**Surface Texture Alterations Change Mesenchymal Cell Proliferation on Additively Manufactured Zinc Implants**

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**Abstract:**

Advances in biomaterials and additive manufacturing (3D printing) are rapidly changing the way orthopedic implants are designed and implemented. Our lab has recently developed a method to 3D print medical grade Zinc, a biocompatible and biodegradable material, and a key micronutrient involved in human health. Zinc is a promising orthopedic biomaterial because it has been shown to stimulate the expression of a transcription factor related to the differentiation of stem cells to pre-osteoblast cells (precursor cells that become osteoblasts). Recent studies have shown that Zinc promotes osteoblast proliferation and increases mineralized matrix deposition via the cAMP-PKA-CREB signaling pathway. Positive effects of Zinc on osteoblast activity occur over a defined dose range. However, we still do not fully understand the relationships between Zinc implant surface texture and mesenchymal stem cell (MSC) behavior. In this bovine cell culture experiment, we sought to quantify survival of MSCs exposed to substrates of different textures and in the presence/absence of fibronectin. Cells attached more readily directly to zinc in comparison to implants coated with fibronectin. The influence of surface texture was insignificant by the 28-day timepoint. Ongoing research will extend this work into vivo models which would better characterize the responses for the human condition.