

# Does Platelet-Rich Plasma Promote Facial Rejuvenation? Revising the Latest Evidence in a Narrative Review

Manuel Neiva-Sousa<sup>1</sup>, Clara Carracha, Luis Nunes da Silva, Paulo Valejo Coelho<sup>1</sup>

Department of Maxillofacial Surgery, Centro Hospitalar Universitário de Lisboa Central, <sup>1</sup>NOVA Medical School, Universidade Nova de Lisboa, Lisbon, Portugal

## Abstract

Facial aging is characterized by progressive macroscopic, histological, and molecular changes. Due to its regenerative and rejuvenating properties, the use of platelet-rich plasma (PRP) as a facial antiaging agent has gained popularity over the last decade. In order to gather and evaluate the latest evidence focusing on the effect of PRP on facial skin rejuvenating, a search through MEDLINE (PubMed) using relevant keywords, inclusion, and exclusion criteria was performed. A total of 539 articles were initially retrieved, and from those, 16 were included in the review. Treatment protocols comprised the use of PRP both in monotherapy and in combination with other substances and by means of direct injection or topical application following skin permeation. The selected studies presented high variability regarding PRP preparation methods, administration protocols, and results assessment. In most studies, PRP seemed to improve to some degree the signs of facial aging, such as wrinkles, skin quality, and pigmentation, accompanied by significant histological and molecular responses. Optimizing treatment protocols should be the next step in assessing the full potential of PRP.

**Keywords:** Aging, face, hyperpigmentation, platelet-rich plasma, PRP, rejuvenation, skin, wrinkles

## INTRODUCTION

Signs of facial aging include the appearance of wrinkles, deepening of expression lines, and altered skin pigmentation, texture, and elasticity. Skin youthfulness relies on a fine-tuned equilibrium between anabolism and catabolism, and aging reflects a progressive metabolic imbalance, that includes increased collagen and elastin degradation, accompanied by reduced and disorganized fiber production.<sup>[1]</sup> A therapeutic agent able to reverse these deleterious processes could, in theory, exhibit an antiaging effect and promote a facial esthetic regeneration. Platelet-rich plasma (PRP) is defined as autologous plasma with a platelet concentration above the baseline (150,000/ $\mu$ L to 400,000/ $\mu$ L), usually four to seven times higher.<sup>[2,3]</sup> The healing role of platelets in response to injury is well known, with clinical effects partially relying on the release of alpha granules, rich in growth factors such as platelet-derived growth factor, transforming growth factor- $\beta$ 1 and - $\beta$ 2 (TGF- $\beta$ 1 and TGF- $\beta$ 2), vascular endothelial growth factor, basic fibroblast growth factor (bFGF), and epithelial growth factor (EGF).<sup>[4]</sup> As wound healing and tissue rejuvenation share some common

metabolic features, it was hypothesized that PRP could act on both pathways.<sup>[5]</sup> PRP has been traditionally used in regenerative treatments in oral and maxillofacial surgery<sup>[6,7]</sup> and orthopedic surgery,<sup>[8]</sup> but in recent years, its potential rejuvenating properties have also sparked the interest of reproductive medicine<sup>[9]</sup> and dermatology.<sup>[10]</sup> When applied in skin, PRP could potentially recycle the damaged extracellular matrix through the activation of leukocyte matrix metalloproteases, stimulation of fibroblast proliferation, and increased collagen production via increased expression of G1 cell cycle regulators.<sup>[11,12]</sup> In the last decade, case reports, prospective studies, and a few clinical trials have addressed the skin-rejuvenating properties of PRP.<sup>[13-15]</sup> Each publication usually describes its own method of preparation and application of PRP and evaluation of final results. This lack of uniformity between authors may help explain why some excitingly

**Address for correspondence:** Dr. Manuel Neiva-Sousa, Departamento de Cirurgia Maxilofacial, Hospital S. José. Rua José António Serrano, 1150-199 Lisbon, Portugal. E-mail: mfsousa@gmail.com

This is an open access journal, and articles are distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 4.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

**For reprints contact:** reprints@medknow.com

**How to cite this article:** Neiva-Sousa M, Carracha C, Nunes da Silva L, Valejo Coelho P. Does platelet-rich plasma promote facial rejuvenation? Revising the latest evidence in a narrative review. *J Cutan Aesthet Surg* 2023;16:263-9.

### Access this article online

#### Quick Response Code:



**Website:**  
www.jcasonline.com

**DOI:**  
10.4103/JCAS.JCAS\_210\_22

describe PRP as the new “fountain of youth,” whereas others simply do not find any differences compared to placebo. In this work, the author aims to systematically review the latest evidence available on the use of PRP for facial skin rejuvenating.

## MATERIALS AND METHODS

MEDLINE (PubMed) was searched for articles focusing on the use of PRP for facial skin rejuvenation. Search terms were ([platelet-rich plasma OR PRP] AND [face, aging, wrinkles, or rejuvenation]). Inclusion criteria were (1) peer-reviewed original clinical trials, (2) written in English language, (3) published from January 1, 2017 through July 31, 2022, (4) focusing of facial skin rejuvenation, and (5) treatment with PRP alone or in association with other procedures. Exclusion criteria were (1) studies other than clinical trials (e.g., case reports, meta-analysis), (2) use of PRP to treat anatomical structures other than facial skin (e.g., joints, ovaries), and (3) treatments not focusing on facial aging (e.g., alopecia, acne scars).

## RESULTS

Initial search retrieved 539 articles and from these, 523 were excluded based on title, abstract and exclusion criteria. A total of 16 articles were included in the review,<sup>[16-31]</sup> with an aggregate of 586 participants [Table 1]. Among the 16 articles, in 10 studies (62.5%), PRP was injected in monotherapy, in five studies (31.2%), PRP was topically applied following ablative laser treatment (CO<sub>2</sub> or erbium), microneedling or electroporation and in one study (6.3%) PRP was injected in conjunction with autologous fat. Eight studies (50.0%) were split-face comparative clinical trials, with PRP being compared to placebo (four articles, 25.0%), platelet-poor plasma (PPP) gel (two articles, 12.5%), trichloroacetic acid (TCA) (one article, 6.3%), and readymade growth factors (one article, 6.3%). One study (6.3%) compared groups of participants treated with ablative CO<sub>2</sub> laser and PRP *versus* ablative CO<sub>2</sub> laser alone and in seven studies (43.8%) participants acted as their own controls in a before- *versus* after-treatment assessment.

In a straightforward attempt to understand how PRP can enhance facial rejuvenation several studies were design to directly compare PRP with placebo. Cameli *et al.*<sup>[20]</sup> and Elnehrawy *et al.*<sup>[25]</sup> evaluated the effect of PRP on facial skin rejuvenation. The former performed three sessions of PRP injection at one-month intervals while the later designed a study using a single PRP injection. Using both subjective (clinical and participants evaluation) and objective (by means of instrumental noninvasive devices) evaluations, Cameli *et al.*<sup>[20]</sup> concluded that PRP improved skin texture, elasticity and smoothness, skin barrier function, and capacitance. Elnehrawy *et al.*<sup>[25]</sup> described a significant improvement of wrinkles, notably the nasolabial fold, after treatment with PRP. In

the following year, Alam *et al.*<sup>[16]</sup> published their results using a split-face model to evaluate the effect of a single injection of PRP to the cheek. Again, evaluation was performed by both physicians (two dermatologists) and participants. No significant improvement was assessed by physicians. In contrast, participants considered that the PRP-treated side was significantly improved in both texture and wrinkles, leading to an increased overall satisfaction. Everts *et al.*<sup>[26]</sup> and Lee *et al.*<sup>[29]</sup> published their studies using pretreatment photographs of participants as controls. In the former, participants received PRP injections in three sessions at one-month intervals, while in the later participants received only a single PRP injection. Everts *et al.*<sup>[26]</sup> described that wrinkle count significantly decreased and skin firmness improved right after the first PRP injection, with these effects being sustained throughout the six-month follow-up period. At the end of this period, a decrease in erythema was also noted. Overall patient satisfaction was above 90%. In contrast, Lee *et al.*<sup>[29]</sup> reported that only 45% of participants showed any type of esthetic improvement according to physician assessment, although most participants were satisfied with the results. Draelos *et al.*<sup>[22]</sup> designed a split-face study in which PRP was not directly injected in the skin as in the previously presented articles, but mixed with a serum and applied as a mask following electroporation, twice daily for 8 weeks. No significant differences were recorded, although results suggested that PRP mixed with serum could improve skin radiance, luminosity, firmness, and softness. Skin biopsies performed on four patients at the end of the evaluation period revealed that PRP mixed with serum was able to improve the architecture of rete peg and upregulate collagen gene expression. Du and Lei<sup>[23]</sup> an interesting study where they not only designed a split-face study to evaluate PRP *versus* phosphate-buffered saline (PBS) injected in three sessions with 2-week intervals but also irradiated a human organotypic skin model with ultraviolet-B light before injecting it with PRP to evaluate effect on gene expression.<sup>[23]</sup> Results showed that PRP improved the skin quality of participants. Multispectral imaging also revealed that PRP decreased wrinkles, texture, and pores when compared with the PBS treatment. The *in vitro* study suggested that PRP ameliorated skin photoaging through regulation of MMP-1, tyrosinase, fibrillin, and tropoelastin gene expression. Finally, Banihashemi *et al.*<sup>[18]</sup> demonstrated that injections with PRP in two sessions with 3-month interval, at 3- and 6-month follow-ups were associated with moderate to excellent improvement of periorbital dark circles and wrinkles, nasolabial folds, and skin stiffness (although only dark circles and nasolabial folds were statistically significant).

Another set of studies focused on comparing the effects of PRP *versus* other substances on facial rejuvenation. Gawdat *et al.*<sup>[27]</sup> proposed to compare PRP with a readymade growth factor solution (mesotherapy) using

**Table 1: Included articles with year of publication, number of participants, study design, outcome, and results**

Author	Year	n	Study design	Outcome	Results
Alam <i>et al.</i> <sup>[16]</sup>	2018	27	Split-face study. Participants and raters masked. Each participant received intradermal injections of PRP to one cheek and sterile normal saline to the contralateral cheek	Primary outcomes were photoaging scores for fine lines, mottled pigmentation, roughness, and sallowness, rated by two masked dermatologists. Secondary outcomes included participant self-assessment scores of improvement	Photoaging scores rated by dermatologists showed no significant difference between PRP and normal saline. At six months after a single treatment, participants rated the PRP-treated side as significantly more improved compared with normal saline for texture and wrinkles
Araco <sup>[17]</sup>	2019	50	Two groups of 25 patients each. Both groups submitted to CO <sub>2</sub> laser skin ablation followed by (first group) topic PRP twice a day for 12 weeks or (second group) gentamicin, betamethasone, and hyaluronic acid gel	Primary outcomes were skin hydration, collagen fiber content and elasticity assessed by a digital skin analyzer. Secondary outcomes included wrinkle reduction and lifting effect assessed by two doctors	Topical PRP improved moisture, amount of collagen fibers and skin elasticity, reduced superficial perioral wrinkles, and restored dermal matrix
Banihashemi <i>et al.</i> <sup>[18]</sup>	2021	30	Participants injected with PRP in two sessions with three-month interval. Comparison between pre- and posttreatment	Outcomes were wrinkle and darkness improvement, based on personal judgment of participants, skin scan, and assessment by the therapeutic physician and a masked second dermatologist	In 3- and 6 months follow-up, injectable PRP significantly improved periorbital dark circles (according to participants, therapeutic physician and second dermatologist) and nasolabial folds (according to therapeutic physician)
Cai <i>et al.</i> <sup>[19]</sup>	2020	158	Skin irradiated with erbium fractional laser, followed by coat of PRP and subsequent cold coat of platelet-poor plasma	Outcomes were participants and physician evaluation of photoaging based on skin color, telangiectasia, enlarged pores, hyperpigmentation, and skin texture	Signs of skin aging, especially skin color, pore expansion, and skin texture, showed clear improvement according to both participants and physicians
Cameli <i>et al.</i> <sup>[20]</sup>	2017	12	Participants injected with PRP in three sessions with 1-month intervals. Comparison between pre- and posttreatment	Clinical and instrumental outcomes were evaluated before and after the end of treatment by means of transepidermal water loss, corneometry, Cutometer, Visioscan, and Visioface	Clinical and patient evaluation showed improvement of skin texture. Skin gross elasticity, skin smoothness parameters, skin barrier function, and capacitance were significantly improved
Diab <i>et al.</i> <sup>[21]</sup>	2021	40	Split-face study focused on the periorbital area. Each participant received intradermal injection of PRP on the right side and subdermal injection of plasma gel on the left side. Two treatment sessions, four weeks apart	Outcome was esthetic improvement, assessed by physician evaluation and participant satisfaction. A 3D camera was used for objective assessment	Both modalities yielded a significant improvement of periorbital wrinkles after the second session, with significantly better results on the plasma gel injected side. Benefits were not maintained for the following three months. No improvement in periorbital pigmentation
Draelos <i>et al.</i> <sup>[22]</sup>	2019	20	Split-face study to evaluate the effect of a PRP-containing serum <i>versus</i> the serum alone on facial photoaging applied twice daily for eight weeks, following electroporation. Histological evaluation on a subset of four participants	Outcomes included appearance assessed by both a dermatologist and the participant. Immunohistochemical evaluation for collagen and elastin and expression of collagen 1A1 (COL1 A), keratinocyte proline rich protein (KPRP), and matrix metalloproteinase 1 (MMP1) genes were also assessed	PRP did not significantly improve appearance. Immunohistochemistry results demonstrated higher levels of collagen type I and qPCR results showed upregulation of collagen mRNA in the PRP + serum
Du and Lei <sup>[23]</sup>	2020	30	Split-face study and <i>in vitro</i> study. Each participant received intradermal injections of PRP on the right side of the face and saline buffer (PBS) contralaterally. Three sessions in 2 weeks intervals. A human organotypic skin model was treated with PBS or PRP followed by UV-B light irradiation	Outcomes included skin texture, thickness, pigmentation, pores, wrinkles, smoothness, porphyrin, UV spots, and brown spots detected with a Visia skin tester. Histology and expression of matrix metalloproteinase-1 (MMP-1), tyrosinase, fibrillin, and tropoelastin were also assessed	PRP improved the skin quality of the participants. Wrinkles, texture, and pores were decreased in the PRP group <i>vs</i> saline buffer treatment. PRP was able to reverse the aberrant gene expression induced by UV-B
El-Domyati <i>et al.</i> <sup>[24]</sup>	2018	24	Split-face study. Three groups of eight participants each: a) dermaroller (DR) alone <i>versus</i> DR + PRP, b) DR alone <i>versus</i> DR + TCA15%, c) DR + PRP <i>versus</i> DR + TCA15%. Sessions every 2 weeks, during 12 weeks. Histological evaluation	Outcomes were wrinkle appearance, skin texture, and overall satisfaction, assessed by two blinded dermatologists and two independent observers. Histological evaluation of collagen and elastin was also conducted	Combined treatment of DR + PRP or DR + TCA15% showed significant improvement when compared with DR alone. DR-PRP presented the best results for the improvement of dermal structures

**Table 1: Continued**

Author	Year	n	Study design	Outcome	Results
Elnehrawy <i>et al.</i> <sup>[25]</sup>	2017	20	Participants injected with PRP in a single session. Comparison between pre- and 8 weeks posttreatment	Outcome included correction of deep nasolabial folds, crows' feet wrinkles, and transverse forehead lines	Significant improvement of wrinkles after treatment with PRP, with nasolabial fold being the most responsive type to treatment
Everts <i>et al.</i> <sup>[26]</sup>	2019	11	Participants injected with PRP in 3 sessions, with one month intervals. Six-month follow-up. Comparison between pre- and posttreatment	Outcome included the biometric parameters wrinkle count, depth and volume, elasticity of the upper skin layers, luminance, and a patient self-assessment satisfaction questionnaire	PRP significantly decreased brown spot count and area, wrinkle count and volume, significantly improved skin firmness, and redness and an average satisfaction score >90% was achieved
Gawdat <i>et al.</i> <sup>[27]</sup>	2017	20	Split-face study to evaluate the effect of injected PRP <i>versus</i> mesotherapy with readymade growth factors in skin rejuvenation. Treatment sessions were conducted every two weeks for a period of three months. Six-month follow-up	Evaluation was based on the Global Aesthetic Improvement Scale (GAIS) and optical coherence tomography (OCT)	Both procedures improved skin turgor, overall vitality, epidermal, and dermal thickness. Mesotherapy was associated with higher burning sensation. Patient satisfaction and effect longevity were significantly higher with PRP
Hui <i>et al.</i> <sup>[28]</sup>	2017	13	Split-face study. Facial skin was first treated with ultra-pulsed fractional CO <sub>2</sub> laser. One side of the face was subsequently treated with PRP and the contralateral side with physiological saline. Three months follow-up	Outcome included objective evaluation of skin wrinkles, texture, and elasticity on both sides using multispectral imaging and subjective satisfaction based on fine wrinkle status, skin texture, and elasticity at the end of the treatment	CO <sub>2</sub> laser + PRP was associated with better improvement of skin wrinkles, texture, and tightness, as well as decrease erythema, edema, and crusting when compared to CO <sub>2</sub> laser alone
Lee <i>et al.</i> <sup>[29]</sup>	2019	31	Single session of PRP injection. Comparison between pre- and posttreatment. 5.7 weeks median follow-up	Outcomes included overall satisfaction with facial appearance and cheeks, psychological well-being and age appearance, based on personal judgment of participants, and degree of facial wrinkles and aesthetic improvement assessed by a dermatologist and a plastic surgeon	Most participants were satisfied with the results and felt the treatment was worth both their time and effort. However, only 45% of participants showed esthetic improvement according to physician assessment
Neinaa <i>et al.</i> <sup>[30]</sup>	2020	68	Split-face study focused on the infraorbital area. Each participant received a platelet-poor plasma gel injection on the right side and an injection of PRP on the left side. Three treatment sessions, 2 weeks apart, followed up monthly for 3 months	Outcomes included clinical and dermoscopic evaluation before treatment and at the end of follow-up period	In both groups, a significant reduction of degree of hyperpigmentation and tear trough was achieved. However, for most participants, PPP gel seemed to be significantly more effective than PRP
Willemsen <i>et al.</i> <sup>[31]</sup>	2018	32	Two groups of 16 participants each. First group treated with facial lipofilling + PRP; second group treated with facial lipofilling + saline. One year follow-up	Primary outcome was skin elasticity. Second outcome included volumetric changes of the nasolabial fold, recovery time, and patient satisfaction	Addition of PRP to the lipograft significantly reduced recovery time reported by participants but did not improve skin elasticity, volume retention nor overall patient satisfaction as compared to lipofilling alone

for a period of 3 months. Although both procedures improved skin turgor, overall vitality, epidermal and dermal thickness, patient satisfaction, and effect longevity were significantly higher with PRP. El-Domyati *et al.*<sup>[24]</sup> published a split-face study comparing the effect of microneedling alone, combined with PRP or with TCA at 15%. Outcomes focused on visual appearance and histological characterization. According to the authors, combining the minimally invasive techniques microneedling with PRP or TCA 15% improved wrinkle appearance and skin texture more than microneedling alone. Moreover, PRP had a better effect on the external cellular matrix of the skin. Neinaa *et al.*<sup>[21]</sup> and

respectively, comparing PRP with PPP gel using a split-face approach. Studies were aimed at the periorbital area, focusing on wrinkle and hyperpigmentation improvement. While both authors described that PPP and PRP reduced tear through, a lighting effect on periorbital dark circles was only noticed by Neinaa *et al.*<sup>[21]</sup> In both studies, the direct comparison between the visual impact of PPP and PRP seemed to favor the former. Treatment with PPP was associated with 10% severe and 17.5% moderate complications. No severe complications were associated with PRP, with only 2.5% of participants experiencing moderate complications, favoring, in this particular aspect, the use of PRP.



Finally, a few authors have evaluated the association of PRP with other esthetic procedures. Hui *et al.*<sup>[28]</sup> and Araco<sup>[17]</sup> proposed to study the synergy between PRP and CO<sub>2</sub> laser skin resurfacing. Both authors design split-face experiments, applying PRP immediately after skin ablation with laser. In addition, Araco<sup>[17]</sup> developed a medical device that was able to embed, preserve, and topically deliver PRP at home, twice a day, during 12 weeks. The association between PRP and CO<sub>2</sub> laser rendered a better improvement of skin wrinkles, texture, moisture, and tightness. Regarding recovery, Hui *et al.* noted a decreased erythema, edema, and crusting when compared to CO<sub>2</sub> laser therapy alone. Cai *et al.*<sup>[19]</sup> irradiated facial skin with fractional erbium laser (2940 nm), followed by PRP coating. Both participants and physicians noted a clear improvement of signs of skin age, mainly color, pore expansion, and skin texture. Finally, Willemsen *et al.*<sup>[31]</sup> evaluated the effect of adding PRP to facial lipofilling *versus* lipofilling alone. According to the authors, adding PRP to the lipograft did not improve skin elasticity, volume retention nor overall patient satisfaction. Nevertheless, combining both substances significantly reduced the recovery time reported by participants.

## DISCUSSION

Throughout the process of analysis of each article, the first feature that popped to the eye was heterogeneity. PRP preparation methods, administration protocols, and results assessment were highly variable among the selected studies. Nevertheless, generically, PRP seemed to improve signs of facial aging.

The use of PRP *versus* placebo was assessed in eight studies.<sup>[16,18,20,22,23,25,26,29]</sup> In five out of eight, a significantly positive effect of PRP was observed by both participants and physicians. Improvements were seen in skin texture, wrinkles, and pigmentation. In contrast, Alam *et al.*<sup>[16]</sup> and Lee *et al.*<sup>[29]</sup> described that improvement was mostly reported by participants, whereas external evaluators relying on photographs assessed a much more discrete effect. Authors theorized that, by knowing their faces intimately and in great detail, participants could perceive differences more clearly and that external reviewers may have not been able to assess some skin details such as texture or smoothness in a photographic evaluation. Despite this explanation, in both studies, the administration protocols described a single PRP injection, as opposed to multisection study designs described in most of the other articles. It is possible that more evident effects could be achieved if more sessions of PRP were attempted. Finally, Draeos *et al.*<sup>[22]</sup> tested the effect of the topical application of PRP following electroporation performed at home, by the patient itself. The lack of statistically significant effects was attributed to the shortness of the 8-week follow-up period. It can also be theorized that electroporation did not permeate

the skin to a level at which PRP could actually reach the dermal layer of the skin in sufficient concentration.

A second set of studies focused on the comparison between PRP and other active substances.<sup>[21,24,27,30]</sup> Gawdat *et al.*<sup>[32]</sup> concluded that both PRP and a readymade growth solution were superior to placebo, with PRP showing the best results regarding patient satisfaction, fewer side effects, and sustainability over time. Readymade growth solution contains a mixture of epidermal growth factor (EGF), insulin-like growth factor-1, bFGF, thioredoxin (TRX), copper tripeptide-1, multivitamins, amino acids, and minerals. However, when analyzing the secretome of activated platelets, it is possible to identify more than 300 bioactive proteins. Therefore, a synergic effect between many of these components that are absent from the readymade growth solution could be responsible for the differences reported by the authors. El-Domyati *et al.* compared the effect of PRP *versus* chemical peeling with TCA 15%, both following microneedling with a dermaroller. Although both treatments enhanced skin quality, the histological effect of each appeared different. Apparently, while TCA had a more pronounced effect on epidermal thickness, PRP seemed to have a better outcome on the architecture of the extracellular dermal structures, highlighting a more physiological effect. Neinaa *et al.*<sup>[30]</sup> and Diab *et al.*<sup>[21]</sup> compared PRP *versus* PPP gel in the treatment of wrinkles and dark circles of the periorbital area. Although both treatments improved the overall satisfaction of participants, PPP, despite having a lower platelet concentration, achieved better scores. Plasma gel is produced by adding activating agents, such as thrombin or calcium chloride to PPP, that induce the formation of a three-dimensional fibrin matrix. Unlike PRP, PPP gel acts as an autologous dermal filler upon injection, immediately stretching the skin, reducing tear through, and enhancing skin lightning. This effect, easily observed by participants, may explain the better outcome of PPP *versus* PRP and why it is not kept beyond 3 months.<sup>[21,30]</sup>

Three studies focused on the use of PRP in association with CO<sub>2</sub><sup>[17,28]</sup> and erbium<sup>[19]</sup> fractional lasers. In all three, the use of PRP enhanced the antiaging effect of laser resurfacing, reducing recovery time and side effects. The use of ablative lasers in facial rejuvenation is well described and relies on the physiological response of skin to injury and subsequent renewal of the extracellular matrix.<sup>[33,34]</sup> Fractional lasers promote tissue vaporization in the shape of uniform columns that reach the dermal layer, and it has been shown that these structures can be used to deliver therapeutic substances.<sup>[35]</sup> By using both fractional lasers and PRP, it seems a synergetic effect is achieved via an initial injury burst and the enhancement of type III and type IV collagen production and dermal stem cells proliferation.<sup>[19]</sup> The association between PRP and lipofilling was studied by Willemsen *et al.*<sup>[31]</sup> Results indicated that the addition of PRP to autologous fat did

not increase patient satisfaction compared to lipofilling alone. It is possible that the immediate effect of lipofilling on volumization could be masking any potential effect of PRP on facial rejuvenation.

In order to understand the biological effect of PRP behind facial rejuvenation, some authors evaluated the effect on tissue architecture and molecular profile. Previous studies conducted in hepatocytes and dermal fibroblasts reported that platelet-released factors enhance collagen expression, hyaluronic acid production, and fibroblast proliferation.<sup>[12,36]</sup> In the studies selected for this review addressing this question, PRP improved elasticity not only by increasing the dermal content on collagen and elastin but also by increasing the water retention capacity of the skin.<sup>[17,20,22-24]</sup> Gene expression analysis revealed PRP had a positive effect on collagen mRNA upregulation and in the response of skin to ultraviolet-B light, by modulating the expression of metalloproteinase-1 (MMP-1), tyrosinase, fibrillin, and tropoelastin genes.<sup>[22,23]</sup>

In conclusion, the use of PRP on facial rejuvenation remains controversial. The lack of uniformity in PRP preparation methods, administration protocols, and results assessment translate into a wide array of outcomes, ranging from the absence of response to remarkable effects on facial skin quality. In most studies included in this review, PRP seemed to revert to some degree the signs of facial aging, such as wrinkles, hyperpigmentation, and dehydration. This visual enhancement was accompanied by significant histological and molecular responses leading to an improved dermal matrix architecture.

### Financial support and sponsorship

Nil.

### Conflicts of interest

There are no conflicts of interest.

## REFERENCES

- Uitto J. The role of elastin and collagen in cutaneous aging: Intrinsic aging versus photoexposure. *J Drugs Dermatol* 2008;7(2 Suppl):s12-6.
- Alves R, Grimalt R. A review of platelet-rich plasma: History, biology, mechanism of action, and classification. *Skin Appendage Disord* 2018;4:18-24.
- Marx RE. Platelet-rich plasma (PRP): What is PRP and what is not PRP? *Implant Dent* 2001;10:225-8.
- 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):3S-22S.
- Pourang A, Rockwell H, Karimi K. New frontiers in skin rejuvenation, including stem cells and autologous therapies. *Facial Plast Surg Clin North Am* 2020;28:101-17.
- Del Corso M, Vervelle A, Simonpieri A, Jimbo R, Inchingolo F, Sammartino G, Dohan Ehrenfest DM. Current knowledge and perspectives for the use of platelet-rich plasma (PRP) and platelet-rich fibrin (PRF) in oral and maxillofacial surgery part 1: Periodontal and dentoalveolar surgery. *Curr Pharm Biotechnol* 2012;13:1207-30.
- Simonpieri A, Del Corso M, Vervelle A, Jimbo R, Inchingolo F, Sammartino G, Dohan Ehrenfest DM. Current knowledge and perspectives for the use of platelet-rich plasma (PRP) and platelet-rich fibrin (PRF) in oral and maxillofacial surgery. Part 2: Bone graft, implant and reconstructive surgery. *Curr Pharm Biotechnol* 2012;13:1231-56.
- Hsu WK, Mishra A, Rodeo SR, Fu F, Terry MA, Randelli P, Canale ST, Kelly FB. Platelet-rich plasma in orthopaedic applications: Evidence-based recommendations for treatment. *J Am Acad Orthop Surg* 2013;21:739-48.
- Sharara FI, Lelea L-L, Rahman S, Klebanoff JS, Moawad GN. A narrative review of platelet-rich plasma (PRP) in reproductive medicine. *J Assist Reprod Genet* 2021;38:1003-12.
- Lynch MD, Bashir S. Applications of platelet-rich plasma in dermatology: A critical appraisal of the literature. *J Dermatolog Treat* 2016;27:285-9.
- Cho JW, Kim SA, Lee KS. Platelet-rich plasma induces increased expression of G1 cell cycle regulators, type I collagen, and matrix metalloproteinase-1 in human skin fibroblasts. *Int J Mol Med* 2012;29:32-6.
- Kim DH, Je YJ, Kim CD, Lee YH, Seo YJ, Lee JH, *et al.* Can platelet-rich plasma be used for skin rejuvenation? Evaluation of effects of platelet-rich plasma on human dermal fibroblast. *Ann Dermatol* 2011;23:424-31.
- Cole AM, Sclafani AP. Theory and evidence for platelet therapy of the aging face. *Facial Plast Surg* 2021;37:218-23.
- Kassir M, Kroumpouzou G, Puja P, Katsambas A, Galadari H, Lotti T, *et al.* Update in minimally invasive periorbital rejuvenation with a focus on platelet-rich plasma: A narrative review. *J Cosmet Dermatol* 2020;19:1057-62.
- Evans AG, Ivanic MG, Botros MA, Pope RW, Halle BR, Glassman GE, *et al.* Rejuvenating the periorbital area using platelet-rich plasma: A systematic review and meta-analysis. *Arch Dermatol Res* 2021;313:711-27.
- Alam M, Hughart R, Champlain A, Geisler A, Paghdal K, Whiting D, *et al.* Effect of platelet-rich plasma injection for rejuvenation of photoaged facial skin: A randomized clinical trial. *JAMA Dermatol* 2018;154:1447-52.
- Araco A. A prospective study comparing topical platelet-rich plasma vs. placebo on reducing superficial perioral wrinkles and restore dermal matrix. *J Cosmet Laser Ther* 2019;21:309-15.
- Banihashemi M, Zabolinejad N, Salehi M, Hamidi Alamdari D, Nakhaizadeh S. Platelet-rich Plasma use for facial rejuvenation: A clinical trial and review of current literature. *Acta Biomed* 2021;92:e2021187.
- Cai J, Tian J, Chen K, Cheng L-H-H, Xuan M, Cheng B. Erbium fractional laser irradiation combined with autologous platelet-rich plasma and platelet-poor plasma application for facial rejuvenation. *J Cosmet Dermatol* 2020;19:1975-9.
- Cameli N, Mariano M, Cordone I, Abril E, Masi S, Foddai ML. Autologous pure platelet-rich plasma dermal injections for facial skin rejuvenation: Clinical, instrumental, and flow cytometry assessment. *Dermatol Surg* 2017;43:826-35.
- Diab HM, Elhosseiny R, Bedair NI, Khorkhed AH. Efficacy and safety of plasma gel versus platelet-rich plasma in periorbital rejuvenation: A comparative split-face clinical and Antera 3D camera study. *Arch Dermatol Res* 2021;314:661-71.
- Draeos ZD, Rheins LA, Wootten S, Kellar RS, Diller RB. Pilot study: Autologous platelet-rich plasma used in a topical cream for facial rejuvenation. *J Cosmet Dermatol* 2019;18:1348-52.
- Du R, Lei T. Effects of autologous platelet-rich plasma injections on facial skin rejuvenation. *Exp Ther Med* 2020;19:3024-30.
- El-Domyati M, Abdel-Wahab H, Hossam A. Combining microneedling with other minimally invasive procedures for facial rejuvenation: A split-face comparative study. *Int J Dermatol* 2018;57:1324-34.
- Elnehrawy NY, Ibrahim ZA, Eltoukhy AM, Nagy HM. Assessment of the efficacy and safety of single platelet-rich plasma injection on different types and grades of facial wrinkles. *J Cosmet Dermatol* 2017;16:103-11.
- Everts PA, Pinto PC, Girao L. Autologous pure platelet-rich plasma injections for facial skin rejuvenation: Biometric instrumental

- evaluations and patient-reported outcomes to support antiaging effects. *J Cosmet Dermatol* 2019;18:985-95.
27. Gawdat HI, Tawdy AM, Hegazy RA, Zakaria MM, Allam RS. Autologous platelet-rich plasma versus readymade growth factors in skin rejuvenation: A split face study. *J Cosmet Dermatol* 2017;16:258-64.
  28. Hui Q, Chang P, Guo B, Zhang Y, Tao K. The clinical efficacy of autologous platelet-rich plasma combined with ultra-pulsed fractional CO<sub>2</sub> laser therapy for facial rejuvenation. *Rejuvenation Res* 2017;20:25-31.
  29. Lee ZH, Sinno S, Poudrier G, Motosko CC, Chiodo M, Saia W, *et al.* Platelet rich plasma for photodamaged skin: A pilot study. *J Cosmet Dermatol* 2019;18:77-83.
  30. Neinaa YME, Hodeib AAEl-H, Morquos MM, Elgarhy LH. Platelet-poor plasma gel vs platelet-rich plasma for infraorbital rejuvenation: A clinical and dermoscopic comparative study. *Dermatol Ther* 2020;33:e14255.
  31. Willemsen JCN, Van Dongen J, Spiekman M, Vermeulen KM, Harmsen MC, van der Lei B, *et al.* The addition of platelet-rich plasma to facial lipofilling: A double-blind, placebo-controlled, randomized trial. *Plast Reconstr Surg* 2018;141:331-43.
  32. Coppinger JA, Cagney G, Toomey S, Kislinger T, Belton O, McRedmond JP, *et al.* Characterization of the proteins released from activated platelets leads to localization of novel platelet proteins in human atherosclerotic lesions. *Blood* 2004;103:2096-104.
  33. Clementoni MT, Pedrelli V, Zaccaria G, Pontini P, Motta LR, Azzopardi EA. New developments for fractional CO<sub>2</sub> resurfacing for skin rejuvenation and scar reduction. *Facial Plast Surg Clin North Am* 2020;28:17-28.
  34. Chen KH, Tam K-W, Chen I-F, Huang SK, Tzeng P-C, Wang H-J, Chen CC. A systematic review of comparative studies of CO<sub>2</sub> and erbium: YAG lasers in resurfacing facial rhytides (wrinkles). *J Cosmet Laser Ther* 2017;19:199-204.
  35. Haedersdal M, Sakamoto FH, Farinelli WA, Doukas AG, Tam J, Anderson RR. Fractional CO(2) laser-assisted drug delivery. *Lasers Surg Med* 2010;42:113-22.
  36. Anitua E, Sánchez M, Nurden AT, Zalduendo MM, de la Fuente M, Azofra J, Andía I. Platelet-released growth factors enhance the secretion of hyaluronic acid and induce hepatocyte growth factor production by synovial fibroblasts from arthritic patients. *Rheumatology (Oxford)* 2007;46:1769-72.