Introduction: The purpose of this study was to determine the performance characteristics of InterGro® DBM Paste and InterGro® Plus BGS as suitable autograft replacements and extenders in a rabbit bilateral posterolateral spine fusion model. InterGro® Paste is DBM (35% w/w) in a natural lecithin carrier. InterGro® Plus is DBM combined with resorbable HA-calcium carbonate ceramic granules (Pro Osteon® 500IR) in a lecithin carrier. Lecithin is composed of phospholipids and has been shown to enhance the osteoinductive capabilities of DBM(1). The DBM/lecithin combination found in InterGro® Paste and Plus provide a superior handling osteoinductive BGS ideal for spine fusion procedures.

Materials and Methods: Skeletally mature New Zealand White Rabbits weighing 4.5-5.5 kg were obtained from Myrtal Rabbitry (Thompson, TN) and entered into the study. All procedures were approved by the Institutional Animal Care Use Committee (#0606109) and conducted at the Bone Healing Research Lab, Iowa Spine Research Center-Oakdale Division. Throughout the study, animals were individually caged and monitored daily for signs of pain and discomfort.

A single level posterolateral intertransverse process fusion was performed in 50 rabbits, bilaterally at L5-L6, with autogenous bone graft (3.0cc/side) from the iliac crest, InterGro® Paste (3.0cc/side), InterGro® Plus (3.0cc/side), deactivated (D)-InterGro® Paste (3.0cc/side) or a combination of InterGro® DBM + autograft (3.0cc/side in 50/50 mix). All InterGro® used in this study was made from pooled rabbit DBM. DBM and D – DBM were validated in an in-vivo athymic rat muscle pouch assay and an in-vitro bioassay(2) to be osteoinductive and non-osteoin-ducive, respectively. All the rabbits were radiographed postoperatively and then weekly until euthanasia at 8 weeks. Following necropsy, high resolution Faxtron radiographs were obtained of the explanted spines.

Results: Radiographic fusion was judged by continuous trabecular continuity between the affected transverse processes. At least one side of the spine had to have continuous bridging bone between the transverse processes to be classified as fused. The autograft group had a 44% fusion rate (4/9). In the InterGro® Paste group, 30% (3/10) of the spine were fused on at least one side. The InterGro® Plus group had a 60% (6/10) fusion rate at 8 weeks. The InterGro® Paste + autograft (50/50 mix) group had a similar radiographic fusion rate (50%, 4/8) as the autograft alone group. There was no evidence of radiographic fusion in the D - InterGro® Paste group (0/10).

Manual Palpation: Stiffness of the fused motion segment was assessed by manual palpation. The fusion was graded by three independent blinded observers as “solid” if no detectable motion at the disc space was detected in flexion and extension. The fusion was graded as “not solid” if motion was present. Final results were determined by agreement of at least 2 of the 3 observers.

The autograft group had a 56% fusion rate (5/9). In the InterGro® Paste group, 30% (3/10) of the spine were fused on at least one side. The InterGro® Plus group had a 60% (6/10) fusion rate at 8 weeks. The InterGro® Paste + autograft (50/50 mix) group had a similar radiographic fusion rate (63%, 5/8) as the autograft alone group. There was no evidence of radiographic fusion in the D - InterGro® Paste group (0/10).

Histology: Specimens from each group were sectioned and examined by a board certified veterinary pathologist. New bone formation, inflammation, and graft resorption, were assessed and scored. The groups had distinct general differences in histologic scores, most notably the D - InterGro® Paste animals had the least average score for new bone formation and evidence for residual graft aggregates. New bone formation was highest in InterGro® Paste + autograft (2.875) followed closely by autograft (2.79), InterGro® Plus (2.75), and InterGro® Paste (2.625).

Discussion: This study demonstrates the efficacy of InterGro® Paste and InterGro® Plus in a rabbit posterolateral fusion model. This model has been used to verify autograft extenders/enhancers with reproducible results.

The manual palpation fusion rate of 56% observed in the autograft control group is consistent with the rate demonstrated in prior studies performed in this laboratory as well as other published studies. InterGro® Paste + autograft and InterGro® Plus demonstrated similar fusion rates to the autograft controls. The ability of the InterGro® Paste to homogenously mix with the morcelized autograft allowed a continuous mixture of substrate with minimal void within the graft site for new bone to develop and fuse the motion segment.

Radiographic fusion assessment and histologic analysis concurred with the manual palpation results. The results of this rabbit study suggest that InterGro® Paste + autograft and InterGro® Plus are effective in producing a posterolateral fusion by radiographic and manual palpation criteria in an extender/enhancer and replacement mode respectively. While animal models can not be translated into clinically successful human applications, the results of this study suggest that further investigation into use of InterGro® DBM in a human clinical setting would be appropriate.