# DPSC-Derived Extracellular Vesicles Promote Rat Maxillofacial Bone Regeneration

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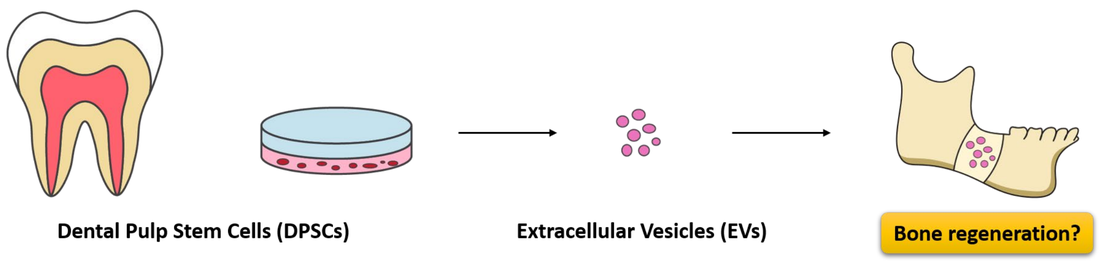
## INTRODUCTION

- Bone marrow-derived mesenchymal stem cells (MSCs) are widely explored in bone regeneration
- **Dental pulp stem cells (DPSCs)** were discovered 20 years ago
- **Extracellular vesicles (EVs)** facilitate cell-cell communication, angiogenesis, and immune regulation
- There is a lack of research on the effects of DPSC-derived EVs on craniofacial bone regeneration




## HYPOTHESIS

**DPSC-derived EVs have osteo-inductive effects on bone regeneration in a critical-sized mandibular bone defect model *in vivo***

## METHODS & MATERIAL

- Human DPSCs cultured and DPSC-secreted EVs isolated
- 24 female rats randomly divided into four groups:
  1. **Defect alone**
  2. **DPSC-EVs 100 µg/rat**
  3. **Collagen membrane**
  4. **Collagen membrane + DPSC-EVs 100 µg/rat**

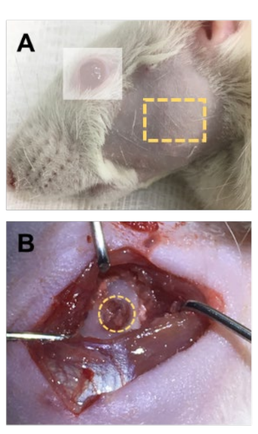



Figure 1. Surgical procedure creating a 3mm diameter defect

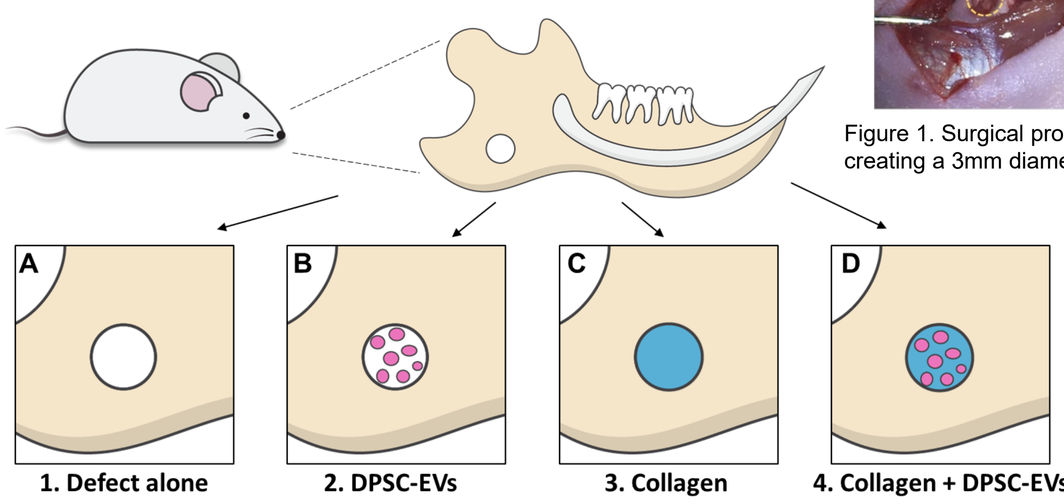



Figure 2. Graphical illustration of control and experimental groups and their treatment conditions

## RESULTS

**DPSC-derived EVs promote bone regeneration**

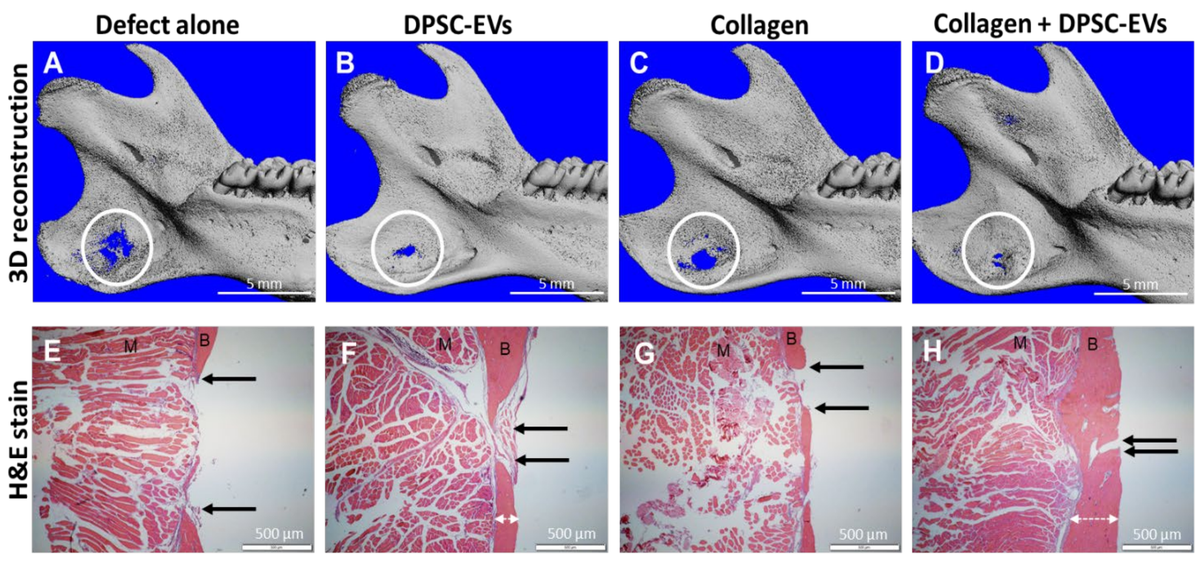



Figure 3. 3D reconstruction and histological analysis of critical-sized defects in rat mandible at 6 weeks. H&E staining showed increased bone growth and thickness for the groups treated with DPSC-EVs. M: muscle, B: bone matrix

## RESULTS (cont.)

**Combined application of collagen and DPSC-derived EVs promotes bone growth**

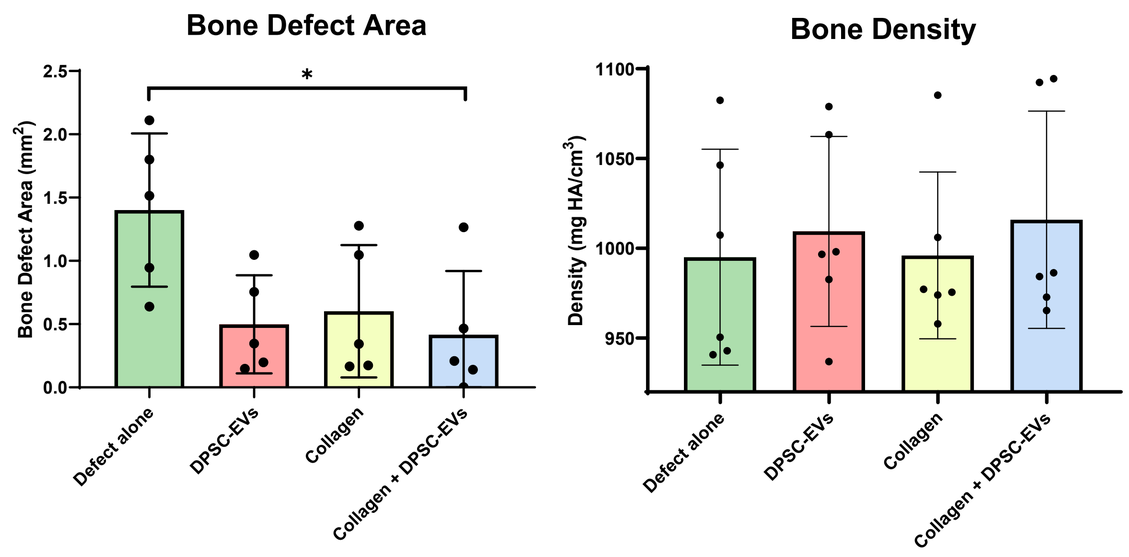



Figure 4. Bone area and density measurements of rat mandibular bone defect model

## CONCLUSION

- Our data suggest that DPSC-derived EVs possess **potent osteo-inductive effects on jaw-bone regeneration in rats**
- Combined use of **DPSC-EVs** and **collagen membrane** resulted in the smallest residual defect areas, suggesting **additive beneficial effects** on mandibular bone regeneration
- In current experimental condition, we did not observe statistically significant effects of DPSC-EVs on **bone density**

## FUTURE DIRECTIONS & IMPLICATIONS

- Future studies include immunohistochemistry, different timeframes, and evaluating effects on larger animal models
- DPSCs are a good candidate source of MSCs due to **abundant availability, accessibility, and rapid proliferation**
- Use of DPSC-derived EV products may provide a **safe and effective approach for craniofacial bone regeneration**

## KEY

**DPSC**, dental pulp stem cell; **EV**, extracellular vesicle; **MSC**, mesenchymal stem cell

## ACKNOWLEDGEMENTS

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