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Original Article

Comparison of efficacy and safety of fractional CO2 laser versus 70% trichloroacetic acid peel in the treatment of facial freckles and lentigines

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Abstract

Objective To evaluate the efficacy and safety of fractional CO2 laser versus 70% trichloroacetic acid peel in the treatment of facial freckles and lentigines in Asian people of skin type III & IV.

Methods This was a randomized clinical trial, and 92 cases, complying with inclusion standards, were enrolled. In groups A, 46 patients were treated with fractional CO2 laser. In group B, 46 patients were treated with 70% trichloroacetic acid peel. All the patients were treated and assessed at four weekly intervals for three consecutive sessions by taking photographs. Final results were concluded one month after the last session.

Results 92 patients completed the study with mean age of 29±5 years. In group A, 38% patients showed 75% lightening while in Group B, 49% patients showed good response in lesions clearance on face (80-90% lightening). So, the efficacy was significantly higher in patients treated with 70% TCA peel as compared to CO2 laser (p-value≤0.001). Overall percentage reduction in PSI score was higher in group B (64.80%) followed by group A (46.61%).

Conclusion 70% TCA was found more efficacious than CO2 laser for pigmented lesions.

Key words
Freckles; Fractional CO2 laser; Lentigines; Trichloroacetic acid.

Introduction

Freckles and lentigines are benign pigmented lesions. After direct exposure to ultraviolet radiations, keratinocytes simply express a large number of lignads, producing reactive oxygen species (ROS). These ROS are absorbed by melanocytes and melanin pigment is produced.[1]

Freckles (freckle, derived from the word "freemen") and aphelia or ephelides also refer to constrained, pigmented skin macules. Freckles usually occur on the mid face and are often noted in early childhood, likely to develop after significant sun exposure. If sun exposure is stopped, ephelides should disappear.[1]

Diagnosis is usually clinical. Histology shows clusters of concentrated melanin and melanocytes containing multiple larger melanosomes, without increase in the number of melanocytes. Dermoscopy of such lesions shows reticular pattern hyper-pigmentation with moth-eaten edges. Freckles are usually genetic i.e. presence related to melanocortin-I variant-receptor gene.[2]

Lentigines are acquired, brownish macules that occur on face, hands, neck and covered parts of body. After adolescence, they increase in number with age and don't fade in winter.[2] On

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histology, there is a localized increase in melanocytes number, with smaller sized melanosomes and an increased melanin concentration in the dermo-epidermis junction with flattening of rete ridges. Under dermoscopy, lesions appear as regularly sized meshes of dark pigment network.[3]

There are different treatment options for freckles and lentigines including; regular use of sunscreen, topical bleaching creams e.g. tretinoin 0.05-0.15%, hydroquinone 2-4%, glycolic acid 5-10%, azelaic acid 15 to 20%, trichloroacetic acid 15 to 70%, chemical peeling, lasers, IPL.

Methods

After approval from ethical review committee, a randomized controlled trial of 92 patients having freckles and lentigines on the face (naked eye examination) was carried out in department of dermatology, Mayo hospital Lahore, from 12/01/2017 to 11/11/2018. Patients of both gender and ages between 15-50 years having skin type III & IV were included after taking written informed consent.

Patients taking systemic retinoids within the past 3 months, taking drugs causing hyper-pigmentation, or patients who were hypersensitive to trichloroacetic acid peel, pregnant or lactating, had undergone previous chemical peeling or dermabrasion or cosmetic surgery, has a keloid tendency, or a history of recurrent herpetic viral infections were excluded from the study.

The patients were randomly divided by lottery method into two treatment groups. Group A (n=46) were treated with fractional CO2 laser for 3 months. Before each session, all makeup was removed as it can cause interference with laser tissue interaction. 5% lignocaine gel was applied on face for 30 min until patient felt numbness. Then face was washed and dried. After that, laser treatment with following parameters was carried out:

Fractional scan mode; spot size:10x10mm; point energy:15-21mJ, pulse duration: up to 3ms; interval: 1ms, distance: 0.8mm.

In Group B (n=46), involved area was degreased with 70% alcohol. Then trichloroacetic acid was applied carefully with cotton buds as spot peel. Frosting was observed immediately. Post-peel topical sunscreen (SPF>15) and emollients were applied. Polyfax skin ointment was applied at home till crust removal. The patients were treated at four weekly intervals for three consecutive sessions or till the removal of freckles and lentigines.

The patients were assessed by the same physician throughout the treatment period with 3 parameters: area, darkness and density to calculate PSI score. Effectiveness was defined as more than 40% reduction in baseline PSI score in terms of percentages as excellent >90%, good 60-89%, satisfactory 30-59% and poor <30%. Reduction in baseline PSI score assessed after 1 month of last session. Photographs were taken before and after treatment **(Figures 2,3)**.

The procedures are considered as safe if ≥50% of the patients have minimal frequency of prolonged side effects (hypo-pigmentation, hyper-pigmentation, scarring and blistering) or do not suffer from these side effects.

Results

A total of 92 patients were enrolled in the study. The mean age in group A was 26.65±6.51 years and in group B it was 27.04±6.61 years. The minimum age in group A was 16 years and maximum 47 years. In group B, maximum age was 45 years and minimum age was 16 years. The male to female ratio was 1:3.2 in group A

Table 1 Percentage Reduction in PSI for both groups.

	Study groups	*Mean*	*S.D.*	*Minimum*	*Maximum*	*p-value*
Reduction (%) in PSI	Group-A	46.61	25.52	6.00	90.00	<0.001
	Group-B	64.80	20.81	9.09	92.00	
	Total	55.71	24.90	9.00	92.00	

Table 2 Study groups (Efficacy)

		Study groups		*Total*
		Group-A	*Group-B*	
Efficacy	Yes	23 (50.0%)	37 (80.4%)	60 (65.2%)
	No	23 (50.0%)	9 (19.6%)	32 (34.8%)
Total		46 (100.0%)	46 (100.0%)	92 (100.0%)

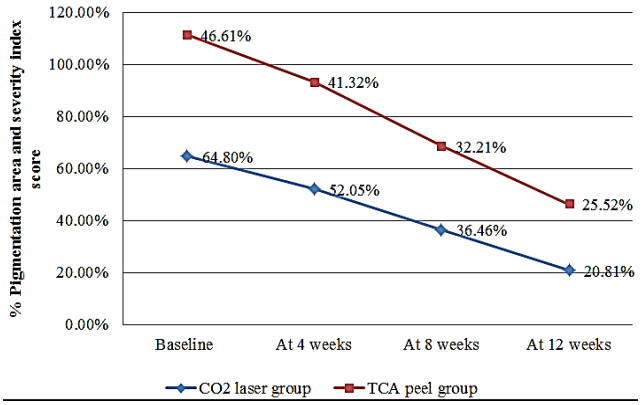

Figure 1 Percent reduction in PSI at different intervals.

including 11 males and 35 females, while it was 1:5.6 in group B including 7 males and 39 females. There were 9 (19.5%) and 37 (80.43%) unmarried cases in group A and group B respectively. There were 30 (65.22%) patients having freckles and 16 (34.78%) patients having lentigines in group A (laser). 32 (69.57%) patients having freckles and 14 (30.43%) patients having lentigines were enrolled in group B (TCA peel).

In this study, 55% of patients in group A had the target problem for more than 5 years duration, 18% with illness of 1-2 years duration while 27% had 2 to 5 years timespan. In group B, 60% patients had the problem for more than 5, years, 10% patients were suffering from it for less than a year and 30% had 1-5 years of duration. Both groups were well matched in terms of age, disease duration and skin type.

At baseline, mean pigmentation area and severity index (PSI) score was 16.78±6.68 for laser group (A) and it was 19.07±6.39 for TCA peel group (B). After 12 weeks, mean PSI reduced to 8.13±3.338 for laser group (A) and it reduced to 6.48±4.25 for peel group (B). The mean change in PSI for group A and group B were 8.65 ±6.59 and 12.95±5.79 respectively. So, the percentage reduction observed one month after last session was 46.61±25.52% for group A and 64.80±20.81 for group B **(Table 1)**. In group A, 52.05% and 36.46% reduction in PSI was observed at 4th and 8th weeks respectively. In group B, 41.32% and 32.21% reduction was observed at 4th and 8th weeks of study **(Figure 1)**. 7 out of 92 patients lost follow up one month after the last session.

More percentage reduction in PSI score was observed in patients having freckles as compared to lentigines with either treatment. TCA peel provided more effective treatment than CO2 laser in patients with freckles who had a low risk of PIH. In patients with lentigines, there was negligible difference in efficacy between TCA peel and CO2 laser. According to grading system, for group A; 17% showed poor grade, 44% satisfactory, 38% good and 1% showed excellent grade. For group B; 11% showed poor grade, 38% satisfactory, 46% good and 5% showed excellent grade. 50% efficacy is observed in group A, while 80% is observed in group B **(Table 2)**. This shows that both

Figure 2 Before and after TCA peel.

Figure 3 Before and after CO2 laser.

treatment options are efficacious in terms of operational definitions.

Different side effects were noted. There were 56% cases who developed pain and 15% patients developed hyper-pigmentation with CO2 laser. Almost all patients felt burning and itching after TCA peel. 32% patients developed hyper-pigmentation, 10% patients developed hypo-pigmentation and 6% patients had scarring 1 month after the last session of peel. PIH is more observed after CO2 laser in patients with lentigines. In both groups, more than 50% of patients showed less number of prolonged side effects like scarring and post-inflammatory dyschromia **(Table 3)**.

Discussion

Treatment of freckles and lentigines is important primarily due to cosmetic reasons, otherwise they are asymptomatic. Lasers and chemical peels have been the promising treatment modalities for pigmented lesions during recent years. Chemical peels have been effective either alone or adjunctive to topical treatment agents. However, no randomized study comparing these peels with laser treatment has been reported in the literature.

This study was designed to compare efficacy and safety of fractional CO2 laser with 70% trichloroacetic acid in the treatment of facial freckles and lentigines in Asian population. Using either treatment in this study, majority of the patients achieved obvious improvement.

This study observed a male to female ratio of 1:3.2 in group A and 1:5.6 in group B. It is because females have more cosmetic concerns as compared to males. Sachdeva *et al.* showed male to female ratio of 1:2.5 in Indian population.[11]

The mean age for both groups was 26.8±6.56 years. Freckles and lentigines are reported mostly in this age group as people are more concerned about their cosmetic appearance. A similar age group with mean age 27.5 years (range 15-45 years) was reported in 2006 by Sachdeva *et al.* Rashid *et al.* enrolled mean age of 23.5years (range 18-40 years) for freckles and

Table 3 Study groups (safety).

		Study groups		*Total*
		Group-A	*Group-B*	
Safety	Yes	33 (71.7%)	37 (80.4%)	70 (76.1%)
	No	13 (28.3%)	9(19.6%)	22 (23.9%)
Total		46 (100.0%)	46 (100.0%)	92 (100.0%)

lentigines in their study performed at Mayo Hospital, Lahore in 2002.[12] In this study, there were 62 (67.3%) patients having freckles and 30 (32.6%) had lentigines. Rashid *et al.* performed their study on 70% patients having freckles and 30% having lentigines.[12]

In the present study, we observed that the mean PSI levels reduced significantly in both groups i.e. fractional CO2 laser (16.78±6.68 to 8.13±3.38, p-value <0.001) and for TCA peel (19.07±6.48 to 4.25, p-value <0.001) at follow up 4 weeks after the last session. In 2012, a study conducted in India by using 70% TCA peel showed comparable efficacy and safety to the current study in skin type III-IV.[13] In 2004, Chun *et al.* showed satisfactory improvement in 58% patients of freckles and 86% of lentigines by using 65% TCA peel.[14] In 2014, El Zawahry *et al.* showed good improvement in 45% of patients after CO2 laser.[15]

So, the mean change in PSI score was less in patients treated with CO2 laser as compared to 70% TCA peel (8.65±6.59 vs. 12.59±5.79, p-value=0.003). The efficacy was higher in patients who were treated with TCA peel in comparison to the patients treated with CO2 laser (80.4% vs. 50.0% p-value <0.05).

More adverse reactions were observed with 70% TCA peel and patients who developed scarring discontinued treatment after the last session (2 out of 46). We also observed pain, erythema, edema, burning and itching, which were transient side effects and were resolved spontaneously within a week. Prolonged side effects like hyper-pigmentation, hypo-pigmentation and scarring are observed more with 70% TCA peel which limits the use of such high strength of acid in the future. While persistent erythema and hyper-pigmentation were also observed with CO2 laser which can be easily treated.

Limitation of this study is short follow-up and smaller sample size. Further studies using long follow-up period, larger sample size and comparison of different techniques are needed to establish the optimal modalities for the treatment of pigmented disorders in Asian skin.

Conclusion

This study concluded that 70% TCA is more efficacious than CO2 laser for pigmented lesions, which along with low cost and ease of application advocates its preferred use in future practice. But CO2 laser is comparatively more safe than TCA peel.

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