3

THE USE OF PRP IN KNEE INJURIES

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Introduction

Cellular therapies offer an interesting option in the treatment of injured Anterior Cruciate Ligament (ACL) and chondral lesions by addressing the defect in healing at a molecular level and leading to a more biological way of healing. Platelet-Rich Plasma (PRP) contains many important growth factors, and recent studies have proven the beneficial effects of PRP in augmenting the healing of ACL. The rationale for the use of PRP is to stimulate a supra-physiological release of platelet-derived factors directly at the site of treatment. Autologous PRP can be obtained from simple blood extraction using a commercially available kit. Once the blood is collected into a tube containing anticoagulant it undergoes a centrifugation process to produce PRP. When PRP solutions are injected directly for topical treatment, platelets are activated by endogenous thrombin and/or intra-articular collagen.

Figure 1: (a) Autologous blood collection (b) centrifugation at 3,500rpm for 5 minutes (c) PRP separated after centrifugation (d) intra-articular injection.

Platelets contain many important bioactive proteins and Growth Factors (GF). These factors regulate key processes in tissue repair, including cell proliferation, chemotaxis, migration, cellular differentiation and extracellular matrix synthesis. These Bioactive proteins and growth factors play an important role in tissue healing as they can regulate key processes in tissue repair, including cell proliferation, chemotaxis, migration, cellular differentiation, and extracellular matrix synthesis.

Our studies

We prospectively studied a group of 50 athletes treated with primary ACL repair combined with GF rich PRP injection and bone marrow stimulation and growth factors for 5-years (1). The final follow-up showed 78% of the patients returning to their sports activities, a significant decrease in the side-to-side difference in anterior translation (4.1mm preoperatively to 1.4mm postoperatively, $P<0.05$), a significant improvement in the postoperative Tegner ($P<0.05$) and the Single Assessment Numeric Evaluation scores ($P<0.05$). Final Marx and Noyes scores were similar to pre-injury values and the final IKDC objective was as follows: normal (A) in 39 patients; nearly normal (B) in 10 patients; and severely abnormal (D) in 1 patient (2%). Re-tear of the repaired ligament was seen in 4 patients, and 1 patient had residual laxity resulting in a survival rate of 90% at the 5-year follow-up.

In another study (2), we prospectively followed up 93 patients with early knee Osteo-Arthritis (OA) (Kellgren-Lawernce classification grade 1-3). All patients were involved in various sports activities (football 14%, ski mountaineering 14%, motocross 12%, basketball and volleyball 12%, jogging 10%) but not at the professional level.

Patients were treated with 1 cycle of intra articular injections (3 injections given each given once a month) with autologous PRP (Regen ACR-C, RegenLab, Switzerland). All patients were followed-up for a minimum period of 2 years. Fifty knees were randomly selected prior to the first injection, to receive a second cycle at the completion of 1 year. The outcomes were assessed with Knee injury and Osteoarthritis Outcome Score (KOOS), Visual Analogue Scale (VAS), Tegner and Marx scoring system, recorded prior to the first injection and then at 12, 18 and 24 months. The results at 12 months showed significant improvement ($P<0.001$) in all scores compared to pre-treatment value in both the groups. At 24 months, the scores declined in both groups but remained above the pre-treatment value with no significant difference between the groups.

Conclusions

Both our studies have demonstrated PRP as an effective technique in biological repair and augmentation of tissue healing. In the ACL study PRP injection was augmented with Mesenchymal stem cell stimulation, and thus the net contribution of PRP becomes difficult to assess. But the second study where PRP alone was used to treat early OA in active population proved its beneficial effect as an isolated entity by showing improved function at the end of 2 years.

The addition of PRP to Bone Marrow Stromal Cells (BMSCs) would form a bioactive composite suited for healing of tissue defects in vivo by acting as sources of growth factors and working cells and can play important roles in future regenerative medicine.

Furthermore, with greater advances in tissue engineering and molecular biology, the concept of scaffolds and cell-scaffold composites and their role in augmenting ligament repair offers interesting therapeutic options.

Studies have reported accelerated healing with increased tissue formation and enhanced ACL cell viability, metabolic activity, and collagen synthesis after the use of PRP-scaffold composites in tissue healing in experimental ACL models.

The underlying premise is that while PRP/BMSCs will act as the source of growth factors and precursor cells, the scaffold would act both as a matrix in the cellular process and as a biomechanical support after primary repair of ACL and provide a secure environment for the cells away from the effects of circulating plasmin in the joint space, which prematurely breaks down the fibrin clot.

References

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2. Gobbi A, Lad D, Karnatzikos G. The effects of repeated intra-articular PRP injections on clinical outcomes of early osteoarthritis of the knee. Knee Surg Sports Traumatol Arthrosc. 2014 Apr 20. [Epub ahead of print]