Engineered MgO nanoparticles: A promising path to synergistic cartilage and bone therapy

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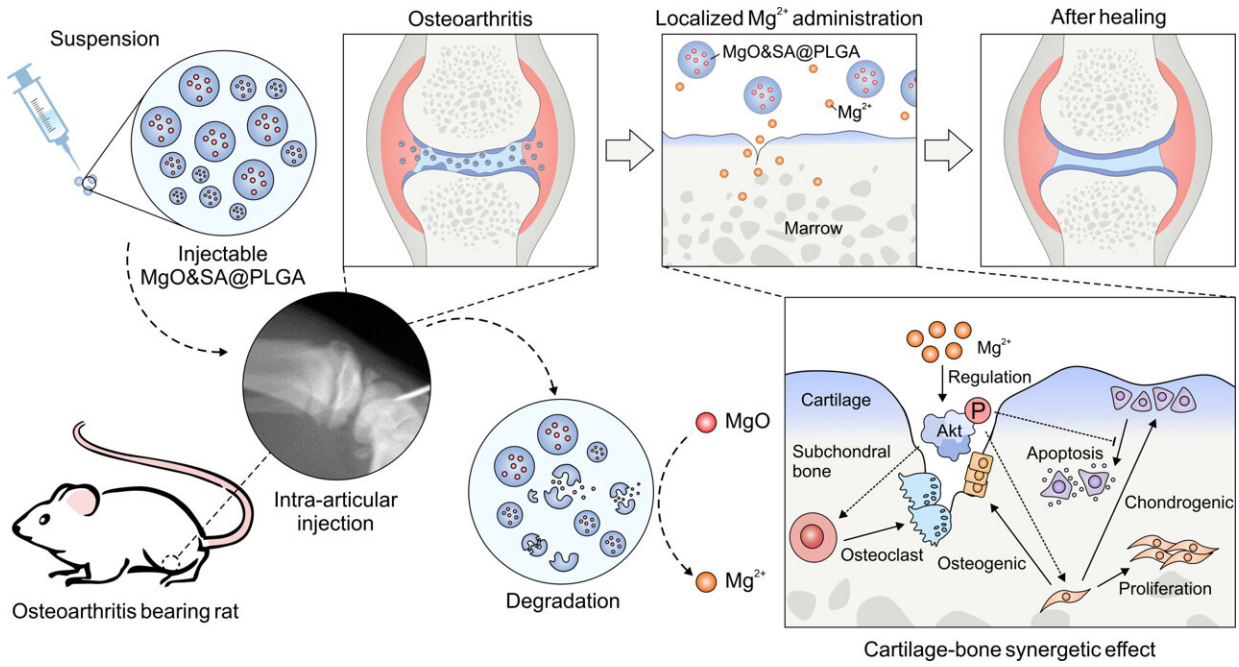

Schematic illustration. We fabricated MgO&SA@PLGA and performed intra-articular injection of MgO&SA@PLGA in rats. The sustainably released Mg^{2+} promoted proliferation and chondrogenic differentiation of BMSCs inhibited the formation of osteoblasts and osteoclasts via regulating the phosphorylation of AKT and protected cartilage and subchondral bone from osteoarthritic damage in vivo. Credit: *Science Advances* (2024). DOI: 10.1126/sciadv.adk6084

In a recent study published in *Science Advances*, researchers from Nanjing Drum Tower Hospital and others have unveiled a promising approach for treating osteoarthritis (OA) using engineered magnesium oxide (MgO) nanoparticles.

Osteoarthritis, a widespread joint disorder affecting millions globally, has long lacked efficient and cost-effective therapeutic solutions. The new method involves targeted regulation of magnesium ions (Mg^{2+}) to address both bone and cartilage issues associated with OA synergistically.

This innovation not only demonstrates the potential of magnesium in halting cartilage damage but also showcases the effectiveness of MgO nanoparticles encapsulated in microspheres for sustained release, providing a more convenient and durable treatment option.

Multi-tissue regulation by magnesium ions

The study's findings shed light on the multifaceted impact of magnesium ions, a vital component for maintaining bone and cartilage health. Experiments revealed that optimal Mg^{2+} concentrations effectively rescued damaged cartilage and regulated the behavior of bone marrow-derived stem cells (BMSCs).

Magnesium's role in inhibiting IL-1β–induced chondrocyte apoptosis and osteoclast formation through the PI3K/AKT pathway presents a comprehensive strategy for combating OA. The successful encapsulation of MgO nanoparticles in poly(lactic-co-glycolic acid) (PLGA) microspheres ensures stable and controlled Mg^{2+} release, demonstrating the potential for a single-injection, sustained therapy with positive outcomes in preclinical models.

Hope for future osteoarthritis therapeutics

This research not only addresses the complexities of osteoarthritis but also paves the way for a new era in cost-effective and targeted treatments.

The engineered MgO nanoparticles encapsulated in PLGA microspheres present a potential game-changer for clinical translation, offering a viable solution to the global burden of osteoarthritis. The study's success in protecting both cartilage and subchondral bone in preclinical models raises hope for improved patient outcomes and emphasizes the potential of magnesium-based therapies in revolutionizing osteoarthritis treatment strategies.

More information: Liming Zheng et al, Engineered MgO nanoparticles for cartilage-bone synergistic therapy, *Science Advances* (2024). DOI: 10.1126/sciadv.adk6084

Provided by Nanjing University

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