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Optimization of leukocyte concentration in platelet-rich plasma for the treatment of tendinopathy.

McCarrel TM¹, Minas T, Fortier LA.

Author information

Abstract

BACKGROUND: Numerous methods are available for platelet-rich plasma (PRP) generation, but evidence defining the optimum composition is lacking. We hypothesized that leukocyte-reduced PRP would result in lower inflammatory cytokine expression compared with concentrated-leukocyte PRP and that maintaining the platelet:white blood cell (WBC) ratio would compensate for the effect of increased WBC concentration.

METHODS: Blood and flexor digitorum superficialis tendons were collected from young adult horses. Three PRP groups were generated with the same platelet concentration but different WBC concentrations: intermediate-concentration standard PRP, leukocyte-reduced PRP, and concentrated-leukocyte PRP. An additional high-concentration PRP group was generated with the same WBC concentration as the concentrated-leukocyte PRP group and the same platelet:WBC ratio as the standard PRP group. The PRP groups were used as media for flexor digitorum superficialis tendon explants in culture for seventy-two hours with 10% plasma in Dulbecco modified Eagle medium (DMEM) serving as control. Tendon gene expression for collagen types I (COL1A1) and III (COL3A1), cartilage oligomeric matrix protein (COMP), matrix metalloproteinase (MMP-13), interleukin-1 β (IL-1 β), and tumor necrosis factor- α (TNF- α) was performed.

RESULTS: The desired PRP groups were successfully generated. The expression of COMP, the COL1A1:COL3A1 ratio, and the expression of MMP-13 in flexor digitorum superficialis tendon explants was not different between PRP groups. The expression of COMP ($p = 0.0027$) and the COL1A1:COL3A1 ratio ($p < 0.0001$) were increased in the PRP groups as compared with the control group, and the expression of MMP-13 was decreased in the PRP groups as compared with the control group ($p < 0.0001$). The expression of IL-1 β was lowest in leukocyte-reduced PRP and highest in concentrated-leukocyte PRP ($p = 0.0001$). The leukocyte-reduced PRP group and the control group had the lowest TNF- α expression, whereas the high-concentration PRP and concentrated-leukocyte PRP groups had the highest expression ($p = 0.0224$).

CONCLUSIONS: A high absolute WBC concentration in PRP contributes to the expression of inflammatory cytokines in flexor digitorum superficialis tendon explants, and maintenance of the platelet:WBC ratio is not able to counteract this effect.

CLINICAL RELEVANCE: The optimum composition of PRP for the treatment of tendinopathy has not been directly investigated. Persistent inflammation results in inferior repair with scar tissue. The present study indicates that in an animal model, WBC in PRP contributes to inflammatory cytokine production. Therefore, leukocyte-reduced PRP may be the optimum preparation to stimulate superior healing without scar tissue formation.

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