

Comparison of Efficacy of Fractional Carbon Dioxide Laser Versus Microneedling with Platelet-Rich Plasma in the Treatment of the Striae

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ABSTRACT

Background: Striae distensae (stretch marks) are common dermatological concerns resulting from excessive skin stretching, leading to dermal collagen and elastin disruption. This study aims to compare the clinical efficacy and safety of Fractional CO₂ Laser (FCL) and Microneedling with Platelet-Rich Plasma (MN-PRP) for the treatment of striae.

Methods: An observational comparative study was conducted over 1.5 years at KDMCHRC. A total of 60 patients (age 18-40 years) were recruited and divided into two equal groups: Group A (treated with FCL) and Group B (treated with MN-PRP). Baseline and post-treatment assessments included digital photography, width measurement of striae, physician assessment score, patient satisfaction score, improvement in skin texture and overall appearance, and occurrence of side effects. The treatments were performed over 3 sessions at monthly intervals, and patients were followed up for 16 weeks.

Results: Fractional CO₂ Laser demonstrated superior early results in terms of width reduction and improved texture at 4 and 12 weeks ($p < 0.05$). However, by 16 weeks, both modalities showed comparable efficacy. Post-inflammatory hyperpigmentation (PIH) was more common in the FCL group (23.33%) than in the MN-PRP group (10%).

Conclusion: FCL provides a faster improvement, but MN-PRP offers a safer alternative for patients prone to PIH. Both modalities are effective, and patient selection should consider individual risk factors and treatment goals.

Key-words: Fractional CO₂ laser, Microneedling, Platelet-rich plasma, Overall appearance, Skin texture, Striae

INTRODUCTION

Straie distensae, commonly known as stretch marks, are a prevalent dermatological condition characterized by linear dermal scars and epidermal atrophy. These marks result from the rapid stretching of the skin and are associated with structural damage to collagen and elastin fibers within the dermal layer ^[1].

Straie distensae are particularly common during periods of significant physical and hormonal changes, such as adolescence, pregnancy, and rapid weight fluctuations ^[2]. Additionally, pathological conditions like Cushing's syndrome, Marfan syndrome, and the prolonged use of corticosteroids can predispose individuals to the development of these scars ^[3].

Despite being benign, striae distensae often cause cosmetic concerns, leading to significant psychological distress and anxiety, especially among women. The prevalence of striae varies, affecting approximately 5% to 35% of the general population, with a higher incidence of 50% to 90% observed during pregnancy (referred to as striae gravidarum) ^[4,5]. While striae do not pose significant medical risks, they are often a source of

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cosmetic concern, prompting many individuals to seek treatment.

Striae distensae typically begin as erythematous or violaceous lines, known as striae rubra, which gradually progress to hypopigmented, atrophic scars referred to as striae alba. The most affected areas include the abdomen, breasts, thighs, buttocks, and lower back [6]. In particular, the condition is widely observed among pregnant women, with studies reporting a prevalence of up to 90% in this population by the third trimester. While the exact pathophysiology of striae remains under investigation, the overstretching of cross-linked collagen fibers and impaired fibroblast activity are believed to play critical roles in their formation. These changes result in the disruption of dermal architecture, leading to the characteristic appearance of striae [7].

The management of striae distensae is particularly challenging, as no universally accepted gold standard treatment exists. Various therapeutic modalities have been explored, including topical agents such as retinoids and glycolic acid, chemical peels, microdermabrasion, radiofrequency devices, and energy-based treatments. Despite the availability of these options, their efficacy varies, and treatment outcomes are often modest, especially for mature striae alba. As a result, patients frequently seek advanced therapies to achieve better cosmetic results [8].

MATERIALS AND METHODS

Study Design & Setting- A hospital-based, comparative observational study was conducted at KDMCHRC over 1.5 years. Ethical clearance was obtained before recruitment, and written informed consent was secured from all participants.

Inclusion Criteria

- ✓ Patient of either sex.
- ✓ Patients aged 18 years and above with clinically diagnosed striae.
- ✓ Who provided informed consent.

Exclusion Criteria

- ✓ Pregnant women
- ✓ Individuals with connective tissue disorders, diabetes, active skin infections, or other conditions affecting wound healing

- ✓ Patients with a history of keloid or hypertrophic scars.
- ✓ Any other treatment procedure for striae within 6 months before the study.

Treatment Protocols- A topical anesthetic was applied 45-60 minutes before the procedure. Then lesions were cleaned and disinfected with normal saline.

Group A (Fractional CO₂ Laser Treatment)- Fractional CO₂ laser was performed using Dermaindia Futura RF 50 machine. Two passes were done. First pass was done along the length of the striae, and the parameters used were: power 20 W, spacing 800 µm, dwell time 800 µs, and 3 stacks. The second pass was done on the whole affected area (striae and surrounding) using the following parameters: power 20 W, spacing 800um, dwell time 800us, and 2 stacks. The dose was changed based on treatment site and was increased at each session according to the patient's tolerance. Ice packs for cooling were applied immediately after the laser sessions. Protective eye goggles were used during the sessions for both patients and the treating physician. Each patient undergoes a total of 3 sessions at 4-week intervals.

Group B (Microneedling with PRP)- PRP was prepared using a double-spin centrifugation method. Microneedling was performed using a dermaroller (needle sizes 1-1.5mm, depending on the treatment site). The skin was stretched, and microneedling was carried out in vertical, horizontal, and diagonal directions about 4-5 times. The endpoint is pinpoint bleeding. Microneedling was done over striae and extended 2-4 mm beyond the margins. This was followed by topical application of platelet-rich plasma. Total of 3 sessions at 4-week intervals.

Post-treatment care- Patients in both groups were advised to apply topical antibiotic cream (fusidic acid cream 2%) and an emollient twice daily for one week after each session.

Outcome Evaluation- Clinical outcomes were assessed one month after the last session using digital photos and the following parameters.

Width reduction of the largest striae- Scored from 0 to 4 based on percentage improvement.

One blinded physician assessment- Scored from 0 to 4.

Patient satisfaction- Scored from 0 to 4.

Improvement in skin texture- Scored from 0 to 4.

Improvement in overall appearance- Scored from 0 to 4.

Sequelae- Presence or absence of post-inflammatory hyperpigmentation (PIH) scored as 0 (present) or 1 (absent).

Scoring System- The following scoring system was used for clinical assessment.

0: No improvement.

1: Minimal improvement (<25%)

2: Good improvement (25–50%)

3: Very good improvement (50–75%)

4: Excellent improvement (>75%)

Data Collection- Data were collected using a structured proforma, and the results were analyzed based on clinical examination, patient-reported outcomes, and photographic documentation. Statistical analysis was

performed to compare the efficacy of the two treatment modalities.

Statistical analysis- Categorical variables were presented as numbers and percentages (%), while quantitative data were expressed as means $\pm$ standard deviation (SD). Data normality was assessed using the Shapiro-Wilk test. Independent t-tests and chi-squared tests were used to analyze quantitative and qualitative variables, respectively. Data entry was performed using Microsoft Excel, and final analyses were conducted using the Statistical Package for Social Sciences (SPSS), version 25 (IBM Corp., Chicago, USA).

RESULTS

The study evaluated treatment outcomes over 16 weeks, assessing improvements in striae width, skin texture, overall appearance, and patient satisfaction. Data were collected at baseline, 4, 8, 12, and 16 weeks, and analysed statistically to compare the efficacy of both treatment modalities. Demographic data and baseline characteristics of 60 patients were comparable between the groups ($p>0.05$) (Table 1).

Table 1: Baseline Characteristics of Study Participants

Variables		Group A (n, %)	Group B (n, %)	p-value
Age groups	18-24 years	14 (46.66)	18 (60.00)	0.07 (NS)
	25-32 years	12 (40.00)	08 (26.66)	
	39-30 years	04 (13.34)	04 (13.34)	
	Mean $\pm$ SD	25.43 $\pm$ 13.22	25.33 $\pm$ 13.08	
Gender	Male	13 (43.33)	14 (46.67)	0.15 (NS)
	Female	17 (56.66)	16 (53.33)	
Duration (Years)	<1 year	13 (43.33)	11 (36.66)	0.11 (NS)
	1-3 years	07 (23.33)	13 (43.33)	
	4-6 years	10 (33.34)	06 (20.00)	
Type distribution	Striae Alba	16 (53.33)	19 (63.33)	0.07 (NS)
	Striae Rubra	12 (40.00)	10 (33.34)	
	Striae Atrophicans	01 (03.33)	01 (03.33)	
Total no. of striae		12.46 $\pm$ 5.22	11.73 $\pm$ 4.12	0.07 (NS)
Width of largest striae		0.81 $\pm$ 0.23	0.71 $\pm$ 0.22	0.08 (NS)
Length distribution of striae	<5 cm	04 (13.33)	11 (36.67)	0.32 (NS)
	5-10 cm	17 (56.67)	16 (53.33)	
	>10 cm	09 (30.00)	03 (10.00)	

NS – Not Significant

Both groups demonstrated a progressive reduction in striae width over time, with a significant difference at the 4-week mark. By 16 weeks, most participants in both

groups had achieved substantial improvement, with 40.00% reaching the highest reduction of 4 grades (Table 2).

Table 2: Percentage of reduction of width of largest striae (score 0-4)

Category	Group A	Percentage	Group B	Percentage	p-value
4 weeks					0.02 (S)
0	05	16.67%	10	33.33%	
1	19	63.33%	15	50.00%	
2	06	20.00%	05	16.67%	
8 weeks					
1	07	23.33%	10	33.33%	
2	17	56.67%	14	46.67%	
3	06	20.00%	06	20.00%	
12 weeks					
1	01	03.33%	06	20.00%	
2	12	40.00%	13	43.33%	
3	14	30.00%	07	23.33%	
4	03	10.00%	04	13.33%	
16 weeks					
1	00	0%	02	20.00%	
2	08	26.66%	06	20.00%	
3	10	33.33%	10	33.33%	
4	12	40.00%	12	40.00%	
Total	30	100%	30	100%	

S – Significant

One Blinded Physician's assessment: Overall, the assessment shows a progressive improvement over time in both groups, with Group A demonstrating a slightly greater proportion of participants achieving higher improvement categories by 16 weeks. 43.33% of patients in Group A had scored 4 compared to 40.00% in Group B by 16 weeks, demonstrating significant improvement in striae severity. The p-value of 0.03 suggests a statistically significant difference in outcomes between the groups (Fig. 1).

Patient satisfaction improved over time in both groups, with Group A showing a slightly higher proportion of patients achieving maximum satisfaction at later time points ($p < 0.02$) (Fig. 2).

The skin texture improved progressively in both groups, with Group A consistently showing better outcomes at each stage. The statistically significant difference at 4

weeks ($p = 0.02$) suggests that Group A had an earlier and more rapid improvement in skin texture compared to Group B. By 16 weeks, both groups reached comparable levels of improvement, but Group A demonstrated a steadier and continuous transition to higher improvement scores (Fig. 3).

Overall, the results indicate a progressive improvement in overall appearance over time in both groups, with Group A demonstrating an earlier and more consistent response. The statistically significant difference at 4 weeks ($p = 0.02$) suggests that Group A showed better initial improvements, which continued to be superior at 8 and 12 weeks. By 16 weeks, both groups had reached similar levels of excellent improvement, but Group A had a smoother and faster transition from minimal to higher improvement scores, while Group B had a more gradual progression, with some participants still in the lower improvement category by the final follow-up (Fig. 4).

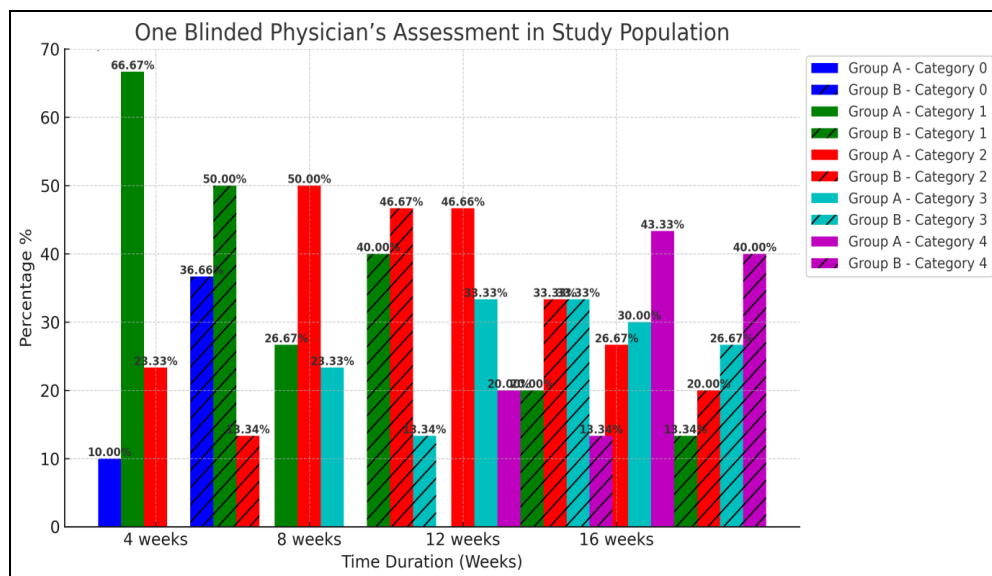


Fig. 1: One Blinded Physician's assessment (score 0-4)

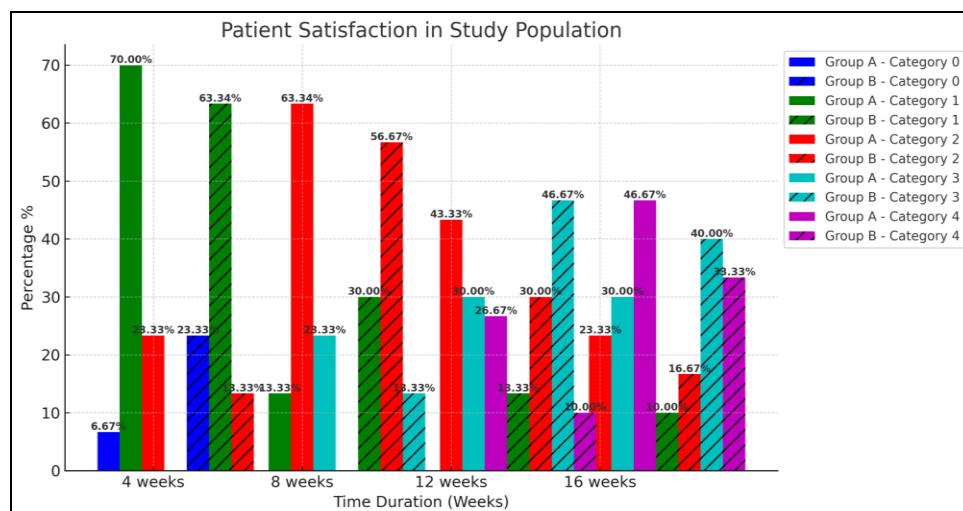


Fig. 2: Patient satisfaction (score 0-4) in study population

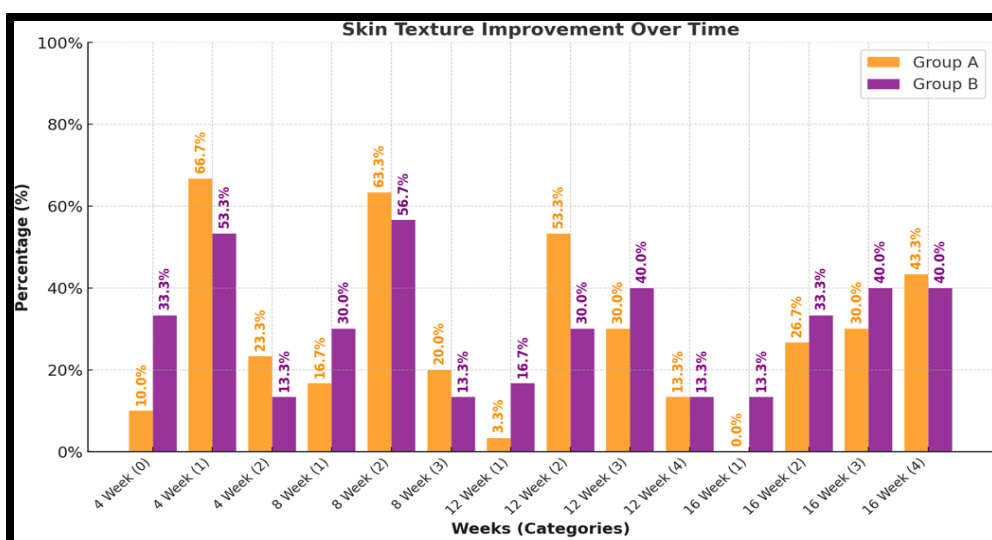


Fig. 3: Improvement in skin texture (score 0-4) in study population

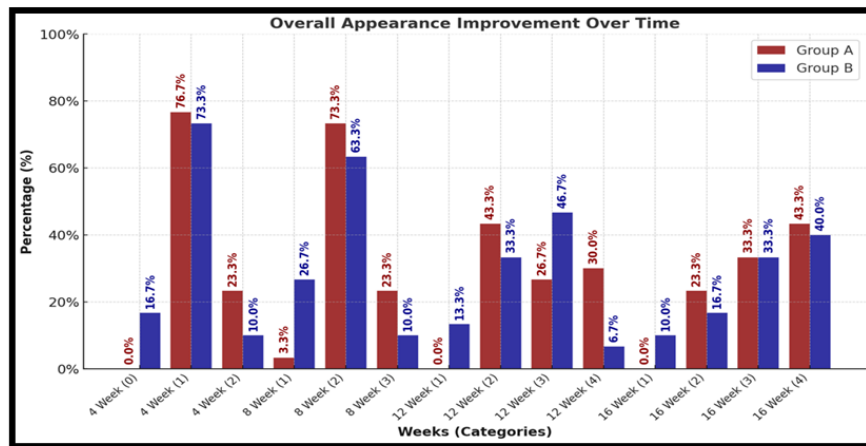


Fig. 4: Improvement in overall appearance (score 0-4) in study population

Overall, both groups had a low occurrence of sequelae throughout the study period, with no complications observed at 4 and 8 weeks. By 12 weeks, a small percentage of participants in both groups showed mild sequelae, which became more noticeable at 16 weeks.

By 16 weeks, 23.33% of patients in Group A developed mild sequelae compared to only 10.00% in Group B, though the overall incidence remained low, indicating that both treatment methods were generally safe and well-tolerated (Fig. 5a & 5b).

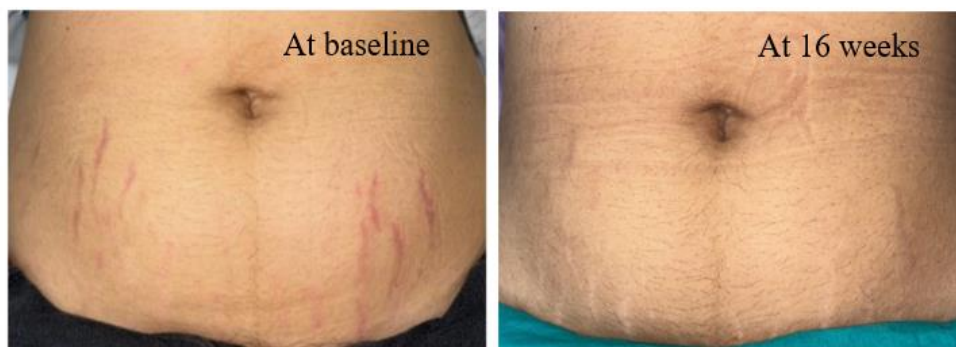


Fig. 5a: Patient 1 treated by FCL

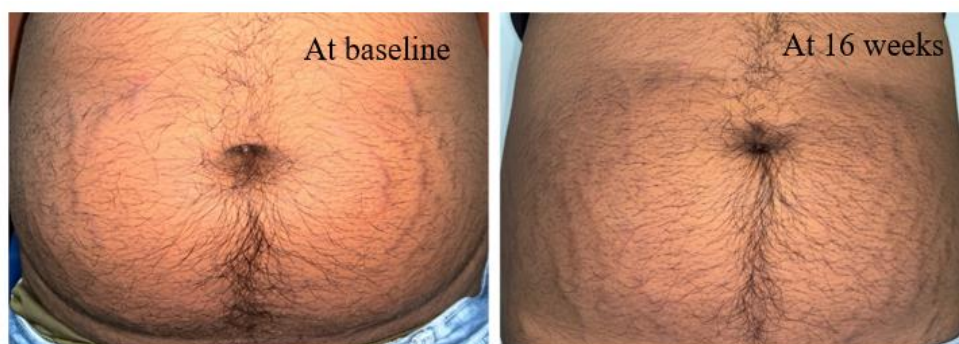


Fig. 5b: Patient 2 treated by MN-PRP

DISCUSSION

This study evaluated the comparative efficacy of Fractional CO₂ Laser (FCL) and Microneedling with Platelet-Rich Plasma (MN-PRP) in managing striae distensae (SD) over 16 weeks. Clinical parameters—such as striae width, skin texture, overall appearance, and patient satisfaction—demonstrated a statistically

significant and earlier improvement in the FCL group (Group A), although both modalities achieved comparable results by the end of the follow-up.

Our findings corroborate those by El Taieb and Ibrahim ^[9], who reported greater efficacy of fractional CO₂ laser compared to IPL for SD, especially in early stages of striae rubra ^[10]. In our study, Group A showed earlier



improvements in striae width, skin texture, and satisfaction scores from week 4 onwards. By week 16, 40% of patients in both groups reached the highest improvement score, mirroring trends in Naein and Soghrati's findings, who demonstrated that FCL achieved >75% improvement in over one-third of patients ^[11].

Patient satisfaction and physician-assessed improvement were also superior in Group A, aligning with results by Leo *et al.* ^[12], who observed better VAS and satisfaction scores in the FCL group compared to MN-PRP.

The MN-PRP group showed gradual yet effective improvement with a lower incidence of side effects, particularly post-inflammatory hyperpigmentation (PIH)—only 10% in Group B versus 23.33% in Group A by week 16. This mirrors the findings of Sobhi *et al.*, who also reported higher PIH in FCL-treated patients compared to those receiving fractional microneedle RF ^[7].

PRP's mechanism likely aids gradual dermal remodeling via the stimulation of collagen and elastin, as reviewed in Anitua *et al.*, where plasma growth factors accelerated tissue repair and neocollagenesis ^[10]. Similarly, Leo *et al.* ^[12] concluded that PRP is a promising adjunct in aesthetic dermatology, especially for treating scars and SD.

Histological studies have shown disorganized collagen and elastic fiber networks in SD, and energy-based devices such as FCL effectively restore dermal structure, especially in earlier lesions ^[13]. Wang *et al.* ^[14] and Mitts *et al.* ^[15] both highlighted how structural damage in SD is more amenable to intervention during the striae rubra stage, supporting our observation that earlier-stage lesions respond better and faster. While FCL offered faster results, it comes with limitations in darker skin types due to a higher risk of PIH. Hence, as supported by Trüeb *et al.* ^[16], MN-PRP remains a safer alternative in skin types III–V.

A limitation of FCL, particularly in darker skin types, is the increased risk of pigmentation changes. This highlights the value of safer alternatives like MN-PRP, especially in Fitzpatrick types IV–V, as supported by Daulatabad *et al.* ^[17].

CONCLUSIONS

Overall, the findings suggest that Fractional CO₂ laser led to faster and more substantial improvements in striae width, skin texture, and overall appearance, with higher patient and physician-rated satisfaction, particularly in

the early weeks. On the other hand, microneedling with PRP demonstrated a more gradual but comparable improvement by 16 weeks, with a lower incidence of sequelae. Thus, Fractional CO₂ laser appears to be a superior option for rapid and significant improvement, while microneedling with PRP provides a safer alternative in patients with dark skin tones with a more gradual response. Further studies with larger sample sizes and extended follow-up are recommended to confirm long-term outcomes and optimise treatment protocols for striae management.

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REFERENCES

- [1] Din S, McAnelly SL, Bowring A, Whiteside S, Morris J, et al. A double-blind controlled clinical trial assessing the effect of topical gels on striae distensae (stretch marks): A non-invasive imaging, morphological and immunohistochemical study. *Arch Dermatol Res.*, 2013; 305: 603–17.
- [2] Sheu HM, Yu HS, Chang CH. Mast cell degranulation and elastolysis in the early stage of striae distensae. *J Cutan Pathol.*, 1991; 18: 410–6.
- [3] Elsaie ML, Baumann L. Striae distensae: a comprehensive review and evidence-based evaluation of prophylaxis and treatment. *Br J Dermatol.*, 2013; 168(3): 584–92.

- [4] Atwal GS, Manku LK, Griffiths CE, Polson DW. Striae gravidarum in primiparae. *Br J Dermatol.*, 2006; 155: 965–69.
- [5] Lokhande AJ, Mysore V. Striae distensae treatment review and update. *Indian Dermatol Online J.*, 2019; 10: 380–95.
- [6] Huang Q, Xu L, Wu T, Mu Y-Z. New progress in the therapeutic modalities of striae distensae. *Clin Cosmet Investig Dermatol.*, 2022; 15: 2101–15.
- [7] Sobhi RM, Mohamed IS, El Sharkawy DA, El Wahab MA. Comparative study between the efficacy of fractional micro-needle radiofrequency and fractional CO₂ laser in the treatment of striae distensae. *Lasers Med Sci.*, 2019; 34(7): 1295–304.
- [8] Mysore V, Lokhande A. Striae distensae treatment review and update. *Indian Dermatol Online J.*, 2019; 10(4): 380.
- [9] El Taieb MA, Ibrahim AK. Fractional CO₂ laser versus intense pulsed light in treating striae distensae. *Indian J Dermatol.*, 2016; 61: 174–80.
- [10] Anitua E, Alkhraisat MH, Orive G. Perspectives and challenges in regenerative medicine using plasma rich in growth factors. *J Control Rel.*, 2012; 157: 29–38.
- [11] Naein FF, Soghrati M. Fractional CO₂ laser as an effective modality in treatment of striae alba in skin types III and IV. *J Res Med Sci.*, 2012; 17(10): 928–33.
- [12] Leo MS, Kumar AS, Kirit R, Konathan R, Sivamani RK. Systematic review of the use of platelet-rich plasma in aesthetic dermatology. *J Cosmet Dermatol.*, 2015; 14(4): 315–23.
- [13] Tong PL, Qin J, Cooper CL, et al. A quantitative approach to histopathological dissection of elastin-related disorder using multiphoton microscopy. *Br J Dermatol.*, 2013; 169: 869–79.
- [14] Wang F, Calderone K, Do TT, et al. Severe disruption and disorganization of dermal collagen fibrils in early striae gravidarum. *Br J Dermatol.*, 2018; 178: 749–60.
- [15] Mitts TF, Jimenez F, Hinek A. Skin biopsy analysis reveals predisposition to stretch mark formation. *Aesthet Surg J.*, 2005; 25: 593–600.
- [16] Trüeb RM. Oxidative stress in ageing of hair. *Int J Trichol.*, 2009; 1(1): 6–14.
- [17] Daulatabad D, Singal A, Grover C, Chhillar N. Profile of Indian patients with premature canities. *Indian J Dermatol Venereol Leprol.*, 2016; 82(2): 169–72.