancer based on MAL-induced PpIX fluorescence. It is demonstrated by spectral analysis that 2PE of endogenously formed PpIX does not provide additional contrast in superficial basal cell carcinomas. In fact, the PpIX signal is overshadowed by the autofluorescent background. The results show that PpIX should be excited at a wavelength giving rise to one-photon anti-Stokes fluorescence. Thus, we present a method, based on near-infrared one-photon anti-Stokes excitation of PpIX, which can be implemented for clinical investigations on endogenously formed PpIX using multiphoton microscopy.

REFERENCES