Original Article

Comparison of Efficacy of Fractional CO2 Laser with Intralesional Steroid Versus Intralesional Steroid Alone in the Treatment of Keloids

Ayesha Shafqat[1], Kehkshan Tahir[2], Fatima Bashir[3], Memoona Tahir[4], Anum Naveed[5], Ghazia Shaheen[6]

Abstract

Background: Keloids are abnormal wound responses characterized by deposition of excessive collagen and glycoprotein. They are distressing for most of the patients symptomatically and aesthetically. Intralesional steroids are the most commonly used treatment for keloids. Fractional CO2 laser is an emerging therapeutic option for keloids which can be used alone or as combination with other therapies.

Objective: To compare the efficacy of fractional CO2 laser with intralesional steroid versus intralesional steroid alone in the treatment of keloids.

Methods: Sixty patients were randomly assigned into two groups (30 patients each). After applying topical anesthesia to patients, Group A received fractional CO2 laser sessions followed by intralesional triamcinolone acetonide (TAC) with a gap of 5 mins every 4th week for total 4 months. Group B received Intralesional TAC alone every 4th week for total 4 months. Efficacy was assessed at the end of 4th session and was labelled if there was grade 3 or grade 4 improvement in width and height of keloid, degree of hypertrophy, dyschromia and texture of keloid using modified quartile score.

Results: Total of 60 patients (30 in each group) were recruited. The mean age was 26.60 ± 5.52 years in group A and 29.76 ± 6.20 years in group B. We found that efficacy was 90% (n=27) in Group A and 66.6% (n=20) in Group B with (P-value-0.028).

Conclusion: Our study results demonstrated that fractional CO2 laser in combination with intralesional TAC has better efficacy as compared to intralesional TAC alone, with a statistically significant difference (P-value-0.028).

Keywords: Keloids, triamcinolone acetonide (TAC), fractional carbon dioxide (FCO2).

How to Cite this: Shafqat A, Tahir K, Bashir F, Tahir M, Naveed A, Shaheen G. Comparison of Efficacy of Fractional CO2 Laser with Intralesional Steroid Versus Intralesional Steroid Alone in the Treatment of Keloids. J Pak Assoc Dermatol. 2025;35(3):221-226.

Received: 23-11-2024 **Revision:** 29-05-2025 **Accepted:** 03-10-2025

Authors Affiliation: [1,4,5,6]Department of Dermatology, PGMI/Lahore General Hospital, Lahore; [2]Department of Dermatology, FJMU/Sir Ganga Ram Hospital, Lahore; [3]Department of Dermatology, Azra Naheed Medical College/ Chaudhry Muhammad Akram Teaching & Research Hospital, Lahore

Corresponding Author: Dr. Fatima Bashir, Senior Registrar, Department of Dermatology, Azra Naheed Medical College/ Chaudhry Muhammad Akram Teaching & Research Hospital, Lahore. **Email:** fatima_57@live.com

Introduction

Keloids are abnormal fibrous tissue formation at the site of trauma, inflammation, surgery or burns. They go beyond the original wound boundaries, and tend to enlarge progressively. Keloids are firm to hard raised tissue. Areas of the upper back, shoulders, sternal skin, upper arms, earlobe and cheeks are more susceptible.[1] Patients younger than 30 years and having darker skin are at risk to develop keloids.[2] Susceptibility to keloids is genetic and more common in Asian, African or Latin population.[3] Patient complaints of pain, itching, restricted movements and emotional distress due to cosmetic concern.[4] The management of keloids is challenging because of limited response to different treatment options. Currently, available

treatment modalities for keloids are intralesional or topical steroids, cryotherapy, silicone compression, laser therapies, surgical excision, radiation, and many others with limited research (intralesional verapamil and 5-fluorouracil). The results of these treatments are variable for different people.[5] Intralesional steroids are the mainstay of treatment of keloids and these are given alone or in combination with other therapies (surgical excision, verapamil, 5-fluorouracil).[4,6] Corticosteroid by increasing tissue hypoxia and decreasing fibroblast it reduces collagen synthesis and promote regression in keloid scars.[6] Most commonly used steroid is triamcinolone acetonide (TAC).[6]

Clinically, the response to corticosteroid injection alone varied, with a recurrence rate of 33% and 50% after 1 and 5 years respectively and a regression rate of 50–100%.[7,8]

Ahsan et al, compared the efficacy of intralesional corticosteroid with cryotherapy versus intralesional corticosteroid alone in patients of keloids. Out of 30 keloid patients treated with intralesional TAC, 25 patients (83.3%) showed improvement.[9] Prabhu et al, conducted a study on 29 patients and in 15 patients who were treated with TAC; the mean reduction in volume was 71.23%.[10] Despite its benefits, intralesional steroid injection use causes pigmentary changes, skin and subcutaneous fat atrophy, telangiectasia, necrosis and has a recurrence rate of 9% to 50%.[11]

Fractional CO2 lasers are an emerging therapeutic option for treatment of keloids.[12] Fractional CO2 laser (FCL) emits energy that is absorbed by skin leading to local destruction of tissue and collagen remodeling. However, laser therapy alone has high recurrence rate at 6–24 months.[13] FCL therapy enhances the penetration and effectiveness of intralesional TAC to give a synergistic therapeutic response. A study by NH Sahib et al, compared the efficacy of fractional CO2 laser with intralesional steroid with intralesional steroid alone in the treatment of keloid. In the combination group, 7 out of 11 patients showed >75% overall improvement and 3 patients showed >50% improvement showing > 50% efficacy in 90.9%. In the other group of patients which received intralesional steroids alone, only 2 patients (18.2%) showed >50% overall improvement.[14]

Rationale of this study was that keloids are a common problem in our population and are distressful for most of the patients aesthetically and symptomatically leading to poor quality of life. Previous techniques have varying recurrence rates and side effects. There is no 100% curative treatment option. There's limited international data available on the effect of fractional CO2 lasers on keloids and no study has been conducted on the local population as far as we know. Hence, this study is planned to generate the latest and effective treatment option applicable on the local population.

Methods

Study was conducted at Dermatology unit of Lahore General Hospital, Lahore during duration of six months from January to June 2021, after approval from the institutional ethical review board of PGMI/Ameer-ud-Din Medical College/ Lahore General Hospital (AMC/PGMI/LGH/Article/ Research No. 00-205-20). It was a randomized control trial of total 60 patients of keloids. Clinically diagnosed patients of keloids of either gender, between 12 to 40 years of age, size of keloid less than 10 cm in any dimension, duration of more than 6 months, located at any site, and those patients who have not taken any treatment in last 6 months were recruited in study.

Pregnant and lactating females were excluded. Patients with local signs of infection, patients with underlying systemic disease i.e. connective tissue disorder, autoimmune disorder, hypertension (BP >140/90), diabetes mellitus (BSR>200 mg/dl), renal failure (creatinine >3 mg/dl), and those having keloids with secondary changes on surface (e.g., excoriation/ eczema) were excluded from study.

A written informed consent was obtained. History was taken (name, age, gender, location and duration of keloid) and examination was performed. The width and height of the keloids were measured using a Vernier caliper. Patients were randomly assigned into two equal groups (Group A and Group B) by random number table. Both groups received topical anesthesia by using 0.1%

lignocaine gel 0.5 to 1 hour before starting treatment. Group A received fractional CO2 laser sessions followed by intralesional TAC with a gap of 5 mins on every 4th week (0, 4, 8, 12th week) for a total of 4 months while Group B received Intralesional TAC alone 4 weeks apart for a total of 4 months. Fractional CO2 session was given with a spot density of 5-60 spots/cm^2 and energy of 10–80 mJ. Various shapes of laser beams were used for different areas and shapes of keloids. Post procedure topical antibiotics were given to the patients. Intralesional TAC 10-20 mg/mL was injected via a 2cc syringe with a 26-gauge needle. Patients were asked to come back for next session after a period of 4 weeks. Photographs were taken at start and every follow-up visits (0, 4, 8, 12th week).

Efficacy was assessed at the end of 4th session and was labelled if there was grade 3 or grade 4 improvement in width and height of keloid, degree of hypertrophy, dyschromia and texture of keloid using modified Manchester quartile score. (Grade 1— none, 2—fair, 3—good, 4—very good).

The following four-point scale was used: 0—(less than 25% improvement), 1—(25%-50% improvement), 2—(50%-75% improvement), 3—(more than 75% improvement). For each patient, average scores in each category were used to get their overall score. All data was noted on a predesigned Performa (attached) and confidentiality was ensured.

The data was entered and assessed using SPSS version 22. Quantitative variables like age, duration of disease, modified quartile score (pre and post treatment) were presented in terms of mean and standard deviations. Frequency and percentages were calculated for gender, site of lesion and efficacy of therapy. Chi-square test was used to compare efficacies of both groups. P value ≤ 0.05 was taken as statistically significant. Data was stratified for age, gender, duration and site of lesion to see effect modifier. Post-stratification chi square was used to compare efficacy in both groups for each strata.

Results

A total of 60 patients (30 in each group) fulfilling criteria were enrolled in our study. Patients age distribution showed that out of 60 patients, 40% (n=24) were between 12-30 years of age and 10% (n=6) were between 31-40 years of age in group A whereas in group B, 28.3% (n=17) were between 12-30 years and 21.7% (n=13) were between 31-40 years of age. There were 30% (n=18) males and

Table 1: *Clinico-demographic data.*

	Group A n=30	Group B n=30
Age		
12-30 years	24 (40%)	17 (28.3%)
31-40 years	6 (10%)	13 (23.3%)
Gender		
Male	18 (30%)	16 (26.7%)
Female	12 (20%)	14 (23.3%)
Duration of lesion	10.10±3.09	11.56±3.72
Lesion Site		
Chest	3 (5.0%)	7 (11.7%)
Neck/upper back	5 (8.3%)	13 (21.7%)
Shoulders	15 (25%)	8 (13.3%)
Other	7 (11.7%)	2 (3.3%)

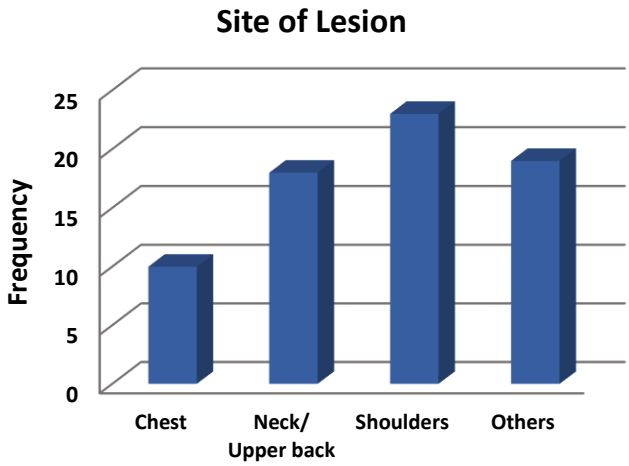

Figure 1: *Frequency distribution according to site.*

Table 2: *Comparison of efficacies of both groups.*

Groups	Efficacy Yes n(%)	Efficacy No n(%)	Total	P value
Group-A	27	3	30	0.028
(FCL+TAC)	(90)	(10)		
Group-B	20	10	30	
(TAC)	(66.6)	(33.3)		

Table 3: *Stratification of data.*

		Efficacy	Group A	Group B	p-value
Age (years)	12-30	Yes	22 (53.7%)	12 (29.3%)	0.077
		No	2 (5%)	5 (12.2%)	
	31-40	Yes	5 (26.3%)	8 (42.1%)	0.342
		No	1 (5.3%)	5 (26.3%)	
Gender	Male	Yes	16 (47.1%)	10 (29.4%)	0.070
		No	2 (6%)	6 (17.6%)	
	Female	Yes	11 (42.3%)	10 (38.5%)	0.192
		No	1 (3.8%)	4(15.4%)	
Duration of lesions (months)	7-12	Yes	22 (53.7%)	11 (26.8%)	0.125
		No	3 (7.3%)	5 (12.2%)	
	>12	Yes	5 (26.3%)	9 (47.4%)	0.120
		No	0 (0 %)	5 (26.3%)	
Site of lesions	Chest	Yes	2 (100%)	4 (50%)	0.408
		No	0 (0%)	3 (37.5%)	
	Neck/Upper Back	Yes	1 (100%)	7 (41.2%)	0.452
		No	1 (5.9%)	6 (35.3%)	
	Shoulders	Yes	14 (60.9%)	7 (30.4%)	0.636
		No	1 (4.3%)	1 (4.3%)	
	Others	Yes	6 (66.7%)	2 (22.2%)	0.571
		No	1 (11.1%)	0 (0%)	

20% (n=12) females in Group A whereas 26.7% (n=16) were male and 23.3% (n=14) were females in Group B (Table No 1)

Distribution of duration, size of keloid (assessed according to quartile score) and site was done. (Table No 1, Figure 1). Efficacy was 90% (n=27) in combination group (fractional CO2 laser with intralesional TAC, Group A) and 66.6% (n=20) in intralesional TAC alone group (Group B) with (p-value-0.028) (Table No 2).

Data was stratified for age, gender, duration and site of lesions (Table No 3).

Discussion

Keloids are abnormal scar tissue proliferation at site of surgery, burn, trauma or inflammation. These are raised scar, larger than the original wound and does not regress. Most susceptible areas of keloids are ear lobes, chest, shoulders and upper back.[1] Keloids can cause itching, pain and discomfort. Populations of Asian, African, or Latin American descent are more susceptible.[3] Treatment modalities for keloids include intralesional or topical steroids, laser therapies, surgical excision, cryotherapy, silicone compression, intralesional verapamil and 5-fluorouracil. Goal is to flatten, soften or shrink the scar tissue.

Most commonly used treatment is intralesional steroids but it has lots of side effects and recurrence rate.[6]

A newer therapy approach for treating keloids is fractional CO2 laser.[12] Fractional laser resurfacing shows significant functional and cosmetic improvement.[12] However, there is high recurrence rate if used alone.[13] FCL therapy give synergistic effect by increasing the penetration and effectiveness of intralesional TAC.

In the current study, patients age distribution showed that out of 60 patients 68.3%(n=24) were between 12-30 years of age and 31.7% (n=19) were between 31-40 years of age. This was comparable to Alexander et al, study in which the majority of patients were below 30 years of age i.e. 44%.[15] Gen-

der distribution of the patients in our study showed that males were 56.7% (n=34) and female patients were 43.3% (n=26). This was different from a study conducted by Alexander et al, in which 24% (n=12) patients were female and 76% (n=38) patients were male. This difference can be due to the fact that females are more concerned about their appearance in our society.[15] In our study, duration of keloid ranged from 6months-1year, while in study conducted by Alexander et al, duration of keloids were 6months to 20 years.[15]

In the current study, we compared the efficacy of fractional CO2 laser with intralesional TAC (Group A) and intralesional TAC alone (Group B). It was seen that efficacy was 90% in Group A and 66.6% in group B. The efficacies of both groups showed statistically significant differences (p-value: 0.028). Sahib et al, compared the efficacy of fractional CO2 laser with intralesional steroid versus intralesional steroid alone in the treatment of keloid. In the combination group, 7 out of 11 patients showed >75% overall improvement and 3 patients showed >50% improvement. In the other group of patients which received intralesional steroids alone, only 2 patients (18.2%) showed >50% overall improvement.[14] These results were comparable to our study as in both studies the combination group showed greater response. A study done in India by Alexander et al, also compared the efficacy of FCL with intralesional TAC against intralesional TAC alone in the treatment of keloids and hypertrophic scar. They reported an improvement of >50% in overall appearance in 43.3% of the lesions. Moreover, in patients who were treated with fractional CO2 laser followed by intralesional TAC injection a statistically significant reduction in height (P = 0.003) and length (P = 0.025) was seen.[15] Kumar et al, conducted a cohort study on 17 keloid patients and treated them with Nd:YAG laser followed by intralesional TAC. They reported complete resolution and flattening of scars in 7 (41.1%) out of 17 patients when intralesional TAC was used after laser therapy.[16] Lee et al, determined the combined effect of CO2 laser, cryotherapy and intralesional TAC and found that the height and pliability scores of keloids showed the most significant and faster responses to the combination therapy i.e. 63.6% and 53.8% respectively with a significant P value (<0.0001).[17]

Data was stratified according to age, gender, duration and sites of keloids and no significant difference in efficacy was seen in different groups of patients. It was comparable to a previous study done by Sahib et al, where no significant difference in efficacy was observed with respect to these variables.[14] We performed this study to compare the efficacy of fractional CO2 laser in combination with intralesional TAC and intralesional TAC alone, in order to provide a better treatment option applicable to our population. In the current study, a better response that was statistically significant, was observed in the combination group.

Fractional CO2 is an emerging treatment modality with superior response and low recurrence rate as compared to conventional treatment options. The standard method for treating keloid scars is intralesional steroid injection, however, fractional laser-assisted steroid delivery may offer a better aesthetic treatment option.

One of the study's drawbacks is the limited sample size. Therefore, it is recommended that in order to control bias future research be multicentric and use a bigger sample size. The study's brief follow-up period was another drawback.

Conclusion

The results of our study demonstrated that fractional CO2 laser in combination with intralesional TAC has better efficacy as compared to intralesional TAC alone, with a statistically significant difference (p-value 0.028). Fractional CO2 laser assisted delivery of intralesional TAC is a promising, effective and emerging modality for the treatment of keloids.

Ethical Approval: The study was approved by the Ethical Review Committee, PGMI/Ameer-ud-Din Medical College/Lahore General Hospital, Lahore Vide AMC/PGMI/LGH/Article/Research No/ 00-205-20.

Conflict of Interest: There was no conflict of interest to be declared by any author.

Funding Source: None.

Author's Contribution

AS: Substantial contributions to concept, study design, acquisition of data, analysis and interpretation of data, manuscript writing and critical review, has given final approval of the version to be published.

KT: Substantial contributions to concept, study design, Critical review, manuscript writing, has given final approval of the version to be publish.

FB: Substantial contributions to concept, study design, acquisition of data, analysis and interpretation of data, manuscript writing and critical review, has given final approval of the version to be published

MT: Substantial contributions to acquisition of data, manuscript writing, has given final approval of the version to be published.

AN: Substantial contributions to acquisition of data, manuscript writing, has given final approval of the version to be published.

GS: Substantial contributions to acquisition of data, manuscript writing, has given final approval of the version to be published.

References

1. O'Toole EA, Mellerio JE. Wound healing. In: Burns T, ed. Rook's Textbook of Dermatology. 8th Edn. West Sussex, UK: Wiley-Blackwell; 2010:14-15.
2. Jucket G, Adams HH. Management of Keloids and Hypertrophic Scars. Am Fam Physician. 2009;80(3): 253-60. PMID: 19621835.
3. Sun LM, Wang KH, Lee YC. Keloid incidence in Asian people and its comorbidity with other fibrosis-related diseases: a nationwide population-based study. Arch Dermatol Res. 2014;306(9):803-8. Doi: 10.1007/s00403-014-1491-5.
4. Asilian A, Daroughen A, Shariati F. New combination of triamcinolone, 5-fluorouracil and pulsed-dye laser for treatment of keloid and hypertrophic scars. Dermatol Surg. 2006;32(7):907-15. Doi: 10.1111/j.1524-4725.2006.32195.x
5. Mutalik S. Treatment of keloids and hypertrophic scars. Indian J Dermatol Venereol Leprol. 2005:71:3-8. Doi: 10.4103/0378-6323.13777
6. Marco Coppola M, Salzillo R, Segreto F, Persichetti P. Triamcinolone acetonide intralesional injection for the treatment of keloid scars: patient selection and perspectives. Clin Cosmet Investig Dermatol. 2018; 11: 387–96. Doi: 10.2147/CCID.S133672.
7. Mustoe TA, Cooter RD, Gold MH, Hobbs FD, Ramelet AA, Shakespeare PG, et al. International Advisory Panel on Scar Management. International clinical recommendations on scar management. Plast Reconstr Surg. 2002;110(2):560-71. Doi: 10.1097/00006534-200208000-00031
8. Munaluchi G, Suzuki S, Onodera M, Ito O, Hata Y, Igawa HH. Long-term outcome of intralesional injection of triamcinolone acetonide for the treatment of keloid scars in Asian patients. Scand J Plast Reconstr Surg Hand Surg. 2006;40(2):111–16. Doi: 10.1080/02844310500430003.
9. Ahsan Q, Sikder UA, Khondker L. Efficacy of combination of intralesional corticosteroid injection and cryotherapy versus intralesional corticosteroid injection alone in patients of keloid. J Pak Assoc Dermatol. 2018; 28(4): 474-81.
10. Prabhu A, Sreekar H, Power R, Uppin VM. A randomized controlled trial comparing the efficacy of intralesional 5-fluorouracil versus triamcinolone acetonide in the treatment of keloids. J Sci Soc. 2012; 39:19-25.
11. Trisliana Perdanasari A, Torresetti M, Grassetti L, Nicoli F, Zhang YX, Dashti T, et al . Intralesional injection treatment of hypertrophic scars and keloids: a systematic review regarding outcomes. Burns Trauma. 2015;3:14. Doi: 10.1186/s41038-015-0015-7.
12. Waibel J, Beer K, Narurkar V, Alster T. Preliminary observations on fractional ablative resurfacing devices: Clinical impressions. J Drugs Dermatol 2009; 8:481–85. PMID: 19537372.
13. Nouri K, Vidulich K, Rivas MP. Lasers for scars: a review. J Cosmet Dermatol. 2006;5(1):14–22. Doi: 10.1111/j.1473-2165.2006.00217.x.
14. NH. Sahib, MK Al-hattab, FA Fakhry, IJ Atiyah. The Role of Fractional CO2 Laser in Treatment of Keloid and Hypertrophic Scar used Alone and in Combination with Intralesional Steroids: Indian J Foren Med Toxicol, 2020;14(3):1576-81.
15. Alexander S, Girisha BS, Sripathi H, Noronha TM, Alva AC. Efficacy of fractional CO2 laser with intralesional steroid compared with intralesional steroid alone in the treatment of keloids and hypertrophic scars. J Cosmet Dermatol. 2019;18(6): 1648-1656. Doi: 10.1111/jocd.12887
16. Kumar K, Kapoor BS, Rai P, Shukla HS. In-situ irradiation of keloid scars with Nd:YAG laser. J Wound Care. 2000;9(5):213-5. Doi: 10.12968/jowc.2000.9.5.25985.
17. Lee YI, Kim J, Yang CE, Hong JW, Lee WJ, Lee JH. Combined Therapeutic Strategies for Keloid Treatment. Dermatol Surg. 2019;45(6):802-810.