AGUMENTATION OF SPINAL FUSION WITH A DEMINERALIZED BONE/HYALURONAN MATRIX

INTRODUCTION
Autogenous iliac crest bone graft continues to be the material of choice for posterolateral lumbar intertransverse process spine fusion. However, continued interest lies in developing bone graft alternatives that can be used as either graft extenders, graft enhancers, or graft substitutes. It was the purpose of this study to evaluate the efficacy of a demineralized bone matrix/hyaluronan formulation as a bone graft enhancer to autograft in rabbit posterolateral spine fusion. For this study, we chose to use an established bone paucity model of posterolateral spine fusion (1).

EXPERIMENTAL METHODS
Posterolateral spine fusion was performed between lumbar vertebra L5 and L6 in 100 skeletally mature New Zealand White rabbits. The rabbits were block randomized into four groups: two control groups and two experimental groups (Table 1). In the experimental groups, demineralized bone matrix/hyaluronan (DBX, Musculoskeletal Transplant Foundation, Edison, NJ) putty was used as an adjunct to 0.7 g of autogenous bone graft in either a 1:1 ratio (by weight) of DBM/HA:autogenous bone graft (Group 3) or a 2:1 ratio (Group 4). The cortical bone (bilateral femora and tibias) of 40 euthanized New Zealand White rabbits were processed into DBM/HA using techniques similar to a commercially available formulation (DBX, Musculoskeletal Transplant Foundation, Edison, NJ).

The fusion rates as determined by a manual palpation test were 0% (Group 1), 13% (Group 2), 13% (Group 3), and 38% (Group 4). The addition of DBM/HA putty to autograft bone in ratio of 2:1 (Group 4) improved the rate of spinal fusion (p < 0.001, Fisher’s Exact Test).

In the autograft-alone groups, the mean bone volumes (+ SEM) of the fusion mass as determined by CT scans were 768.5 +/- 58.3 mm³ and 1224.7 +/- 98.7 mm³ for Groups 1 and 2, respectively (Figure 1). In the DBM/HA groups, mean bone volumes were 1637.4 +/- 72.9 mm³ and 2305.1 +/- 107.2 mm³ for Groups 3 and 4, respectively. The addition of DBM/HA to autograft bone was found to increase mineralized bone volume (Groups 1 versus 3, 1 versus 4, 2 versus 3 and 2 versus 4, p < 0.05, One-Way Anova; post hoc analysis using the Bonferroni test for multiple comparisons). The mineralized bone volume was greater when DBM/HA putty was used in a 2:1 ratio (DBM/HA:autogenous bone graft) when compared with a 1:1 ratio (p < 0.05, One-Way Anova: Bonferroni post hoc analysis). Furthermore, fused spines recorded greater fusion mass when compared to non-fused spines (p < 0.01, Mann–Whitney U Test).

CONCLUSIONS
The results of this study indicate that allogeneic demineralized bone matrix/hyaluronan putty enhances rabbit posterolateral spinal fusion when used as an adjunct to autogenous bone graft. The fusion rate was greater when DBM/HA was used in conjunction with autograft bone consistent with increased bone volume as determined by CT images (approximately 113% to 200% greater; Groups 3 and 4, respectively). The results of this study indicate that DBM/HA putty is highly osteoinductive. Newer demineralized bone matrix formulations may have a clinical role as an adjunct to autogenous bone graft in posterolateral spinal fusion.

REFERENCES