Autologous blood clots as a therapeutic vehicle for treatment of large, subcritical-sized femoral defects

David M. Richter[1], Sheridan Hayes[1], Di Lu[2], Ryan Luedtke[1], Megan A. Moore[1], Kristi Bailey[3], Tao Yang[2], Yong Li[1]

[1]Division of Biomedical Engineering, Dept. of Surgical Sciences, Western Michigan Univ. Homer Stryker MD School of Medicine

[2]Dept. of Cell Biology, Van Andel Institute, Grand Rapids, MI

[3]Dept. of Pathology, Western Michigan Univ. Homer Stryker MD School of Medicine

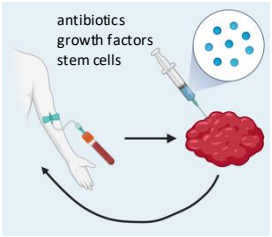
INTRODUCTION

Large, subcritical bone defects

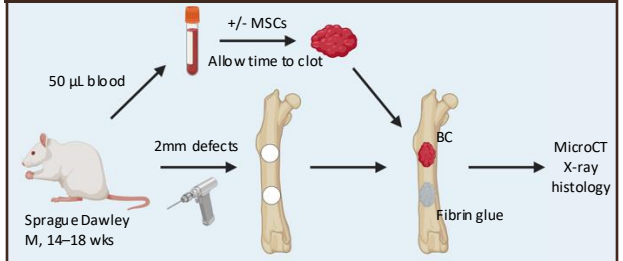
- Critical and large subcritical bone defects pose a therapeutic challenge, as they will become a nonunion. Especially infected defects.
- Current standard of care is mechanical stabilization and autologous bone grafting. Bone transplantation and distraction osteogenesis are alternatives.
- However, such approaches have notable drawbacks, including pain, infection risks, recovery time, and costs.
- Therefore, novel treatment alternatives are required.

Autologous blood clots (ABCs)

- Autologous blood clots (ABCs) may serve as an economical and effective scaffold for regenerative medicine applications
- Our lab has shown that ABCs:
  1. Improve healing of surgical skin wounds and cutaneous burns, and
  2. provide an effective e vehicle for sustained delivery of antibiotics to a local wound site
- Therefore, we investigated the ability of ABCs conjugated with mesenchymal stem cells (MSCs) to promote healing of femoral defects



METHODS



Also, MSCs were cultured in osteogenic media and osteogenic markers were quantified

RESULTS

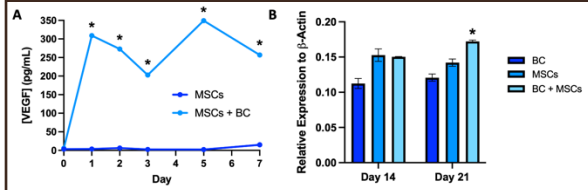


Figure 1. After culture in osteogenic media, there is an increase in VEGF released by MSCs when conjugated with BCs (A) and increased expression of COL1A1 at day 21 (B), suggesting enhanced osteogenic differentiation. Data presented as mean ± SD. * denotes $p < 0.05$. n=3

Figure 2. Femoral defects after being filled with control gel (white) or autologous blood clot preparations (black).

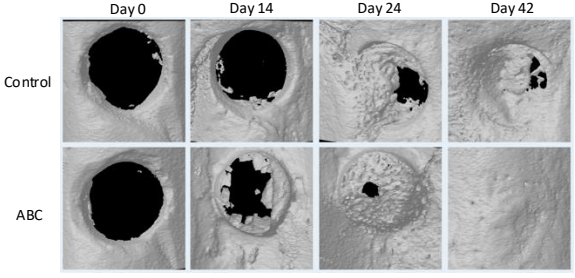


Figure 3. Three-dimensional microCT reconstructions of control- and ABC-treated femoral defects at time of defect creation and postoperative days 14, 24, and 42. Representative of n=3.

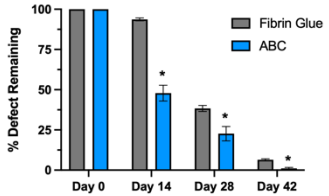


Figure 4. Percent defect remaining at 0, 2, 4, and 6 weeks. Data presented as mean ± SD. n=3. * denotes $p < 0.05$

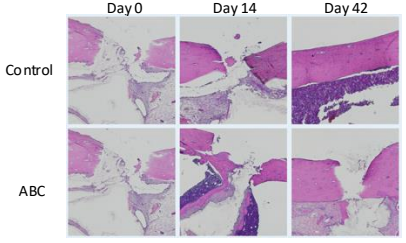


Figure 5. H&E staining of defects at 0, 2, and 6 weeks. n=1

CONCLUSION

- ABCs are an economical, quick, and easy to prepare biomaterial for regenerative medicine.
- ABCs appear to provide an effective therapeutic vehicle for the treatment of femoral defects in a rodent model.
- Ongoing research focuses on conjugation with additional materials and larger size defects

REFERENCES

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