Proceedings of German Society for Stem Cell Research (PGSSCR)

Influence of platelet rich plasma (PRP) on chondrogenic differentiation and proliferation of chondrocytes (CC) and mesenchymal stem cells (MSC)

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Published online on 16 May 2007

Introduction:

Our clinical aim is to develop a one-step procedure for autologous chondrocyte transplantation, i.e. harvesting, isolation and reimplantation of CCs performed in one surgical procedure. Consequently there wouldn’t be an increase in cell number. The use PRP, a mitogenic agent, might compensate for this. The aim of this study was to test the influence of PRP on proliferation and differentiation of freshly isolated CCs. In parallel, we submitted MSC to the same experimental set-up.

Material and Methods:

Cartilage from adult sheep was collected and CCs isolated via digestion. After removal of undigested cartilage, cells were directly submitted to the experiment. MSCs were obtained using a standardized protocol, expanded and dealt with analogous to CCs. PRP extracts were produced according to published protocols. We had six different treatment groups: (1) Cells cultured as a micromass (MM); (2) same as (1) but with the addition of activated PRP; (3) cells suspended in a fibrin sealant; (4) cells suspended in a PRP clot; (5) cells in monolayer (ML); (6) same as (5) but with addition of activated PRP. Chondrogenicity was assessed via quantification of collagen type II mRNA (Col_II_mRNA) and immunohistochemical analysis.

Results:

MM culture best conserved the chondrogenic phenotype of CCs. Addition of PRP diminished significantly the amount of expressed Col_II_mRNA. Culturing freshly isolated CCs in ML led to a significant reduction of Col_II_mRNA compared to MM; here, addition of PRP had only a weak influence on chondrogenicity. For MSCs, MM culture showed the highest level of Col_II_mRNA. Addition of PRP reduced expression rate. Still, a 3D-growth together with PRP led to a higher expression level of Col_II_mRNA compared to ML.

For both cell types a proliferative effect of PRP was observed.
Discussion and Conclusions:

Freshly isolated CCs combined with PRP lose their chondrogenic phenotype during in vitro culture. Loss of chondrogenicity seems to be connected with an increase in proliferation. According to our results, it might be possible that MSCs combined with PRP could improve the healing of cartilage defects in vivo.