Role of Platelet Rich Plasma (PRP) in fracture healing: new insights

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Introduction

Open fractures of bone are often colonized by several bacteria and the organism is challenged by inflammation. Infections of bone lead to a poor healing response. Platelet Rich Plasma (PRP), Platelet Poor Plasma (PPP) and Platelet Rich on Growth Factor (PRGF) are laboratory concentrated platelet fractions from patient’s whole blood. PRP is widely used as an effective treatment modality for various surgical procedures and chronic wounds. The composition of proteins and growth factors in PRP and the effects of PRP are largely unknown. The existence of antimicrobial peptides in platelets is also not known so far. Aim of the present study was to evaluate the potential of Platelet Rich Plasma (PRP) concerning infection prevention in fracture healing and concerning activation of the Nrf2/ARE system which combats reactive oxygen species during inflammation.

Material and Methods

The PRP is obtained after centrifuging process of patient’s own whole blood. The expression of antimicrobial peptides (AMPs) from Platelets is investigated by Western Blot using anti human beta Defensin-2 antibodies. In order to investigate the osteogenic potential of PRP, the Bone Morphogenetic Protein-4 (BMP-4) was quantified using ELISA. For evaluation of the activation of the Nrf2/ARE system a Dual Luciferase assay was used. Measurement of translocation of Nrf2 in the nucleus of SAOS-2 osteoblasts was performed using Western-Blot.

Results

We demonstrated the expression of antimicrobial peptide HBD-2 in PRP by Western Blot (Figure 1). PRGF contains strong amounts of osteogenic BMP-4 (Figure 2). Dual Luciferase assay revealed an activation of the antioxidant response element (ARE) after 6 hours incubation with 10% PRGF. Western Blot experiments revealed a translocation of Nrf2 in the nucleus of SAOS-2 cells.

Discussion

PRP includes the antimicrobial peptides HBD-2 and therefore an antimicrobial potential. PRP also contains the osteoinductive protein BMP-4. Hence application of PRP could lead to an increased fracture healing. The activation of ARE and the translocation of Nrf2 in the nucleus of SAOS-2 osteoblasts after PRGF stimulation could combat reactive oxygen species during inflammation. The approved beneficial effect of PRP in fracture healing may result in an antimicrobial and antioxidative manner. Using autologous PRP or PRGF in order to increase fracture healing and prevent postoperative bone infection seems to be a suitable addition to conventional therapy.

Fig. 1 hBD-2 Western Blot of human PRP samples.