NADH Fluorescence Lifetime Detects Metabolic Changes in the Osteogenic Differentiation of Human Mesenchymal Stem Cells (hMSCs)

Han-Wen Guo[1], Chien-Tsuen Chen[3], Yau-Huei Wei[3], Oscar K. Lee[2], Vladimir Ghukasyan[1], Fu-Jen Kao[1], and Hsing-Wen Wang[1*]

Institutes of Biophotonics[1], Clinical Medicine[2], Biochemistry and Molecular Biology[3], National Yang-Ming University, Taipei 112, Taiwan

*Corresponding author: Tel 02-2826-7378, email hwwang2@ym.edu.tw

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1. Abstract

Fluorescence lifetime imaging microscopy (FLIM) is a functional imaging technique for mapping the fluorescence lifetime of interested chromophores. The fluorescence signal of coenzyme reduced nicotinamide adenine dinucleotide (NADH) has been used to optically monitor cell metabolism because NADH is a key component in metabolic pathways. Recently, studies has shown that the changes in NADH lifetime reflected cell metabolic activities.[1]

In this study, we present a non-invasive method to detect the metabolic changes of human mesenchymal stem cells(hMSCs) in osteogenic medium via fluorescence lifetime measurements of NADH and the ratio of NADH amounts at free to protein-bound forms using two-photon FLIM. Our results suggest that the ratio changes may be a potential optical probe to identify hMSCs from further differentiated osteocytes.

2. Results

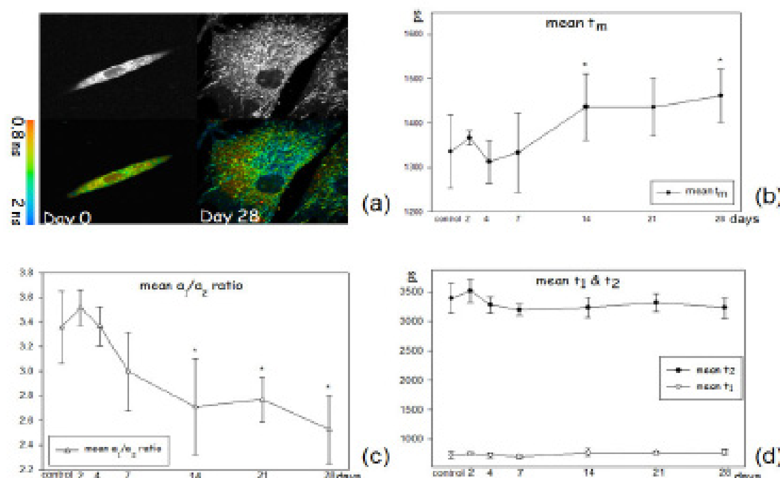

Figure (a) The images of fluorescence intensity and lifetime of NADH between non-differential (Day 0) and differential (Day 28) hMSCs. (b) The mean tm of NADH changed in the osteogenic differentiation from day 0 (non-differential) to day 28. (c) Free(a_1) and protein-bound(a_2) of NADH altered in the osteogenic differentiation from day 0 to day 28. (d) The mean t_1 and t_2 of NADH changed in the osteogenic differentiation from day 0 to day 28.

3. References

Bird DK, Yan L, Vrotsos KM, Eliceiri KW, Vaughan EM, Keely PJ, White JG, Ramanujam N. “Metabolic mapping of MCF10A human breast cells via multiphoton fluorescence lifetime imaging of the coenzyme NADH.” Cancer Res., **65,** 8766-8773.