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Increased survival of free fat grafts with platelet-rich plasma in rabbits

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KEYWORDS
Platelet-rich plasma;
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Summary *Background:* Numerous applications of autogenous platelet-rich plasma (PRP) have been studied so far; however, its property of enhancing the survival of free fat grafts has not been defined yet. In the literature, many reports are anecdotal and few include controls to definitely determine the role played by PRP in these grafts.
Objective: PRP was investigated to study its effect in free fat grafts' survival in a rabbit model.
Material and method: A total of 30 New Zealand male rabbits aged 6 months received 0.8 g fat tissue (harvested by scissors dissection from the scapular area of the own animal) in the ears and were randomised into two groups. Group 1 (PRP group) was given the combination of 0.8 g of free fat graft and 1 ml of PRP. Group 2 (control group) received 0.8 g of free fat graft and 1 ml of saline solution. The rabbits were followed up for a period of 6 months after the procedure and then euthanised. The grafted tissue was stained with haematoxylin–eosin and submitted to microscopical evaluation. Graft histopathology was investigated for adipocyte viability, number of blood vessels and the presence of necrosis and fibrosis. All data were statistically analysed by the differences between the study groups.
Results: Three major effects of the addition of PRP in the free fat graft were observed. Group 1 showed a significantly higher fat survival weight as compared with the control group ($P < 0.05$). Histopathological investigations revealed that the number of viable adipocytes and blood vessels was higher in group 1, and still, a larger number of necrotic areas and fibrosis were detected between group 2 ($P < 0.05$).
Conclusion: Application of autogenous PRP can enhance free fat graft survival in rabbits.

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The correction of contour defects and the augmentation of soft-tissue volume represent a considerable challenge in plastic surgery. Autologous fat transplantation has many advantages over other methods of soft-tissue augmentation. Fat tissue is abundant, easily harvested, nonimmunogenic, and has favourable physical characteristics.[1,2] However, surgeons have been reluctant to use autologous fat as grafts because 20—50% of graft volume is lost after transplantation.[3] There is a great variety of factors such as donator area, recipient area, method of harvesting the tissue and treatment of fat before transplantation that interfere in the long-term viability of the transplanted tissue.

Over the past few decades, researches have focussed on finding techniques that would be able to maximise soft-tissue restoration, therefore prolonging the survival of a graft. The development of a biologic agent with these properties would be desirable.

Growth factors have been proposed as a biologic agent for increasing the volume of autologous fat grafts and prolong their survival.[4—7] In this sense, platelets, which play a fundamental role in haemostasis, could be used as a natural source of growth factors because they store, within their α-granules, substances such as platelet-derived growth factor (PDGF), insulin-like growth factor (IGF), vascular endothelial growth factor (VEGF), platelet-derived angiogenic factor (PDAF) and transforming growth factor-beta (TGF-β).

PRP is developed from autologous blood and consists of a volume of autologous plasma with a platelet concentration above the baseline and therefore, an increased concentration of platelet growth factors is present as well. For this reason, PRP is assumed to have a high potential of healing; however, there is a paucity of data to support or oppose its use in fat graft's surgery.

The aim of this study was to evaluate a possible additive effect of the application of PRP in the survival of free fat grafts.

Material and method

Fat source

The fat graft was harvested by scissors dissection from the scapular area of the own animal, where the fat pouches are located. No local anaesthetics or adrenaline were injected before the fat dissection.

Animal model

The protocol of the study was approved by the local ethical animal committee. A total of 30 New Zealand male rabbits aged 6 months were used in this study. The animals were sedated with the use of two anaesthetics (ketamine 0.25 ml kg^{-1} and xylazine 0.05 ml kg^{-1}) through an intramuscular injection.

A surgical dissection of two fat fragments with dimensions of 10 mm and weight of 0.8 g each was done by an incision of the dorsal middle line. This was obtained from the right and left scapular regions, where the fat pouches are located. (Figure 1)

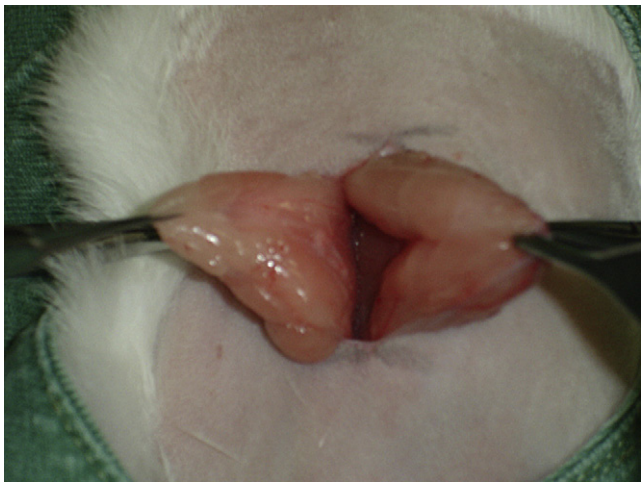

Figure 1 Dissection of the two scapular adipose sacs.

The tissue fragment from the right side was soaked with 1 ml of PRP activated with $CaCl_2$ and thrombin before being transferred (group 1) (Figure 2). The tissue from left side was soaked with 1 ml of saline solution before being transferred (group 2).

The ears of the rabbits were chosen as the recipient site of the fat graft, because of the absence of subcutaneous fat in this area. The fat tissue fragments were transplanted into the ears of the animals through a surgical incision. The graft with PRP was transplanted into the right ear and the control one into the left ear. The animals were fed *ad libitum* on standard laboratory chow and water.

Preparation of PRP

A total of 10 ml of blood was obtained from each rabbit and processed under sterile conditions by two sessions of centrifuging for 10 min each at 1450 and 2100 rpm. The first session allowed the separation of the red cells from the plasma and in the second session, only the plasma was centrifuged, which resulted in the gathering of PRP.

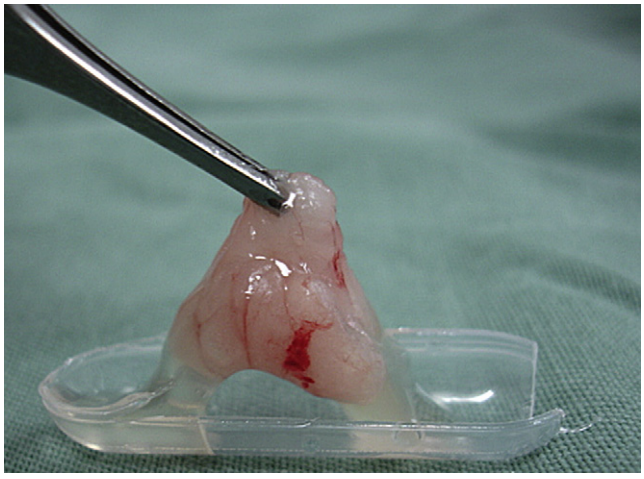

Figure 2 Addition of PRP to the fragment of the adipose tissue taken from the right scapular area.