Evaluation of Bone Regeneration within a Critical-Sized Calvarial Defect in Athymic Rats Utilizing a DBM/AM Composite

Qing-Qing Qiu[a], H. Vince Mendenhall[b], David S. Garlick[b], Jerome Connor[a]
[a]LifeCell Corporation,
[b]Charles River Laboratories

Purpose: This study was to investigate the bone-regenerative potential of a demineralized bone and acellular matrix (DBM/AM) composite in comparison with autologous bone using a rat calvarial defect model.

Methods: Critical-sized calvarial defects (5mm) were created in athymic rats. The defects were grafted with either the DBM/AM composite (AlloCraft™ DBM, Stryker Spine, Allendale, NJ) or the acellular human dermal matrix (AM), and compared to the defects filled with autologous bone (positive control) and the empty defect (negative control). Histological and radiographic assessments were carried out at four and eight weeks after surgery to determine the biological healing, the amount and type of new bone formation and the percentage of new bone filled in the critical defects.

Results/Discussion: At four weeks, DBM/AM composite group had the highest percentage of the defect filled with new bone (84%), which was significantly greater than autologous bone (62%), AM (41%) and untreated control (32%) groups. At eight weeks, the DBM/AM continued to have the highest percentage of the defect filled with new bone (91%). The autologous bone group increased the percentage of bone fill to 83%. The defects either filled with AM or left untreated still had less of the defect filled with new bone, 57% and 33%, respectively. The total healing of defects grafted with DBM/AM was comparable to autologous bone group at 8 weeks (Figure 1).

Conclusions: The results demonstrated that the DBM/AM composite promoted new bone formation more rapidly than autologous bone at calvarial defect in athymic rats. The study supports that the DBM/AM composite is a potential substitute of autologous bone for bone repair.

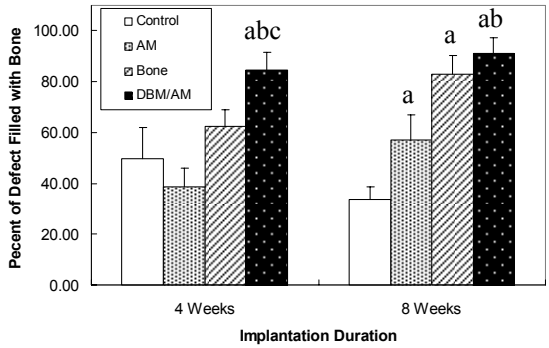

Figure 1. Histomorphometric analysis of area of new bone. a: statistically significant difference as compared to the control (empty defect); b: statistically significant difference as compared to the AM; c: statistically significant difference as compared to the autologous bone.

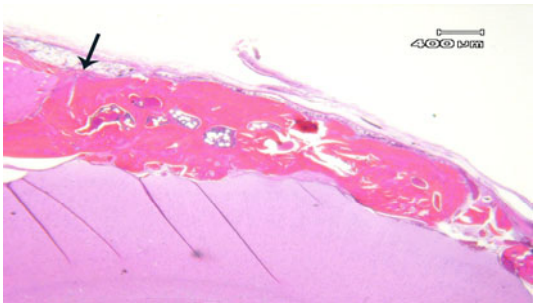

Figure 2: Low power photomicrograph of defect at eight weeks treated with DBM/AM showing complete healing and deposition of new bone; complete integration with wound margins at arrow.

References: Qiu Q, Mendenhall HV, Garlick DS, Connor J (10 Oct 2006). *J Biomed Mater Res Part B: Appl Biomater.*