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Effect of PRP and PPP on proliferation and migration of human chondrocytes and synoviocytes *in vitro*

Research Article

Judita Amrichová[1], Tímea Špaková[1]*, Ján Rosocha[1], Denisa Harvanová[1], Darina Bačenková[1], Marek Lacko[2], Slavomír Horňák[3]

[1]*Associated Tissue Bank of Faculty of Medicine of P. J. Šafárik University and L. Pasteur University Hospital, 041 66 Košice, Slovakia*

[2]*Department of Orthopaedics and Traumatology of Locomotory Apparatus, Faculty of Medicine of P. J. Šafárik University and L. Pasteur University Hospital, 041 66 Košice, Slovakia*

[3]*University of Veterinary Medicine and Pharmacy in Košice, 041 81 Košice, Slovakia*

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Abstract: Cartilage tissue engineering can provide substantial relief to people suffering from degenerative cartilage disease, such as osteoarthritis. The autologous platelet-rich plasma (PRP) application appears to improve cartilage healing due to its ability to positively influence cellular mechanisms, mainly in cells from synovium and cartilage. Primary cultures of human synovial fluid stem cells (synoviocytes, SCs) and chondrocytes (CCs) were exposed to various concentrations of non-activated PRP and platelet-poor plasma (PPP) prepared by apheresis. Cell proliferation and migration were evaluated in real-time with the non-invasive xCELLigence System. It was found that PRP had a similar effect on the growth of cells as fetal bovine serum (FBS). Surprisingly, our proliferation assay results indicated that 50% PPP had the largest effect on both cell types, with a statistically significant increase in cell number ($P<0.001$) compared to the (0% FBS) in vitro control. The migratory ability of SCs was significantly enhanced with 10% PRP and 0.8% hyaluronic acid (HA). HA also augmented migration of CCs. In summary, these results demonstrate that directed cell proliferation and migration are inducible in human articular CCs and SCs, and that both platelet-derived fractions may exert a positive effect and modulate several cell responses that are potentially involved in tissue integration during cartilage repair.

Keywords: *Platelet-rich plasma • Platelet-poor plasma • Synoviocytes • Chondrocytes • Proliferation • Migration • Impedance based real-time assay*

1. Introduction

Osteoarthritis (OA) is one of the most prevalent musculoskeletal disorders, generally characterized by a catabolic and inflammatory joint environment. OA is associated with the loss of articular cartilage, intra-articular bone hypertrophy and many different immunological and morphological effects. Cartilage tissue is composed of chondrocytes and is embedded in the dense extracellular matrix (ECM). It has poor autonomous regeneration capacity, mainly due to its avascular nature. Another factor contributing to poor regenerative capacity of articular cartilage is the restricted number of ECM producing cells. The percentage of highly specialized chondrocytes (CCs) in cartilage tissue is only 1–3% [1]. CCs are embedded in extracellular matrix, rendering them unable to migrate to a site of injury; they are able to synthesize fibrous repair tissue, but not sufficiently to fill even small defects (<3 mm in diameter) with a cartilage-like matrix [2]. Cartilage defects in OA are associated with major loss of performance. Various treatments, including cell therapy, nonsteroidal anti-inflammatory medications, corticosteroid injections, glucosamine and chondroitin supplements, as well as topical analgesics are used to treat inflammation and cartilage degeneration [3,4]. Intra-articular injection of HA is widely used as a safe and effective therapy for knee OA treatment,

* *E-mail: timea.spakova@upjs.sk*