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Platelet quantification and growth factor analysis from platelet-rich plasma: implications for wound healing.

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Growth factors released from activated platelets initiate and modulate wound healing in both soft and hard tissues. A recent strategy to promote the wound-healing cascade is to prepare an autologous platelet concentrate suspended in plasma, also known as platelet-rich plasma, that contains growth factors and administer it to wound sites.

The purpose of this study was to quantitate platelet number and growth factors released from a prepared platelet concentrate. Whole blood was drawn from 10 healthy patients undergoing cosmetic surgery and concentrated into platelet-rich plasma.

Platelet counts on whole blood and platelet-rich plasma were determined using a Cell-Dyn 3200. Platelet-derived growth factor-BB, transforming growth factor-beta1, vascular endothelial growth factor, endothelial growth factor, and insulin-like growth factor-1 were measured in the platelet-rich plasma using the enzyme-linked immunosorbent assay method.

In addition, platelet activation during the concentration procedure was analyzed by measuring P selectin values in blood serum. An 8-fold increase in platelet concentration was found in the platelet-rich plasma compared with that of whole blood (baseline whole blood, $197 \pm 42 \times 10^4$ platelets/microl; platelet concentrate, $1600 \pm 330 \times 10^4$ platelets/microl). The concentration of growth factors also increased with increasing platelet number.

However, growth factor concentration varied from patient to patient. On average for the whole blood as compared with platelet-rich plasma, the platelet-derived growth factor-BB concentration increased from 3.3 ± 0.9 ng/ml to 17 ± 8 ng/ml, transforming growth factor-beta1 concentration increased from 35 ± 8 ng/ml to 120 ± 42 ng/ml, vascular endothelial growth factor concentration increased from 155 ± 110 pg/ml to 955 ± 1030 pg/ml, and endothelial growth factor concentration increased from 129 ± 61 pg/ml to 470 ± 320 pg/ml. No increase was found for insulin-like growth factor-1. In addition, no increase in platelet activation occurred during the concentration procedure as determined by the platelet surface receptor P selectin (45 ± 16 pg/ml to 52 ± 11 pg/ml, $p = 0.65$).

In conclusion, a variety of potentially therapeutic growth factors were detected and released from the platelets in significant levels in platelet-rich plasma preparations. Sufficient concentrates and release of these growth factors through autologous platelet gels may be capable of expediting wound healing in a variety of as yet undetermined specific wound applications.

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