The Effect of Platelet Rich Plasma Formulations on Human Synoviocytes

Hillary J. Braun, Hyeon Joo Kim, PhD, Constance R. Chu, MD, Jason L. Dragoo, MD.
Stanford University, Redwood City, CA, USA.

Disclosures:
H.J. Braun: None. H. Kim: None. C.R. Chu: None. J.L. Dragoo: 3B; Genzyme, Ossur, RNLBio, Exactech, DePuy/Mitek,. 5; Linvatec. 6; Ossur, Smith & Nephew. 7; Exactech.

Introduction: The effect of platelet rich plasma (PRP) on chondrocytes has been studied in cell and tissue culture, but considerably less attention has been given to the effect of PRP on synoviocytes. Fibroblast-like synoviocytes (FLS) compose 80% of the normal human synovium and produce cytokines and matrix metalloproteinases (MMP’s) that can mediate cartilage catabolism. The purpose of this study was to compare the effects of leukocyte-rich PRP (LR-PRP), leukocyte-poor PRP (LP-PRP), red blood cell (RBC) concentrate, and platelet-poor plasma (PPP) on human FLS in order to determine whether leukocyte and erythrocyte concentration of PRP formulations differentially affect the production of inflammatory mediators.

Methods: Peripheral blood was obtained from three donors and processed to create LR-PRP, LP-PRP, RBC, and PPP. Human synoviocytes were cultured for 96 hours with the respective experimental conditions using standard laboratory conditions. Cell viability and inflammatory mediator production were then evaluated and compared across treatment conditions using one-way analysis of variance with Bonferonni post-hoc correction.

Results: Treatment with LR-PRP resulted in significantly greater synoviocyte death (4.9±3.1) when compared with LP-PRP (0.72±0.70%, p=0.035), PBS (0.39±0.27%, p=0.018), and PPP (0.26±0.30%, p=0.013). Synoviocytes treated with RBC concentrate demonstrated significantly greater cell death (12.5±6.9%) when compared with PBS (p<0.001), PPP (p<0.001), LP-PRP (p<0.001), and LR-PRP (4.9±3.1%, p<0.001). IL-1β content was significantly higher in cultures treated with LR-PRP (1.53±0.86 pg/ml) compared with those treated with PBS (0.22±0.295, p<0.001), PPP (0.11±0.179, p<0.001), and RBC (0.64±0.58, p=0.001). IL-6 content was also higher with LR-PRP (32,097.82 pg/ml ± 22844.300) treatment all other groups (p-values <0.001). TNF-α levels were greatest in LP-PRP (9.97±3.110 pg/ml) and this was significantly greater compared with all other culture conditions (p-values <0.001). IFN-γ levels were greatest in RBC (64.34±22.987 pg/ml) and significantly greater than all other culture conditions (p-values <0.001).

Discussion: The results of this study demonstrate that LR-PRP and RBCs are particularly cytotoxic to synoviocytes. Both treatments resulted in significant synoviocyte death when compared with LP-PRP, PPP, and PBS. LR-PRP treatment caused a significant increase in pro-inflammatory cytokines IL-1β and IL-6, while RBC treatment caused significant production of IFN-γ and LP-PRP treatment caused significant production of TNF-α. These results appear to suggest that the interaction of either a) polymorphonuclear (PMN) WBCs or b) erythrocytes with synoviocytes result in cell activation, and release of pro-inflammatory mediators, or death.

Significance: Whether due to a therapeutic injection of LR-PRP or an intra-articular joint bleed (RBCs) secondary to joint injury, it is important to recognize that these substances may activate inflammation and lead to synovial injury within the joint.

Acknowledgments: N/A

References: N/A

ORS 2014 Annual Meeting
Poster No: 0389