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Effects of autologous platelet-rich plasma on the metabolism of human articular chondrocytes
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Purpose: Platelet-rich plasma (PRP) is a fraction of plasma in which platelets are concentrated and is reported to be utilized as a source of multiple growth factors. Recent basic studies have shown that autologous PRP has a promotoive effect on chondrocyte metabolism. For the clinical application of PRP to cartilage defects, it is essential to use autologous prepared PRP in each case. The purpose of this study was to examine the effect of autologous PRP on adult human chondrocytes.

Methods and Materials: Fresh blood (54ml) and cartilage tissue were obtained from three patients (mean age: 57.0±6.9) underneath total knee arthroplasty with their consent. Platelet poor plasma (PPP) and PRP were prepared using a platelet concentration system. Chondrocytes were isolated with enzymatic digestion and cultured in monolayer. WST-8 was used for cell proliferation assay. Gene expression of types I, II collagen and aggrecan were examined with a relative quantitative real time RT-PCR assay.

Results: The concentrations of PDGF and TGF-betas in the PRP were much higher than those in the PPP. The WST-8 assay showed a higher absorbance in the PRP group, which reflects an enhancement of cell proliferation. PRP significantly enhanced type II collagen synthesis by human chondrocytes, while their aggrecan synthesis was inhibited.

Conclusions: We demonstrated for the first time that autologous PRP stimulated proliferation and collagen synthesis of adult human chondrocytes. PRP is easy to prepare and utilizes both soluble platelet releasate and fibrin gel. The results of this study suggested the usefulness of autologous PRP for the treatment of cartilage defects.

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Effects of Hyperbaric oxygen on the expression of interleukin-1β, matrix metalloproteinases, and tissue inhibitors of matrix metalloproteinases in human degenerated intervertebral disc cells
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Purpose: An imbalance between matrix metalloproteinases (MMPs) and tissue inhibitors of matrix metalloproteinases (TIMPs) has been proposed to exist in the degenerating disc. This study evaluates the effects of hyperbaric oxygen (HBO) on the expression of interleukin-1β (IL-1β), matrix metalloproteinases (MMPs) and tissue inhibitors of matrix metalloproteinases (TIMPs) in human degenerated intervertebral disc (IVD) cells.

Methods and Materials: Cells were released from the degenerated IVD via enzyme digestion. All hyperoxic cells were exposed to 100% O2 – 2 at 2.5 atmospheres absolute (ATA) in a hyperbaric chamber. Cell growth was determined by the increase in cell numbers. The mRNA expression of IL-1β, MMPs, and TIMPs were detected by reverse transcription polymerase chain reaction (RT-PCR). The amounts of IL-1β, MMPs and TIMPs in the conditioned medium were quantified by enzyme-linked immunosorbent assay (ELISA).

Results: Cell growth increased significantly after HBO treatment. The mRNA expression of TIMP-1 increased significantly but that of IL-1β, MMPs decreased significantly after HBO treatment. No significant effect of HBO treatment on MMP-3 and MMP-9 expression. Examination of protein levels in condition medium showed that HBO treatment increased protein level of TIMP-1 but decreased that of IL-1β, MMP-1, MMP-3, MMP-9 and MMP-13.

Conclusions: IL-1β production in IVD cells were significantly suppressed by HBO treatment, which then improved the imbalance between TIMPs and MMPs. HBO treatment suppress the MMP-1 and MMP-13 production. In addition, HBO treatment increased TIMP-1 production to inhibit the MMPs degradation of PGs.

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Evaluation of chondral repair by MRI: comparison of T2 mapping and dGEMRIC
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Purpose: In this study we investigated the use of two MRI sequences to evaluate the cartilage regeneration of chondral defects after implantation with a collagen-based scaffold.

Methods and Materials: Two 4mm full thickness chondral defects were generated in both right and left medial condyles of 4 Yucatan micro minipigs. Defects were left empty or implanted with a Type I collagen-based honeycomb scaffold. Implants were secured in place using a collagen based sealant. At 3-4 months necropsy was performed and the joints were dissected and the medial condyles removed. MR imaging was performed with a Bruker 8.0T helium magnet. Images were taken in the sagittal oblique plane with 117mm resolution. For all sequences, 5 slices were captured at 1mm slice thickness, 256x256 matrix, and 3x3cm2 FOV. T2 mapping was performed with the following parameters: 10 echoes (TE 8.3-83ms) and TR 3000ms. Tis were obtained at TE 8.3, NEX 1 and 6 TRs (180-4480ms) and 10 TRs post-Gd-DTPA (100-2000ms).

Results: In the empty defect group, 5 of 8 defects were 48-66% filled with tissue and 3 were slightly overfilled. Alternatively, the implant group had 7 of 8 defects with 75-90% fill and with 66% fill. Results of dGEMRIC showed a longer post-Gd T1 for the implant group compared to the empty defects with mean values of 527 ±19 and 434 ±58, respectively. T2 mapping showed little matrix organization within the defect sites compared to the adjacent cartilage in either group.

Conclusions: MR imaging can provide compositional as well as structural information for evaluation of cartilage regeneration.