Arthroscopic airbrush assisted cell implantation for cartilage repair in the knee: a controlled laboratory and human cadaveric study.

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Abstract:

OBJECTIVE: The objective of this study was to investigate the feasibility of arthroscopic airbrush assisted cartilage repair.

METHODS: An airbrush device (Baxter) was used to spray both human expanded osteoarthritic chondrocytes and choncrocytes with their pericellular matrix (chondrons) at 1 x 10(6) cells/ml fibrin glue (Tissucol, Baxter) in vitro. Depth-dependent cell viability was assessed for both methods with confocal microscopy. Constructs were cultured for 21 days to assess matrix production. A controlled human cadaveric study (n = 8) was performed to test the feasibility of the procedure in which defects were filled with either arthroscopic airbrushing or needle extrusion. All knees were subjected to 60 min of continuous passive motion and scored on outline attachment and defect filling.

RESULTS: Spraying both chondrocytes and chondrons in fibrin glue resulted in a homogenous cell distribution throughout the scaffold. No difference in viability or matrix production between application methods was found nor between chondrons and chondrocytes. The cadaveric study revealed that airbrushing was highly feasible, and that defect filling through needle extrusion was more difficult to perform based on fibrin glue adhesion and gravity-induced seepage. Defect outline and coverage scores were consistently higher for extrusion, albeit not statistically significant.

CONCLUSION: Both chondrons and chondrocytes can be evenly distributed in a sprayed fibrin glue scaffold without affecting viability while supporting matrix production. The airbrush technology is feasible, easier to perform than needle extrusion and allows for reproducible arthroscopic filling of cartilage defects.