Pediatric BMSC Exosome Treatment Requires Interaction With Bone Tissue Defect Environment To Improve Bone Repair

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Exosomes secreted by pediatric bone marrow mesenchymal stem cells (pBMSC-Exos) demonstrate optimal characteristics for bone tissue engineering. MSC-Exos of alternate origin have expedited bone formation, but pBMSC-Exos have not been studied to repair bone tissue defects. This novel study isolated interactions of pBMSC-Exos with osteoprogenitor cells in standard growth media to elucidate pBMSC-Exos' role in osteoblast mineralization. Additionally, this study evaluated the efficacy of pBMSC-Exos to expedite the healing cascade through Micro-CT image analysis of calvarial defects with pBMSCs and subsequent secreted factors. Preosteoblast cells with pBMSC-Exos, along with additional experimental groups of pBMSCs and pBMSC microvesicles, did not display a significant increase in bone mineralization. Conversely, Micro-CT image analysis from four weeks post-op revealed that defects with pBMSC-Exos healed significantly more (35.24%) than defects with pBMSC microvesicles (17.22%) and pBMSC cells (9.88%)($p = 0.0003$). The superior efficacy of pBMSC-Exos in bone tissue defect environments, coupled with lack of success when isolated with osteoprogenitor cells, suggests that the osteoblasts are not the primary target cells for pBMSC-Exo uptake. Results support growing research that pBMSC-Exos communicate with related biological factors in bone tissue defect environments, such as those involved in angiogenesis and ECM deposition, to mediate their efficacy. This novel form of bone tissue engineering with pediatric BMSC-Exos has primary applications for increasing the efficacy procedures for pediatric patients with skeletal defects.

Awards Won:
Second Award of $2,000