

The positive effects of different platelet-rich plasma methods on human muscle, bone, and tendon cells.

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Source

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Abstract

BACKGROUND:

Clinical application of platelet-rich plasma (PRP) in the realm of orthopaedic sports medicine has yielded variable results. Differences in separation methods and variability of the individual may contribute to these variable results.

PURPOSE:

To compare the effects of different PRP separation methods on human bone, muscle, and tendon cells in an in vitro model.

STUDY DESIGN:

Controlled laboratory study.

METHODS:

Blood collected from 8 participants (mean \pm SD age 31.6 ± 10.9 years) was used to obtain PRP preparations. Three different PRP separation methods were used: a single-spin process yielding a lower platelet concentration (PRP(LP)), a single-spin process yielding high platelet and white blood cell concentrations (PRP(HP)), and a double-spin that produces a higher platelet concentration and lower white blood cell concentration (PRP(DS)). Human bone, muscle, and tendon cells obtained from discarded tissue samples during shoulder surgery were placed into culture and treated with the 3 PRP preparations, control media (2% fetal bovine serum [FBS] and 10% FBS), and native blood. Radioactive thymidine assays were obtained to examine cell proliferation, and testing with enzyme-linked immunosorbent assay was used to determine growth factor concentrations.

RESULTS:

Addition of PRP(LP) to osteocytes, myocytes, and tenocytes significantly increased cell proliferation ($P \leq .05$) compared with the controls. Adding PRP(DS) to osteoblasts and tenocytes increased cell proliferation significantly ($P \leq .05$), but no significance was shown for its addition to myocytes. The addition of PRP(HP) significantly increased cell proliferation compared with the controls only when added to tenocytes ($P \leq .05$). Osteoblasts: Proliferation was significantly increased by addition of PRP(LP) compared with all controls (2% FBS, 10% FBS, native blood) ($P \leq .05$). Addition of PRP(DS) led to

significantly increased proliferation compared with all controls, native blood, and PRP(HP) ($P \leq .05$). Proliferation was significantly less when PRP(HP) was added compared with PRP(DS) ($P \leq .05$). Myocytes: Proliferation was significantly increased by addition of PRP(LP) compared with native blood ($P \leq .05$). Adding PRP(HP) or PRP(DS) to myocytes showed no significant increase in proliferation compared with the controls or the other separations. Tenocytes: Proliferation was significantly increased by addition of PRP(LP) compared with all controls (2% FBS, 10% FBS, native blood) ($P \leq .05$). Addition of PRP(DS) showed a significant increase compared with the controls and native blood. For tenocytes, there was a significant increase ($P \leq .05$) seen when PRP(HP) was added compared with the controls and native blood but not compared with the other separations.

CONCLUSION:

The primary findings of this study suggest the application of different PRP separations may result in a potential beneficial effect on the clinically relevant target cells in vitro. However, it is unclear which platelet concentration or PRP preparation may be optimal for the treatment of various cell types. In addition, a "more is better" theory for the use of higher platelet concentrations cannot be supported. This study was not intended to prove efficacy but to provide a platform for future research to be built upon.

CLINICAL RELEVANCE:

The utilization of different PRP separations may result in a potentially beneficial effect on the clinically relevant target cells in vitro, but it is unclear which platelet concentration or PRP preparation may be optimal for the treatment of various cell types.