Research Article

Comparative Study of Hamstring Graft Healing Time after Anterior Cruciate Ligament Reconstruction with Augmentation of Platelet-Rich Plasma

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Abstract

Aim: To Compare hamstring graft healing time after anterior cruciate ligament (ACL) reconstruction with the use of augmentation of platelet-rich plasma.

Methods: 30 patients between age group of 18 to 40 years with complete ACL tear were randomly divided into two groups the control group in which only ACL reconstruction was done and second group in which acl reconstruction was performed along with augmentation with Platelet rich plasma. For the PRP group, 3 ml of PRP was obtained in the operation room and was injected into femoral tunnel just before after portal suture. MRI was obtained post operatively 3 month, 6 month and 9th month for both the groups. Graft healing time was defined as the time taken for the graft to reach ligamentization phase when the graft became hyperintense or was visualised similar to PCL or the remnant which was preserved during reconstruction.

Results: Patients in PRP augmented group achieved ligamentization phase significantly earlier as compared to those in the control group, with mean time of 3.4 months as compared to 8.1 months in the control group.

Conclusion: PRP helps in faster healing of the Hamstring graft. However further studies are required to correlate graft healing time with return to previous activity.

Keywords: Anterior cruciate ligament reconstruction; Hamstring graft; Platelet-rich plasma; Sports injury; Ligamentization; Biological augmentation

1. Introduction

Anterior cruciate ligament (ACL) tear is most common injury occurring in various sports like soccer basketball and other outdoor sports [1] and are usually operated as it causes instability of the knee and early osteoarthritis [2]. United States has approved use of Platelet-rich plasma (PRP) for enhancing regeneration of tissue in bone, cartilage, ligaments [3-9]. The ligamentization process of the graft usually takes anywhere between 6 months to 1 year, which can be correlated on magnetic resonance imaging as isointensity with PCL10. This can be also confirmed histologically but taking a biopsy of the ligament makes it an invasive procedure [11-13]. We evaluated graft healing time as the ligamentization of hamstring graft using MRI after ACL reconstruction with or without PRP injection.

2. Materials and Methods

Between May 2018 to May 2019 30 patients between 18 to 40 years of age with complete ACL tear were randomly divided and undergone ACL reconstruction with quadruple hamstring graft with or without PRP injection. Patients who had signed the consent form, with or without an associated meniscal tear, with duration of injury less than 6 months and the patients had full range of motion pre operatively. Patients who were excluded were the patients with concurrent Posterior Cruciate Ligament injury, with previous knee surgery or injury, patients who had knee infection, skin lessions near knee joint like psoriasis eczema, patients with metabolic bone disease, neoplasm. The institutional ethics committee's approval was taken prior to study. Both the groups underwent surgery by the same group of surgeons and the postoperative rehabilitation was also identical. Diagnostic knee arthroscopy was performed under spinal anaesthesia followed by ipsilateral hamstring graft (semitendinosus and gracilis) harvesting which was quadrupled. Femoral tunnel was drilled with the help of an femoral offset and the average femoral tunnel diameter was 9 mm. Tibial tunnel was being drilled with 55^{o} angle guide with an average tibial diameter of 9 mm. The reconstructed graft was fixed on the femoral side with the help of suspensory fixation with a titanium button whereas Hydroxyapatite screws were used as fixation device in tibia.For the PRP group in addition to standard reconstuction, 10 ml of whole blood was obtained from cubital vein and was centrifuged at 3200 rpm for 15 mins and around 3 ml of Platelet Rich Plasma (PRP) was obtained which was injected into the femoral tunnel just after completing the fixation and lavage of the joint. No drain was put post operatively. Postoperatively, patient was mobilised on 1st day after surgery and gradual and measured knee range of motion exercise were done obtaining flexion upto 90-110^{o} till suture removal which was done on 14th days. However the patient was mobilised non weight bearing with a knee brace and walker. At week 4, progressive weight-bearing was started as per patients pain tolerance. Shallow water swimming was started at 6th week, outdoor cycling at 3rd month, running was started progresively at 4th month and gradual return to sports was done at 9th month. 3 Tesla MRI was one at 3 , 6, and 9 months post surgery. Graft ligamentization of all the patients was observed by same radiologist blinded to treatment. The 2 groups were compared using the Chisquare test and p value of <0.05 was considered statistically significant.

3. Results

Both the groups did not differ significantly in terms of age, sex, graft width, graft length, tunnel diameters, fixation devices, post operative protocol. Patients in the PRP augmented group attained ligamentization early (mean time 3.4 month) as compared to the control group which was not augmented (mean time 8.1 month) with a range from 2 months to 5 months for PRP augmented group and 4 months to 11 months for the control group. We did not encounter any complication in either of the group.

Groups	**Control group (A)**	**PRP augmented group (B)**
Number of pateints	15	15
Minimum time for healing	4 months	2 months
Maximum time for healing	11 months	5 months
Mean time	8.1 month	3.4 month

4. Discussion

ACL reconstruction stabilises the knee joint and restores the function of the knee joint back [12]. Patellar tendon, hamstrings, peroneus longus, allografts, synthetic tendons are the various grafts which can used for ACL reconstruction [12] at our centre we prefer Hamstring grafts unless otherwise indicated. Initialy there is phase of hypocellularity due to necrosis because of loss of blood supply and collagen fragmentation. This continues till revascularisation takes place by the synovial cover at the tendon bone contact points in both the tunnels and cellularisation takes place (about 1 year post surgery) [13]. Complete graft healing takes around 1 year in humans when the vascularity and fibre pattern appears to be as close to normal as possible12. On histological examination of a patellar tendon graft, revasularisation was noted at 2nd month whereas the structure similar to native tissue was seen at 4th to 5th month 11. Therefore, to prevent graft failure aggressive physiotherapy is be avoided in the 1st month of healing [14]. To diagnose the ACL injury and to evaluate reconstruction MRI plays a very important role as it is an accurate and non invasive tool [15, 16]. MRI can also be used to evaluate the stage of graft healing [17]. In this study, ligamentization stage was used to evaluate the graft healing time. The application of various biological methods for promoting tissue healing has increased, especially the use of autologous Platelet Rich Growth Factors [8, 18, 19]. The tissue repair occurs by angiogenesis, tissue proliferation, and extracellular matrix formation. The healing process is also associated with mechanical stress on the tendon [8]. PRGF has various mediators which take an important role in tissue healing namely transforming growth factor-1 (TGF-1), platelet derived growth factor (PDGF), vascular endothelial growth factor (VEGF), epithelial growth factor (EGF), hepatocyte growth factor (HGF), and insulin-like growth factor (IGF-I) [8]. Out of these PDGF, TGF-1 and few TGF subtypes are responsible for the acceleration of tissue healing and increased graft tension [18]. Collagen production and proliferation in human tenocytes is stimulated by PRP [5] whereas tensile force and resistance of the graft is increase by TGF-1, TGF-2, and TGF-3 [17]. Fibroblast synthesis and increased collagen formation is found in canine graft because of Growth Factors and EGF [20]. Biochemical properties is increased by PRGF [6]. Recovey was observed faster in the patients suffering with Tendo Achillis tendon injury after PRGF Injection [8]. Significant pain relief and functional

improvement was seen in cuff repair surgery patients when treated with PRP [7]. PRGF decreases the time take to recover in cases of medial collateral ligament injury in soccer players [2]. Based on the this MRI was done to compare the graft healing time with and without augmentation which showed quicker healing when augmented with PRP. Limitation of the study was it was solely based on MRI findings and didn't take into account the clinical outcome.

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