

History of autologous platelet-rich plasma: A short review

Patrycja Mościcka MSc | Andrzej Przylipiak MD

Department of Esthetic Medicine, Faculty of Pharmacy, Medical University of Białystok, Białystok, Poland

Correspondence

Andrzej Przylipiak, Department of Esthetic Medicine, Faculty of Pharmacy, Medical University of Białystok, Białystok, Poland.
 Email: andrzej.przylipiak@umb.edu.pl

Funding information

Medical University in Białystok, Grant/Award Number: SUB/1/DN/21/002/2230

Abstract

Background: Platelet-rich plasma (PRP) is a medical material with numerous applications. It produces particularly spectacular effects when applied in cosmetic dermatology.

Aim: To illustrate the origin of the treatment.

Conclusion: The therapy originates from transfusiology, where it is applied as a concentrate of platelets to treat thrombocytopenia. PRP treatment is 70 years old and has an increasing number of applications. PRP holds particular promise for cosmetic dermatology.

KEY WORDS

cosmetic dermatology, history, platelet-rich plasma, regeneration, rejuvenation

1 | INTRODUCTION

Platelet-rich plasma (PRP), whose therapeutic value is equal to that of stem cells, is currently one of the most promising therapy agents in regenerative medicine. It is increasingly being used in different areas of medicine including aesthetic dermatology, orthopedics, sports medicine and surgery. The aim of the present paper was to explain the origin of this treatment.

The discovery of structures other than erythrocytes and leucocytes in blood by Donné in 1842 astounded his contemporaries.¹ Julius Bizzozero was the first to name the new structures "le piastrine del sangue" – platelets. In 1882, he described the role of platelets in blood coagulation *in vitro*, as well as their involvement in the etiology of thrombosis *in vivo*. He also found that the vascular wall had an inhibitory effect on platelet adhesion.^{2,3} Further progress in the development of regenerative therapy techniques was achieved by Wright who discovered megakaryocytes, which are precursors of platelets.⁴

In the early 1940s, clinicians used embryonic "extracts" composed of growth factors and cytokines to promote wound healing.⁵ Rapid and effective wound healing is crucial for the success of

surgical procedures. Therefore, Eugen Cronkite et al. introduced a combination of thrombin and fibrin in skin grafting.⁶ Firm and stable adhesion of flaps, guaranteed by the use of the above components, plays an important role in this type of surgery.

In the early 20th century, clinicians saw an urgent need to introduce platelet transfusion in the treatment of thrombocytopenia. This resulted in improvements in techniques of platelet concentrate preparation. Supplementation with platelet concentrate prevents bleeding in the patient. At the time, clinicians and laboratory hematologists attempted to prepare platelet concentrate for transfusion. Methods for obtaining concentrates developed rapidly and were significantly improved since isolated plates rapidly lose their viability and therefore have to be stored at 4°C and administered within 24 hours.⁷

2 | MATERIALS AND METHODS

In the 1920s, citrates were used as anticoagulants in obtaining platelet concentrates. Progress in platelet concentrate preparation accelerated when flexible plastic blood containers were created in the 1950s and 1960s.⁸

Patrycja Mościcka and Andrzej Przylipiak equally contributed to the work.

This is an open access article under the terms of the Creative Commons Attribution-NonCommercial License, which permits use, distribution and reproduction in any medium, provided the original work is properly cited and is not used for commercial purposes.

© 2021 The Authors. *Journal of Cosmetic Dermatology* published by Wiley Periodicals LLC.

The term "platelet-rich plasma" was used for the first time in 1954 by Kingsley et al. to refer to the standard platelet concentrate for transfusion.⁹ During the 1960s, the first blood bank PRP preparations appeared and became popular in 1970s.¹⁰

At the end of the 1950s and 1960s, the "EDTA Platelet Pack" was used. The set contained a plastic bag with EDTA blood and allowed for platelets, which remained suspended in a small amount of plasma after the procedure, to be concentrated by centrifugation.¹¹

3 | RESULTS

It was hypothesized that growth factors (GFs) were further compounds of PRP which were secreted from platelets and participated in its action. The hypothesis was confirmed in the 1980s. It was demonstrated that bioactive molecules (GFs) were released from platelets to repair damaged tissue, such as skin ulcers.^{11,12} A number of studies exploring this issue have been conducted to date. One of the most frequently investigated subjects in this field is a combination of PRP and hyaluronic acid.¹³ Epidermal growth factor (EGF) was discovered by Cohen in 1962. Further GFs followed are platelet-derived growth factor (PDGF) in 1974 and vascular endothelial growth factor (VEGF) in 1989.⁴

Progress in medicine in general has also led to rapid advances in platelet application. In 1972, for the first time, Matras used platelets as sealants to establish blood homeostasis during surgical procedures.¹⁴ Furthermore, in 1975 Oon and Hobbs were the first scientists to use PRP in reconstructive treatment.¹⁵ In 1987, Ferrari et al. used platelet-rich plasma in heart surgery as an autologous source of transfusion for the first time, thus reducing intraoperative blood loss, hematological disorders of the peripheral pulmonary circulation, and subsequent use of blood products.^{16,17}

In 1986, Knighton et al. were the first scientists who described platelet concentrate protocols and named them autologous platelet-derived wound healing factors (PDWHF).¹⁸ Since formulating the protocols, this technique has been increasingly applied in aesthetic medicine.¹⁹ Since the late 1980s, PRP has been used in regenerative medicine.¹²

Apart from general and cardiac surgery, maxillofacial surgery is another area in which PRP became popular in the early 1990s.²⁰ PRP was applied to improve transplant incorporation in mandibular reconstructions.²¹ PRP also started to be implemented in dentistry, where it has been used since the late 1990s to improve incorporation of dental implants and facilitate bone regeneration.²² Additionally, fibrin glue is a well-known related material introduced at the time.¹⁰ Further development in the application of PRP in dentistry occurred after the invention of platelet-rich fibrin (PRF), a type of platelet concentrate which does not require the addition of anticoagulants, by Choukroun.¹⁸ The popularity of PRF grew in the 2000s, with increased application in dental procedures including regeneration of hyperplastic gingival tissue and periodontal defects, palatal wound closure, treatment of gingival recession, and extraction sockets.²³

4 | DISCUSSION

The use of PRP in the process of plasmapheresis in enhancing bone regeneration was described in 1999 by Anitua.¹⁵ Having observed beneficial effects of the treatment, the scientist conducted further research of the phenomenon. His subsequent papers reported the impact of this fraction of blood on chronic cutaneous ulcers, dental implants, tendon healing, and orthopedic sport injuries.¹⁵

Since 2000, several agents activating PRP have been used, for example, calcium chloride and bovine thrombin.¹⁰

Thanks to its excellent properties, PRP is used in orthopedics. The results of the first in-depth study on the effects of growth factors on tendon tissue in humans were published in 2005.²⁴ PRP therapy is currently used to treat degenerative disorders and promote the healing of tendons, ligaments, muscles, and cartilage.¹⁷ It is indicated that the continuing popularity of this procedure in orthopedics may also be associated with the frequent use of PRP by sports stars.²⁵

In 2009, an experimental animal study confirming the hypothesis that PRP concentrate improves the healing of muscle tissue was published.²⁶ Potential mechanisms of PRP action in the skin are currently the subject of intensive scientific research.²⁷

Since 2010 or earlier, PRP has been successfully applied in cosmetic dermatology. Following a PRP injection, the skin looks younger, displays considerably improved hydration, flexibility, and color.²⁷ PRP is also used to improve hair growth.²⁸ Two types of PRP are currently used in hair growth therapy – non-activated platelet-rich plasma (A-PRP) and activated platelet-rich plasma (AA-PRP). However, Gentile et al. demonstrated that improved hair density and hair count parameters can be achieved by injecting A-PRP.²⁹ Furthermore, it has been proven that treatment with PRP prior to hair transplantation results in enhanced hair growth and improved hair density.^{30,31} In addition, in 2009, studies demonstrate that fat graft acceptance and survival can be improved by using a mix of PRP and fat, which may produce enhanced effects of plastic surgery.^{32,33}

The most recent research results in cosmetic dermatology demonstrate that the combined therapy of PRP and CO₂ laser treatment produces a more marked reduction in acne scars.^{36,37} Similarly, PRP and microneedling result in more organized collagen bundles in the skin in comparison with the PRP therapy alone [41,42].

The history of PRP is not short, and the discoveries related to this blood fraction are significant. Clinicians and scientists are actively searching for new treatment modalities. As one such modality, PRP is used in many fields of medicine, including gynecology,²⁰ urology,³⁴ and ophthalmology.³⁵

5 | CONCLUSIONS

This concise review demonstrates that the history of PRP is at least 70 years old. Therefore, the method is sufficiently established to allow for wide application in medicine and, in particular, in cosmetic dermatology.

CONFLICT OF INTEREST

There is no conflict of interest.

REFERENCES

1. Hajdu SI. A note from history: The discovery of blood cells. *Ann Clin Lab Sci*. 2003;33(2):237-238.
2. Stassen JM, Nyström A. A historical review of hemostasis, thrombosis, and antithrombotic therapy. *Ann Plast Surg*. 1997;39(3):317-329.
3. de Gaetano G. Historical overview of the role of platelets in hemostasis and thrombosis. *Haematologica*. 2001;86(4):349-356.
4. Sánchez-González DJ, Méndez-Bolaina E, Trejo-Bahena NI. Platelet-rich plasma peptides: key for regeneration. *Int J Pept*. 2012;2012:532519.
5. Zielins ER, Atashroo DA, Maan ZN, et al. Wound healing: An update. *Regen Med*. 2014;9:817-830.
6. Raeissadat SA, Babaee M, Rayegani SM, et al. An overview of platelet products (PRP, PRGF, PRF, etc.) in the Iranian studies. *Future Science OA*. 2017;3(4):FSO231.
7. Vassallo R, Scott Murphy, MD: platelet storage pioneer. *Transfus Med Rev*. 2011;25(2):156-161.
8. Aster RH. Blood platelet kinetics and platelet transfusion. *J Clin Invest*. 2013;123(11):4564-4565.
9. Hurjui I, Delianu C, Hurjui Loredana L, et al. Platelet derivatives with dental medicine applications. *J Oral Rehabil*. 2020;12:142-152.
10. Ra Hara G, Basu T. Platelet-rich plasma in regenerative medicine. *Biomed Res Ther*. 2014;1:25-31.
11. Fredriksson L, Li H, Eriksson U. The PDGF family: four gene products form five dimeric isoforms. *Cytokine Growth Factor Rev*. 2004;15(4):197-204.
12. Conde Montero E, Fernández Santos ME, Suárez FR. Platelet-rich plasma: applications in dermatology. *Actas Dermosifiliogr*. 2015;106(2):104-111.
13. De Angelis B, D'Autilio MFLM, Orlandi F, et al. Wound healing. In Vitro and In Vivo evaluation of a bio-functionalized scaffold based on hyaluronic acid and platelet-rich plasma in chronic ulcers. *J Clin Med*. 2019;8(9):1486.
14. Khan F, Parayaruthottam P, Roshan G, et al. Platelets and their pathways in dentistry: systematic review. *J Int Soc Prevent Commun Dent*. 2017;7(2):55-60.
15. Cervelli V, Bocchini I, Di Pasquali C, et al. P.R.L. platelet rich lipotransfert: our experience and current state of art in the combined use of fat and PRP. *Biomed Res Int*. 2013;2013:434191.
16. Girijala RL, Riahi RR, Cohen PR. Platelet-rich plasma for androgenic alopecia treatment: A comprehensive review. *Dermatol Online J*. 2018;24(7):13030/qt8s43026c.
17. Wu PI, Diaz R, Borg-Stein J. Platelet-rich plasma. *Phys Med Rehabil Clin N Am*. 2016;27(4):825-853.
18. Ghanaati S, Herrera-Vizcaino C, Al-Maawi S, et al. Fifteen years of platelet rich fibrin in dentistry and oromaxillofacial surgery: how high is the level of scientific evidence? *J Oral Implantol*. 2018;44(6):471-492.
19. Cieslik-Bielecka A, Choukroun J, Odin G, Dohan Ehrenfest DM. L-PRP/L-PRF in esthetic plastic surgery, regenerative medicine of the skin and chronic wounds. *Curr Pharm Biotechnol*. 2012;13:1266-1277.
20. Bos-Mikich A, de Oliveira R, Frantz N. Platelet-rich plasma therapy and reproductive medicine. *J Assist Reprod Genet*. 2018;35(5):753-756.
21. Tözüm TF, Demiralp B. Platelet-rich plasma: a promising innovation in dentistry. *J Can Dent Assoc*. 2003;69(10):664.
22. Anita E. Plasma rich in growth factors: preliminary results of use in the preparation of future sites for implants. *Int J Oral Maxillofac Implants*. 1999;14(4):529-535.
23. Miron RJ, Fujioka-Kobayashi M, Hernandez M, et al. Injectible platelet rich fibrin (i-PRF): opportunities in regenerative dentistry? *Clin Oral Invest*. 2017;21:2619-2627.
24. Anita E, Sanchez M, Nurden AT, et al. Autologous fibrin matrices: a potential source of biological mediators that modulate tendon cell activities. *J Biomed Mater Res A*. 2006;77:285-293.
25. Rachul C, Rasko JEJ, Caulfield T. Implicit hype? Representations of plateletrichplasmainthe newsmedia. *PLoS One*. 2017;12(8):e0182496. <https://doi.org/10.1371/journal.pone.0182496>
26. Lubkowska A, Dolegowska B, Banfi G. Growth factor content in PRP and their applicability in medicine. *J Biol Regul Homeost Agents*. 2012;26(2 Suppl 1):3-22.
27. Maisel-Campbell AL, Ismail A, Reynolds KA, et al. A systematic review of the safety and effectiveness of platelet-rich plasma (PRP) for skin aging. *Arch Dermatol Res*. 2020;312:301-315.
28. Gentile P, Garcovich S, Bielli A, Scigli MG, Orlandi A, Cervelli V. The effect of platelet-rich plasma in hair regrowth: a randomized placebo-controlled trial. *Stem Cells Transl Med*. 2015;4(11):1317-1323.
29. Gentile P, Calabrese C, De Angelis B, et al. Impact of the different preparation methods to obtain autologous non-activated platelet-rich plasma (A-PRP) and activated platelet-rich plasma (AA-PRP) in plastic surgery: wound healing and hair regrowth evaluation. *Int J Mol Sci*. 2020;21(2):431.
30. Cervelli V, Garcovich S, Bielli A, et al. The effect of autologous activated platelet rich plasma (AA-PRP) injection on pattern hair loss: clinical and histomorphometric evaluation. *Biomed Res Int*. 2014;2014:760709.
31. Uebel CO, da Silva JB, Cantarelli D, Martins P. The role of platelet plasma growth factors in male pattern baldness surgery. *Plast Reconstr Surg*. 2006;118(6):1458-1466.
32. Gentile P, Garcovich S. Systematic review—the potential implications of different platelet-rich plasma (PRP) Concentrations in regenerative medicine for tissue repair. *Int J Mol Sci*. 2020;21(16):5702. <https://doi.org/10.3390/ijms21165702>
33. Cervelli V, Gentile P, Scigli MG, et al. Application of platelet-rich plasma in plastic surgery: clinical and in vitro evaluation. *Tissue Eng Part C Methods*. 2009;15(4):625-634.
34. Matz EL, Pearlman AM, Terlecki RP. Safety and feasibility of platelet rich fibrin matrix injections for treatment of common urologic conditions. *Investig Clin Urol*. 2018;59(1):61-65.
35. García-Conca V, Abad-Collado M, Hueso-Abancens JR, et al. Efficacy and safety of treatment of hyposecretory dry eye with platelet-rich plasma. *Acta Ophthalmol*. 2019;97(2):e170-e178.
36. Tawee A, Refae A, Hamed A, Kamal A. Comparative study of the efficacy of Platelet-rich plasma combined with carboxytherapy vs its use with fractional carbon dioxide laser in atrophic acne scars. *J Cosm Dermatol*. 2019;18:150-155.
37. El-Domyati M, Abdel-Wahab H, Hossam A. Microneedling combined with platelet-rich plasma or trichloroacetic acid peeling for management of acne scarring: A split-face clinical and histologic comparison. *J Cosmet Dermatol*. 2018;17:73-83. <https://doi.org/10.1111/jocd.12459>

How to cite this article: Mościcka P, Przylipiak A. History of autologous platelet-rich plasma: A short review. *J Cosmet Dermatol*. 2021;20:2712-2714. <https://doi.org/10.1111/jocd.14326>