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The Efficacy Of Intrinsic Cartilage Mesenchymal Stem Cells To Produce Native-Like Graft Tissue For Cartilage Injury.

Trauma / Knee & Lower Leg Trauma / Surgical Treatment

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Background
Autologous chondrocyte implantation (ACI) is the gold standard for treating traumatic osteochondral defects but is limited by chondrocyte dedifferentiation, leading to fibrocartilaginous repair and possible inflammation. Cartilage-derived progenitor cells (CPCs), a subset of mesenchymal stem cells (MSCs), may overcome these limitations through enhanced proliferative and chondrogenic capacity.

Objectives
To assess the ability of CPCs to generate native-like cartilage and promote integration within a cartilage defect model.

Study Design & Methods
Disc ring (DR) constructs (n=72) were prepared from non-diseased human cartilage. The central disc was replaced with native cartilage, chondrocyte-seeded agarose, or CPC-seeded agarose, and cultured for four weeks. Integration was evaluated via 2B6/DMMB staining, and matrix production quantified using DMMB assay and collagen fluorescence imaging.

Results
Cartilage–cartilage DRs showed limited cell migration at the defect margin. Chondrocyte-seeded constructs demonstrated poor integration and minimal glycosaminoglycan (GAG) deposition. In contrast, CPC-seeded constructs displayed strong DMMB staining, viable GAG-producing cells, and migration into the wound site. CPC explants showed significantly higher collagen ($p<0.001$) and GAG ($p<0.01$) content compared to both cartilage and chondrocyte controls.

Conclusions
CPCs form tissue closely resembling native cartilage, with superior matrix synthesis and integration compared to chondrocytes. These findings support CPCs as a promising alternative to chondrocytes in ACI, which may improve outcomes in traumatic cartilage repair.

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