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Platelet lysate paradox: Loss of phenotype, but improved redifferentiation of articular chondrocytes

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INTRODUCTION: Osteoarthritis and focal cartilage defects in the knee occur frequently. With increasing life expectancy, the need for therapies other than knee replacement is growing. Since the intrinsic repair capacity of cartilage is limited, other ways to stimulate cartilage regeneration are being explored. Platelet-rich plasma (PRP) is a blood product containing high growth factor levels and can be used in versatile applications [1]. PRP can be injected intra-articularly for the treatment of knee osteoarthritis. Moreover, platelet lysate (PL) is used for the expansion of cells for cell therapy [2]. This study aims to investigate the potential of using PL to stimulate cartilage matrix production by chondrocytes in vitro. In addition, the potential of PRP as a 3D cell carrier is explored.

METHODS: PRP and PL were prepared from human blood and platelet enrichment in PRP was determined. Human chondrocyte monolayers were subjected to a range of PL concentrations for 7 days. Cell proliferation and morphology were assessed. Expression of chondrogenic genes was determined by RT-PCR. Next, chondrocytes were brought back into 3D culture and cartilage matrix production was assessed after 28 days. Outcomes were cartilage extracellular matrix (ECM) formation by biochemical assays (glycosaminoglycans (GAG), collagen, and DNA quantification), gene expression analyses and histology. Next, PL was used at 1% and 5% as a supplement for redifferentiation of chondrocytes in pellets with similar outcomes on cartilage ECM production. Finally, PRP was used to make chondrocyte-loaded 3D gels.

RESULTS & DISCUSSION: PL had a dose-dependent effect on chondrocyte proliferation, but expression of chondrogenic markers was decreased. When brought back into 3D pellet culture, GAG production after 28 days was significantly higher for chondrocytes that were expanded with 1% PL compared to controls. When used for redifferentiation of chondrocyte pellets, PL decreased GAG and collagen production. This was confirmed by (immuno)histochemistry. Finally, chondrocyte-containing PRP gels showed similar results in terms of low GAG and collagen production. Again, this was confirmed by histology.

CONCLUSIONS: Platelet lysate stimulates chondrocyte proliferation in 2D monolayer and cartilage ECM production in subsequent 3D pellet culture. However, this does not work for high levels of PL. Furthermore, PL and PRP are not suitable for redifferentiation of chondrocytes.

REFERENCES

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