



A Split Face Study of CO₂fractional Laser Vs Radiofrequency Cautery for the Destruction of Various Benign Non-Infectious Epidermal and Appendageal Tumors of Skin

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ABSTRACT: Background. Benign non-infectious epidermal and appendageal tumors of skin comprise a large and disparate group of tumors and no single classification system unifies them, as their cells of origin and clinical presentation vary substantially. **Materials and methods:** A total of 70 patients attending the OPD with bilateral various benign non-infectious epidermal and appendageal tumors of skin were evaluated, graded and clinically offered 1-3 sittings of radiofrequency ablation on right side of face and CO₂ fractional laser on left side of face as required. **Results:** All patients completed the treatment protocol. Age of the patients ranged from 18-48 years with a mean of 28years. Out of 70 patients, 30 patients had acquired melanocytic nevi, 23 were having milia, 10 had syringoma, 5 had senile comedones and 2 had angiofibromas. The results were statistically analyzed using paired "t" test and compared using "z" test. Both modalities showed significant results but RF Ablation did not proved to be as efficacious when compared with CO₂ fractional laser in treating various benign non-infectious epidermal and appendageal tumors of skin. **Conclusions:** In a fully equipped centre and good patient affordability, CO₂ laser is the best modality, while in poor settings or poor patient affordability, radiofrequency ablation along with other medical therapies and counselling is also an option to be considered for the treatment of various benign non-infectious epidermal and appendageal tumors of skin. **KEYWORDS:** Benign tumors of skin, CO₂ fractional laser, RF Ablation, syringoma, senile comedones, acquired melanocytic nevi

I. INTRODUCTION

Benign non-infectious epidermal and appendageal tumors of skin comprise a large and

disparate group of tumors and no single classification system unifies them, as their cells of origin and clinical presentation vary substantially.

Syringomas¹⁻³ are benign skin tumor that are usually multiple. It is a relatively uncommon lesion, occurring more commonly in females. They usually appear at adolescence. It does not appear to be hereditary. The individual small dermal papules⁴⁻¹² are skin-colored, yellowish or mauve, but sometimes appear translucent and cystic.

Milia are small subepidermal keratin cysts that are quite common at all ages from infancy onwards. Many arise in undeveloped sebaceous glands. The lesions are firm, white or yellowish, rarely more than 1 or 2 mm in diameter and appear to be immediately beneath the epidermis¹³.

Acquired melanocytic naevi is a benign cluster of melanocytic nevus cells arising as a result of proliferation of melanocytes at the dermal-epidermal junction, in which the melanocytes (nevus cells) proliferate for some time but then cease proliferation and differentiate (or senesce) and come to resemble cells of neural or fibroblast lineage.¹⁴⁻¹⁷ They may have a large diameter of up to 10 mm.

Senile comedones are seen in elderly people, especially in the periorbital areas. These are multiple, open, and closed comedones superimposed on a sun damaged skin.

Angiofibroma consist of hyperplastic blood vessels with some sebaceous glands of immature hair follicles. These are firm, discrete, red-brown, telangiectatic papules, 1-10 mm in diameter.

Carbon dioxide (CO₂) (10,600 nm) laser

The CO₂ laser is effective for the treatment of a wide range of dermatologic conditions. It vaporize intra- and extracellular



water, causing tissue ablation, rapid enough to limit dermal injury and reduce the likelihood of additional scarring.

Radiofrequency Ablation

Radiofrequency Ablation uses heat generated in body tissue for the destruction and removal of diseased tissue or for cutting through normal tissue with minimal bleeding¹⁸

Many treatment modalities are described in the literature, including topical and surgical methods but comparative studies between RF ablation and CO₂ laser are very rare.

II. MATERIALS AND METHODS

A split-face trial was conducted in a total number of 70 patients of both genders aged 18-50 years with various benign non-infectious epidermal and appendageal tumors of skin attending Dermatology outpatient department of Muzaffarnagar Medical College, Muzaffarnagar, U.P. were included in the study.

Inclusion criteria:

Adult patients with bilateral facial lesions and realistic expectation

Exclusion criteria:

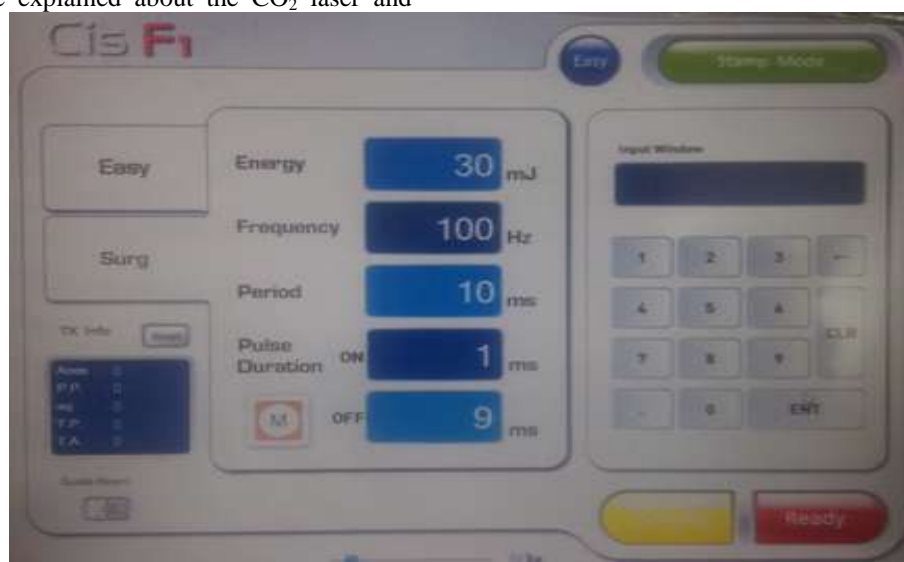
Patients below 18 years with known allergy to lignocaine, on anticoagulation therapy, having pacemakers with known cardiac illness, with keloidal tendency, Pregnant and lactating mothers.

First the participants were elaborately explained about the procedure. Oral and written consent was taken from each individual. The patients were explained about the CO₂ laser and

radiofrequency ablation therapy, the cost factor involved, benefits, duration, possible side effects and prognosis of the treatment. Digital photographs of the face were taken before and after the procedure and on subsequent follow ups. Skin biopsy before taking the treatment to confirm the clinical diagnosis and to determine the depth and diameter of the lesion had been taken for all the patients. Although the number of lesions was unequal on both sides, to maintain uniformity for comparison, as a standard protocol all the lesions on right side of the face was subjected to radiofrequency ablation and left side of the face was treated with CO₂ fractional laser.

Procedure For Co2 Fractional Laser

Before the procedure, the treatment areas were cleansed of debris, including dirt, makeup, and powder, using a mild cleanser and 70% isopropyl alcohol. Lidocaine, 2.5%, and prilocaine, 2.5%, cream (dolocaine, tetralid cream) was applied under occlusion to the left side of face. After an hour of application, the anesthetic cream was removed to obtain a completely dry skin surface and alcohol was used to degrease the skin. Eyes were protected with opaque goggles. The procedure was done under proper aseptic condition. The number of passes and the fluence to be used depends on the thickness of the lesion. A half-face, single-pass treatment was then performed without pulse overlapping using a 15-W CO₂ laser using 0.6 - 1.2 ms of pulse duration. The energies used were between 24 - 36 mJ, depending on the severity of the lesion. Frequency taken were in the range of 50-100 MHz and the period of 10-20 ms with Stamp mode.



LESION	ENERGY (mJ)	FREQUENCY (Hz)	PERIOD (ms)	PULSE DURATON (ms)	MODE
MOLE	24 - 30	80 - 100	10	0.8 – 1.0	STAMP
MILIA	24 - 30	50 - 70	20	0.8 – 1.0	STAMP
ANGIOFIBROMA	24 - 30	80 - 100	10	0.8 – 1.0	STAMP
SYRINGOMA	24 - 30	80 - 100	10	0.8 – 1.0	STAMP
SENILE COMEDONES	24 - 30	50 - 70	20	0.8 – 1.0	STAMP

Table 1. Parameters of CO₂ Laser

All participants received one to two sessions of ablative CO₂ fractional resurfacing on left side of the face. Immediately after the irradiation, there was a distinct carbon particles that aided in visualization of the treatment progress.

The thin layer of superficial crusting was not removed because this served as a biocompatible wound dressing. Each participant was followed-up for a period of 24 weeks.

Procedure For Raiofrequency Ablation



Before the procedure, the treatment areas were cleansed of debris, including dirt, makeup, and powder, using a mild cleanser and 70% isopropyl alcohol. Lidocaine, 2.5%, and prilocaine, 2.5%, cream (dolocaine, tetralid cream) was applied under occlusion to the left side of face. After an hour of application, the anesthetic cream was removed to obtain a completely dry skin surface and alcohol was used to degrease the skin. Eyes were protected with opaque goggles. The procedure was done under proper aseptic condition and under local anesthesia by using Megasurg Gold™ (M/s Dermaindia) with a frequency 0.2–2.93 MHz, 230 volts, using both cut and coagulation modes. Ablation was done initially under the cutting mode to flatten the skin and later, under the coagulation mode to smoothen the skin

further and control the bleeding. The mild crusting which was collected initially was removed with fine-tipped Adson's forceps and hydrogen peroxide. There was no evidence of scarring.

After the procedure, the patients were instructed to prevent sun exposure for the next 4-5 days after each procedure and a topical non-occlusive antibiotic cream formulation was prescribed over this period. Ice packs were applied over the treated areas. The subjects were instructed to follow strict photo-protective measures with UVA+UVB spectrum of sunscreens. The patients were reviewed after 1 week for any adverse effects. Any adverse effect that occurred due to the treatment was noted down. The objective parameters were estimated at the end of 24 weeks using global improvement scale and also by



evaluating patient's satisfaction score (PSS). Photographs of both sides of the face were taken at 0 and 24 weeks under consistent background, position and lighting and compared with the pre-treatment images.

The improvement on global improvement score was rated as worsened, minimal improvement, moderate improvement, marked improvement and near total improvement depending upon the change in grade of lesions by both treating physician and the patient. The improvement on global improvement score was rated as worsened (GRADE 0), minimal improvement (GRADE 1), moderate improvement (GRADE 2), marked improvement (GRADE 3) and near total improvement (GRADE 4) depending upon the change in grade of lesions by both treating physician and the patient.

III. OBSERVATION AND RESULTS

The present study was conducted in the Department of Dermatology, Venereology and Leprology at Muzaffarnagar Medical College, Muzaffarnagar, UP. The study was conducted between March 2016 and August 2017 (18 months). A total number of 70 patients with various benign, non-infectious, epidermal and appendageal tumors of skin presenting bilaterally over the face in the patients of age >18 years, who fulfilled the inclusion and exclusion criteria were enrolled for the study.

Proper informed consent in patient language was taken. A complete history was taken and thorough examination of all the patients was carried out in the study group. Required investigations were performed and patients who fulfilled were included. Female patients (49 in number, 70%) outnumbered male patients (29 in number). Age of the patients ranged from 18-48 years with a mean \pm SD of 28.6 ± 6.24 . Although the number of lesions was unequal on both sides, to maintain uniformity for comparison, as a standard protocol all the lesions on right side of the face was subjected to radiofrequency ablation and left side of the face was treated with CO₂ fractional laser. All patients completed the study, including the 6 months follow up. The results were statistically analyzed using paired "t" test and results of radiofrequency ablation was compared with CO₂ fractional laser using "z" test. The data was presented as MEAN \pm SD and p values were calculated referring to appropriate tables.

The improvement is estimated at the end of 6 months by using a global improvement scale. The

value of $p < 0.06$ for radiofrequency ablation and < 0.0001 for carbon dioxide laser was obtained. The patients were graded into 0-4 grades of improvement by using Global improvement scale. However, we compared effect (with photographs) at 0 week and 24 weeks only. Out of 70 patients, 30 patients had acquired melanocytic nevi, 23 were having milia, 10 had syringoma, 5 had senile comedones and 2 had angiofibromas. At the end of the session, all patients showed improvement with results in grade 3 with radiofrequency ablation and in grade 4 with carbon dioxide laser).

The mean \pm SD of Global Improvement Scale for various benign non-infectious epidermal and appendageal tumors of skin was 3.01 ± 0.9 at 24th week for the right side of the face with RF Ablation and was 3.12 ± 0.8 at 24th week for the left side of the face with CO₂ Laser with confidence interval of 95%. The results were then compared using z-test. The comparative value (z) between the two modalities was 2.19 and the P value was < 0.0001 which is statistically significant. Improvement result was also obtained by patient satisfaction score (PSS) which was calculated as follows: 0= none, 2= mild, 4= good, 6= very good, 8= excellent. The result of CO₂ laser was highly significant ($p < 0.0001$). Both modalities showed significant results but RF Ablation ($p < 0.06$) did not prove to be as efficacious when compared with CO₂ fractional laser ($p < 0.0001$) in treating various benign non-infectious epidermal and appendageal tumors of skin.

Patient Satisfaction Score (PSS): A final PSS was calculated on the basis of an anonymous record filled by patient at 24th week. 41.42% showed very good result (score 6) with RF ablation and 35.71% with excellent result (score 8) for CO₂ fractional laser.

According to patient satisfaction score, 25 patients in CO₂ group showed an excellent response compared to RF group in which 20 patients showed an excellent response after 6 months. 24 patients in CO₂ group showed very good response compared to RF group in which 29 patients showed very good response after 6 months. 12 patients in CO₂ group showed good response compared to RF group in which 14 patients showed good response after 6 months. 9 patients in CO₂ group showed mild response compared to RF group in which 7 patients showed mild response after 6 months.



Number of patients (n=70)	Percentage of patients	Result	Score
0	0	None	0
7	10	Mild	2
14	20	Good	4
29	41.42	Very good	6
20	28.57	Excellent	8

TABLE 2. Patient satisfaction score (RF Ablation)

Number of patients (n=70)	Percentage of patients	Result	Score
0	0	None	0
9	12.85	Mild	2
12	17.14	Good	4
24	34.28	Very good	6
25	35.71	Excellent	8

TABLE 3. Patient satisfaction score (CO2 Laser)

According to global improvement scale, 27 patients in CO2 group showed near total improvement compared to RF group in which 24 patients showed near total improvement after 6 months. 26 patients in CO2 group showed marked improvement compared to RF group in which 27 patients showed marked improvement after 6

months. 16 patients in CO2 group showed moderate improvement compared to RF group in which 12 patients showed moderate improvement after 6 months. 1 patients in CO2 group showed minimal improvement compared to RF group in which 4 patients showed minimal improvement after 6 months.

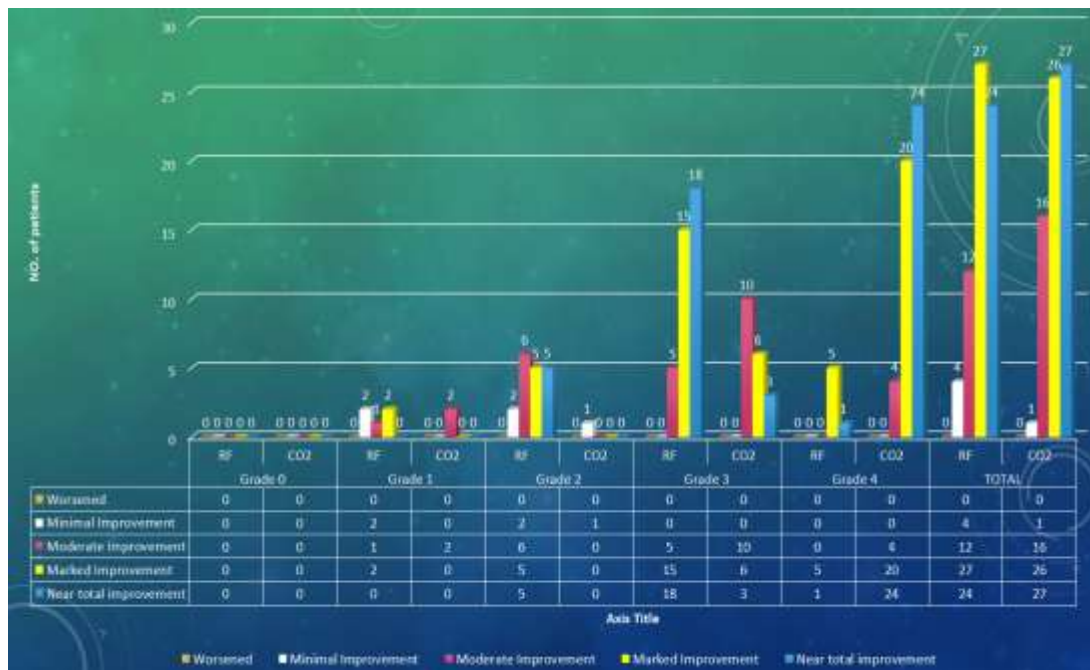


Fig 1. Comparison data in global improvement scale between RF Ablation and CO2 Laser after 6 months



Fig 2. Pre and post treatment photographs of RF (right side) and CO₂ Fractional laser (left side) at 0 and 24 weeks in a patient of acquired melanocytic nevi.



Fig 3. Pre and post treatment photographs of RF (right side) and CO₂ Fractional laser (left side) at 0 and 24 weeks in a patient of angiofibromas.



Fig 4. Pre and post treatment photographs of RF (right side) and CO₂ Fractional laser (left side) at 0 and 24 weeks in a patient of senile comedones.



Fig 5. Pre and post treatment photographs of RF (right side) and CO₂ Fractional laser (left side) at 0 and 24 weeks in a patient of periorbital syringomas.



Fig 6. Pre and post treatment photographs of RF (right side) and CO₂ Fractional laser (left side) at 0 and 24 weeks in a patient of milia.

Adverse effects:

51 patients from RF side and 53 patients from CO₂ does not required more than 1 session. Postoperatively in all patients, the scab was formed in the focal areas and the time of decrustation was 1 to 5 days. Temporary erythema and hyperpigmentation occurred in the majority of patients and then cleared spontaneously in 2 to 3 weeks. Post procedure, topical antibiotics, hydroquinone and broad spectrum sunscreens (UVA + UVB) are prescribed and instructed to take strict measures. After 6 months from the termination of the treatment session, most patients were pleased with the results, except 12 patients who developed postinflammatory hyperpigmentation, PIH (7 with RF and 5 with CO₂) and 6 patients who developed scarring (4 with RF and 2 with CO₂).

IV. CONCLUSION

In a fully equipped centre and good patient affordability, CO₂ laser is the best modality, while in poor settings or poor patient affordability, radiofrequency ablation along with other medical therapies and counselling is also an option to be considered for the treatment of various benign non-infectious epidermal and appendageal tumors of skin. Also we conclude that senile comedones and acquired melanocytic nevi showed good response to both the treatment modalities but response with

CO₂ was better appreciated than RF with minimal side effects. Further large scale studies are needed to see the efficacy and response of CO₂ laser in benign appendageal tumors.

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