

Magnesium engineered mesoporous silica nanoparticles loaded with infliximab attenuated rheumatoid arthritis in mice

Jia Hu¹, Hongjiang Chen¹, Guangshuai Nie¹, Zhen Wang¹, Fanjia Zeng¹, Weixin Zeng¹, Jiechen Chen¹, Jiankun Xu², Jun Hu¹

¹ First Affiliated Hospital, Shantou University Medical College, Shantou, Guang-dong, China, ²Musculoskeletal Research Laboratory of Department of Orthopaedics & Traumatology and Innovative Orthopaedic Biomaterial & Drug Translational Re-search Laboratory, Li Ka Shing Institute of Health Sciences, The Chinese Uni-versity of Hong Kong, Hong Kong, China
Email of Presenting Author: hujia642545251@163.com

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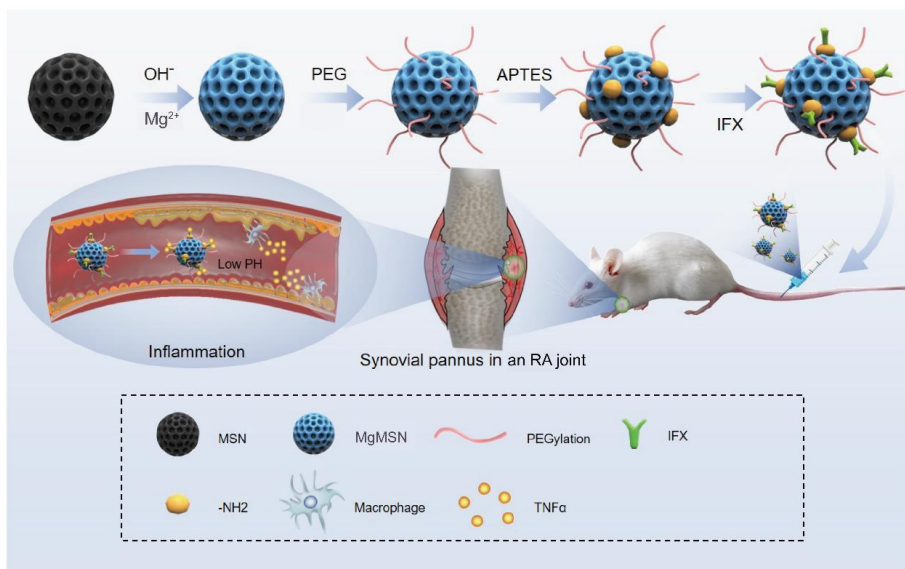
INTRODUCTION: Rheumatoid arthritis (RA), one of the most common inflammatory joint diseases, is characterized by facet joint pain and stiffness, and usually leads to irreversible joint fusion at the late stage. Infliximab (IFX) is a monoclonal antibody that specifically neutralized TNF- α , a key detrimental factor in RA, thus ameliorating the condition and delaying disease progression. IFX combined with Methotrexate (MTX) is utilized in the treatment of rheumatoid arthritis; however, they have disadvantages such as low bioavailability and significant systemic side effects. Currently, there is a lack of research on developing an optimized IFX combination. Magnesium (Mg) is an essential mineral for the human body. Numerous studies indicate that magnesium particles exert anti-inflammatory and osteogenic effects. Therefore, combination of Mg and IFX may be an optimal strategy for treating RA.

METHODS: Herein, we doped magnesium ions with mesoporous silica to fabricate mesoporous silica nanoparticles (MSNs), using a hydrothermal method to synthesize a nano-particle skeleton, which further served as a carrier to transport IFX in a complex, denoted as IFX@MgMSN.

RESULTS SECTION: IFX@MgMSNs exhibited high affinity to the inflammatory macrophages. The release of magnesium ions from nanoparticles in an inflammatory weak acidic environment was validated in an RA mouse model. This system robustly increased the anti-inflammatory efficiency while reduced the side effects of IFX. Histological evaluation of the knee joint further confirmed that the IFX@MgMSNs treatment group exhibited a declined number of inflammatory cells as well as declined vascular infiltration and bone destruction.

DISCUSSION: The current study proved that IFX@MgMSNs exerted a satisfactory therapeutic effect on RA and provided a potentially effective nano-drug for the treatment of RA. Unfortunately, the CIA model cannot accurately simulate the human body because it lacks pathological factors related to RA, such as anti-nuclear antibodies and rheumatoid factors and we cannot translate the real-time detection of disease efficacy through fluorescence into model.

SIGNIFICANCE/CLINICAL RELEVANCE: IFX@MgMSNs may reduce bone damage and cartilage erosion occasioned by joint inflammation in RA.



IMAGES AND TABLES: