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Original Article

The use of platelet-rich fibrin with platelet-rich plasma support meniscal repair surgery☆

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ABSTRACT

Introduction: Platelet-rich fibrin (PRF) is the only autologous blood product that releases growth factors and has scaffolding properties. We hypothesized that the use of PRF and Platelet-rich plasma (PRP) would improve operative results, including the recovery of function and repaired meniscus.

Materials and Methods: Seventeen patients underwent arthroscopic meniscus repair with PRF and PRP (PRF group) using our novel device for the injection of the PRF into the joint. Another five patients as a control group underwent meniscal repair without PRF and PRP (non-PRF group). The groups were compared in terms of clinical results (Tegner Activity Level Scale, Lysholm Knee Scoring Scale, and International Knee Documentation Committee [IKDC] scores) and changes in magnetic resonance imaging (MRI) findings before surgery and 6 months after surgery.

Results: The Lysholm and IKDC scores improved in all patients postoperatively. However, there was no significant differencies in the postoperative score between the PRF group and the non-PRF group. Follow-up MRI findings did not clearly show improvements.

Conclusions: PRF and PRP are autologous, safe, and cost-effective sources of growth factors. Therefore, we propose a new application of PRF and PRP for autologous transplantation in meniscus repair surgery.

1. Introduction

Platelet-rich plasma (PRP) is a liquid that includes an anticoagulant, which forms a PRP clot by activation. However, PRP clots are fragile and unstable. By contrast, original platelet-rich fibrin (PRF) is a gelatinous solid body. This PRF matrix is turned into strong fibrin architecture as a PRF membrane by compression.

PRF appears to be the only material that can rigidly seal a meniscus defect while supplying growth factors. In angiogenesis, PRF acts in the stimulation phase, promoting vascular growth and increasing collagen synthesis through fibroblast proliferation.[1] PRP and PRF have different characteristics, including a difference in the release peak of the growth factors that they contain.[2] PRF is the only autologous fibrin matrix that releases growth factors slowly and continuously and also has scaffolding properties.[3–5] Therefore, we aimed to assess the benefits of PRF with PRP in arthroscopic meniscal repair. We hypothesized that the use of PRF with PRP would improve operative clinical results, including the recovery of function and repaired meniscus.

The report Platelet-Rich Fibrin Facilitates Rabbit Meniscal Repair by Promoting Meniscocytes Proliferation, Migration, and Extracellular Matrix Synthesis[6] supports our hypothesis that PRF and PRP have great potential for the treatment of injured meniscus.

The aim of this study was to assess the benefits of PRF with PRP in arthroscopic meniscal repair.

2. Materials and methods

2.1. Processing PRF and PRP

We used leukocyte- and platelet-rich fibrin (L-PRF), called Choukroun's PRF, and leukocyte- and platelet-rich plasma (LR-PRP) in four different families of platelet concentrates.[7]

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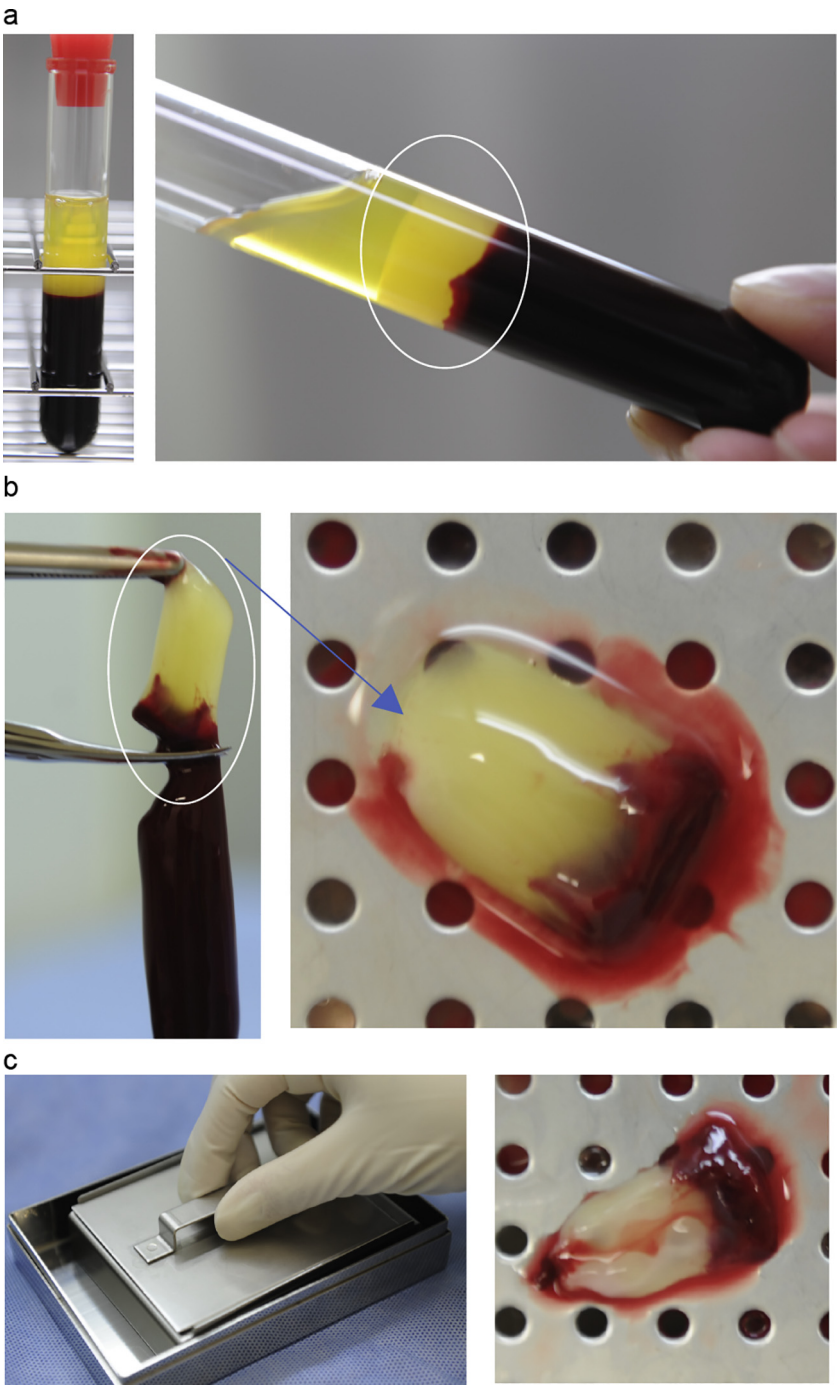

Fig. 1. Platelet-rich fibrin (PRF).
(a) Platelet-rich fibrin is shown in a glass cylinder after centrifuging at 400 g for 13 min (white circle). (b) The PRF matrix is shown (white circle). (c) The PRF membrane after compression by the PRF box is shown.

2.1.1. Preparation of PRF (L-PRF)

Venous blood was taken from each patient using a 21-gauge needle. According to the previously published protocol,[8] blood samples were rapidly and gently collected without an anticoagulant in sterilized 10-mL dry glass tubes and immediately centrifuged at 400*g* for 13 min at room temperature (KUBOTA CORPORATION tabletop centrifuge 2420, Tokyo, Japan) (Fig. 1a). Two samples were prepared in case of production failure. After centrifuging, all procedures were performed on a clean bench. The PRF clot was removed from the tube using sterile tweezers, separated from the red blood cell base using scissors (discarding the red blood cell part), and placed in a PRF box (BS Medical, Tokyo, Japan) (Fig. 1b). The PRF clot was compressed in the PRF box to produce a PRF membrane. Thick tube-like PRF clots were shaped or compressed to fit the size of the implantation site. Thereafter, the PRF membrane was cut vertically to form a red corpuscle residue-buffy coat-fibrin matrix. A red band coated one side of the white area, which was used as a marker during the meniscal repair (Fig. 1c).

2.1.2. Preparation of PRP (LR-PRP)

Centrifugation was performed twice using a double spin method. First, two blood samples were collected with an anticoagulant (sodium citrate solution) in sterilized 10-mL glass tubes and immediately centrifuged at 1000*g* for 6 min at room temperature (Fig. 2a). The centrifugation allowed blood separation into 3 distinct layers. At the