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KELOIDS TREATED WITH CRYOTHERAPY COMBINED WITH INTRALESIONAL TRIAMCINOLONE VS FRACTIONAL CO2 COMBINED WITH TOPICAL TRIAMCINOLONE

Dermatology

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ABSTRACT

Background: Keloids are the type of scars which is formed when there is excess production of collagen due to failure of inhibition of activity of TGF-β during wound healing process. Cryotherapy, intralesional and topical triamcinolone, and fractional CO2, are some modalities used in treatment of keloids. **Objective:** To compare the efficacy of Intralesional Triamcinolone combined with cryotherapy and fractional CO2 Laser combined with Topical Triamcinolone in Keloidal Scars. **Method:** All patients discontinued ongoing keloid-related treatments before the study. Participants were divided into two groups: Group A received cryotherapy followed by intralesional triamcinolone, while Group B underwent fractional CO_2 laser therapy with topical triamcinolone. Standard post-procedure care included sun avoidance, antibiotic cream application, and sunscreen use. Scar outcomes were assessed using the Manchester Scar Scale, focusing on parameters such as color, texture, and overall appearance to evaluate treatment effectiveness. **Results:** At baseline, both groups were similar in demographics and scar profiles, although Group A had a slightly higher mean scar score (15.24) compared to Group B (14.35), reflecting marginally worse scars. With treatment, progressive improvement was observed in both groups. However, Group B consistently demonstrated superior outcomes, achieving a lower final mean scar score (8.18) versus 9.29 in Group A. Patient satisfaction was greater in Group B, with 47.1% reporting excellent results compared to 35.3% in Group A. **Conclusion:** Fractional CO2 Laser combined with topical triamcinolone has better efficacy than the Intralesional Triamcinolone combined with cryotherapy. Also, the adverse effects in Group B were less as compared to the Group A.

KEYWORDS

INTRODUCTION

Scarring is a frequent outcome of inflammatory skin conditions that result in extensive damage to both the epidermis and underlying dermal collagen. These scars typically present in one of two forms: atrophic or hypertrophic.[1] Key contributors to scar formation include severe acne, infections, and physical trauma. In particular, injuries such as burns and trauma are more likely to result in hypertrophic scars.[1]

Keloids have excess of collagen deposition with decreased collagenase activity while the wound healing and remodelling. These appears to be more red – purplish papule and nodule which can extend beyond the boundaries of original injury. More profoundly occur in darker skin type and on trunk.[2]

Triamcinolone, a long-acting corticosteroid, can be given via topical, intralesional, or intramuscular routes at intervals of 3–4 weeks. It aids keloid regression by multiple mechanisms: reducing inflammation through inhibition of leukocyte migration and phagocytosis, inducing vasoconstriction to limit nutrient supply, and exerting antimitotic effects that suppress keratinocyte and fibroblast activity, thereby slowing collagen synthesis. It also enhances collagen breakdown by decreasing protease inhibitors, while lowering TGF-β, IGF-1, and hydroxyproline levels. Despite efficacy, intralesional use may lead to adverse effects such as skin atrophy, telangiectasia, pigmentary changes, ulceration, necrosis, injection pain, and rarely systemic Cushing's syndrome.[3,4]

Cryotherapy is another modality that remodels tissue by impairing fibroblast proliferation and causing keratinocyte damage, reducing keloid mass. It is frequently combined with intralesional steroids for better outcomes.[5,6]

Fractional laser therapy is a recent advancement targeting microscopic skin zones to promote healing and collagen production. Ablative lasers, such as CO_2 and erbium, improve skin texture and firmness by removing superficial layers. Fractional CO_2 lasers selectively treat patterned areas, while non-fractional types cover the entire surface. Though effective, side effects include redness, crusting, post-inflammatory hyperpigmentation, bruising, and occasionally scar worsening.[7-11]

Aims and Objectives:

Aim: To compare the efficacy of Intralesional Triamcinolone combined with cryotherapy and fractional CO_2 Laser combined with Topical Triamcinolone in Keloidal Scars.

Objectives:

1. To evaluate the efficacy of Intralesional Triamcinolone combined with cryotherapy and fractional CO_2 Laser combined with Topical Triamcinolone in Keloidal Scars.
2. To evaluate the adverse effect associated with the treatment modalities

MATERIALS & METHOD:

This hospital-based Prospective study in which patients of 18 – 50 years age groups are included who had visited the Skin and VD department's OPD with primary complaints of Keloids.

A self-designed proforma had been used to record patient data.

A CO_2 Laser device (MicroFrxl (3 in 1), Dermaindia) has been used to perform the Fractional CO_2 laser and Dermaindia Cryogun is used for the Cryotherapy.

Clinical photographs had been taken for documentation purposes.

Inclusion Criteria

- Patients of 18 – 50 years age groups of both sexes were included.
- Individuals who had been presented with keloids and given written consent were included.

Exclusion Criteria

- Patients who had undergone invasive procedures on the lesion within the past 6 months had been excluded.
- Patients who had taken isotretinoin within the past 1 month had been excluded.
- Lesions with Active dermatitis and infection over treatment area had been excluded.
- Pregnant and Lactating women.

All the patients were asked to stop any applications over the keloids and all the other medications were relevant to keloids were stopped. No other cosmetic procedures were allowed between sessions in both the groups, and only sunscreens and specific topical antibiotic creams were prescribed post-procedure. Baseline photographs of the scars were taken after informed consent.

To achieve satisfactory anaesthesia, a topical cream containing prilocaine and lignocaine, applied under occlusion for an hour. Then treatment area was cleaned, and Cryotherapy for 10-15 seconds was done for 2 cycles of freezing and thawing, later when the frosting disappeared, intralesional triamcinolone 40mg/mL is being administered in 1-2 units per cm^2 in Group A. In Group B, Fractional CO_2 laser treatment was administered to keloids, including its margins and then the triamcinolone 40mg/mL is sprinkled over the lesions and rubbed thoroughly.

After treatment, patients were advised to strictly avoid sun exposure for 15 days and apply a non-occlusive antibiotic cream for 7 days. A broad-spectrum sunscreen was also be prescribed for use between sessions. The Manchester Scar Scale was used to assess scar appearance based on factors like colour, texture, distortion, contour, and surface changes in relation to surrounding skin. This assessment with maximum score of 18 and minimum of 5, helped to track the effectiveness of the treatment. The treatment's efficacy was evaluated based on improvements in these scar characteristics.

RESULTS

Table 1 shows that:

The age distribution shows that the majority of participants in both groups were young adults aged 20–30 years, slightly higher in Group B (70.6%) compared to Group A (52.9%). The mean ages were comparable (24.24 ± 7.95 vs. 23.88 ± 5.01). Female predominance was observed in Group B (58.8%), while Group A had more males (58.8%). Most participants were unmarried in both groups. Occupation patterns revealed that students formed the largest subgroup equally in both groups (47.1%), though homemakers and receptionists were more common in Group B, whereas nurses and doctors were only represented in Group A. Skin type distribution was similar, with type IV and V almost equally present.

In terms of scar sites, when both groups (n=34) are combined, the chest is the most common site overall, accounting for 10 out of 34 cases (29.4%). This is followed by the knee (5, 14.7%), elbow (4, 11.8%), arm (3, 8.8%), hand (3, 8.8%), shoulder (4, 11.8%), thigh (2, 5.9%), and leg (1, 2.9%). The chest involvement was higher in Group A (41.2%), while Group B showed more scars over the thigh, leg, and knee. Symptomatically, pruritus was the most frequent symptom, seen in 24 patients (70.6%), making it the dominant clinical feature across the study. Pain was present in 15 patients (44.1%), though never in isolation; it was always combined with pruritus and/or cosmetic disfigurement. Cosmetic disfigurement was also observed in 15 patients (44.1%), frequently associated with other symptoms. Asymptomatic scars were reported in 7 patients (20.6%), indicating that one-fifth of the study population had asymptomatic scars. Pruritus was more frequent in Group A (29.4%), whereas a combination of pruritus, pain, and cosmetic disfigurement was strikingly higher in Group B (47.1%).

Table 1: Demographic Data of the Participants

Category	Sub-category	Group A (n=17)	%	Group B (n=17)	%
Age Distribution	1–10	0	0.0	0	0.0
	10–20	5	29.4	3	17.6
	20–30	9	52.9	12	70.6
	30–40	2	11.8	2	11.8
	40–50	0	0.0	0	0.0
	50–60	1	5.9	0	0.0
	Total	17	100	17	100
	Mean ± SD	24.24 ± 7.95		23.88 ± 5.01	
	Range	17–50		10–30	
Sex	Male	10	58.8	7	41.2
	Female	7	41.2	10	58.8
	Total	17	100	17	100
Marital Status	Unmarried	13	76.5	12	70.6
	Married	4	23.5	5	29.4
	Total	17	100	17	100
Occupation	Student	8	47.1	8	47.1
	Home maker	1	5.9	2	11.8
	Farmer	2	11.8	1	5.9
	Teacher	2	11.8	2	11.8
	Computer Operator	1	5.9	1	5.9
	Nurse	1	5.9	0	0.0
	Receptionist	0	0.0	2	11.8
	Doctor	1	5.9	0	0.0
	Total	17	100	17	100
Skin Type	IV	8	47.1	9	52.9
	V	9	52.9	8	47.1
	Total	17	100	17	100

Past History

- In Group A, over half of the patients (52.9%) had no significant past history, compared to only 23.5% in Group B, suggesting a healthier baseline in Group A.
- Trauma-related scars were equally distributed in both groups (35.3% each), showing comparable representation.
- Burn repair history was more frequent in Group B (29.4%) than in Group A (11.8%), indicating that Group B had a relatively higher proportion of complex or severe baseline scars.

Previous Treatment: None of the patients in either group had undergone prior laser treatment or any topical or intralesional treatments with triamcinolone or any other drugs, ensuring a uniform baseline without prior intervention bias.

General Examination: All patients in both groups were within normal limits (WNL), indicating no systemic abnormalities or comorbid conditions affecting general health.

Systemic Examination: Similarly, systemic findings were normal in all patients across both groups, confirming that the study population was medically fit and comparable for treatment evaluation.

Overall, both groups were well-matched at baseline with no confounding medical issues or prior laser exposure, strengthening the reliability of subsequent outcome comparisons.

Table 2 shows that:

- In terms of scar colour, both groups predominantly showed mismatch, with Group B having more cases of obvious mismatch (47.1%) compared to Group A (35.3%).
- Surface examination showed a higher proportion of smooth/shiny scars in Group B (52.9%) versus Group A (35.3%), while Group A had more rough/matte scars (64.7%).
- Contour analysis revealed that keloid scars were the most common type in both groups, slightly higher in Group A (58.8%) than Group B (52.9%). Hypertrophic scars were present in both groups with similar proportions.
- Distortion severity was higher in Group A, with 41.2% showing severe distortion compared to 23.5% in Group B. Conversely, Group B had more mild-to-moderate distortion.
- For scar texture, firm scars predominated in both groups, but were more frequent in Group B (76.5%) compared to Group A (58.8%). Hard texture was more common in Group A (29.4%) than in Group B (11.8%).

Overall, Group A demonstrated relatively more severe distortion and hard textures, while Group B showed relatively better scar surface smoothness and firmer but less hard textures.

Table 2: Scar Examination Parameters

Category	Sub-category	Group A (n=17)	%	Group B (n=17)	%
Colour	Obvious mismatch (O)	6	35.3	8	47.1
	Gross mismatch (G)	7	41.2	5	29.4
	Slight mismatch (SM)	0	0.0	0	0.0
	Perfect (P)	0	0.0	0	0.0
	Total*	13	76.5	13	76.5
Surface	Smooth/Shiny (S)	6	35.3	9	52.9
	Rough/Matte (R)	11	64.7	8	47.1
	Total	17	100	17	100

Contour	Hypertrophic (H)	4	23.5	5	29.4
	Keloid (K)	10	58.8	9	52.9
	Indented (I)	0	0.0	0	0.0
	Flush/Discolored (FD)	0	0.0	0	0.0
	Total*	14	82.3	14	82.3
Distortion	Mild	4	23.5	6	35.3
	Moderate	6	35.3	7	41.2
	Severe	7	41.2	4	23.5
	None	0	0.0	0	0.0
	Total	17	100	17	100
Texture	Firm (F)	10	58.8	13	76.5
	Hard (H)	5	29.4	2	11.8
	Palpable (P)	0	0.0	0	0.0
	Normal (N)	0	0.0	0	0.0
	Total*	15	88.2	15	88.2

Table 3 showed that:

- Both groups demonstrated progressive improvement in total scar scores from baseline to 6 months, indicating significant clinical benefit over time.
- At baseline (0 week), the mean total scores of Group A (15.29 ± 1.49) and Group B (15.12 ± 1.76) were almost identical, with no statistically significant difference (p = 0.763). This indicates that both groups were comparable at the start of the study.
- At 3 months, both groups showed a reduction in scores, with Group B (11.00 ± 1.90) improving more than Group A (12.12 ± 1.69). However, the difference between them was not statistically significant (p = 0.079), suggesting a similar treatment effect up to this time point. Figure 1(a) and 2(b) representing the lesions at the initial point of study.
- At 6 months, further reductions in scores were noted in both groups, with Group B (8.29 ± 1.16) showing greater improvement compared to Group A (9.29 ± 1.57). The difference between the groups was statistically significant (p = 0.043), indicating that Group B achieved superior outcomes at the final follow-up. Figure 1(b) and 2(b) showing the final outcome of the lesion at the end of the 6 months.

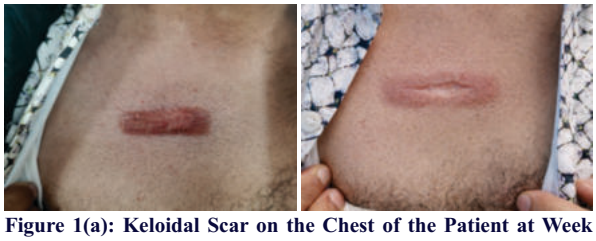

Figure 1(a): Keloidal Scar on the Chest of the Patient at Week Zero; 1(b): Keloidal Scar After 6 Months in Group A

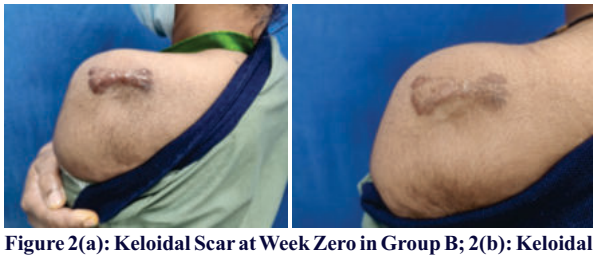

Figure 2(a): Keloidal Scar at Week Zero in Group B; 2(b): Keloidal Scar Showing Improvement at the End of the 6 Months in Group B

Table 3: Clinical Outcomes and Patient Satisfaction

Category	Sub-category	Group A (n=17)	Group B (n=17)
Total Score – Baseline (0 week)	Mean ± SD	15.24 ± 1.35	14.35 ± 1.37
	Range	13 – 18	12 – 17
Total Score – 3 months	Mean ± SD	11.76 ± 1.56	10.24 ± 1.58
	Range	9 – 15	7 – 13
Total Score – 6 months	Mean ± SD	9.29 ± 1.18	8.18 ± 1.11
	Range	7 – 11	6 – 11
Patient Satisfaction	Poor (0–25)	0 (0.0%)	0 (0.0%)
	Fair (26–50)	2 (11.8%)	2 (11.8%)
	Good (51–75)	9 (52.9%)	7 (41.2%)
	Excellent (76–100)	6 (35.3%)	8 (47.1%)
	Total	17 (100%)	17 (100%)

Patient satisfaction reflected these findings: while the majority in both groups rated outcomes as Good or Excellent, Group B had a higher proportion of Excellent ratings (47.1% vs. 35.3%). The p value is 0.7283, which is a non-significant difference between groups. Overall, both treatments were effective, but Group B participants showed relatively superior clinical improvement and higher patient satisfaction.

The most common adverse event observed was pain, affecting 85.3% of patients, highlighting it as a significant treatment-related discomfort. Erythema was the next frequent reaction, reported in 73.5%, reflecting post-procedural inflammatory changes. Hyper-pigmentation occurred in 67.6%, making it a prominent cosmetic concern following therapy. Skin atrophy was noted in 44.1%, representing a well-recognized side effect, particularly of corticosteroid use. Hypopigmentation was the least frequent event, present in only 17.6% of cases.

DISCUSSION

In this study of 34 participants, the majority of patients in both groups belonged to the 20–30 years age range, indicating that younger adults were the predominant study population, with mean ages were comparable between Group A (24.24 ± 7.95) and Group B (23.88 ± 5.01), showing no significant difference in age distribution. It was similar to study of Nishi N et al[12].

The total males and female were 17 each. But in Group A, males were more (10 vs 7) as compared to females whereas, in Group B males were less (7vs 10), which approximately concordant with the study of Nishi N et al[12].

In this study, the most common cases of keloid were with non-significant past history, seen in 13 patients (38.2%). Trauma-related history was present in 12 patients (35.3%). Burn repair history was observed in 7 patients (20.6%). We have different percentage of causes for the keloids than the study of Jannati P et al[13], who found burns as the main causative followed by accident and surgery.

The most common site of keloid in our study was chest (29.4%), similar to the study of Nishi N et al[12], Jannati P et al[13], and Behera B et al[14] who also found mid-sternum and chest as the most common site. The most common symptom present in this study was pruritus, seen in 24 patients (70.6%), which was of mild and moderate intensity, and was also a similar finding with these studies.[12-13] But the Behera B et al[14] had cosmetic concerns more in his patients.

The patients included in both groups were comparable with respect to their demographic data.

For their scar assessment and the response to the treatment, according to the MSS and photographic assessment, there was significant improvement in the colour of the scars in both the groups, mostly patients achieved the 'slight mismatch' appearance starting from the 'obvious mismatch' most common in group A and 'gross mismatch' in group B. Similar results were seen in the contour, which improved to 'indented' (more common in group A) and 'flushed with surrounding appearance' (more common in group B). Surface improvement which was measured in 'shiny' and 'matte', scars improved to 'shiny' surfaces. Also, the Distortion improved to 'mild' distortion from 'severe' and 'moderate', and texture showed improvement from 'firm' or 'hard' to 'palpable' in both the groups with slight better improvement in group B. These findings were consistent with the findings of the study of Nishi N et al[12] and Behrangi E et al[15], who also used MSS.

In study of Waible J et al[16], they recorded the dyschromia, hypertrophy, texture and the overall appearance through the photographic assessment and noticed the improvement in the parameters with use of Fractional CO_2 combined with the Topical Triamcinolone application as done in our Group B participants, and we found the consistent result as theirs.

At the baseline (Week 0), there was no significant difference in the MSS scoring in both the groups, p value of 0.07, which signifies non-significnat.

At 3 months, the total MSS mean scoring in Group A and Group B

reduced, but there was not much significant difference in the mean score and the p value was 0.079, non-significant difference.

At 6 months, the total MSS mean scoring in Group A was 9.29 ± 1.57, and in Group B, it reduced to 8.29 ± 1.16. The difference between the groups was statistically significant (p = 0.043).

In this study, pain was the most frequent adverse event which occurred due to the intralesional injection and just following the procedures, reported in 85.3% of patients, followed by erythema, indicating common inflammatory reactions, which mostly persisted a day or two after the procedures. Hyperpigmentation posing a notable cosmetic issue, which improved later, while skin atrophy consistent with steroid-related effects. Hypopigmentation was mostly seen in Group A participants due to use of steroids as well as cryotherapy. These findings are consistent with other studies.[12-16]

Group B has comparatively lesser side effects as compared to the Group A, which signifies that the concentration of steroid increased after cryotherapy posed more side effects but irregular surface improvement while in case of Fractional CO_2 Laser by creating multiple grids like holes through which topically applied steroid worked as an aid to the Fractional CO_2, leading to uniform action of drug, synergizing the effect of Fractional CO_2.

CONCLUSION

Fractional CO2 Laser combined with Topical Triamcinolone, as in Group B, has better efficacy than the Intralesional Triamcinolone combined with Cryotherapy, as in Group A. Also, the adverse effects in Group B were less as compared to the Group A.

Limitations

- Scars, keloids, generally require more treatment sessions than those performed here.
- The small sample size reduces statistical strength and limits the representativeness.
- The scar evaluation method used lacks standardization, which may introduce variability and subjectivity in outcomes, emphasizing the need for more reliable and standardized assessment tools in future studies.

Conflict of Interest: None

Declaration of Patient Consent:

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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