Effects of Selenium nanoparticles on bone differentiation of MC3T3-E1 cells at high reactive oxygen speices concentrations

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Introduction

Recently many studies have focused on the growth of nanomaterial bone and the complex interactions between nanomaterials and osteocyte in vivo and in vitro. Nanomaterials with physical properties such as size and shape are ideal mediator for promoting tissue regeneration and improving cell proliferation by interacting with cells and tissues.

MC3T3-E1 Cells serve as a model for mouse pre-osteoblasts and have been previously used in research for the study of transcription factors in osteoblast differentiation.

Selenium is one of the important trace elements in the human body that regulates various physiological functions such as antioxidant, anti-inflammatory, and immunity.

Materials & Methods

Seed $6x10^4$ MC3T3-E1 cells on 24 wells-plate. Cell viability according to the concentration of selenium nanoparticles and H_2O_2 was confirmed by CCK-8. Every 2 days, change Osteogenic differentiation Media(ODM) with B-glycerophosphate, Dexamethasone and Ascorbic acid. On the 14 days, ALP staining was conducted to the cells. On the 27 days, ARS staining was performed to confirm cell differentiation.

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Results

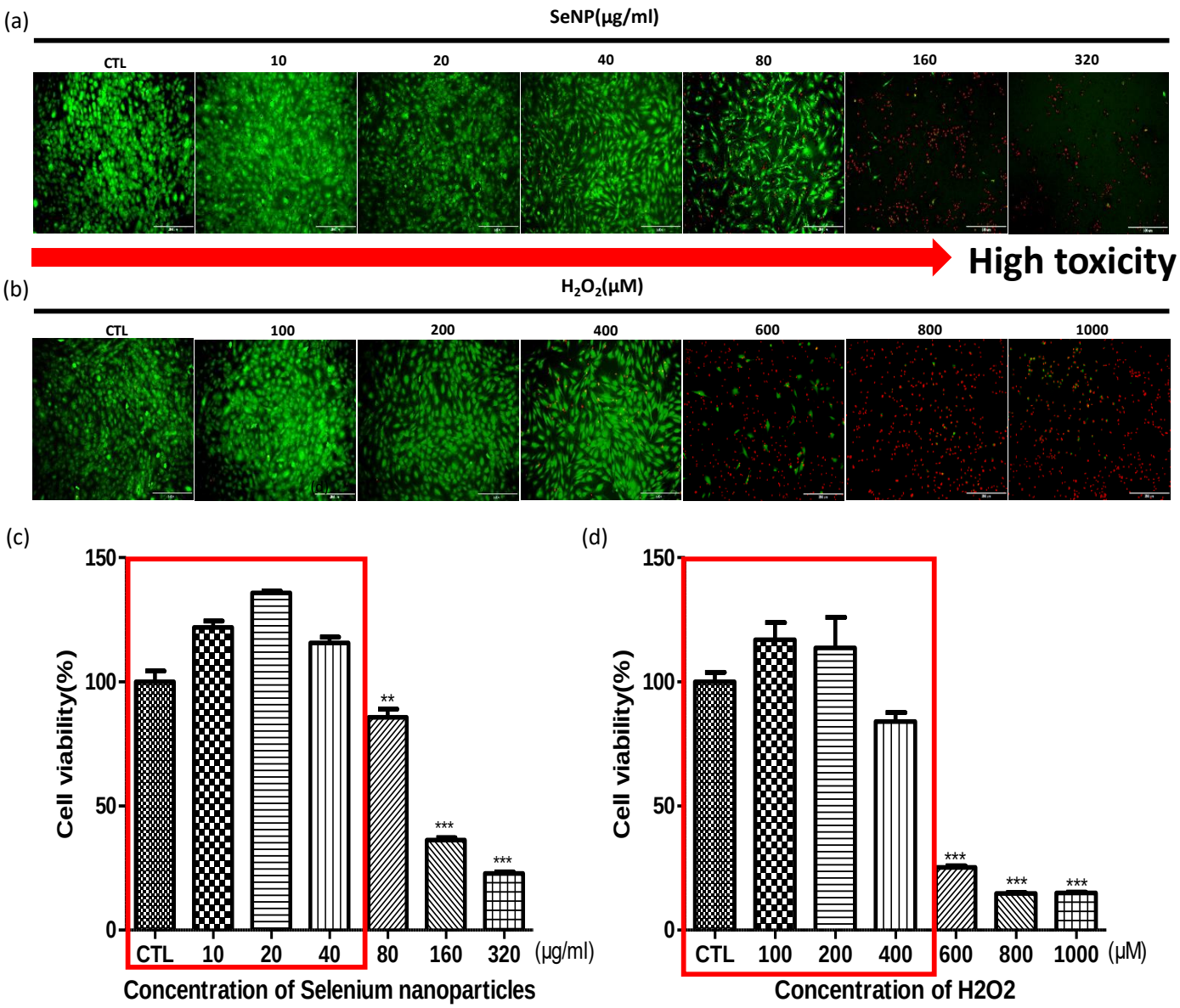

Figure 1. Results of Cell viability treated by Selenium nanoparticle and Hydrogen peroxide on MC3T3-E1 respectively.

a) Live & Dead staining of MC3T3-E1 treated by Selenium nanoparticle
b) Live & Dead staining of MC3T3-E1 treated by Hydrogen peroxide
c) Cell viability analysis of MC3T3-E1 treated by Selenium nanoparticle using by CCK-8
d) cell viability analysis of MC3T3-E1 treated by Hydrogen peroxide using by CCK-8

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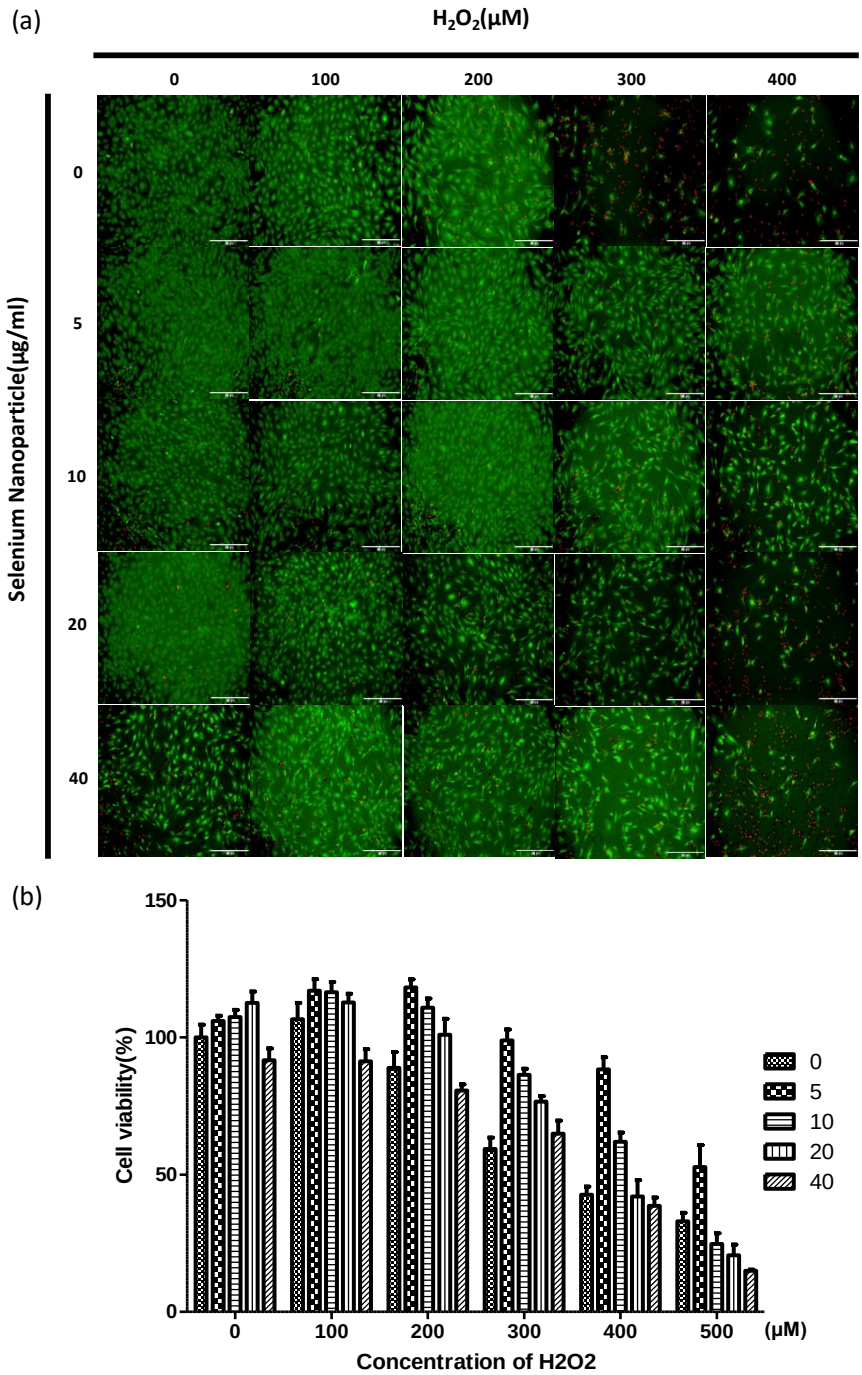

Figure 2. Cell viability treated with selenium nanoparticles and H2O2

a) Live & Dead staining of MC3T3-E1 treated by Hydrogen peroxide

b) Cell viability analysis of MC3T3-E1 treated by Selenium nanoparticle using by CCK-8

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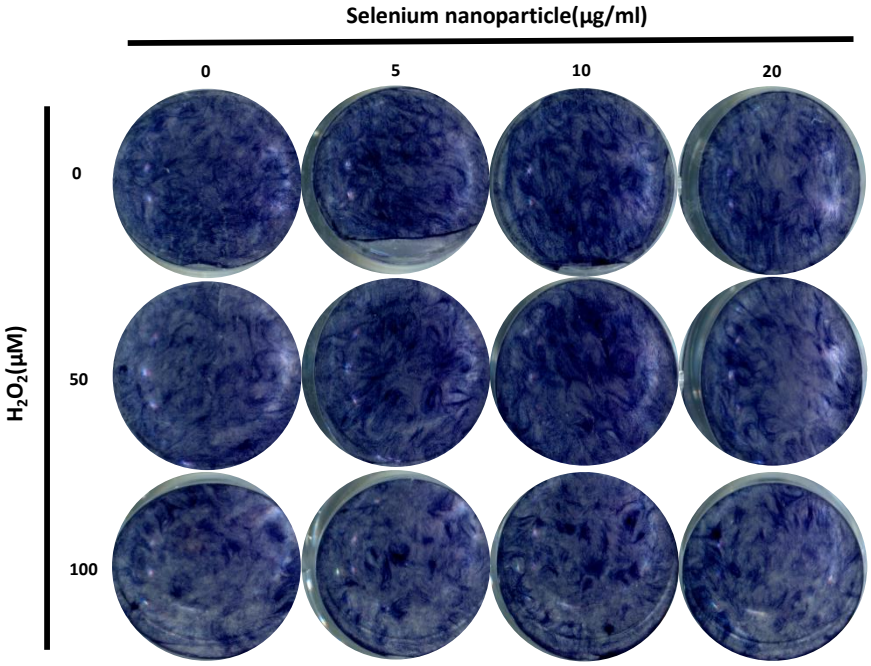

Figure 3. ALP staining of MC3T3-E1. MC3T3-E1 was treated with Selenium nanoparticle and Hydrogen peroxide.

After treat 2 days, MC3T3-E1 was treated with Selenium nanoparticle and Hydrogen peroxide, changed with Osteogenic differentiation media(ODM) every 2 days.

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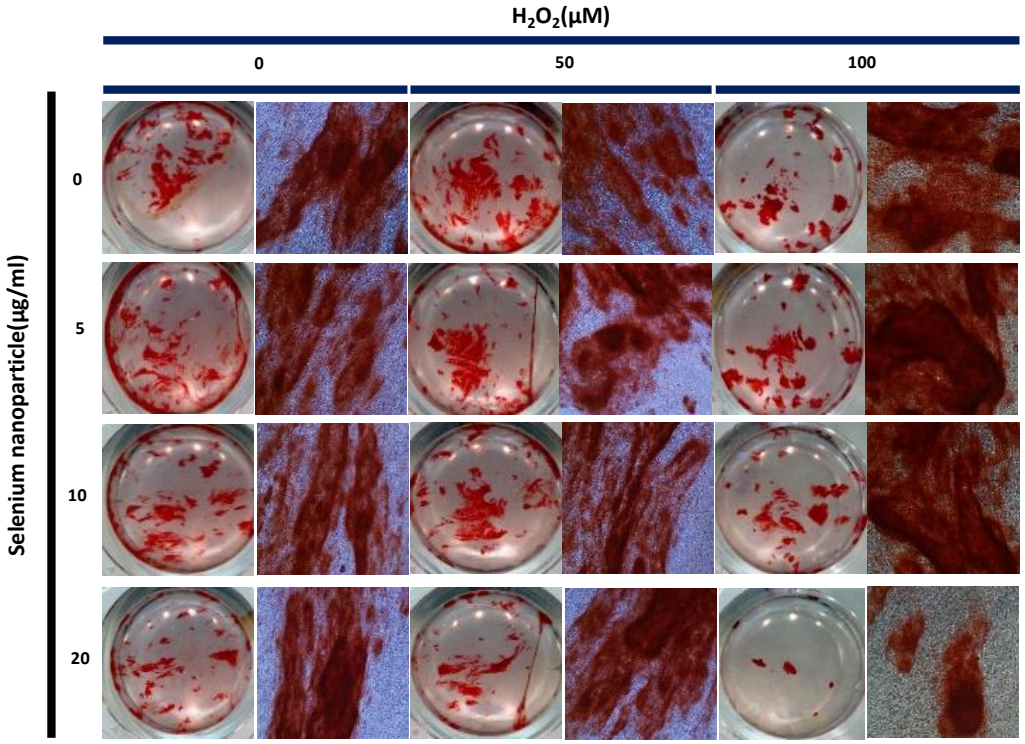

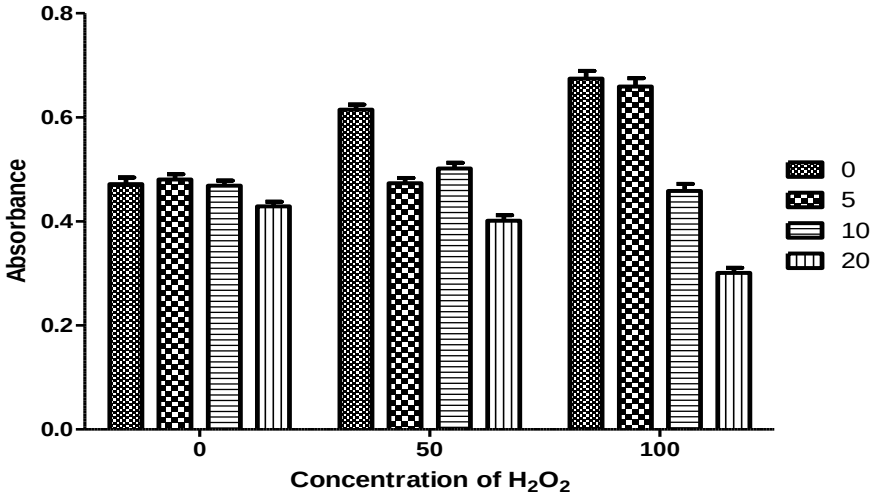

Figure 4. Mineralization and Cell Differentiation analysis by Alizarin red S and quantification .
After treat 27 days, Mineralization were measured by ARS staining of MC3T3-E1.
MC3T3-E1 was treated with Selenium nanoparticle and Hydrogen peroxide, changed with Osteogenic differentiation media(ODM) every 2 days.

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Conclusion

It was confirmed that cell differentiation was promoted by treating MC3T3-E1 cells with selenium nanoparticles at a high reactive oxygen concentration. This shows the potential application of Selenium to dental treatment by affecting the tooth formation process. In addition, it is considered that accurate analysis of osteoblast differentiation is necessary by additionally quantifying the ALP activity test and confirming bone formation markers through PCR.

Reference

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Acknowledgement

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