



A COMPARATIVE ANALYSIS OF FRACTIONAL CO₂ LASER PLUS PLATELET RICH PLASMA VERSUS FRACTIONAL CO₂ LASER ALONE FOR SKIN REJUVENATION

Dermatology

Nidhi Gupta	MBBS, MD (Dermatology), Senior Resident, Department of Skin and Venerology Disease, SMS Medical College, Jaipur, Rajasthan, India.
Rajkumar Kothiwal	MBBS, MD (Dermatology), Professor and Head of Department, Department of Skin and Venerology Disease, JLN Medical college, Ajmer, Rajasthan, India.
Ajay Gupta	MBBS, MD (Community Medicine), Epidemic Intelligence Officer, National Centre for Disease Control, Delhi, India.
Sachin Kumar Bansal*	MBBS, MD (Anaesthesia), Senior Resident, Department of Anaesthesia, SMS Medical College, Jaipur, Rajasthan, India. *Corresponding Author

ABSTRACT

Introduction: This study was conducted to compare the efficacy of two new therapies i.e fractional CO₂ laser + platelet rich plasma (PRP) and fractional CO₂ laser alone in treatment of skin rejuvenation and investigate whether the combination of PRP and fractional CO₂ laser had a synergistic effect for facial rejuvenation and reduced occurrence of adverse reactions. **Methodology:** This hospital based observational study was conducted for a period of 14 months at a tertiary care facility, Ajmer, Rajasthan. Total 60 patients of 18 years and above age, diagnosed with skin aging receiving both treatment regimen was selected by simple random method and enrolled into study groups. In group A patients who were receiving Fractional CO₂ laser alone and in group B, patients were treated with both Fractional CO₂ laser and intradermal injections of platelet rich plasma were included. The effectiveness of treatment was assessed at regular intervals of 1 month, 2 months and 3 months. **Results:** Improvement in wrinkles, texture, and elasticity in CO₂ laser + PRP group is significantly higher than CO₂ laser group (p value<0.05). Similarly, improvement in terms of improved glow, more even complexion and improved facial contour was proportionately more in CO₂ laser + PRP group than CO₂ laser. Although this improvement was statistically insignificant (p value>0.05). **Conclusion:** PRP and fractional CO₂ laser had a synergistic effect on the therapy for facial rejuvenation and provides better overall clinical improvement so PRP should be considered as an adjuvant therapeutic option for skin rejuvenation along with fractional CO₂ laser.

KEYWORDS

Elasticity, Facial rejuvenation, Fractional CO₂ laser, Fractional CO₂ laser + PRP, Wrinkles.

INTRODUCTION

Skin aging is a complex biological process, which is characterized by wrinkles, epidermal and dermal atrophy, rough texture, pigmentation, telangiectasia and skin laxity.¹ Sun exposure, aging, some heredity and lifestyle factors including nutrition, alcohol consumption, smoking and stress all contribute to facial wrinkling.² Conditions that can be treated with skin rejuvenation include static and dynamic wrinkle, scar, vascular conditions and other related skin conditions that lead to loosening of skin. Skin rejuvenation means to give new youthful appearance to skin, or to restore vitality, particularly the face.^{3,4} Individual factors, such as the patient's expectations, the recovery time required until the patient can return to daily social activities, and the patient's economic status also influence the choice of rejuvenation method.⁵

Facial rejuvenation procedures can be roughly divided into face lift surgery and non-operative less invasive procedures, such as fat grafts, fillers, botulinum toxin injections, thread lifts, or laserabrasion.^{5,6} Laser radiation for skin rejuvenation has recently become popular and appears to be effective. The basic principle behind this approach is that heat is localised to the target by using a pulse duration that is shorter than the thermal relaxation time of tissue.⁷

Fractional lasers include non-ablative and ablative fractional lasers, they commonly provide columns into the skin at a depth of 1 and 2.5 mm, respectively.⁸ Non-ablative lasers only affect the, leaving the epidermis unaffected. Clinical improvements were seen with both procedures, although the ablative fractional erbium laser produced more collagen and elastin production and skin edema than the non-ablative one.⁹ Although laser skin resurfacing can eliminate fine wrinkles of skin, it may also be able to repair deep wrinkles by stimulating the production of collagen.¹⁰ Depending on the depth of the lesion, skin healing following deep peeling and laser resurfacing is referred to as a wound healing process.¹¹ Fractional CO₂ laser was developed for tissue rejuvenation and scar remodelling.⁵ The fractional CO₂ laser thermally modifies a section of the skin, leaving intervening zones of normal skin unaffected, allowing the ablated columns of tissue to quickly recover. Although fractional CO₂ laser offers the best outcomes available, people find it unpleasant due to side effects include erythema, oedema, infections, and the possibility of developing hyper- or hypopigmentation.¹²

Widely utilised in non-invasive anti-aging treatments, ultra pulsed fractional CO₂ laser is the gold standard for face rejuvenation and severely photo-aged skin.¹³ Although resurfacing has positive results, these are also accompanied by unfavourable symptoms such as erythema, edema, and pigmentation. Topical application of growth factors encourages the rejuvenation of photo-aged facial skin, enhancing its clinical appearance and triggering the production of new collagen.^{14,15} Due to the fact that platelet rich plasma (PRP) secretes a variety of growth factors that are involved in skin regeneration. By promoting the activation of fibroblasts, PRP may cause the creation of collagen and other matrix components, renewing the skin.

Even though PRP is frequently utilised in clinical dermatology, there are very few experimental research demonstrating its effects on ageing fibroblasts. Therefore, we conducted this study with the aim to compare the efficacy of two new therapies i.e fractional CO₂ laser plus PRP and fractional CO₂ laser alone in treatment of skin rejuvenation and investigate whether the combination of PRP and fractional CO₂ laser had a synergistic effect for facial rejuvenation and reduced occurrence of adverse reactions.

Objective- To compare the efficacy and side effects of Fractional CO₂ laser plus PRP versus Fractional CO₂ laser alone for skin rejuvenation.

MATERIAL AND METHODS

This hospital based observational study was carried out in Department of Dermatology, Venereology & Leprosy, tertiary care facility, Ajmer (Rajasthan). Data collection for the study was started in November 2020 after clearance from the Institutional Ethical Committee (Reference 1994/Acad-1/MCA/2022 dated 16/10/2020) of the institution, and data collection was completed in October 2021. An additional two months was taken for data analysis. A total of 60 patients of 18 years and above age, diagnosed with skin aging receiving both treatment regimens were selected by simple random method and enrolled into study groups. And patients whose skin is prone to scar tissue or have received some other treatment for the same or have some other systemic illnesses were excluded from the study. Written informed consent was taken from all patients included in the study and detailed demographic data along with clinical history was recorded on a predesigned Proforma. In group A, we enrolled patients who were being treated with Fractional CO₂ laser alone and in group B

patients were treated with both Fractional CO₂ laser and intradermal injections of platelet rich plasma. Topical anaesthetic cream i.e EMLA (lidocaine 2.5% + prilocaine 2.5%) was applied for 45-60 minutes before the start of therapy. A regular follow up was done to assess the effectiveness of treatment at regular intervals of 1 month, 2 months and 3 months. On each visit, complete dermatological examination was done and tolerance to the procedure and any undesirable effects during or just after procedure were noted. The self-designed Proforma was used to assess the efficacy of treatment. Treatment response to the therapy was recorded in the form of reduction or improvement in wrinkles, texture, and elasticity. We have classified response in wrinkles, texture and elasticity after three months of therapy into four categories from 0 to 3, 0 as no improvement, 1 as mild improvement, 2 as moderate improvement and 3 as marked improvement. At each session digital photographs were taken under the same conditions before and after treatment with identical settings and lighting at every follow-up before successive session using Canon EOS 1200D 18MP Digital SLR Camera. Patient satisfaction, and general perception regarding the treatment.

Statistical Analysis-

Data was entered in Microsoft Excel Spreadsheet. Discrete data was expressed in form of proportion and continuous data was expressed as mean and standard deviations. The difference in proportion was analysed using Chi-Square test and the difference in mean among the groups was analysed using the student-t Test¹⁶, 0.5% probability level was considered as statistically significant.

RESULTS

The mean age of the cases in group A was 31.27±7.89 years and in group B was 32.28±8.46 years. Table I depicts the sociodemographic profile of both study groups. Almost half of patients were of 21-30 years age group in both study groups, around three fourth were male in both groups, majority of patients were Hindu. Most of the patients were from urban areas. Figure I depicts the side effects. Proportion of patients having Erythema, Swelling, post inflammatory hyperpigmentation and burning sensation was relatively higher in CO₂ laser group compared to CO₂ laser + PRP group, although this difference was statistically insignificant using Chi-square test (p value>0.05). No patients were reported with pain in CO₂ laser group. None of the patients in either study group had bleeding. Table II showed response in wrinkles, texture, and elasticity in both study groups. Improvement in wrinkles, texture, and elasticity in CO₂ laser + PRP group is significantly higher than CO₂ laser group. Association of improvement in Fine wrinkles with type of procedure was found to be statistically significant (p value<0.05). Table III showed response in glow, facial contour and even complexion. In CO₂ laser group, improved glow, more even complexion and improved facial contour was observed in 46.67%, 46.67% and 40% cases respectively. whereas CO₂ laser + PRP group had more even complexion, improved glow and improved facial contour in 66.67%, 63.33% and 56.67% respectively. Although these improvements were found to be better in CO₂ laser + PRP group as compared to CO₂ laser group but the difference in improvement between study groups was statistically insignificant (p value>0.05).

Table I- Sociodemographic Profile Of Patients Of Both Study Groups

Variables		Fractioned CO ₂ Laser		Fractioned CO ₂ Laser + PRP		P-Values
		No. of cases	Percentage	No. of cases	Percentage	
Age group (Years)	≤20	1	3.33	0	0	0.378 NS
	21-30	17	56.67	14	46.67	
	31-40	8	26.67	10	33.33	
	41 to 50	3	10	4	13.33	
	51 to 60	1	3.33	2	6.67	
Sex	Male	9	30	7	23.33	0.770 NS
	Female	21	70	23	76.67	
Religion	Hindu	26	86.67	27	90	1.000 NS
	Muslim	4	13.33	3	10	
Residence	Rural	4	13.33	4	13.33	0.704 NS
	Urban	26	86.67	26	86.67	
Marital status	Married	17	56.67	19	63.33	0.792 NS
	Unmarried	13	43.33	11	36.67	
Dietary habits	Non vegetarian	4	13.33	4	13.33	0.704 NS
	Vegetarian	26	86.67	26	86.67	

Literacy	Primary	1	3.33	3	10.00	0.988 NS
	Secondary	4	13.33	3	10.00	
	Graduation	16	53.3	14	46.7	
	Post-graduation	9	30	10	33.3	

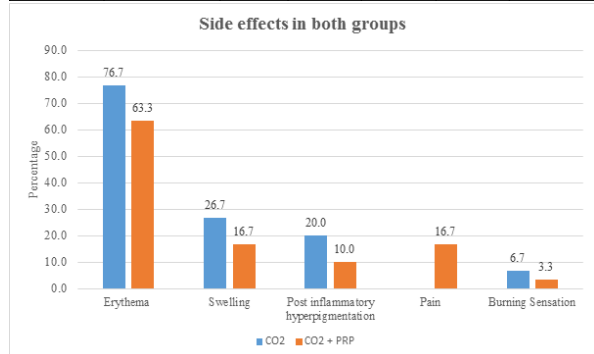


Figure I- Side Effects In Both Study Groups

Table II- Response In Wrinkles, Texture And Elasticity

Variables		CO ₂		CO ₂ + PRP		Test of significance
		No. of cases	%	No. of cases	%	
Fine Wrinkles	0	2	6.67	0	0	X ² =9.329, Df=3, p value=0.032
	1	14	46.67	6	20	
	2	11	36.67	14	46.67	
	3	3	10	10	33.33	
Deep Wrinkles	0	18	60.00	2	6.67	X ² =19.572, Df=3, p value<0.001
	1	9	30.00	20	66.67	
	2	3	10.00	7	23.33	
	3	0	0.00	1	3.33	
Texture	0	4	13.33	0	0	X ² =10.034, Df=3, p value=0.023
	1	19	63.33	13	43.33	
	2	7	23.33	15	50	
	3	0	0	2	6.67	
Elasticity	0	12	40	4	13.33	X ² =13.029, Df=2, p value=0.001
	1	18	60	17	56.67	
	2	0	0	9	30	
	3	0	0	0	0	

Table III- Response in Glow, Facial contour and Even complexion

Responses	CO ₂		CO ₂ + PRP		Test of significance
	No. of cases	%	No. of cases	%	
Improved glow	14	46.67	19	63.33	X ² =1.077, Df=1, p value=0.299
Improved facial contour	12	40	17	56.67	X ² =1.068, Df=1, p value=0.301
More even complexion	14	46.67	20	66.67	X ² =1.697, Df=1, p value=0.193

DISCUSSION

The synergistic effect of ultra-pulsed fractional CO₂ laser and PRP provoked epidermal regrowth and dermal remodelling. Min-Kyung Shin et al¹⁷ verified that the number of fibroblasts and collagen was higher in combination treatment via histological analysis.

In our study, majority of patients (70%) were females in group A similarly in Group B, around three fourth (76.67%) were female, which depicts female preponderance similar to study conducted by Murad Alam et al¹⁸. Similar level of Literacy, Religion and Occupation was found in both groups of our study. We detected in both study groups, most (86.67%) patients were from Urban area, which may be attributed to higher level of awareness in urban population.

Improvement in fine wrinkles was significantly higher in CO₂+ laser group than CO₂ laser group (p value<0.05). Min-Kyung Shin et al¹⁷ found that all patients that received combination treatment (fractional laser + PRP) and 58% of the group that received fractional laser treatment alone reported improvement in fine wrinkles. Pedram

Mehryan et al¹⁹ concluded that the combination of fractional CO₂ laser and PRP treatment in skin rejuvenation demonstrates subjective improvements in wrinkles. PRP was suggested to be effective in the rejuvenation of photoaged skin.²⁰ Murad Alam et al¹⁸ observed that six months after injections patients rated the PRP treated site as significantly more improved compared with normal saline side for texture and wrinkles. Rachel L et al²¹ observed that there was significantly more improvement in fine lines and skin texture after a single treatment of intradermal PRP to the cheek compared with normal saline.

Improvement in deep wrinkles in CO₂+ laser group was significantly higher compared to improvement in CO₂ laser group (p value<0.05), which was like Qiang Hui et al²² which found that after treatment for 3 months, subjective scores of the PRP combined laser treatment group was better than laser alone group and there was significant difference between the two groups.

Improvement in texture in CO₂+ laser group was found to be significantly higher than improvement in CO₂ laser group (p value<0.05), which is comparable to the study conducted by Qiang Hui et al²². They observed that improvement of skin texture, in the group receiving CO₂ laser + PRP was better compared to group receiving CO₂ laser + physiological saline and results were statistically significant. Grace Lee et al²³ noted that PRP has been shown to improve texture, wrinkles, and facial volume.

Improvement in elasticity in CO₂+ laser group was found to be significantly higher than improvement in CO₂ laser group (p value<0.05), our observation was parallel to the study conducted by Qiang Hui et al²², they observed that improvement of skin tightness in the experimental group (CO₂ laser + PRP) was better compared with the control group (CO₂ laser + physiological saline). Min-Kyung Shin et al¹⁷ combined PRP treatment with fractional laser and reported increased length of dermal – epidermal junction, volume of collagen, and objective improvement of skin elasticity. We found, improved facial contour, improved glow and more even complexion in CO₂ laser + PRP as compared to CO₂ laser, however these differences did not reach statistical significance.

PRP is commonly injected to the face and neck to help increase facial volume through collagen stimulation. PRP injections have been shown to improve the skin texture as well as the depth of fine lines and wrinkles through an increase of dermal collagen. PRP was found to have capacity to increase dermal elasticity by keratinocyte and fibroblast proliferation and collagen production and generates volume and skin turgor.^{24,25} It was reported that hyaluronic acid polymers decrease in skin on aging. So, increase in hyaluronic acid level will improve the appearance of the skin.

We perceived that, among patients who underwent CO₂ laser procedure, most common side effect was transient erythema in 76.67%, followed by swelling in 26.67%, post inflammatory hyperpigmentation in 20%, burning sensation in 6.67%. None of the patients had pain, bleeding, infection, and scarring. Among patients who underwent CO₂ laser + PRP procedure, 63.33% had transient erythema, followed by swelling and pain each in 16.67% patients. None of the patients had bleeding, infection and scarring. Although less side effects were observed in CO₂ laser + PRP group, no statistically significant difference was observed in both the groups (p value>0.05), similar results were reported by Martin et al²⁴, they stated that PRP decreases the healing time and enhances the healing overall when combined with other resurfacing modalities. Qiang Hui et al²² saw that patient in the CO₂ laser + PRP group had faster recovery, less duration of adverse events and better effects than that in the CO₂ laser + physiological saline group. Rachel L et al²¹ observed that, adverse events with PRP included transient redness, swelling, bruising, pruritus, and skin dryness. No serious adverse events were observed.

Furthermore, the current literature lacks enough comparison investigations on Fractional CO₂ laser in conjunction with platelet rich plasma and Fractional CO₂ laser alone. There is presently no research that compare the literacy, religion, residence, marital status, and diet of Skin Rejuvenation patients. More studies with a larger sample size and a longer follow-up time with a greater number of sessions are needed to further prove the efficacy of combination therapy of fractional CO₂ laser and platelet rich plasma for skin rejuvenation compared to fractional CO₂ laser alone.

CONCLUSION

In addition to greatly easing the erythema, pigmentation, and coarse pores brought on by laser therapy, combined application of fractional CO₂ laser with PRP could also successfully minimise the wrinkles and texture on the face. Patients also reported that burning pain caused by laser therapy was alleviated by coating with PRP. It can be concluded that, PRP and fractional CO₂ laser had a synergistic effect on the therapy for facial rejuvenation and provides better overall clinical improvement so PRP should be considered as an adjuvant therapeutic option for skin rejuvenation along with fractional CO₂ laser.

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