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Spine Fusion Using Cell Matrix Composites Enriched in Bone Marrow-Derived Cells

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Bone marrow-derived cells including osteoblastic progenitors can be concentrated rapidly from bone marrow aspirates using the surface of selected implantable matrices for selective cell attachment. Concentration of cells in this way to produce an enriched cellular composite graft improves graft efficacy. The current study was designed to test the hypothesis that the biologic milieu of a bone marrow clot will significantly improve the efficacy of such a graft. An established posterior spinal fusion model and cancellous bone matrix was used to compare an enriched cellular composite bone graft alone, bone matrix plus bone marrow clot, and an enriched bone matrix composite graft plus bone marrow clot. Union score, quantitative computed tomography, and mechanical testing were used to define outcome. The union score for the enriched bone matrix plus bone marrow clot composite was superior to the enriched bone matrix alone and the bone matrix plus bone marrow clot. The enriched bone matrix plus bone marrow clot composite also was superior to the enriched bone matrix alone in fusion volume and in fusion area. These data confirm that the addition of a bone marrow clot to an enriched cell-matrix composite graft results in significant improvement in graft performance. Enriched composite grafts prepared using this strategy provide a rapid, simple, safe, and inexpensive method for intraoperative concentration and delivery of bone marrow-derived cells and connective tissue progenitors that may improve the outcome of bone grafting.

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List of Abbreviations

BMP	bone morphogenetic protein
EGF	epidermal growth factor
FGF	fibroblast growth factor
PDGF	platelet-derived growth factor
TGF-beta	transforming growth factor-beta
IGF	insulinlike growth factor