Examining HIV infected cells using optical trapping and Raman spectroscopy

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Abstract

Manipulation of biological cells using optical trapping is a non-invasive approach in which individual living cells are examined without causing any damage because there is no direct mechanical contact with cells. Optical trapping uses a tightly focused laser beam emitted through a high numerical aperture microscope objective lens to hold microscopic particles. When using this technique, there is minimal chances of exposing cells to contamination and optically handled cells can still be utilised in downstream sterile experiments whenever necessary. In this study, optical trapping is used to trap HIV infected cells, which are then analysed by Raman spectroscopy. Raman spectroscopy as an analytical technique provides specific chemical/molecular details about a sample based on the fundamental vibrational modes of the chemicals. By combining these two light-based technologies, HIV infected TZM-bl cells were distinguished from the uninfected cells as they exhibited different molecular fingerprints. The acquired results both confirm and provide more detail to the findings of the previous study where transmission spectroscopy was used to differentiate between HIV infected and uninfected cells. This current study shows how the two cell populations differ according to the chemical/molecular composition and distribution. These results present valuable information that would be essential in the development of a label-free HIV point of care diagnostic device.