INFORMATION BRIEF (RAPID REVIEW)

FACIAL SKIN REPAIR: MICRONEEDLING AND PLATELET-RICH PLASMA APPROACHES FOR SCARS AND FIBROSIS

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FACIAL SKIN REPAIR: MICRONEEDLING AND PLATELET-RICH PLASMA APPROACHES FOR SCARS AND FIBROSIS

PURPOSE

To provide a concise overview of the effectiveness, safety and cost-efficiency of using microneedle and/ or platelet-rich plasma in treating scars and skin fibrosis on face.

BACKGROUND

Wound healing is a complex and dynamic biological process by which the skin regenerates after injury to restore its function and integrity. In facial skin, this process is particularly nuanced due to its unique vascularity, dermal architecture and exposure to mechanical stress and environmental factors. Normal healing is a finely tuned process divided into four overlapping phases: haemostasis, inflammation, proliferation and maturation-remodelling. These phases involve a perfectly adapted cascade of cellular interactions and molecular mechanisms. However, when this cascade is disrupted, it can result in pathological scarring and fibrosis, especially in the face where tension, mobility and hormonal influences are pronounced. Facial scars, including hypertrophic and keloid types, emerge from an imbalance between tissue synthesis and degradation, driven largely by dysregulated fibroblast activity and excessive extracellular matrix deposition. In more chronic cases, facial fibrosis develops, characterised by persistent myofibroblast activation, stiffening and functional impairment such as restricted movement or induration.[1]

The pathological process of facial skin fibrosis constitutes a major global health concern, contributing to approximately 45.0% of deaths in industrialised nations.[2,3] Cutaneous fibrosis, frequently arising from trauma, surgical interventions or thermal injuries can profoundly affect patient well-being through disfigurement and functional limitations. Skin scarring is highly prevalent, with nearly half of the global adult population reporting at least one scar.[4] Despite its widespread impact, pathological scarring remains a therapeutic challenge, as no single intervention has achieved universal acceptance as the standard of care.[5,6]

Extensive research has demonstrated that individuals with darker skin tones exhibit a heightened risk of scar formation.[7,8] Notably, Asian populations are more prone to developing hypertrophic scars compared to their Caucasian counterparts,[9] indicating substantial differences in the underlying pathophysiology of scarring between these groups. Asian skin is characterised by increased fibroblast activity and elevated collagen synthesis during the wound healing process,[7] which predisposes it to excessive scar formation and post-inflammatory hyperpigmentation. Additionally, scar maturation in Asian skin tends to be prolonged, often accompanied by extended hyperemia.[7,8] Consequently, the existing International Clinical Recommendations on Scar Management, primarily developed based on Caucasian skin responses, may not be fully applicable to Asian populations.[10] In Malaysia, while specific scar and skin fibrosis prevalence data are not available, one study noted that Malay patients were the predominant group in both the acne and trauma scarring studies, with Malay (56.0%) being the majority in the population overall, followed by Chinese (35.4%) and Indian/ others (8.5%).[11]

Current treatment modalities for facial scars and skin fibrosis are diverse but often associated with significant limitations. A wide range of options exists, from traditional topical agents and injectable to modern energy-based devices and surgical procedures. For instance, dermal fillers are effective for atrophic scars but provide temporary results, typically lasting only six to 24 months and often require combination with other techniques like subcision to break fibrotic

tethers for optimal outcomes. Conversely, highly efficacious energy-based treatments such as ablative fractional lasers and deep chemical peels carry inherent risks, including post-inflammatory hyperpigmentation and scar neogenesis, particularly in patients with darker skin tones. Injectable treatments like steroid injections or 5-fluorouracil, while useful for flattening hypertrophic scars and keloids, may cause undesirable side effects such as skin atrophy and discoloration. The fragmented nature of the current therapeutic landscape, where each modality offers a narrow scope of efficacy and carries its own set of risks and disadvantages, highlights a significant clinical unmet need.[12]

In this context, microneedling **(see Figure 1)** has emerged as a promising, minimally invasive standalone therapy. Also known as collagen induction therapy, microneedling utilises fine needles to create controlled micro-injuries in the dermis while preserving the integrity of the epidermis. This controlled injury initiates a powerful wound healing cascade, leading to the release of various growth factors, including platelet-derived growth factor, transforming growth factor beta and fibroblast growth factor. These factors subsequently trigger the migration and proliferation of fibroblasts, which lay down a fibronectin matrix and stimulate new collagen and elastin production, a process known as neocollagenesis. Microneedling's ability to mechanically break down scar strands and stimulate new blood vessel formation provides a dual mechanism for scar remodelling. As a result of its mechanism of preserving the epidermis, microneedling is claimed to be safe and inexpensive alternative to more aggressive procedures, with minimal downtime and a low risk of post-inflammatory hyperpigmentation, making it suitable for a broad range of skin types.[13,14]

(a) **(b)**

Figure 1: Microneedling devices may be categorised as either (a) manual or (b) motorised. Manual devices feature fixed needles that protrude continuously from the surface and penetrate the skin through rolling or stamping motions. In contrast, motorised devices utilise a mechanised system to drive the needles in and out of the device interface. Certain motorised models allow healthcare practitioners to precisely regulate both the depth and velocity of needle penetration, enabling tailored treatment parameters based on clinical requirements.[15]

A separate but equally promising modality is platelet-rich plasma (PRP), which offers a biologic foundation for skin regeneration **(see Figure 2)**. The PRP is an autologous therapy, meaning it is derived from the patient's own blood, which is centrifuged to concentrate platelets and their growth factor-rich granules. Upon administration to a damaged area, the platelets activate and secrete a potent cocktail of growth factors, including platelet-derived growth factor, vascular endothelial growth factor, transforming growth factor beta and epidermal growth factor. This concentration of bioactive molecules promotes cellular proliferation, angiogenesis and tissue remodelling, leveraging the body's natural regenerative processes. The autologous nature of PRP confers a well-established safety profile with minimal risk of allergic reactions or disease transmission. However, a significant limitation hindering its widespread, consistent application is the lack of standardised preparation protocols. The variability in centrifuge settings and g-forces across different clinical settings can lead to inconsistent platelet concentrations and consequently, variable clinical outcomes which complicates research and

diminishes its reliability as a standalone therapy.[16,17] **Table 1** outlines the key characteristics of facial microneedling and PRP therapy.

(a) **(b)**

Figure 2: a) Platelet-rich plasma therapy entails the extraction of a small volume of the patient's blood, followed by centrifugation using a specialised system to isolate platelets from other cellular components,[18] b) The concentrated platelet-rich fraction is then administered either topically or via injection into designated treatment sites to promote tissue regeneration and healing.[19]

Table 1: Differences between facial microneedling and platelet-rich plasma therapy.[13,14,20,21]

CHARACTERISTIC	MICRONEEDLING (STANDALONE)	PLATELET-RICH PLASMA (PRP) (STANDALONE)
MECHANISM OF ACTION	Creates controlled micro-injuries in the dermis, initiating a wound healing cascade that stimulates the production of new collagen and elastin. The procedure also mechanically breaks down scar strands.	An autologous therapy derived from the patient's own blood, PRP delivers a high concentration of growth factors (such as PDGF, TGFβ, and VEGF) to promote cellular proliferation, angiogenesis and tissue remodelling.
ADVANTAGES	Considered a safe, inexpensive and well-tolerated procedure. It has a minimal risk of post-inflammatory hyperpigmentation because it preserves the epidermis.	Due to its autologous nature, there is a minimal risk of allergic reactions or disease transmission. It leverages the body's natural regenerative processes to improve skin texture, colour and elasticity.
LIMITATIONS	While effective, it may be insufficient for more severe or deep fibrotic lesions when used alone.	A significant limitation is the lack of standardised preparation protocols, which can lead to inconsistent clinical outcomes. A lot of the topically applied substance can be lost.
SYNERGISTIC EFFECT	Creates thousands of microchannels, making it an effective delivery system for topically applied regenerative agents like PRP ensuring they reach deeper skin layers.	When combined with microneedling, it is delivered directly to the site of injury, amplifying its biological effects and leading to superior clinical outcomes and higher patient satisfaction compared to microneedling alone.

PDGF, platelet-derived growth factor; TGFβ*, transforming growth factor beta; VEGF, vascular endothelial growth factor*

Although several evidence supporting these therapeutic approaches are compelling, some critical research gaps remain that must be addressed to advance its clinical utility. Foremost among these is the absence of standardised protocols for PRP preparation, which hinders the comparability and interpretation of study outcomes. To ensure consistency and reproducibility, more investigations should prioritise the development and implementation of uniform preparation methodologies. Furthermore, robust, multi-center randomised controlled trials are warranted to assess the long-term efficacy of this therapy across diverse scar etiologist and to benchmark its performance against conventional treatment modalities.

EVIDENCE SUMMARY

A systematic review was conducted. A total of 899 titles were retrieved through the Ovid interface: Ovid MEDLINE® All <1946 to 8 September 2025>, Embase and United States of Food and Administration. Google was used to search for additional web-based materials and information. There was no language limitation in the search and the last search was conducted on 9 September 2025. There were five systematic reviews with/ without meta-analysis, eight randomised controlled trials and four randomised clinical trials included. The 17 studies were conducted mainly in Middle East Regions (Egypt, Pakistan, Saudi Arabia, Iran), followed by Asia Continents (Indonesia, Thailand, China, Korea) and Italy.

EFFECTIVENESS

A total of seven studies evaluated the effectiveness of microneedling, five focused on PRP and another five investigated the combined use of both modalities in treating facial scars and skin fibrosis.

a. Facial microneedling

A systematic review (Sitohang IBS et al., 2020; Indonesia) investigated the efficacy and safety of microneedling for atrophic acne scars across nine randomised controlled trials published between January 2000 and October 2020. The study included 341 adult patients (>18 years old) with dermatologist-confirmed atrophic acne scars, where microneedling was either a monotherapy or combined with other treatments. It included various devices (e.g., dermarollers, fractionated microneedle radiofrequency) with needle lengths typically between 0.8 mm and 3.5 mm (mean 1.5 mm). Treatment durations ranged from five weeks to five months, with follow-up periods from 18 weeks to eight months.[22, level I]

Microneedling consistently proved effective for atrophic acne scars, both alone and combined with treatments like glycolic acid, Jessner's solution, polylactic acid or subcision. Its outcomes were comparable to tazarotene 0.1%, [redacted] and 1550 nm [redacted]aser, though one study noted superior results with [redacted] laser. Patient satisfaction was generally high, with combination therapies yielding better outcomes.[22, level I]

A split-face, double-blinded, placebo-controlled randomised clinical trial was explored at Ramathibodi Hospital, **Thailand** by involving 29 healthy patients aged 18 to 50 years with atrophic acne scars on both cheeks **(Rattananukrom T et al., 2025)**. Each side of a patients' face was randomly assigned to receive either microneedle fractional radiofrequency (MFR) combined with topical insulin or MFR combined with a placebo (normal saline solution). Four treatment sessions were administered every four weeks over a 12-week period, with patients and investigators blinded to the topical treatment.[23, level I]

Both MFR with topical insulin and MFR with placebo showed significant reductions in atrophic acne scar volume; 16.20 ± 8.58 mm^3 at week 12 ($p = 0.017$) and 15.28 ± 8.21 mm^3 at week 16 ($p = 0.001$), respectively. By week 24, both groups demonstrated notable improvements in scar volume, skin roughness and Echelle d' évaluation clinique des cicatrices d' acne (ECCA) scores, with reductions of 46.77% ± 21.33% for insulin and 46.39% ± 20.14% for placebo (both $p \leq 0.001$).[23, level I]

Huang C et al. (2024; China) carried out a prospective, randomised controlled trial to evaluate the efficacy and safety of MFR versus photodynamic therapy for moderate-to-severe acne vulgaris. Eighty patients with Fitzpatrick skin types III to IV and moderate-to-severe acne

(Investigator Global Assessment; IGA scale 3 or 4) were enrolled and randomly allocated to either the MFR (n=40; mean age 22.4 ± 3.4 years) or photodynamic therapy group (n=40; mean age 23.8 ± 4.0 years) using a random number table. The MFR group received treatment with a 3.5-mm needle delivering high-frequency current for 0.25 to 0.60 s at 6.0 to 7.0 W, while the photodynamic therapy group had 5.0% aminolaevulinic acid solution applied for 90 min, followed by 15 min of red light (633 nm) irradiation. Both treatments were administered in three consecutive sessions at 2-week intervals, with clinical evaluations by two blinded dermatologists before each treatment and at four and 12 weeks after the final session.[24, level I]

Both treatments significantly reduced inflammatory and non-inflammatory lesions, but MFR showed a faster response and better safety profile. Inflammatory lesions decreased by 81.0% with MFR versus 73.0% with photodynamic therapy after the third session, with early improvement seen from the first session. Some photodynamic therapy patients experienced reactive acne initially. The MFR also reduced non-inflammatory lesions more effectively after the second session (55.0% versus 44.0%), though no significant difference was noted at later time points. More MFR patients reached IGA clear/ almost clear status, and satisfaction scores were generally higher.[24, level I]

Another **split-face, randomised comparative clinical study** was implemented to compare the efficacy and safety of microneedling combined with topical insulin versus microneedling with topical placebo (normal saline) for atrophic post-acne scars **(Abdel Hay R et al., 2024; Egypt)**. Twenty-one patients, primarily females (76.2%) with a mean age of 29.5 ± 9.0 years, were recruited from Kasr Al-Ainy Dermatology outpatient clinic in Cairo University, between February and August 2022. One side of patients' face was randomised to receive microneedling followed by 1.0 to 2.0 ml of [redacted] insulin, and the other side received microneedling followed by 1.0 to 2.0 ml of normal saline. Four treatment sessions were administered at 3-week intervals, with a follow-up one month after the last session. Microneedling was performed using a motorised dermapen with needle depths of 2.0 to 2.5 mm on cheeks and 0.5 to 1.0 mm on bony areas.[25, level I]

Both insulin-treated and placebo-treated sides showed significant improvement in atrophic acne scars, with mean percentage changes of 35.8% and 32.7% on the Global Scarring Grading System (GSGS), and 35.8% and 33.6% on the Lipper and Perez scores ($p < 0.001$ for all). Most patients reported good or moderate satisfaction, and Facial Acne Scar Quality of Life (FASQoL) scores improved significantly across all participants ($p < 0.001$).[25, level I]

Kim J et al. (2023; Korea) also executed a split-face, randomised, single-blinded clinical study, to investigate the efficacy and safety of fractional microneedle radiofrequency combined with ablative fractional laser (FMR + AFL) versus AFL alone for treating facial inflammatory acne and acne scars in 23 patients with Fitzpatrick skin types III to IV, aged 19 to 36 years. Participants received three successive treatment sessions at 4-week intervals using a dual-wave FMR device and an ablative fractional carbon dioxide laser (eCO_2).[26, level I]

The FMR + AFL showed superior efficacy over AFL alone in acne severity, lesion counts and patient satisfaction. The combination significantly reduced hemi-modified Global Acne Grading Score (mGAGS) scores ($p < 0.001$) and achieved greater reductions in total, inflammatory and non-inflammatory lesions after the second session. At week 20, inflammatory lesions decreased by 46.3% with FMR + AFL versus 12.0% with AFL ($p = 0.005$).[26, level I]

At week 20 **(see Figure 3)**, the FMR + AFL group showed significantly greater improvement in acne scar severity on the Scar Global Assessment (SGA) scale compared to AFL alone ($p = 0.03$). Depressed scar volume differed significantly between groups by RM-ANOVA ($p = 0.048$), though post-hoc analysis did not confirm significance at specific time points. Patient and investigator satisfaction was higher with FMR + AFL (82.6% versus 60.9%). Immuno-

histochemical analysis revealed increased nucleo-cytoplasmic FoxO1A ratio and Peroxisome Proliferator-activated Receptor gamma (PPAR-γ) staining intensity with FMR + AFL ($p < 0.001$ and $p < 0.05$), alongside a significant reduction in sebum secretion (83.3 ± 14.4 to 72.9 ± 20.7 μg/cm², $p < 0.05$), not seen with AFL alone.[26, level I]

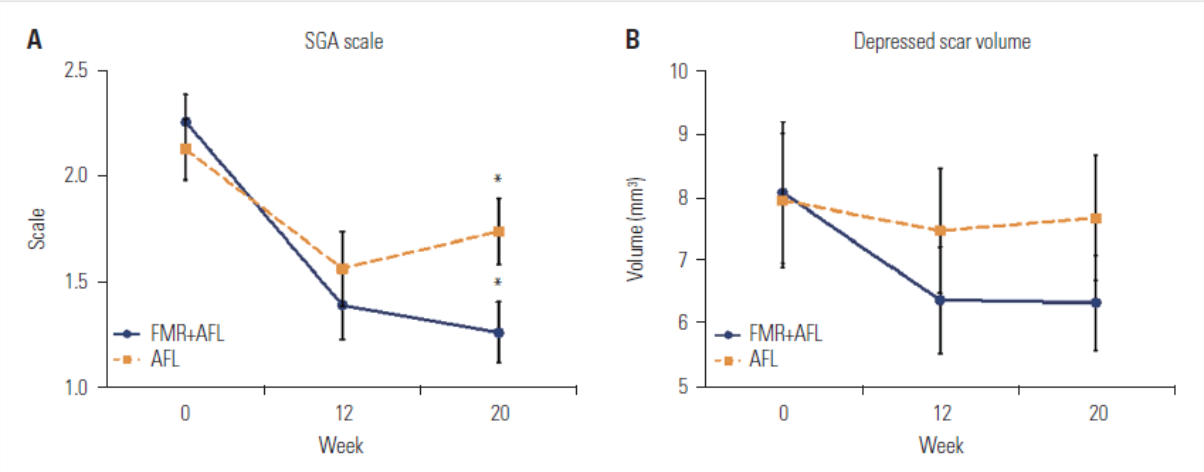

Figure 3: Changes in acne scar severity by time and the treatment group, (A) measured by the Scar Global Assessment scale and (B) changes in the depressed volume of the scar during the study period.[26, level I]
**p<0.05 in post-hoc analysis with Bonferroni correction at each time point. AFL, ablative fractional laser; FMR, fractional microneedle radiofrequency*

Another **randomised controlled trial** was conducted at the Outpatient Department of Dermatology, Lahore from September 2021 to March 2022 **(Shahbano et al., 2023; Pakistan).** This study evaluated the comparative effectiveness and safety of a 35.0% glycolic acid peel combined with microneedling versus glycolic acid peel monotherapy in the management of acne scars. A total of 60 patients, aged 18 to 45 years, with Fitzpatrick skin types I to IV and acne scars graded II to IV, were randomly assigned to two treatment arms; the first group received six biweekly sessions of the combination therapy (glycolic acid peel plus microneedling), while the other group underwent six sessions of glycolic acid peel alone. Patients were scheduled for follow-up one month after the final treatment session.[27, level I]

Treatment efficacy was higher in the combination group, with 96.7% of patients showing improvement compared to 73.3% in the monotherapy group ($p = 0.011$). Stratified analysis showed significant benefits of combination therapy in patients aged 31 to 45 years, those with disease duration over six months, and especially in icepick scars, where efficacy reached 100.0% versus 66.7% with monotherapy ($p = 0.018$).[27, level I]

A six-month, **randomised controlled trial** was also conducted at Benazir Bhutto Hospital's Department of Dermatology in Rawalpindi in **Pakistan**, to compare the efficacy of microneedling versus 35.0% glycolic acid chemical peels for atrophic acne scars in patients with Fitzpatrick Skin Phototypes IV to VI **(Ishfaq F et al., 2022).** Sixty patients aged 15 to 50 years, with clinically diagnosed acne scars, were randomised into two groups of 30: one group received microneedling and another group received 35.0% glycolic acid peels, with treatments administered every two weeks for six sessions. Post-treatment care involved topical Vitamin A and C, antibiotics and sunscreen for microneedling group, and moisturising cream, antibiotics and sunscreen for glycolic acid group.[28, level I]

At three months, 73.3% of patients treated with microneedling achieved efficacy, significantly outperforming glycolic acid (33.3%, $p = 0.001$). Microneedling showed superior results for icepick scars and was more effective for rolling than boxcar scars.[28, level

b. Platelet-rich plasma on face

A systematic review was carried out by Cruciani M et al. (2024; Italy) to critically assess the efficacy and safety of PRP for facial rejuvenation, either as monotherapy or combined with other treatments, by analysing systematic reviews published between 2015 and 2023. Eight studies (n=3,221) evaluated PRP in combination with modalities such as laser therapy and fat grafting, while 20 focused on PRP alone. Only one systematic review conducted a meta-analysis, which showed that PRP as an adjunct improved patient satisfaction (mean difference 0.63; 95% CI: 0.25 to 1.00; p = 0.001), though the certainty of evidence was low due to bias and inconsistency. Descriptive findings from four systematic reviews suggested that PRP combined with laser therapy may enhance satisfaction, skin elasticity and reduce erythema index, albeit with very low certainty.[29, level I]

Aljefri YE et al. (2022; Saudi Arabia) conducted a systematic review and meta-analysis aimed to determine the efficacy and safety of PRP combined with ablative fractional carbon dioxide (FCO_2) laser in treating moderate to severe atrophic acne scars. The methodology involved systematically exploring several scientific databases up to July 2021. Eleven randomised controlled trials encompassing 313 patients (mean age 24.3 to 36.8 years) were included in the quantitative synthesis and meta-analysis.[30, level I]

Combined laser and PRP treatment showed significantly greater clinical improvement (odd ratio [OR] = 2.56, 95% CI 1.37 to 4.78, p < 0.01; **Figure 4**), higher patient satisfaction (OR = 3.38, 95% CI 1.80 to 6.34, p < 0.01; **Figure 5**) and better qualitative acne scar scores (standardised mean difference [SMD] = -0.40, 95% CI -0.65 to -0.14, p < 0.01; **Figure 6**) compared to laser alone. Erythema duration was also shorter (SMD = -0.67, 95% CI -1.32 to 0.01, p = 0.05; **Figure 7**), confirmed by sensitivity analysis (SMD = -0.95, 95% CI -1.41 to 0.49, p < 0.01). Although meta-analysis for oedema duration was not feasible, most studies descriptively favoured the combined approach.[30, level I]

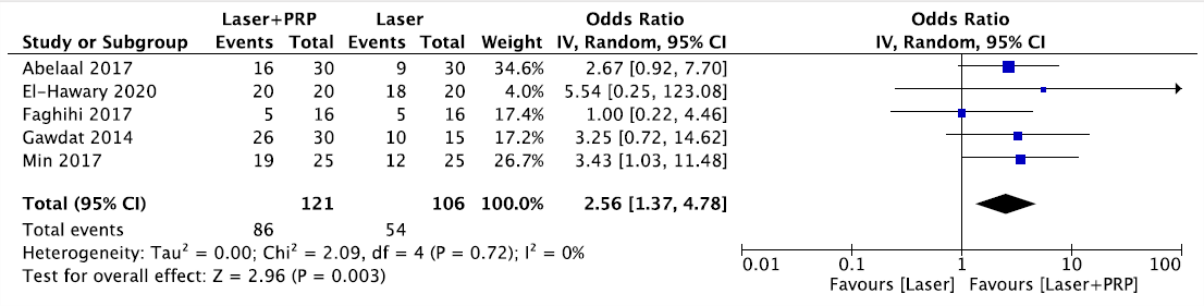

Figure 4: Forest plot for clinical improvement.[30, level I]

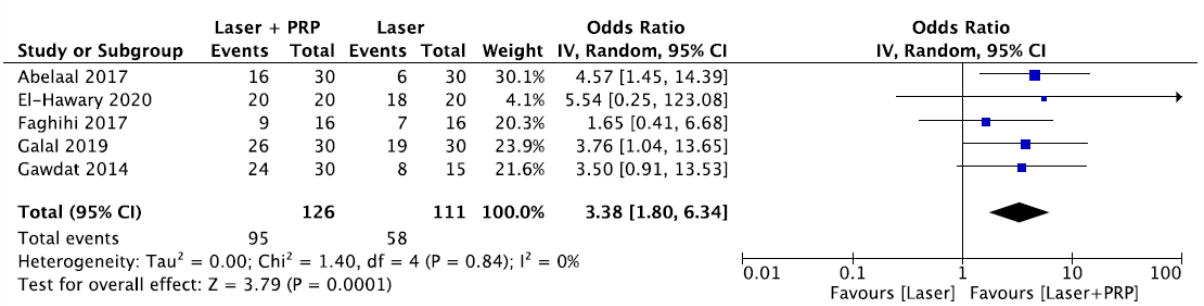

Figure 5: Forest plot for patient satisfaction.[30, level I]

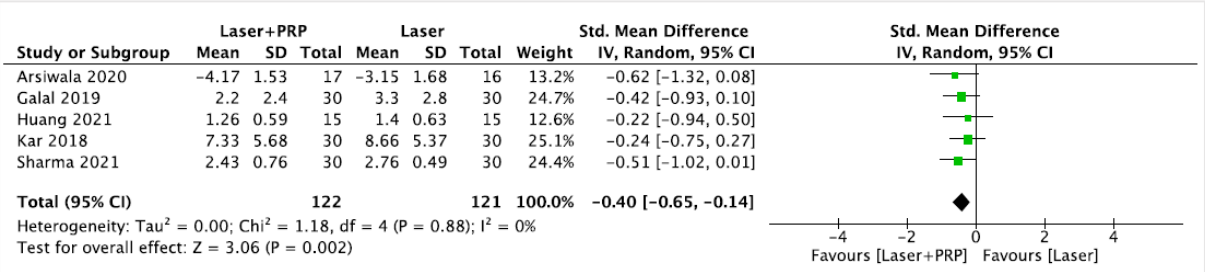

Figure 6: Forest plot for Goodman and Baron's qualitative acne scar grading scale.[30, level I]

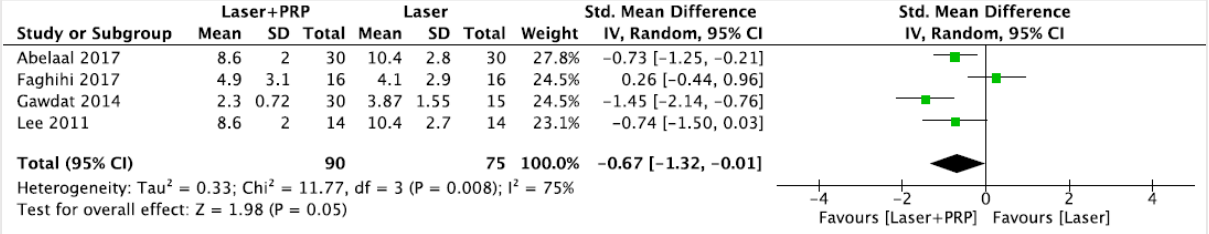

Figure 7: Forest plot for duration of erythema.[30, level I]

Another systematic review and meta-analysis was implemented by Ebrahimi Z et al. (2022; Iran) to assess the effectiveness and safety of PRP, either alone or combined with other methods for managing atrophic or hypertrophic/ keloid scars. The study systematically searched major databases up to September 2020, for randomised clinical trials comparing PRP with ablative lasers, microneedling or subcision in treating atrophic acne scars. It included 855 patients aged 16 to 52, predominantly in their twenties or thirties, with an average male proportion of 42.0% and most having skin photo types III to IV. Treatment outcomes were typically assessed one to four months' post-intervention, with follow-up periods ranging from zero to 12 months. Thirteen clinical trials were included in the meta-analysis, primarily focusing on atrophic scars, with only one study on hypertrophic/ keloid scars meeting the review criteria.[31, level I]

Overall response rates were similar across interventions (22.0% to 23.0%), but PRP monotherapy showed lower efficacy (12.0% excellent, 29.0% poor) compared to laser (0.0% excellent, 16.0% poor) and microneedling (3.0% excellent, 25.0% poor). Combining PRP with microneedling or ablative lasers significantly improved outcomes, raising excellent responses to 23.0% and 32.0%, marked responses to 43.0% and reducing poor outcomes to 4.0% to 5.0%.[31, level I]

Twisy HO (2025; Egypt) explored a randomised comparative trial aimed to assess the therapeutic efficacy of topical retinoid alone versus combined PRP and topical retinoid therapy in treating acne vulgaris. The study included 40 patients with varying severity of facial acne vulgaris, randomised into two groups. One group (mean age 24.5 years) received four PRP injections over two months alongside daily topical adapalene 0.1%, while the other group (mean age 27.5 years) used adapalene alone. The PRP was prepared by centrifuging 6 ml of blood with anticoagulant.[32, level I]

At three months, the combination group showed significantly greater reduction in acne severity ($p = 0.002$) compared to adapalene alone ($p = 0.014$). Both groups improved in comedone lesions, but the combination yielded better results, with no significant difference in papulopustular lesions. Overall improvement ($p = 0.011$) and patient satisfaction ($p = 0.004$) were higher in the combination group, with 45.0% showing excellent improvement versus 0.0% in the adapalene group. Recurrence rates were lower with combination therapy (15.0% versus 35.0%), though not statistically significant.[32, level I]

A blind, randomised controlled clinical trial was conducted by Refahee SM et al. (2019; Egypt) from December 2016 to February 2018, aimed to evaluate the effect of PRP injection on scar width following unilateral complete cleft lip repair using a modified Millard technique. Twenty-four patients with nonsyndromic unilateral complete cleft lip, aged three to six months, were equally assigned to a study group and a control group (12 patients each). All patients underwent modified Millard cheiloplasty; the study group received PRP injected into the muscle and skin layers immediately after wound closure, while the control group received no PRP. The PRP was prepared using a double centrifugation technique, resulting in a significantly increased platelet count and decreased white blood cell count compared to whole blood ($p < 0.0001$ for both).[33, level I]

After six months, the study group showed significantly narrower scar widths than the control group. Ultrasound measurements through the orbicularis oris muscle averaged 3.8 ± 0.886 mm versus 4.96 ± 0.929 mm ($p = 0.0047$). Photographic assessments also confirmed narrower skin surface scars in study and control group, at point 1 (0.831 ± 0.231 mm versus 1.49 ± 0.442 mm, $p = 0.0001$) and point 2 (1.015 ± 0.103 mm vs. 2.275 ± 0.984 mm, $p = 0.0003$).[33, level I]

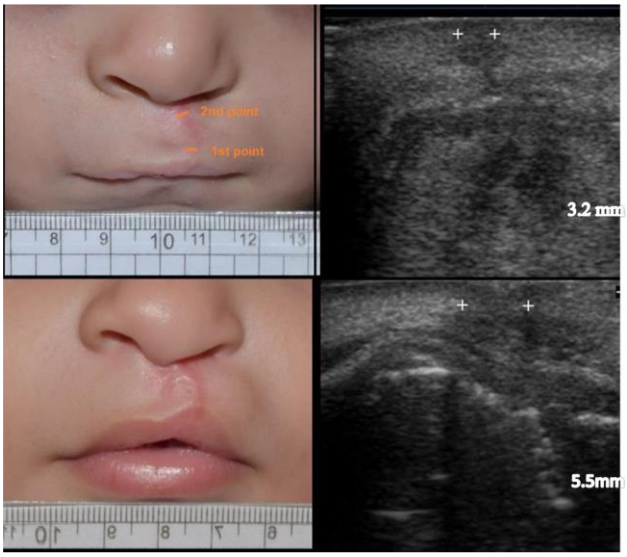

Figure 8: The upper row illustrates the scar of one patient in the study group and lower row illustrates the scar of one patient in the control group at six-month follow-up.[33, level I]

The intraclass correlation coefficient **(see Figure 9)** demonstrated excellent inter-rater agreement for photographic measurements, with values of 0.995 ($p < 0.001$) at the first assessment point and 0.950 ($p < 0.001$) at the second.[33, level I]

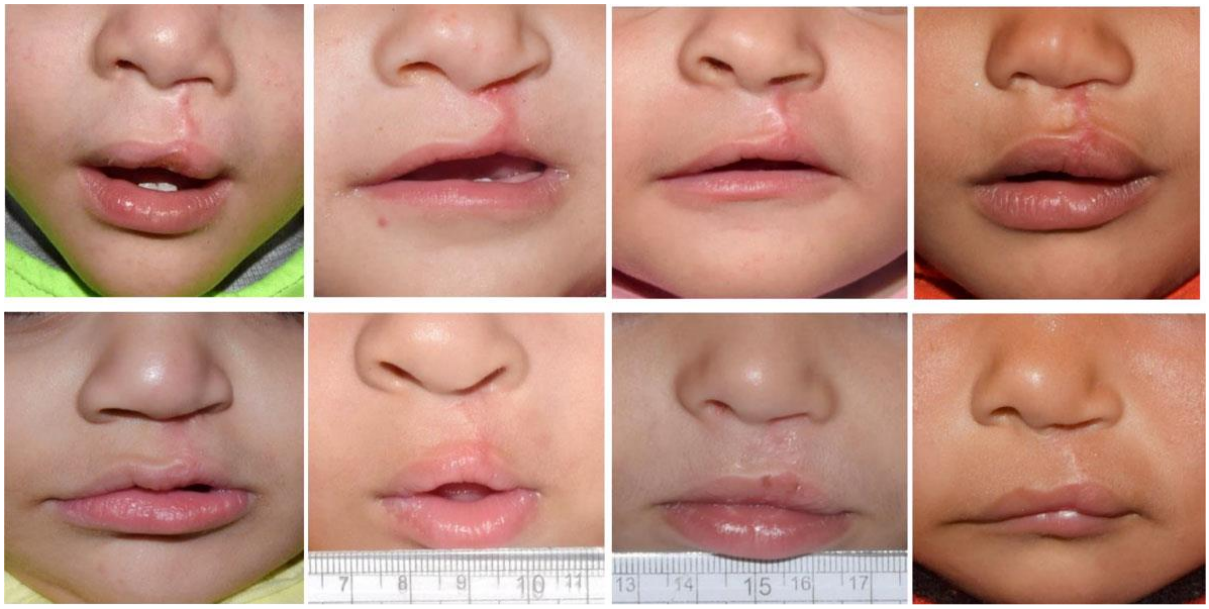

Figure 9: Scar of four patients in the control group (upper row) and scar of four patients in the study group (lower row) at 6-month follow-up.[33, level I]

c. Combination of facial microneedling and platelet-rich plasma

Kang C et al. (2022; China) executed a meta-analysis to investigate the efficacy and safety of microneedling combined with PRP for treating acne scars, compared to microneedling alone. The methodology comprised a systematic search for randomised and non-randomised controlled studies published up to June 2021. Fourteen eligible studies (mostly from India and Egypt), encompassing 472 patients (aged 23.7 to 32.2 years), comparing microneedling combined with PRP versus microneedling alone for atrophic acne scars were included. Each treatment involved two to six sessions, with follow-up periods ranging from four to 32 weeks.[34, level I]

The meta-analysis revealed that combined treatment significantly increased the odds of clinical improvement of >50.0% in Goodman's qualitative scale (OR: 2.97, 95% CI 1.96 to 4.51, $p < 0.001$; $I^2 = 0.0\%$), with this effect being more pronounced in randomised controlled trials. Furthermore, the combined therapy led to a significantly higher patient satisfaction rate (OR: 4.15, 95% CI 2.13 to 8.09, $p < 0.001$; $I^2 = 53.0\%$).[34, level I]

A randomised controlled trial was carried out by Khan AI et al. (2023; Pakistan) at the Dermatology Department of Shaikh Zayed Hospital, Lahore from December 2018 to December 2019, aimed to compare the effectiveness of microneedling alone versus microneedling combined with PRP in treating acne scars. A total of 182 patients with facial acne scars (Goodman and Baron grade II to IV), aged 18 to 35 years were equally divided into two groups of 91 patients each. One group received four sessions of microneedling alone, while another group received microneedling combined with autologous PRP, prepared using a double centrifugation method over a 4-week interval between sessions.[35, level I]

At three months, microneedling with PRP showed significantly better outcomes, with 80.0% of patients improving compared to 49.5% in the microneedling-only group. Among those with grade III and IV scarring, 72.0% in the combination group achieved a one-grade improvement versus 52.0% with microneedling alone.[35, level I]
The next **randomised controlled trial** aimed to compare the outcome of microneedling with autologous PRP versus microneedling with topical insulin in treating post-acne atrophic scars **(Mubeen S et al., 2023; Pakistan)**. Eighty patients with Fitzpatrick skin types IV to VI and grades II to IV atrophic acne scars were randomised into two groups: one received

microneedling with topical insulin (mean age 23.68), and the other with topical PRP (mean age 24.48), administered over four monthly sessions. Scar grades were evaluated monthly and at a 2-month follow-up.[36, level I]

Microneedling with topical insulin showed significantly greater efficacy than with PRP, achieving a mean scar grade reduction of 55.42% versus 23.33%. Marked improvement was seen in 50.0% of insulin-treated patients compared to none in the PRP group ($p = 0.001$). The insulin combination also outperformed PRP across all scar types and in patients with Fitzpatrick skin type IV ($p < 0.05$).[36, level I]

Another **randomised clinical trial (Behrangi E et al. (2022; Iran)** evaluated the comparative efficacy of microneedling with and without PRP versus FCO_2 laser therapy for acne scar treatment. Ninety patients with acne scarring were evenly divided into three groups: microneedling alone (aged 32.73 ± 7.88 years), microneedling with PRP (aged 32.95 ± 8.20 years) and FCO_2 laser therapy (aged 29.64 ± 6.27 years). All patients underwent three treatment sessions spaced three weeks apart.[37, level I]

At 3-month post-treatment, both microneedling groups showed significantly greater scar severity improvement than the laser group ($p < 0.0001$). The microneedling + PRP group achieved the highest patient satisfaction ($p = 0.04$) and the greatest reduction in scar depth ($p = 0.02$).[37, level I]

Ismail SA et al. (2022; Egypt) in a randomised split-face clinical study evaluated the efficacy of microneedling alone, intradermal PRP alone and microneedling combined with PRP for treating atrophic post-acne scars in adult patients aged 17 to 35 years. Thirty patients were divided into two groups: one received microneedling with topical PRP on one side of the face and microneedling alone on the other; the other received microneedling with topical PRP on one side and intradermal PRP on the other. Each underwent up to four sessions at three-week intervals, with follow-up after one month.[38, level I]

Combined microneedling and PRP showed overall improvement across all measures, though not statistically significant. However, microneedling with topical PRP demonstrated significant superiority over intradermal PRP, with higher rates of excellent and marked photographic responses ($p = 0.006$), greater ECCA score reduction ($p = 0.001$) and better patient satisfaction ($p = 0.002$).[38, level I]

Table 2 summarised all the reported effectiveness of microneedle and/ or PRP on face for scars and skin fibrosis.

Table 4: Effectiveness of microneedling and/ or platelet-rich plasma on face for treating scars and skin fibrosis.

Study	*Study Characteristics/ Follow-up*	*Intervention*		*Findings*
		Treatment	**Control**	
Facial microneedling				
Sitohang IBS et al./2020/SR Indonesia[22]	9 RCTs N=341 >18 years old Atrophic acne scars 18 week-8 months	Microneedle + other treatments*	Microneedle alone	• Effective for treating atrophic acne scars as both monotherapy and combination therapy. • Combination therapies yielded enhanced outcomes when microneedling was paired with 70.0% glycolic acid, Jessner's solution, polylactic acid or subcision. • Patient satisfaction was positive, with dual therapies often outperforming monotherapy.
Rattananukrom T et al./2025/RCiT Thailand[23]	N=29 18-50 years old Atrophic acne scars 4,8,12,16,24 weeks	MFR + topical insulin	MFR + normal saline	Scar volume reduction: • MFR + topical insulin: 18.22 ± 9.86 mm³ → 16.20 ± 8.58 mm³ at week 12 (p = 0.017). • MFR + normal saline: 18.02 ± 9.24 mm³ → 15.28 ± 8.21 mm³ at week 16 (p = 0.001). ECCA score reduction: • MFR + topical insulin: 46.77% ± 21.33% • MFR + normal saline: 46.39% ± 20.14% • Both reductions were statistically significant (p ≤ 0.001)
Huang C et al./2024/RCT China[24]	N=80 Moderate-to-severe acne vulgaris 4, 12 weeks	MFR 22.4 ± 3.4 years old	Photodynamic therapy 23.8 ± 4.0 years old	Lesion reduction: • Significant improvement in inflammatory and non-inflammatory lesions in both groups. • MFR showed faster response and better safety profile. Inflammatory lesions: • MFR: 81.0% reduction vs. photodynamic therapy: 73.0% after third session. • MFR showed early efficacy from first session. • Photodynamic therapy occasionally triggered reactive acne. Non-inflammatory lesions: • After second session: MFR 55.0% vs. photodynamic therapy 44.0%. • No significant difference at final follow-up. Clinical outcomes: • More MFR patients achieved IGA clear/almost clear status by sessions 2 and 3. • Higher patient satisfaction with MFR.

Abdel hay R et al./2024/RCiT Egypt[25]	N=21 29.5 ± 9.0 years old Atrophic post-acne scars 1 month	Microneedle + topical insulin	Microneedle + normal saline	Scar improvement: • Significant reduction in atrophic acne scars on both insulin-treated and saline-treated sides. • GSGS: 35.8% (insulin) vs. 32.7% (saline), p < 0.001. • Lipper & Perez: 35.8% (insulin) vs. 33.6% (saline), p < 0.001. Patient-reported outcomes: • Majority reported good or moderate scar improvement and satisfaction. Quality of life: • Significant improvement in FASQoL scores post-treatment (*p* < 0.001)

Kim J et al./2023/RCiT Korea[26]	N=23
	19-36 years old
	Inflammatory acne and acne scars
	
	12, 20 weeks
		MFR + AFL	AFL alone	Efficacy:
				• FMR + AFL showed superior outcomes vs. AFL alone in acne severity, scar grading, lesion counts and satisfaction.
				
				Lesion reduction:
				• Significant decrease in hemi-mGAGs (p < 0.001).
				• At 20 weeks:
				  ○ Inflammatory lesions: 46.3% (FMR + AFL) vs. 12.0% (AFL), p = 0.005.
				  ○ Total and non-inflammatory lesions also significantly reduced after second session.
				
				Scar assessment:
				• SGA scores significantly improved in FMR + AFL group (p = 0.03).
				• Depressed scar volume: significant by RM-ANOVA (p = 0.048), but not at specific time points.
				
				Satisfaction:
				• 82.6% of FMR + AFL patients rated outcomes as “much” or “very much improved” vs. 60.9% for AFL alone.
				
				Biomarker modulation:
				• Increased FoxO1A nucleo-cytoplasmic ratio (p < 0.001).
				• Enhanced PPAR-γ staining intensity (p < 0.05).
				
				Sebum reduction:
				• Significant decrease with FMR + AFL: 83.3 → 72.9 μg/cm² (p < 0.05).
				• No reduction observed with AFL alone.

Shahbano et al./2023/RCT Pakistan[27]	N=60
	18-45 years old
	Acne scars
	
	1 month
		Microneedle + 35.0% glycolic acid peel	35.0% glycolic acid peel alone	Overall efficacy:
				• Treatment group vs. control: 96.67% (n=29) vs. 73.3% clinical improvement (n=22), p = 0.011.
				
				Stratified analysis:
				• Combination therapy favoured in:
				  ○ Age group 31–45 years.
				  ○ Disease duration >6 months.
				  ○ Icepick scars: 100.0% (treatment group) vs. 66.67% (control group), p = 0.018.

Ishfaq F et al./2022/RCT Pakistan[28]	N=60 15-50 years old Atrophic acne scars 3 months	Microneedle	35.0% glycolic acid peel	3-month efficacy: • Microneedle vs. glycolic acid: 73.33% (n=22) vs. 33.33% (n=10) achieved efficacy, p = 0.001. Morphology-specific response: • Microneedling showed improved efficacy for icepick scars. • Rolling scars responded better than boxcar scars within the microneedling group.
Platelet-rich plasma on face				
Cruciani M et al./2024/SR Italy[29]	8 studies N=3,221 Facial rejuvenation	PRP + other treatments**	PRP alone	Meta-analysis findings: • PRP as an adjunct significantly improved patient satisfaction. • (PRP + fractional laser) + (PRP + HA) vs. saline/ platelet poor plasma/ topical TCA + LA/ growth factors/ fractional laser only: Mean difference: 0.63 (95% CI: 0.25–1.00), p = 0.001. • Low certainty due to bias and inconsistency. Descriptive review insights: • PRP + laser therapy may enhance satisfaction, skin elasticity and erythema index.
Aljefri YE et al./2022/SRMA Saudi Arabia[30]	11 studies N=313 24.3 to 36.8 years old Severe atrophic acne scars 1 month-1 year	PRP + FCO_2	FOC_2 alone	Clinical efficacy: • PRP + FCO_2 showed superior improvement vs. laser alone. • OR = 2.56 (95% CI: 1.37–4.78), p < 0.01. Patient satisfaction: • Higher with combination therapy. • OR = 3.38 (95% CI: 1.80–6.34), p < 0.01. Scar severity: • Significant reduction in Goodman & Baron scores. • SMD = –0.40 (95% CI: –0.65 to –0.14), p < 0.01.

				Erythema duration: • Shorter with PRP + FCO_2. • SMD = –0.67 (95% CI: –1.32 to 0.01), p = 0.05. • Sensitivity analysis: SMD = –0.95 (95% CI: –1.41 to 0.49), p < 0.01.
Ebrahimi Z et al./2022/SRMA Iran[31]	13 studies N=855 16-52 years old Atrophic, hypertrophic/ keloid scars 0-12 months	PRP + ablative lasers/ microneedle/ subcision	PRP alone, ablative lasers/ microneedle/ subcision alone	Overall response rates: • Comparable across interventions: 22.0%–23.0% for PRP monotherapy, PRP + microneedle, PRP + ablative laser, microneedle alone and ablative laser alone. PRP monotherapy showed: • 12.0% excellent improvement. • 29.0% poor response. Combination therapies markedly improved outcomes: • PRP + microneedle: 23.0% excellent, 43.0% marked response, 4.0% poor. • PRP + ablative laser: 32.0% excellent, 5.0% poor.
Twisy HO/2025/RCT Egypt[32]	N=40 Acne vulgaris 3 months	PRP + topical retinoid (adapalene gel 0.1%)	Topical retinoid (adapalene gel 0.1%) alone	Acne severity: • Treatment group showed greater reduction (p = 0.002) vs. control (p = 0.014). Lesion response: • Both groups improved in comedone lesions, with better results in treatment group. • No significant difference in papulopustular lesions. Overall improvement: • Treatment group had superior outcomes (p = 0.011) and higher patient satisfaction (p = 0.004). • Excellent improvement: 45.0% in treatment group vs. 0.0% in control. Recurrence: • Lower in treatment group (15.0%) vs. control (35.0%), though not statistically significant.
Refahee SM et al./2019/RCT Egypt[33]	N=24 3-6 months old Cleft repair 6 months	PRP	No PRP	Ultrasound measurement: • Scar width through orbicularis oris significantly reduced in PRP group. • PRP: 3.8 ± 0.886 mm vs. control: 4.96 ± 0.929 mm (p = 0.0047). Photographic assessment: • Point 1: 0.831 ± 0.231 mm (PRP) vs. 1.49 ± 0.442 mm (control), p = 0.0001. • Point 2: 1.015 ± 0.103 mm (PRP) vs. 2.275 ± 0.984 mm (control), p = 0.0003.

				Inter-rater reliability: • Excellent agreement for photographic measurements. • First assessment point: ICC = 0.995 ($p < 0.001$). • Second assessment point: ICC = 0.950 ($p < 0.001$).
Combination therapies				
Kang C et al./2022/MA China[34]	14 studies N=472 23.7-32.2 years old Acne scars 4-32 weeks	Microneedle + PRP	Microneedle alone	Clinical improvement: • Combined treatment significantly increased odds of >50.0% improvement on Goodman's qualitative scale. • OR = 2.97 (95% CI: 1.96–4.51), $p < 0.001$; $I^2 = 0.0\%$. • Effect more pronounced in RCTs. Patient satisfaction: • Significantly higher with combined therapy. • OR = 4.15 (95% CI: 2.13–8.09), $p < 0.001$; $I^2 = 53.0\%$.
Khan AI et al./2023/RCT Pakistan[35]	N=182 18-25 years old Acne scars 3 months	Microneedle + PRP	Microneedle alone	Overall improvement: • Microneedle + PRP vs. microneedle alone: 80.0% vs. 49.5%. Grade III–IV scarring: • One-grade improvement in 72.0% (combination) vs. 52.0% (monotherapy).
Mubeen S et al./2023/RCT Pakistan[36]	N=80 Post-acne atrophic scars 1-2 months	Microneedle + PRP 24.48 ± 4.75 years old	Microneedle + topical insulin 23.68 ± 5.03 years old	Scar grade reduction: • Microneedle + PRP vs. microneedle + insulin: 23.33 ± 16.79% vs. 55.42 ± 12.74%; $p = 0.001$. Marked improvement (>50.0%): • 50.0% of insulin group vs. 0.0% in PRP group. Scar type efficacy: • Insulin combination superior for ice pick, boxcar, and rolling scars. Skin type response: • Better outcomes in Fitzpatrick type IV ($p < 0.05$).
Behrangi SA et al./2022/RCiT Iran[37]	N=90 Acne scar 3 months	Microneedle alone 32.73 ± 7.88 years old	Microneedle + PRP 32.95 ± 8.20 years old, FCO_2	Scar severity: • Both microneedle groups showed significantly greater improvement than FCO_2 group, $p < 0.0001$. Patient satisfaction: • Highest in microneedle + PRP, $p = 0.04$.

			29.64 ± 6.27 years old	Scar depth: • Greatest improvement observed in microneedle + PRP, p = 0.02.
Ismail SA et al./2022/RCiT Egypt[38]	N=30 17-35 years old Atrophic post-acne scars 1 month	Split face: Microneedle + topical PRP, microneedle alone	Split face: Microneedle + topical PRP, intradermal PRP	Treatment group: • Microneedle + topical PRP showed greater improvement across all measures. • Differences were not statistically significant. Control group: • Microneedle + topical PRP significantly outperformed intradermal PRP alone. • Higher photographic response rates (p = 0.006). • Greater ECCA score reduction (p = 0.001). • Improved patient satisfaction (p = 0.002).

** 70.0% glycolic acid peeling, 1550 nm Er:Glass fractional laser, fractional ablative 2940 nm Er:YAG laser, tazarotene gel 0.1% once daily, 100.0% trichloroacetic acid CROSS, topical poly-lactic acid, Jessner's solution (salicylic acid, 14 g; resorcinol, 14 g; lactic acid [85%], 14 g; and ethanol to 100 mL).*
*** Fractional laser therapy, carbon dioxide laser, far grafting, minimal access cranial suspension-lift fat grafting, hyaluronic acid.*
SR, systematic review; RCT, randomised controlled trial; RCiT, randomised clinical trial; MFR, microneedle fractional radiofrequency, ECCA, Echelle d' évaluation clinique des cicatrices d' acne; IGA, investigator global assessment; GSGS, Global Scarring Grading System; FASQoL, Facial Acne Scar Quality of Life, AFL, ablative fractional laser; hemi-mGAGS, hemi-modified Global Acne Grading Score; SGA, Scar Global Assessment; FoxO1A, Forkhead box O1; PPAR-γ, Peroxisome Proliferator-activated Receptor gamma; HA, hyaluronic acid; TCA, trichloroacetic acid; LA, lactic acid; CI, confidence interval; FCO_2, fractional carbon dioxide; OR, odd ratio; SMD, standard mean difference; SRMA, systematic review and meta-analysis; ICC, intraclass correlation coefficient; MA, meta-analysis

SAFETY

Thirteen studies reported on the safety profile of microneedling and/ or PRP for facial treatment of scars and skin fibrosis.

Across the reviewed studies, no serious adverse events were reported, affirming a generally favourable safety profile for microneedle, PRP and combination therapies. Mild and transient side effects such as pain, erythema, oedema, crusting and swelling were commonly observed, with microneedle typically associated with shorter downtime and fewer pigmentary changes compared to laser or peeling treatments, although pain intensity may vary. Platelet-rich plasma, whether used alone or in combination was well tolerated, with no hypoglycaemic symptoms or systemic complications and showed reduced adverse effects when paired with corticosteroids for hypertrophic/ keloid scars. Modalities such as microneedle with topical insulin or radiofrequency demonstrated lower rates of post-inflammatory hyperpigmentation and improved tolerability. While some studies reported isolated cases of transient hyperpigmentation or lymphadenopathy, these were infrequent and resolved without sequelae. Systematic reviews largely confirmed the absence of serious risks, though safety reporting was inconsistent. Overall, the interventions were associated with mild, self-limiting adverse effects and no significant differences in severe event incidence between treatment groups.[22-27,29,31-34,36-38; level I]

The United States of Food and Drug Administration (FDA) regulated microneedling devices classified as medical devices when intended to alter tissue structure or function, such as for the treatment of acne scars, wrinkles or abdominal scarring. These devices are typically motorised, pen-shaped instruments designed to penetrate deeper layers of the skin and are cleared for use in individuals aged 22 years and older. Due to potential risks including infection and improper application, the FDA advised that microneedling procedures be performed exclusively by trained healthcare professionals. Over-the-counter microneedling devices were not authorised by the FDA. Detailed regulatory guidance is provided in the agency's document titled Regulatory Considerations for Microneedling Products.[39,40]

Under FDA guidelines, PRP is classified as a 361 HCT/P product, indicating it is minimally manipulated autologous tissue and generally falls under the practice of medicine when used within the same surgical procedure, such as facial rejuvenation. In this context, PRP does not require premarket FDA approval, provided it is used without added biologics or drugs. However, clinics administering PRP must comply with Good Manufacturing Practices and maintain strict sterility standards to ensure patient safety.[41]

As of the latest update, a total of two microneedling products and two PRP products have been registered with the Medical Device Authority.[42]

ECONOMIC IMPLICATION

No study to date has assessed the cost-effectiveness of microneedling and/ or PRP in the management of facial scars and skin fibrosis.

In Malaysia, the cost of a single microneedling session ranges from MYR 300 to MYR 2,800, with an average price at some clinics starting at MYR 800. Achieving optimal results typically requires a series of three to six sessions spaced four to six weeks apart. The PRP monotherapy costs between MYR 800 and MYR 2,500 per session. The combined microneedling with PRP treatment, often called a Vampire Facial is a more advanced and

more expensive option, ranging from MYR 1,500 to MYR 3,000 per session, with a similar requirement of three to six sessions for best results.[43-46]

CONCLUSION

The high level of evidence showed that microneedling and PRP, particularly when used in combination, offer significant efficacy in the treatment of facial scars and skin fibrosis, frequently resulting in superior clinical outcomes and higher patient satisfaction compared to monotherapies. While microneedling with topical insulin may achieve greater scar grade reduction than PRP in specific contexts, PRP monotherapy demonstrates comparable overall response rates to other interventions. Both modalities, whether applied individually or together, exhibit a favourable safety profile with adverse effects predominantly mild and transient, typically limited to pain, erythema and oedema with no serious complications reported. The FDA regulates these devices and products, mandating professional administration and compliance with manufacturing and sterility standards. Economically, the treatments require multiple sessions, with Malaysian costs ranging from MYR 300 to MYR 2,800 for microneedling, MYR 800 to MYR 2,500 for PRP monotherapy and MYR 1,500 MYR 3,000 per session for the combined approach.

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