Active and Passive Mineralization of Bio-Gide® Membranes in Rat Calvaria Defects

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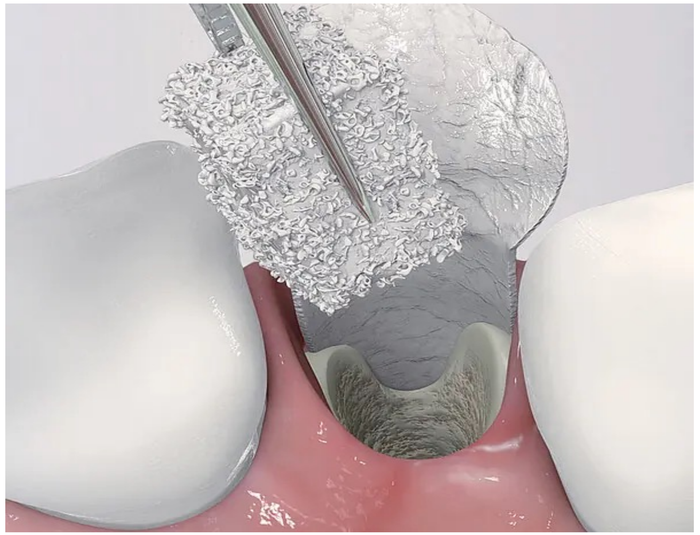
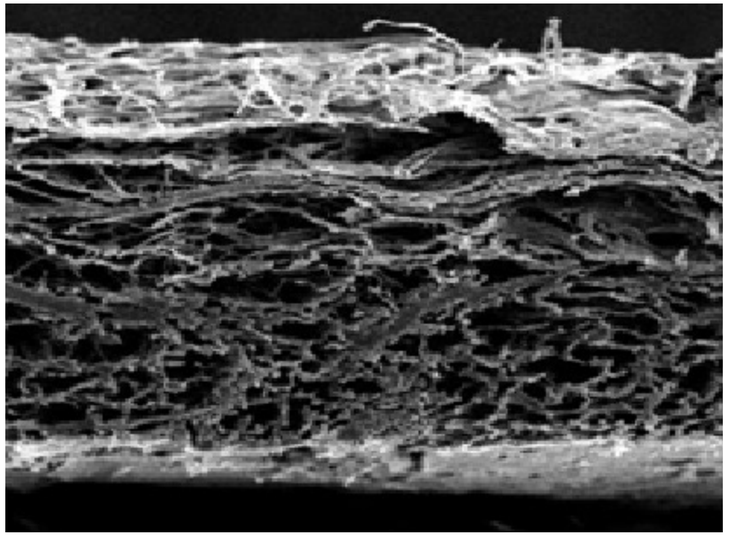
2024 ANNUAL MEETING

Background

In clinical cases with several bone loss, we opt for GBR as our preferred clinical method.



For several years, collagen membrane (CM) has been used only as a mechanical barrier in combination with bone grafts[1].



However, recent studies showed CM alone exhibits osteoconductive properties and can lead to spontaneous mineralization[2,3].

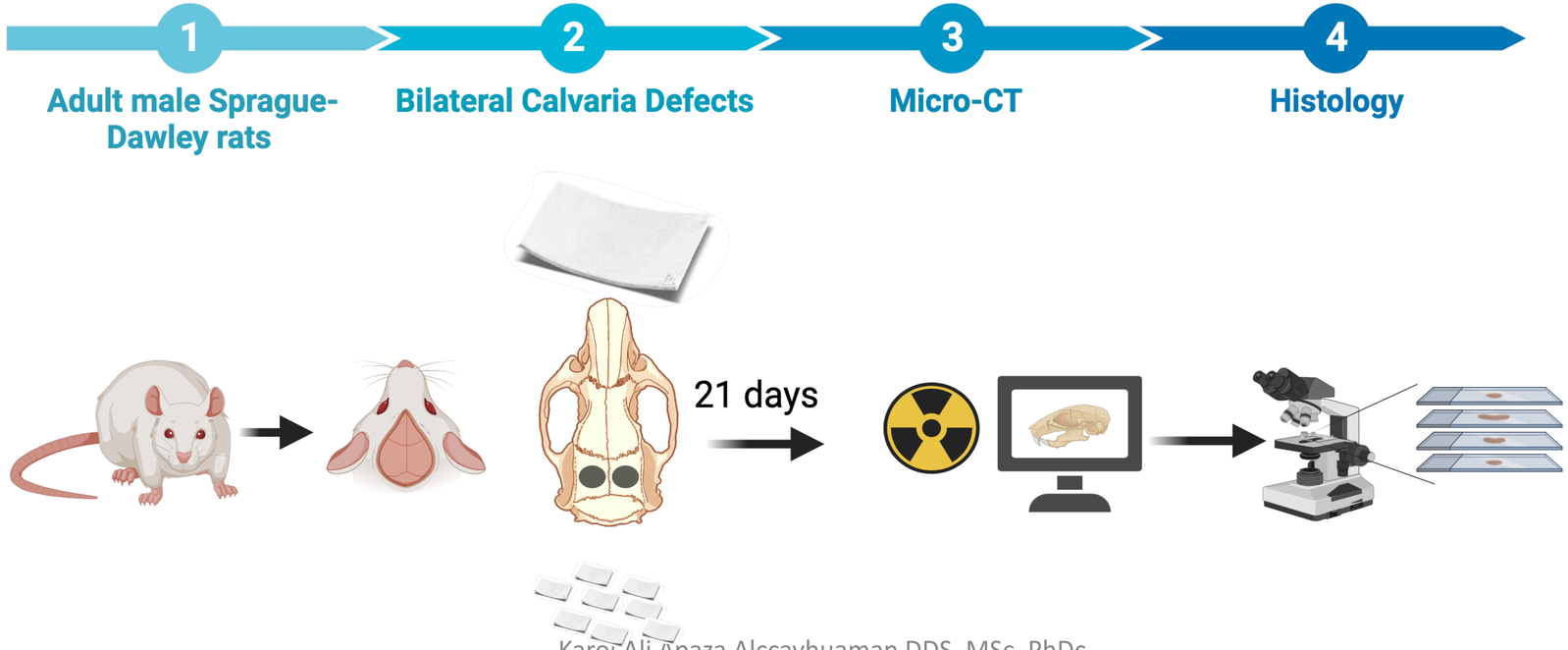
1. Mizraji, G.; Davidson, A.; Gursoy, M.; Gursoy, U.K.; Shapira, L.; Wilensky, A. Membrane barriers for guided bone regeneration: An overview of available biomaterials. *Periodontol 2000* **2023**,.
2. Feher, B.; Apaza Alccayhuaman, K.A.; Strauss, F.J.; Lee, J.S.; Tangl, S.; Kuchler, U.; Gruber, R. Osteoconductive properties of upside-down bilayer collagen membranes in rat calvarial defects. Int J Implant Dent 2021, 7, 50,
3. Alccayhuaman, K.A.A.; Tangl, S.; Blouin, S.; Hartmann, M.A.; Heimel, P.; Kuchler, U.; Lee, J.S.; Gruber, R. Osteoconductive Properties of a Volume-Stable Collagen Matrix in Rat Calvaria Defects: A Pilot Study. Biomedicines 2021, 9,

Hypothesis and Aim

Hypothesis: The use of minced CM will compromise the integrity of the membrane, thus disrupting its osteoconductive properties and spontaneous active mineralization.

Aim: We aimed to shift active mineralization in intact collagen membranes towards passive mineralization.

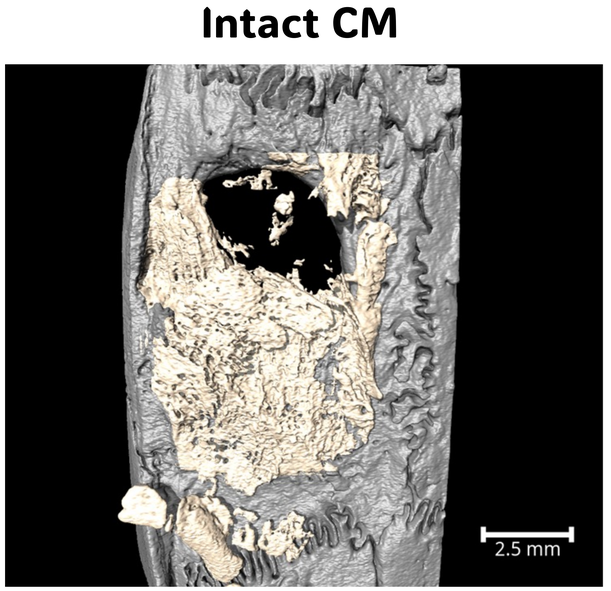
Material and Methods

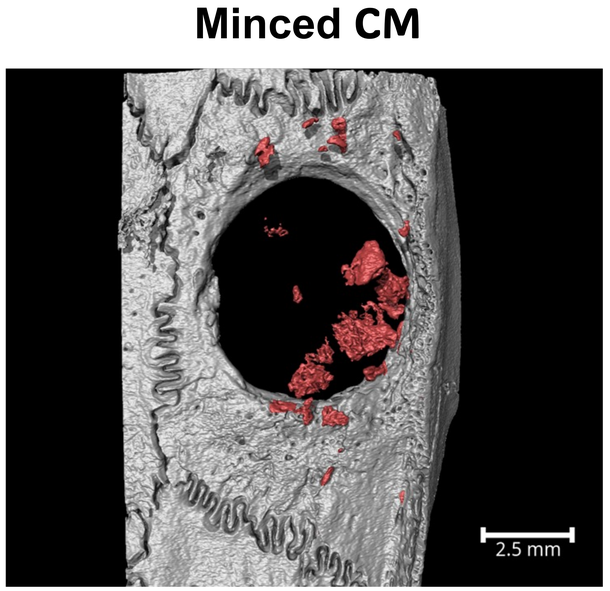


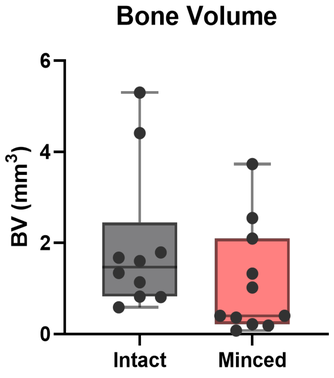
Results

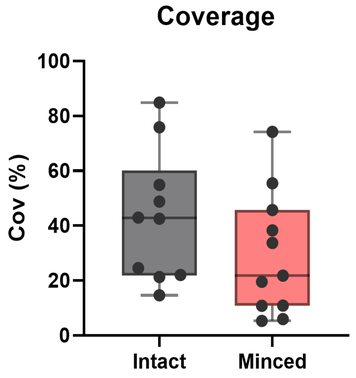
Micro- CT Analysis

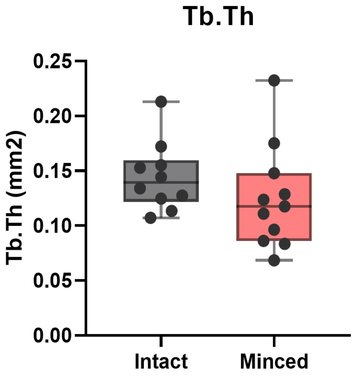
- 3D images depicted mineralized bone volume and bone islands in the minced group, which looked like real bone due to strong density.
- Bone Volume (BV), trabecular thickness (Tb.Th), and coverage in the minced group almost reached values similar to those in the intact group.







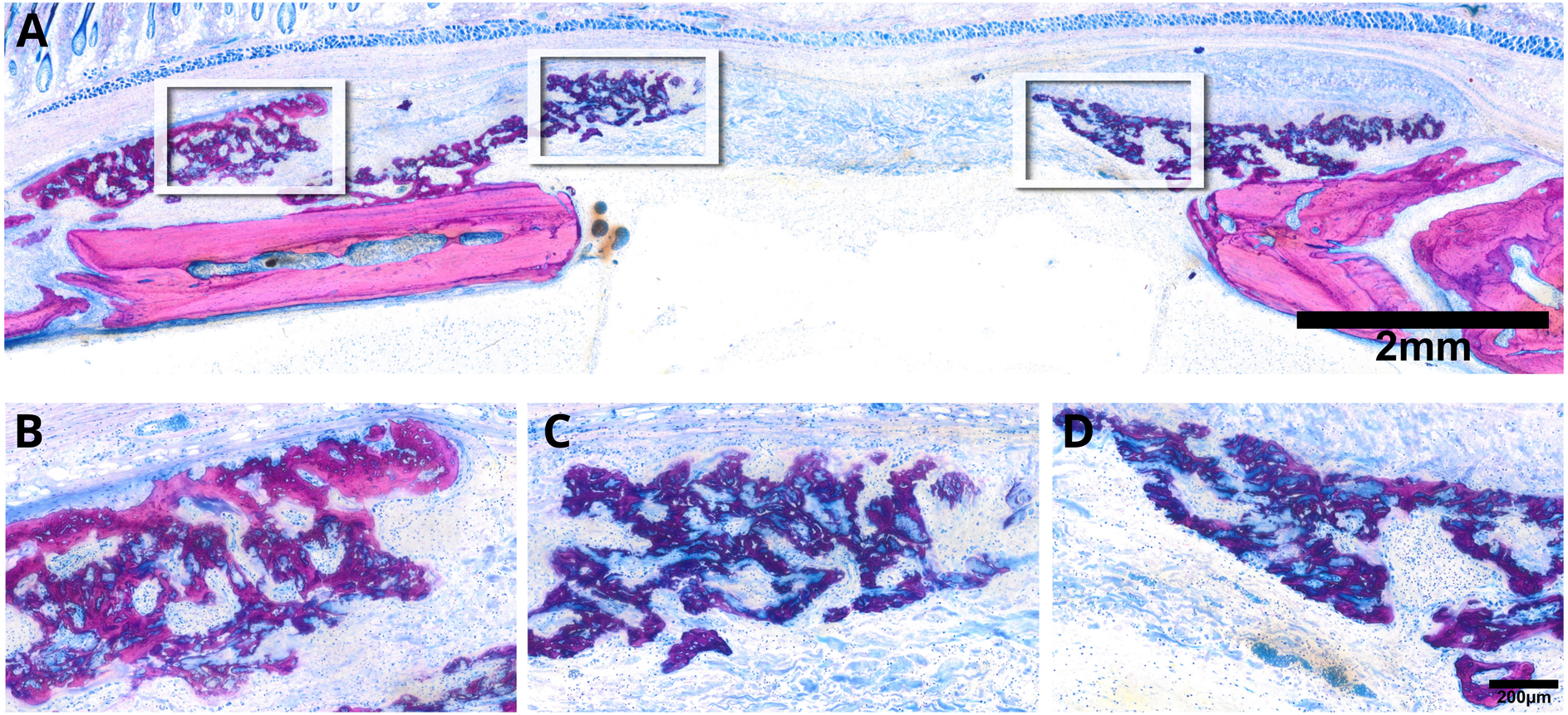




Histology

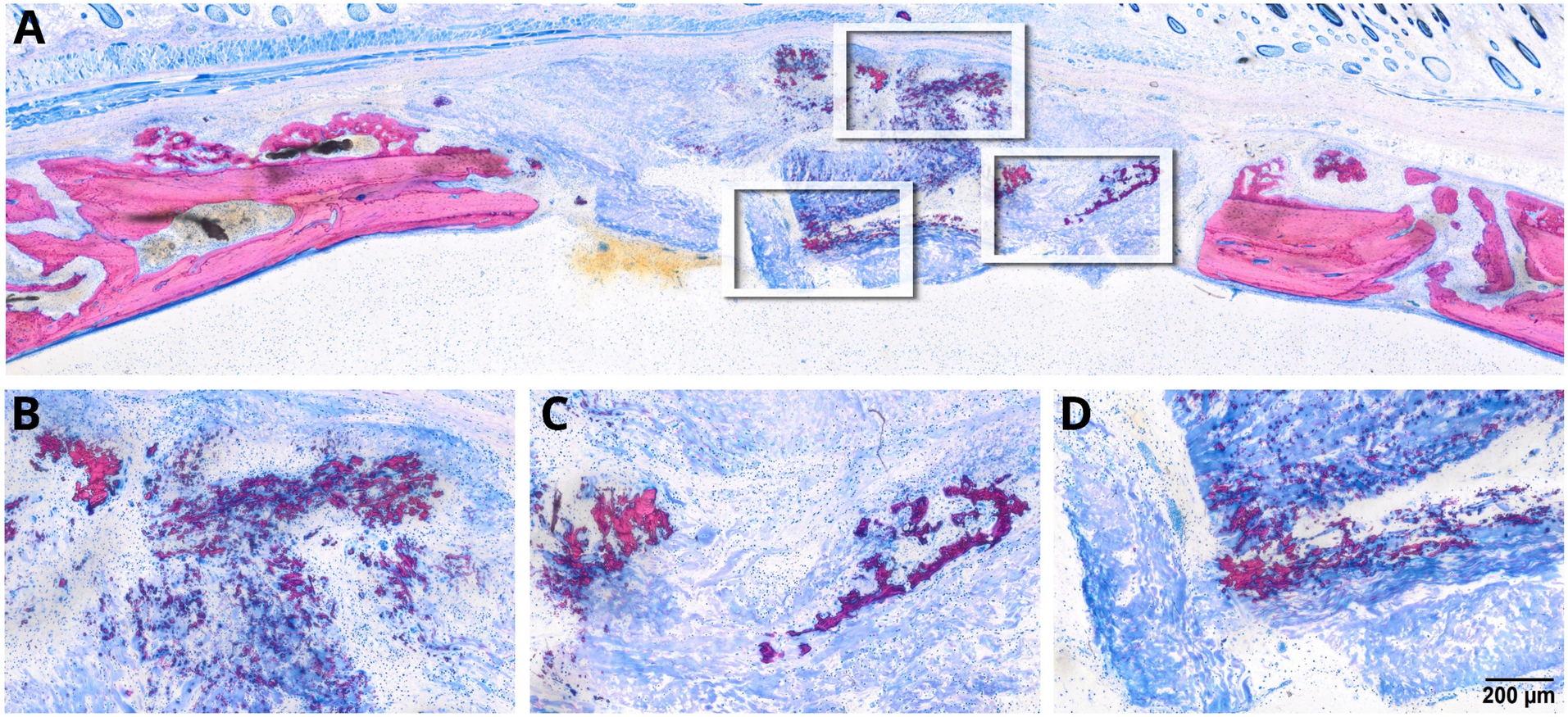
Intact CM

The image shows an intact CM(A), with new bone growth visible within it (B) and towards the center (C). This new bone contains collagen fibers from the membrane named hybrid bone (D).



Minced CM

The image shows a minced CM that has mineralized areas (A). There are clusters of fibers (B) resembling bone tissue, but no bone cells or osteoid matrix (C) were found. The mineralized collagen fibrils interconnect the membrane fragments (D).



Conclusion

Collagen membranes (CM) allow biomineralization, independent of bone cells and osteoid matrix. This is promising because we can exploit the intrinsic properties of CM to accelerate bone repair and regeneration in the clinical setting.