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Bone Marrow Aspirate Concentration Enhance Tendon to Bone Healing on Chronic Rotator Cuff Tear in a Rabbit Model

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Summary:
The purpose of this study was (1) to create a chronic rotator cuff rabbit model, (2) to evaluate the influence of BMAC on tendon to bone healing in the chronic rotator cuff tear rabbit model.

Abstract:
Background:
The re-tear rate after surgical repair of chronic rotator cuff tears remains relatively high, however, little is known about the tendon to bone healing mechanism. More recently, bone marrow aspirate concentrate (BMAC) increases attention as a regenerative therapy for musculoskeletal disorder. The purpose of this study was (1) to create a chronic rotator cuff rabbit model, (2) to evaluate the influence of BMAC on tendon to bone healing in the chronic rotator cuff tear rabbit model.

Material and methods:
(1) To make a chronic rotator cuff model, 40 adult New Zealand white rabbits, aged 4 to 5 months, with a mean body-weight of 2.9 kg were enrolled, a chronic tear was created by the supraspinatus tendon transection at the insertion site to the greater tuberosity and wrapping the torn tendon with a 10 mm–long silicone Penrose to inhibit adhesion to the surrounding soft tissue, then it was left alone for 6 weeks. (2) The rabbit model were randomly divided into 5 groups (8 rabbits per group) as follows: Control group (C), Repair + Saline (RS), Repair + PRP (RP), Repair + BMAC (RB) and Repair + PRP + BMAC (RPB). The torn tendon was repaired in an open transosseous manner. BMAC was prepared and administered onto the repair site according to the protocol, 6 weeks after repair the shoulder samples were harvested for the histological and biomechanical test. (3) In vitro study, BMAC was processed to analyze the growth factor level of PDGF-AB, IGF, TGF-ß1 and VEGF.

Result:
(1) The chronic rotator cuff model was confirmed by the development of fatty infiltration within the muscle after detachment 6 weeks. (2) The mechanical evaluation showed that RB group had a significantly higher stiffness and Young's module compared with the RS group (P = 0 .002, P = 0 .002, respectively). The ultimate load-to-failure was significantly higher in the RPB group compared with the RS and RP groups (P = 0 .001, P = 0 .03, respectively). The histological evaluation revealed that the BMAC treated groups (RB and RBP) showed better collagen fiber continuity and more regularly arranged collagen fibers than the group R and group RP. (3) The growth factor IGF, TGF-ß1 and VEGF was significantly higher in BMAC compared with PRP (P <0 .01).

Conclusion:
This study showed that BMAC release the greatest concentration of growth factors and play a central role to enhance the mechanical strength of tendon to bone junctions and to improve histological presentation after rotator cuff repair.

Key words:
growth factors; bone marrow aspirate concentration; animal model; chronic rotator cuff;