

## COMPARATIVE MACROSCOPIC ASPECTS OF REGENERATION IN SKIN LESIONS TREATED WITH PLASMA RICH IN PLATELETS

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### Abstract

*Plasma rich in platelets (PRP) is a biological material that contains high levels of platelets, blood cells that are rich in growth factors involved in the initiation of the healing process. PRP can be used on a large number of lesions, including those induced on the skin. The efficiency of the product was tested on an experimental lot of rabbits of the same age, weight and gender. Lesions consisting of incisions and excisions were induced on the skin of the rabbits of both a control and a test group, in the dorsal thoracic region. This sites were then subsequently treated with PRP every 7 days over a period of 4 weeks, in the test group only. The procedure was performed by perilesional inoculations with activated plasma, watching the comparative evolution of the healing process within the 2 groups: control and test. The results revealed an acceleration of the healing process in the tested group. Positive characteristics were noted regarding: retraction of the wound, the presence and thickness of the crust, peripheral erythema, hair regeneration and the visibility more or less pronounced of the scars. In this study we have found beneficial aspects after using platelet-rich plasma, consisting of an acceleration of the healing process and a pronounced anti-inflammatory effect, features that recommend its use in the skin lesions.*

**Ke words:** hair, plasma rich in platelets (PRP), platelets, regeneration, skin.

### INTRODUCTION

The skin represents the first barrier of defense for the organism, thus it is most exposed to external factors.

Our primary expectation in case of a skin injury is simple: the healing should be done in the shortest amount of time, and without complications (bacterial) which would prolong the healing.

This article proposes a new approach in treating skin injuries, using platelet-rich plasma (PRP) to accelerate the healing. By using PRP, a high concentrate release of growth factors occurs at the level of the injury, resulted from the degranulation of the platelets (Song et al., 2003). Actually supraphysiologic levels of autologous platelets are used in the lesion outbreak, which lead to the acceleration of the healing process, in half the time, to be exact (Marx, 2004).

### MATERIALS AND METHODS

The experiment conducted to test the effectiveness of the platelet-rich plasma (PRP) in case of lesions induced to the skin, was carried out at the University of Medicine Science, Cluj-Napoca, in the discipline of Compared Anatomy. The experiment subjects were represented by a group consisting of 4 rabbits, 6 weeks of age, and of California white breed. They were males, between 1000-1400 grams.

Next, they were divided into two groups: one for control, and one for test. Both groups were induced with two types of skin injuries. The first category of lesion was an incision between 3-4 cm on the skin, going down to the subcutaneous connective tissue. The skin was then sutured with a nonresorbable nylon thread. The second category of lesion consisted of an excision of a 3/3 cm square of skin down to the

subcutaneous connective tissue, located in the dorsal thoracic region.

The protocol for accelerating the healing assumed local application at the level of the healing, and through an injection, perilesional, of the platelet-rich plasma (Anitua et al. 2012). The subcutaneous injections started from day 0 (the day the lesions occurred). After this there was one administration of platelet-rich plasma each 7 days. In all of this time, a weekly observation of the macroscopical aspect, and the dynamics of the process of healing was made, in comparison to the control group. The technique to preparing PRP comprised of the following steps: first a sample of blood with anticoagulant (Sodium Citrate) was taken. Then it was put in a centrifuge at 2000 rpm for 5 minutes. Then the platelets were activated with 12% calcium chloride, 50 µl for each ml of plasma. So for 3 ml of plasma (the quantity we manage to take) we used, 0.15 ml of calcium chloride. In the final stage we injected PRP perilesional.

## RESULTS AND DISCUSSIONS

The results of the induced skin lesions of the rabbits and the treatment with the PRP, were evaluated microscopically through inspection and palpation, each week.

In the first week we saw a contraction if the excised zone, on both groups, thus the lesion was visibly smaller. This contraction was a bit accelerated on the group treated with PRP. Also the wounds had surface crust on them. The control group had a thicker crust than the test group. There was no sign of infection. Around the lesion and at the suture zone, was seen an acceleration of hair growth, in the test group, compared to the control group. In week two they were more obvious. The control group had a surface crust on a wider area than the test group (Figure 1). The contraction of the wound if more obvious on the test group, and the peripheral erythema is less expressed in the case of the test group. On the control group this still persists. Remarkable results were obtained in hair regeneration.



Figure 1. Evolution of healing – week two (superior – control, inferior – test)

This is obvious in the test group compared to the control group. This can be seen in Figure 2. We also saw differences on the same individual, where a difference in hair growth was seen depending on the localization. The hair was long and thick around the lesion, where we injected PRP, and a large quantity of growth factors were released (Figure 3, 4).



Figure 2. Comparative hair regeneration (Control↑, Test↓)



Figure 3. Pronounced perilesional hair regeneration



Figure 4. Pronounced perilesional hair regeneration

In the 3<sup>rd</sup> week the shaved surface, including the lesion area was completely covered by hair on the test group. The hair was the same length and density as the rest of the fur. We could not observe any post lesion scars, but we could feel a densification of the skin (Figure 5). The control group had visible post lesion scars. The hair started to regenerate, but it did not cover the whole shaved surface, and it was shorter than the rest of the fur. (Figure 6).



Figure 5. Healing of the test subject I – week 3



Figure 6. . Healing of the test subject II – week 3

In the case of the second test subject we saw the absence of the crust compared to the control subject and a complete epithelialization of the excised area (Figure 7). Also the hair characteristics of the second test subject are superior in comparison to the control subject. The hair was the same as the surrounding fur (Figure 8).



Figure 7. Healing of the control subject I – week 3



Figure 9. Evolution of the healing in control 1 – week 4



Figure 8. Healing of the control subject II – week 3



Figure 10. Evolution of the healing in test subject 1 – week 4

In the 4<sup>th</sup> week, the dynamic of the lesion healing was more obvious at the control group. On the test group the lesions were barely perceptible, and the hair regeneration was complete (Figure 10).

So at the control subjects we could see an obvious hair regeneration, but it did not uniformly cover the whole shaved area. (Figure 9).

## CONCLUSIONS

In conclusion to the experiment we obtained remarkable results regarding the usage of PRP in the healing process of lesions and especially in hair regeneration.

These results bring compelling arguments in behalf of PRP, in the treatment of skin level injuries like:

- an acceleration of the healing process was observed;
- scarring and retraction of the wound was realized more rapidly in the test group compared to the control group;
- the crust on the lesion were small, thin, less adherent, and with epithelial tissue

- all around them on the tests subjects, compared to the control group;
- the perilesional erythema was greatly diminished on the test group;
  - the hair regeneration was highly impressive, and much accelerated in the test group treated with PRP, then in the control group. There were also differences regarding the size of the hair;
  - regarding the hair strands, we saw differences even on the same test subject. The subject's hair was more thick in the area where we made the injections, comparative to the outer shaved area.

Given the above, we recommend using the platelet-rich plasma to accelerate the healing process.

The application technique is not difficult, and it does not need any special equipment, and the results are impressive, with minimum risk and complication.

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