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CONCISE COMMUNICATION

Treatment of acne scars with PRP and laser therapy: an up-to-date appraisal

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Abstract
Clinically significant scarring is a common complication of acne vulgaris. Recent treatments have included the use of platelet-rich plasma (PRP), especially in combination with laser therapy. Here, we offer backgrounds on PRP and laser therapy and review combination treatment for acne scars. It is important to note that current data are limited to small studies and that there is no standard protocol for PRP administration. Larger studies are needed to better evaluate combination treatment and determine the best modality.

Keywords Esthetics · Dermatology · Lasers · Acne scars · Platelet-rich plasma

Introduction

As a common complication of acne vulgaris, patients may be left with permanent scarring. Epidemiological data are varied, but clinically significant scarring has been shown to occur in about 50% of those suffering with acne [20]. Here, we offer background on platelet-rich plasma (PRP) and laser therapy for acne scars and review combination treatment.

PRP therapy

PRP is an autologous blood-derived product with an increased concentration of platelets suspended in plasma. Preparation of PRP includes spinning down blood until the product separates into specified layers. The resultant plasma contains a platelet concentration that is about 3–6.4 times greater than unaltered plasma [21, 24]. As there is currently no standard method for preparation, the concentration of platelets can vary.

To obtain PRP, roughly 10–60 cc of whole blood is added to an anticoagulant, which prevents clotting and the premature secretion of alpha granules. Either the single or double spin method can be used. In the single spin method, the contents of the tube are centrifuged to create three layers. The bottom layer includes red blood cells, the middle layer is the PRP, and the platelet-poor plasma (PPP) resides in the top layer. Some argue that the single spin method cannot adequately concentrate the platelets. In the double spin method, the first spin separates the red blood cells from the plasma, while a second spin can be performed with just the plasma and superficial buffy coat. The second spin, known as at the soft spin, will produce the PRP and separate it from the PPP. In rabbits, the double spin method produced a higher platelet concentration, but also caused alterations in platelet morphology [15]. The effects of this remain unknown. A recent study found that platelet concentration in PRP varied widely between 33 commercially available PRP systems, which correlated with volume of blood and centrifugal force [5].

Clinically, PRP has been used since the 1970s in areas of cartilage repair, bone graft, and musculoskeletal injury healing [9, 23, 24]. In dermatology, PRP has recently been used with some success in areas of skin aging, alopecia, vitiligo, and scarring [24]. PRP contains chemokines, cytokines, plasma proteins, and growth factors, which all contribute to the acceleration of healing, tissue growth, and generation of hyaluronic acid. Platelets store and release growth factors, including platelet-derived growth

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factor (PDGF), insulin-like growth factor (IGF), vascular endothelial growth factor (VEGF), platelet-derived angiogenic factor (PDAF), and transforming growth factor beta (TGFβ) [21]. These growth factors recruit and activate stem cells as well as improve the proliferation, differentiation, and regenerative potential of cells [12]. At the site of PRP, fibroblasts begin to accumulate and deposit collagen, which can lead to the reduction and attenuation of scarring [16, 17].

Laser therapy

Laser resurfacing treatment has been proven to be efficacious in treating acne scars, especially those that are atrophic, which is the most common type seen in 80–90% of patients [4, 22]. Generally, lasers are ablative or non-ablative and are further subdivided into traditional and fractional. Lasers use thermal energy to selectively destroy targeted tissue and stimulate the replacement of collagen and elastin by dermal fibroblasts [4, 19].

Traditionally, ablative lasers have been considered the gold standard for treating acne scars due to marked clinical improvement after one treatment [4]. However, they are associated with significant downtime and possible adverse reactions that include erythema, post-inflammatory hyper- or hypopigmentation, and scarring [8]. Newer fractional lasers offer reduced downtime and side effects, but usually require more treatment sessions for maximum improvements [18]. Monotherapy with one of the fractional ablative resurfacing lasers (FAR) has been proven to be effective, especially for atrophic acne scars [8, 11]. With the creation of microscopic columns of injury to the dermis, the intervening untreated areas support quicker re-epithelization compared to non-fractional ablative lasers, including CO_2 and erbium:YAG.

Review

Fractional lasers and PRP are both known to aid in collagen production and remodeling. It has been proposed that the combination of both modalities can enhance acne scar treatment. PRP is thought to improve and accelerate recovery after laser damage, and may reduce post-treatment effects, such as erythema and edema [9, 10]. Intradermal and topical administration of PRP, either before or after laser treatment, have proven to be effective to some degree and have no additional adverse effects [3]. Histologic studies following PRP administration have revealed a greater concentration of organized collagen bundles with a thicker epidermal layer compared to control groups following laser treatment [14].

Intradermal PRP

Lee et al. conducted a study to examine the effects of PRP after FAR for acne scars [10]. In a split-face trial, 14 Korean patients underwent two treatments of FAR with PRP injections on one side and saline injections on the other. The investigators used the double spin method, in which the first spin was at 3000 rpm for 3 min and the second spin at 4000 rpm for 3 min. Each participant received 0.3 cc of PRP or normal saline in each injection site. PRP treatment was associated with less erythema on day 4 and decreased duration of erythema compared to control. After the second treatment, less edema and decreased duration of edema were noted on the side treated with PRP. The authors concluded that PRP quickens recovery of laser-induced injury.

Another split-face study compared FAR with intradermal PRP to FAR alone in 30 Egyptian patients with acne scars [1]. PRP was obtained via double spin method at 3000 rpm for 7 min and then at 4000 rpm for 5 min. Each injection site received 0.1 cc of PRP. There was overall improvement of acne scars on the PRP-treated side compared to null treatment. PRP was associated with quicker clearance of erythema. Although both sides had statistically significant improvement in acne scars, the addition of PRP led to more pronounced clinical improvement.

However, a study by Faghihi et al. found contrasting results [6]. A split-face study evaluated FAR combined with either intradermal PRP or saline in 16 patients. For obtaining PRP, blood was spun at 2000*g* for 3 min and then at 5000*g* for 5 min. Each injection site received 0.2 cc of PRP or normal saline. Although atrophic acne scars improved with intradermal PRP, the difference was not statistically significant at either 1 month after the first treatment or 4 months after the second treatment compared to control. Additionally, there was more severe edema and prolonged erythema on the side treated with PRP. The authors concluded that adding PRP did not produce synergistic effects and only resulted in worse side effects with longer downtime.

Al Taweel et al. compared the use of intradermal PRP with either carboxytherapy or FAR [2]. Carboxytherapy involves intradermal injection of carbon dioxide, which is believed to improve collagen synthesis, blood flow, and appearance of fine lines. The PRP was prepared using a double spin method, which involved 1500 rpm for 6 min and then 2500 rpm for 15 min. The study found that acne scars improved with both treatments, but the FAR treatment arm showed statistically significant improvement compared to carboxytherapy. However, treatment with FAR was also associated with increased pain and edema. While the authors concluded that FAR with PRP is superior for treatment of acne scars, carboxytherapy with PRP may still offer a promising treatment modality with fewer side effects.

The molecular mechanisms behind combination PRP and laser therapy were recently examined. A split-face trial compared FAR with intradermal PRP to FAR with saline injections [13]. The PRP was prepared with the first spin at 160*g* for 10 min and the second spin at 400*g* for 10 min. The PRP-treated side demonstrated superior clinical improvement and less erythema compared to control. Histologically, staining revealed increased levels of TGFβ1, TGFβ3, c-myc, collagen 1, and collagen 3 on the side treated with PRP. The authors hypothesized that increased collagen deposition associated with PRP may be induced by TGFβ, which has been shown to increase fibroblast proliferation and collagen formation. It was also postulated that increased c-myc expression resulted in cell cycle progression, since it is an important mediator between growth factors and cell proliferation. The authors concluded that TGFβ and c-myc may work together to contribute to increased collagen deposition.

Topical PRP

Kar and Raj conducted a split-face study on 30 patients with severe acne scars to evaluate the effects of FAR with and without topical PRP [9]. The PRP was prepared using two spins, with the first at 1500 rpm for 10 min and the second at 3000 rpm for 20 min. The resulting PRP was applied immediately after laser treatment in a topical fashion. They found that both treatment arms offered improvement, but the addition of topical PRP did not alter the overall scar appearance. However, the addition of PRP was associated with decreased erythema, swelling, and pain. The authors suggested that topical PRP could be used to improve downtime when treating with FAR.

Another study examined the efficacy of topical PRP combined with erbium fractional laser [25]. The PRP was obtained using a double spin process. Entire faces were treated with the erbium fractional laser and subsequently coated with autologous PRP. Following the first treatment at 4 weeks, 68% of subjects demonstrated marked or excellent improvement, while after the third treatment, this number increased to 90.9%. The authors concluded that PRP with erbium fractional laser is effective for the treatment of acne scars and even those still with active acne. However, the study did not include a control arm, which limits generalizability.

Intradermal vs topical PRP

Gawdat et al. conducted a split-face study to compare intradermal and topical PRP when combined with FAR in 30 patients [7]. PRP was obtained using a double spin method at 150*g* for 15 min and then 400*g* for 10 min. One group received FAR with either intradermal PRP or saline to each side. Another group received FAR with either intradermal or topical PRP to each side. Injections were performed at ten different sites with approximately 0.2 cc of PRP or normal saline placed in each site. Results showed that combined treatment with FAR and PRP had significantly better response, shorter downtime, and fewer side effects than laser therapy alone. There were no statistical differences between intradermal and topical PRP with regard to the degree of response and downtime. However, topical PRP was associated with lower pain scores. This was the only available study comparing modalities of PRP administration for the treatment of acne scars. Interestingly, the efficacy of PRP was not compromised using less painful topical administration.

Conclusion

Overall, current medical literature has demonstrated the beneficial effects associated with the addition of PRP to laser therapy for the treatment of acne scars. Most studies found significant clinical improvement and decreased downtime with combination therapy compared to laser treatment alone, while a single study not only failed to demonstrate clinical improvement with PRP but also indicated prolonged healing in this group. Another study also suggested that there was no significant clinical difference between intradermal and topical PRP delivery. However, topical PRP may offer a more comfortable patient experience. It is important to note that there is currently no standard procedure for PRP preparation and administration, so an exact comparison of studies may be challenging. Additionally, these are all small studies, and there is need for a larger controlled study. Future studies should help to determine the optimal protocol for utilizing PRP in the treatment of acne scars.

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Compliance with ethical standards

Conflict of interest The authors have no conflict of interest to declare.

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