Journal of Biophotonics

Laser-enhanced drug delivery of antiretroviral drugs into human immunodeficiency virus-1 infected TZMbl cells

Rudzani Malabi[1,2*] | Sello Lebohang Manoto[1] | Saturnin Ombinda-Lemboumba[1] | Malik Maaza[2] | Patience Mthunzi-Kufa[1,2]

[1] Biophotonics, National Laser Centre, Council for Scientific and Industrial Research, Pretoria, South Africa
[2] College of Science, Engineering and Technology, Department of Physics, NB Pityana Building, University of South Africa, Florida, South Africa

https://onlinelibrary.wiley.com/doi/epdf/10.1002/jbio.201800424

Abstract

The introduction of highly active antiretroviral therapy (HAART) has significantly increased life expectancy and improved management of the human immunodeficiency virus-1 (HIV-1) disease globally. This well-established treatment regime has shown to reduce viral capacity to undetectable limits when using traditional clinical assays. The establishment of viral reservoirs during the early stages of infection are the major contributors to failure of the current regimens to eradicate HIV-1 infection since the reservoirs are not affected by antiretroviral drugs (ARVs). Therefore, advanced modification of the present treatment and investigation of novel antiretroviral drug delivery system are needed. The aim of this study was to use femtosecond (fs) laser pulses to deliver ARVs into HIV-1 infected TZMbl cells. Different ARVs were translocated into TZMbl cells using fs pulsed laser (800 nm) with optimum power of 4 μW and 10 ms laser to cell exposure time. Changes in cellular processes were evaluated using cellular morphology, viability, cytotoxicity and luciferase activity assays. Cells treated with the laser in the presence of ARVs showed a significant reduction in viral infectivity, cell viability and an increase in cytotoxicity. This study demonstrated that fs laser pulses were highly effective in delivering ARVs into HIV-1 infected TZMbl cells, causing a significant reduction in HIV-1 infection.