**Platelet-Rich Plasma for Excisional Wound Healing**

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**Introduction**

Faulty or impaired healing is the key cause of chronic skin wounds. Scaffold systems have been used to speed the process of wound repair. A fibrin clot is the natural provisional matrix formed at the onset of injury serving as a scaffold with included cells and biologically active compounds. Fibrin scaffolds have been used for skin wounds and other applications with a clinical fibrin tissue adhesive available in the U.S., over the last decade, for use as a sealant or suture replacement.

Research, however, has also been aimed at obtaining quick, relatively inexpensive, autologous fibrin glue products. For example, platelet-rich plasma (PRP), which can be obtained during the surgical procedure, not only sets up like other fibrin gels, but has a higher concentration of platelets. The increased platelets is beneficial, since platelet α-granules are a source of many growth factors that signal mesenchymal and epithelial cells to migrate, divide, and increase collagen and matrix synthesis. It was hypothesized that the addition of PRP to skin wounds would improve overall healing by increasing epithelialization rate and reducing contraction rate with the amount of PRP influencing the response.

**Methods**

Four 2.5 x 2.5 cm partial-thickness wounds were made on the dorsum of 15 New Zealand white rabbits. The PRP was applied to three of the wounds in different volumes (0.3ml, 0.6ml, and 0.9ml), with the remaining wound serving as the control. All wounds were covered by an occlusive dressing and excised at one or two week time points.

Digital pictures were taken of the wounds at the time of surgery. Histological sections were analyzed histomorphometrically with a Bioquant software program to determine the healing rates. Epithelialization rate (ER), the average of the length of the new epithelial layer from both sides of the wound and contraction rate (CR) half the change in wound diameter over time (between the vertical lines) were calculated from histological slides (Figure). Overall healing rate (HR) is the sum of ER and CR and the ratio of CR/ER is used to indicate the quality of repair.

A paired t-test was used to determine if there was a difference between each of the treatments compared to the control with ANOVA used to determine differences between the treatment groups.

**Results and Discussion**

There were no statistically significant differences between wounds at the one-week time point. At two weeks, the ER was significantly increased for the 0.6 ml PRP treatment (1.03 mm/wk—63% increase) when compared to the control (0.63 mm/wk). Although the 0.9 ml PRP had a 54% increase in ER over the control, it was not statistically significant. The CR, significantly decreased for both the 0.6 ml (2.44 mm/wk—29% decrease) and 0.9 ml PRP treatments (2.14 mm/wk—37% decrease) compared to the control (3.42 mm/wk). The significant decrease in CR for the 0.9 ml treatment also led to a significant decrease in HR (23%).

The failure of the smallest volume to completely cover the wound was probably responsible for its inability to significantly enhance the healing process. The 0.9 ml wounds exhibited a non-statistically significant increase in ER with the lowest CR and thus had the lowest CR/ER ratio (2.21 vs. 5.43 for the control). The 0.6 ml wounds exhibited the highest ER with CR and CR/ER ratios comparable to the 0.9 ml PRP. For both the 0.6 ml and 0.9ml treatments the reduction in CR was greater than the increase in ER, in terms of mm/wk, leading to a reduction in overall HR. This decrease, however, was only statistically significant for the 0.9 ml treatment. In this case, an improved healing and regenerative response came at the expense of a delay in total healing (HR).

Therefore, the 0.6 ml treated wounds appeared to have the better compromise of increased ER (0.4 mm/wk) with decreased CR (0.98 mm/wk) leading to a not statistically significant drop in HR (14%) as well as a better CR/ER ratio (2.37) when compared to the control. Determining the best treatment, however, is dependent on the clinical situation. For some patients the speed of healing is more important and for others it may be the quality of healing. For example, if esthetics, functionality, or the prevention of recurrence is important quality of tissue repair would be the goal. In many cases, however, the speed of repair is important, since patients are bed-ridden or have reduced mobility until the wound is healed.

Future studies will examine other strategies to enhance the scaffolding effect of the PRP. It is also possible that intermediate volumes between 0.6 and 0.9 ml would provide better compromises between regenerative healing and healing rate. In addition, further control of the growth factor concentration and the release as well as the cellular makeup of the PRP could also be investigated to improve healing rate. Also changes in the configuration and porosity of the PRP could enhance its efficacy as a scaffold.

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Figure 1. Histological section of a healing wound