

## **Comparison of Reamer-Irrigator-Aspirator to Bone Marrow Aspirate Concentrate for Osteoprogenitor Cell Retention and Osteoinductive Protein Release on Cancellous Bone**

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**Purpose:** This study was undertaken to determine if bone harvested with RIA (Reamer-Irrigator-Aspirator) is associated with significantly higher osteoprogenitor cell concentration and osteoinductive protein elution compared to bone marrow aspirate concentrate (BMC) when cultured on human cancellous allograft.

**Methods:** With Animal Care and Use Committee approval (ACUC #9167), both BMC percutaneously harvested from iliac crest (7%) and 10-mm RIA from ipsilateral femur (3 passes) were collected from skeletally mature purpose-bred hounds (n = 3, F). ~250  $\mu$ L of BMC or RIA were used to saturate 2 cancellous allograft bone cubes per dog. Bone cubes (n = 6/type) were cultured individually in a 6-well plate for 7 or 14 days. On days 7 and 14 (n = 3/type/time point) cellular adherence to the bone block was determined using the microscopic cell viability stain calcein AM, and cellular adherence to the plate well was assessed. On day 3, 7, and 14 media were collected and assessed for leptin, platelet-derived growth factor (PDGF)-AA, PDGF-BB, SOST, vascular endothelial growth factor (VEGF), DKK-1, fibroblast growth factor (FGF)-23, osteocalcin, osteoprotegerin (OPG), osteopontin (OPN), and adrenocorticotrophic hormone (ACTH).

**Results:** Media Biomarker Concentration On day 3, BMC had significantly higher concentrations of DKK-1, EGF, OPN, and OPG compared to RIA. On day 7 BMC only had significantly higher concentrations of DKK-1, however RIA had a higher concentration of PTH. On Day 14 there were no significant differences in the concentrations between RIA and BMC. Bone Block Cell Adherence On day 7 and 14, BMC had extensive cell adhesion to bone block surface and infiltration into block. On the other hand, RIA had minimal cell adhesion to bone block surface and no infiltration into block. Well Surface Cell Adherence On day 14, BMC had both cell adhesion and expansion compared to RIA with no cell adhesion or expansion.

**Conclusion:** In this canine in vitro model with human allograft bone cubes, BMC had significantly higher concentrations of DKK-I, EGF, OPN, and OPG, while RIA had a significantly higher concentration parathyroid hormone. Furthermore, BMC had a higher number of progenitor cells on the bottom of the well and on the allograft cubes. These results were somewhat unexpected and prove the null hypothesis. To see if this holds true in humans, we are in the process of performing a prospective human clinical study. These results will help delineate the effectiveness and indications for each technique to augment bone healing.