Adhesive Injectable Hydrogel-Loaded Exosomes for Advancing Osteoarthritis Therapy
Chien-Wei Lee¹, Ming Chin Tsai¹, Hao-Hsiang Wu¹, Yu-Fan Chen¹, Oscar K. Lee¹,²,³
¹Center for Translational Genomics & Regenerative Medicine Research, China Medical University Hospital, ²Department of Orthopedics, China Medical University Hospital, ³Institute of Clinical Medicine, National Yang Ming Chiao Tung University, Taiwan
oscarlee9203@gmail.com

Disclosures: To the best of our knowledge, all authors have no conflict of interest, financial or otherwise.

INTRODUCTION: Osteoarthritis (OA) poses a significant health burden with wide-reaching socioeconomic implications. Mesenchymal stem cell-derived exosomes (MSC-exosomes) hold promise for OA treatment, yet their swift clearance in vivo hampers therapeutic effectiveness. Thus, innovative strategies are needed to ensure efficient delivery and prolonged presence of exosomes at the injury site to optimize therapeutic outcomes.

METHODS: We developed an adhesive injectable hydrogel (aiGel) as a delivery platform for mesenchymal stem cell-derived exosomes (MSC-exosomes) to target and enhance their reparative potential in osteochondral defect regions. The destabilization of the medial meniscus (DMM) surgery was employed to create an osteoarthritis (OA) model in mice, followed by intra-articular injections of treatments one-month post-DMM surgery.

RESULTS SECTION: After treatment for one month, co-administration of MSC-exosomes with aiGel notably enhanced their retention within the joint cavity compared to MSC-exosomes alone. Co-treatment improved therapeutic efficacy by reducing cartilage destruction and promoting cartilage extracellular matrix regeneration. Remarkably, the combined therapy effectively alleviated pain associated with osteoarthritis in DMM mice, evidencing by gait analysis.

DISCUSSION: The adhesive injectable hydrogel (aiGel) allows for controlled exosome release. Further investigations are warranted to optimize dosage parameters, such as the minimal effective dose and maximal efficacy.

SIGNIFICANCE/CLINICAL RELEVANCE: aiGel provides a vehicle for efficient delivery and sustained release of therapeutic exosomes into the synovial cavity, presenting a promising avenue for treating OA. This combination approach opens new prospects for advancing OA treatment strategies.

REFERENCES: NA

ACKNOWLEDGEMENTS: This work was supported by the National Science and Technology Council, Taiwan (Reference No. 111-2320-B-039-070-MY3) and China Medical University Hospital (EXO-113-004; EXO-113-005; DMR-112-147; DMR-112-220). Experiments and data analysis were performed in part through the use of the Medical Research Core Facilities Center, Office of Research & Development at China medical University, Taichung, Taiwan, R.O.C.

IMAGES AND TABLES: