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PROCEEDINGS

Sequential Activation of M1and M2 Phenotype in Macrophages by Mg Degradation from Ti-Mg Alloy for Enhanced Osteogenesis

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ABSTRACT

Background: Even though the modulatory effects of Mg and its alloys on bone healing cells during the last two decades, relatively limited attention has been paid on their inflammation-modulatory properties. Understanding the activation process of macrophages in response to the dynamic degradation process of Mg as well as the relationship between macrophage phenotypes and their osteogenic potential is critical for the design and development of advanced Mg-based or Mg-incorporated biomaterials.
Methods: In this work, Ti-0.625Mg (wt.%) alloy fabricated by mechanical alloying (MA) and subsequent spark plasma sintering (SPS) was employed as a material model to explore the inflammatory response and osteogenic performance *in vitro* and *in vivo* by taking pure Ti as control. The data analysis was performed following Student's t-test.
Results: The results revealed that the macrophages grown on the Ti-0.625Mg alloy underwent sequential activation of M1 and M2 phenotype during a culture period of 5 days. The initially increased environmental pH (~8.03) was responsible for the activation of M1 macrophages, while accumulated Mg^{2+} within cells contributed to the lateral M2 phenotype activation. Both M1 and M2 macrophages promoted osteoblast-like SaOS-2 cell maturation. *In vivo* experiment further showed the better anti-inflammatory response, regenerative potentiality and thinner fibrous tissue layer for Ti-0.625Mg alloy than pure Ti.
Conclusion: The results highlighted the roles of Mg degradation in the Ti-0.625Mg alloy on the sequential activation of macrophage phenotypes and the importance of modulating M1-to-M2 transition in macrophage phenotypes for inflammation-modulatory biomaterial design and development.

KEYWORDS

Mg degradation; inflammation; osteogenesis

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