Evaluation of MSC Source on Angiogenesis in 3D Co-Culture

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Osteogenesis and angiogenesis are coupled during bone formation and healing. Pre-vascularization as a strategy for clinical-scale tissue engineering relies on this co-dependence in attempt to generate large volume bone scaffolds for implantation. Although the osteo-differentiation of MSCs has been well characterized for a variety of cell sources, the potential of these MSCs to induce angiogenesis in co-culture with ECs has not. We aim to characterize angiogenic response of multiple commercially-available MSC sources with two distinct EC populations. Endothelial cells were obtained as commercially-available HUVECs or umbilical cord-blood derived endothelial colony-forming cells (ECFCs). EC aggregates were co-cultured with MSCs, purchased from Lonza or RoosterBio, either in suspension or within the aggegrate. Cells were embedded in fibrin hydrogels as previously described and cultured for up to 3 weeks under media conditions optimized for network formation. Samples were fixed, and stained for CD31 (HUVEC), UEA lectin (ECFC) or αSMA (MSC). Extensive, interconnected vessel structures were formed in all four combinations. The highest vessel structure area was observed using HUVECs and Lonza MSCs co-aggregates, resulting in a total area of 1.6 mm^2. RoosterBio MSCs resulted in significantly larger diameter vessels when cultured in suspension with ECFC aggregates compared to Lonza MSCs (28.0±4.4 μm vs 16.2±1.7 μm, $p<0.001$). In conclusion, we describe the angiogenic potential of MSC sources in distinct co-culture systems.

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