Official Journal of TESMA
Regenerative Research
www.regres.tesma.org.my
E-ISSN 2232-0822
Tissue Engineering and Regenerative Medicine Society of Malaysia

Regenerative Research 7(1) 2018 128

GRAPHENE OXIDE INDUCES OSTEOGENESIS IN WHARTON'S JELLY-DERIVED MESENCHYMAL STEM CELLS

Hiew VV*, Teoh PL

Biotechnology Research Institute, University Malaysia Sabah, Jalan UMS,
88400, Kota Kinabalu, Sabah, Malaysia.

ARTICLE INFO

Published: 26th August 2018
*Corresponding author:
VV Hiew
Email:
vunvun0524@hotmail.com

KEYWORDS

Mesenchymal stem cell;
Grapheme oxide;
Osteogenesis;
DNA methylation

SUMMARY

Graphene oxide (GO) as a scaffold for mesenchymal stem cells (MSCs) has found to enhance differentiation potentials in tissue engineering applications. Understanding how it affects gene regulation is among the most necessity for clinical applications and eventually to treat human diseases. However, its underlying molecular mechanisms in dictating the lineage differentiation of MSCs are largely unknown. WJ-MSCs were cultured in the presence of GO for 7 days then osteogenic differentiation assay was performed using Alizarin red. This was followed by RNA extraction and RT-PCR. Cell surface marker profile showed that WJ-MSCs expressed a subset of positive markers including *CD44*, *CD73* and *CD90* but did not express negative markers *CD45* and *CD133*. Through PCR array, preliminary results revealed that there was an upregulation of osteogenic markers *RUNX2*, and *OCN* in WJ-MSCs-GO cultured in osteogenic induction media when compared to the controls. Other osteogenic related genes were also upregulated including *BMP2*, *BMP6*, and *TGFβ1*. The downregulation of *CD44* and *CD73*, which both are stemness-related genes, indicating that GO promotes osteogenesis in WJ-MSCs in the presence of induction media. Conversely, without induction media, WJ-MSCs-GO showed an upregulation of stemness genes *OCT4* and *SOX2*, and downregulation of osteogenic genes, suggesting that GO is capable of maintaining pluripotency in WJ-MSCs. Besides that, promotion of osteogenesis by GO was found to be associated with the reduction of *DNMT1* and *DNMT3A* expression. This demonstrated that DNA methylation has implications in restricting osteogenic differentiation. In conclusion, the loss of pluripotency is correlated to osteogenic differentiation and that under the presence of induction media, GO promotes osteogenesis in WJ-MSCs.