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*J Bone Joint Surg Am.* 2014 Mar 5;96(5):423-9. doi: 10.2106/JBJS.M.00726.

## Comparison of platelet-rich plasma formulations for cartilage healing: an in vitro study.

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#### Abstract

**BACKGROUND:** Platelet-rich plasma (PRP) has been advocated as one treatment for cartilage tissue regeneration. To date, several different platelet-rich formulations have been available, but a deep knowledge of their composition and mechanism of action in a specific clinical use is needed. The aim of this study was to investigate the effect of various PRP formulations on human chondrocytes in vitro.

**METHODS:** Blood from ten human volunteers was used to prepare three formulations: (1) PRP with a relatively low concentration of platelets and very few leukocytes (P-PRP), (2) PRP with high concentrations of both platelets and leukocytes (L-PRP), and (3) platelet-poor plasma (PPP). Selected growth factors in the formulations were measured, and the in vitro effects of various concentrations were tested by exposing chondrocytes isolated from osteoarthritic cartilage of four different men and measuring cell proliferation, matrix production, and gene expression.

**RESULTS:** L-PRP contained the highest levels of growth factors and cytokines. All three formulations stimulated chondrocyte proliferation throughout the culture period evaluated; the only significant difference among the formulations was on day 7, when P-PRP induced greater cell growth compared with the other two formulations. P-PRP stimulated chondrocyte anabolism, as shown by the expression of type-II collagen and aggrecan, whereas L-PRP promoted catabolic pathways involving various cytokines. However, L-PRP induced greater expression of the hyaluronic acid synthase-2 gene and greater production of hyaluronan compared with P-PRP.

**CONCLUSIONS:** L-PRP and P-PRP induced distinct effects on human articular chondrocytes in vitro, possibly because of differences in the concentrations of platelets, leukocytes, growth factors, and other bioactive molecules. The identification of the optimal amounts and ratios of these blood components could ideally lead to a formulation more suitable for the treatment of cartilage lesions.

**CLINICAL RELEVANCE:** PRP formulations that are suitable for the treatment of degenerative joint diseases will likely contain balanced concentrations of platelets and leukocytes.

PMID: 24599205 [PubMed - in process]

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