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# Dermabrasion of acne scarring using continuous fractional carbon dioxide laser versus heat dermabrasion using diathermy needle in patients with dark complexion

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## Abstract

***Objective:*** There are different types of scars that could be induced by different etiological factors like infections, acne, inflammatory skin diseases and trauma, but the most common and important is acne scarring. The objective of the study is to compare the efficacy and safety of fractional CO2 laser compared with heat dermabrasion using diathermy needle in the treatment of different types of acne scars.

***Methods:*** One hundred and forty patients with different types of acne scars were divided into two groups: *Group A (CO2 laser)*: Forty patients, 30 (75%) females and 10 (25%) males were treated with one session of CO2 dermabrasion using continuous fractional CO2 laser. *Group B (heat dermabrasion):* One hundred patients, 60 (60%) females and 40 (40%) males were treated with one session of heat dermabrasion using diathermy needle. Scoring was done during follow-up period to assess the reduction in the scars.

***Results:*** *Group A (CO2) laser:* Severity of scars: mild in 10 (25%) cases, moderate in 20 (50%), and severe in 10 (25%). Reduction rate: 4 weeks post CO2 laser session; the reduction was moderate (5%), marked (90%) and excellent (5%). *Group B (heat dermabrasion):* Severity of scars: mild in 23 (23%) patients, moderate in 49 (49%), and severe in 28 (28%). Reduction rate: 4 weeks post heat dermabrasion session, the reduction rates were moderate (5%), marked (52%) and excellent (43%).

***Conclusion:*** Overall, while both heat dermabrasion and CO2 laser are effective in reducing scar severity, single session of heat dermabrasion may offer superior outcomes in terms of achieving higher levels of scar reduction with minimal side effects.

***Keyword:*** Acne scarring; Heat dermabrasion; CO2 laser; Reduction.

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## Introduction

Acne is a common chronic inflammatory skin disease affecting more than 90% of adolescents and young adults.[1] The pathogenesis of acne and subsequent scarring is complex and includes several factors such as excessive sebum production, follicular

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hyperkeratinization, inflammation caused by Propionibacterium acnes, and various immune responses. Acne can cause permanent scarring, significantly impacting the quality of life of many patients.[2]

About 80-90% of acne scars are atrophic, while the remaining 10-20% are classified as hypertrophic or keloidal. Atrophic scars are further classified as icepick, boxcar and rolling scars, each with distinct morphological characteristics.[3] There are a variety of treatments available to decrease the appearance of acne scars. These include chemical peels, dermabrasion and laser treatments, each with different effectiveness and adverse effect profiles.[4-8]

Peeling methods used to treat acne scars include superficial, medium, and deep peels, trichloroacetic acid (TCA) being the most commonly used among medium peels.[4]

Ablative fractional lasers vaporize targeted tissue and remove a thin layer of skin. They deliver high-intensity laser energy to the skin, causing controlled thermal damage. These lasers are significantly effective at rejuvenating the skin, with variable results regarding acne scar treatment. The most commonly used type of ablative fractional laser is the Carbon Dioxide (CO2) laser; it was introduced in 2004.[9]

Dermabrasion, a skin resurfacing procedure that removes the epidermis and upper part of dermis, has been developed over the years. Originally performed using sandpaper, modern powered devices are now used to treat facial scars caused by acne, trauma, or surgery.[6] Recently, a novel technique called heat dermabrasion (HD) using diathermy needle has been developed as an alternative that minimizes side effects with significant results. It was introduced by Sharquie KE to treat different types of acne scars, volumeplasty of bulky nose, wrinkles of the face and acquired and congenital melanocytic nevi.[10-17]

The purpose of this study is to compare the efficacy and safety of fractional CO2 laser compared with HD using diathermy needle in the treatment of different types of acne scars.

**Patients and methods**

This a comparative therapeutic study of acne scars using either CO2 fractional laser (continuous mode at 30 volts) or HD using ordinary diathermy needle. It was conducted during the period from to 2012-2015 in CO2 laser group and from 2018-2023 in patients treated with HD. All patients with Fitzpatrick skin typing III-IV were included.

Exclusion criteria included age less than 18 years, pregnancy and lactation, use of topical or systemic therapies in the last one month, patients with other facial dermatoses, patients who refused follow up, patients with keloidal or hypertrophic acne scars, history of recurrent herpes simplex infections, and medical conditions such as epilepsy or diabetes.

Sharquie's scoring [18-20] **(Table 1)** was used to assess the severity of the acne scars. This system includes a scoring scale from 5 to 20 points. Grading of acne scars is as follows: (5–9) mild, (10–14) moderate, and

**Table 1** Sharquie's scoring to assess the severity of scarring in acne vulgaris.

| *Parameter* | | *Score* | | | |
|---|---|---|---|---|---|
| | | *1* | *2* | *3* | *4* |
| 1 | No. of scars | ≤ 10 | 11-20 | 21-30 | >30 |
| 2 | Total area of scars | ≤1⁄4 | >1/4-1/2 | >1/2-3/4 | >3/4 |
| 3 | Type of scars | Flat | Depressed | Hypertrophic | Keloid |
| 4 | Color of scars | Skin colored | Erythematous or hypopigmented | Hyperpigmented | Bluish or grayish |
| 5 | Psycholgical effects | None or mild discomfort | Mild dysmorphophobia | Moderate dysmorphophobia | Severe dysmorphobia or social Withdrawal |

(15–20) severe.

One hundred forty patients with different types of acne scars were included in this study. These patients were divided into two groups:

Group A (CO2 laser): Forty patients were enrolled in this group, out of which 30 (75%) were females and 10 (25%) were males, their ages ranged from 20-40 years with a mean age of 29.7 years. They were treated with one session of CO2 dermabrasion using continuous fractional CO2 laser.

Group B (HD): One hundred cases, 60 (60%) females and 40 (40%) males, their ages ranged from 25-40 years with mean of 33.5 years were treated with one session of HD using diathermy needle (RB Medical Heavy Duty Set 708 with probe, Nuneaton, UK**).** Two passes, one superficial and one deep, were performed until a smooth erythematous surface was obtained**.**

Before starting therapeutic session, patients were given detailed information about expected outcome, complications and possible adverse effects. After all participants signed written consent, photographs of the acne scars were first taken, ensuring optimal camera angles and lighting.

Before intervention, the involved area was cleaned with 70% alcohol and allowed to dry completely before proceeding. Saline-soaked gauze was then applied all over the area to be treated to ensure full cleaning. After that, to minimize pain during the treatment session, topical anesthetic cream (EMLA) was applied to the affected area 30 minutes to an hour before intervention.

Patients in both groups were prescribed oral and topical antibiotics for 2 weeks after the intervention. Follow-up was done at 2 weeks, 4 weeks and 8 weeks after the therapeutic session. Sharquie's scoring for scar reduction **(Table 2)**[12,21,22] was used 4 weeks after the end of therapeutic session to evaluate the reduction of acne scars. Also, after the session, all patients were advised to avoid sun exposure, however topical sunblock was avoided.

**Table 2** Sharquie's scoring to assess the percentage of reduction of acne scars.

| *Parameter* | *Reduction (%)* | *Score* |
|---|---|---|
| No change | 0 | 0 |
| Mild reduction | 1-25 | I |
| Moderate reduction | >25-50 | II |
| Marked reduction | >50-75 | III |
| Excellent reduction | >75-100 | IV |

## Results

For group A (CO2 laser), severity of acne scar was mild in 10 (25%) cases, moderate in 20 (50%) cases and severe in 10 (25%) cases. After four weeks of CO2 laser session, the reduction rates are as shown in **(Table 3)**.

While in group B (HD), the severity of acne scars was mild in 23 (23%) cases, moderate in 49 (49%) cases, and severe in 28 (28%) cases. After four weeks of HD session, the reduction rates are shown in **(Table 4)**.

In both groups, 8 weeks after the end of therapeutic session, the scar reduction was the same as after 4 weeks, while erythema and pigmentations were subsided.

No significant adverse effects were recorded apart

**Table 3** Percent reduction of acne scaring after CO2 lasers session according to Sharquie's scoring.

| *Reduction rate* | *No. of patients* | *Percentage (%)* | **P value* |
|---|---|---|---|
| Moderate | 2 | 5 | |
| Marked | 36 | 90 | *0.000001 |
| Excellent | 2 | 5 | |
| Total | 40 | 100 | |

**Table 3** Percent reduction of acne scaring after CO2 lasers session according to Sharquie's scoring.

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from temporary post-inflammatory hyperpigmentation that was seen in 2 (5%) cases in group (A) and 2 (2%) in group (B). This pigmentation reversed overtime with topical treatment.

**Figures 1-5** shows the cases before session, and during the follow-up period for both groups.

## Discussion

Acne scars present a significant clinical challenge for patients, especially when severe, as they can cause significant cosmetic and psychological discomfort. A variety of procedures have been used to improve the appearance of these scars, including resurfacing techniques like ablative laser, chemical peels, dermabrasion and non-ablative laser therapy; surgical procedures like subcision, punch excision, grafting; dermal filler injections and autologous fat grafting.[23-26] Nevertheless, despite these available therapies, the treatment of acne scars remains a challenge for many dermatologists, highlighting the need for more effective treatments.

Mechanical dermabrasion is one of the earliest and oldest method used for correcting and treating acne scars.[6,27] This technique is effective, but it usually needs general anesthesia. Moreover, the process is often bloody and messy, as the use of a brush can result in blood contamination in the surroundings, posing a high risk of infection from the patient to the staff. Furthermore, it is an expensive technique and carries the risk of complications.[28] On the other hand, HD is simple to perform and does not require the degree of clinical training when compared with CO2 laser or mechanical dermabrasion.

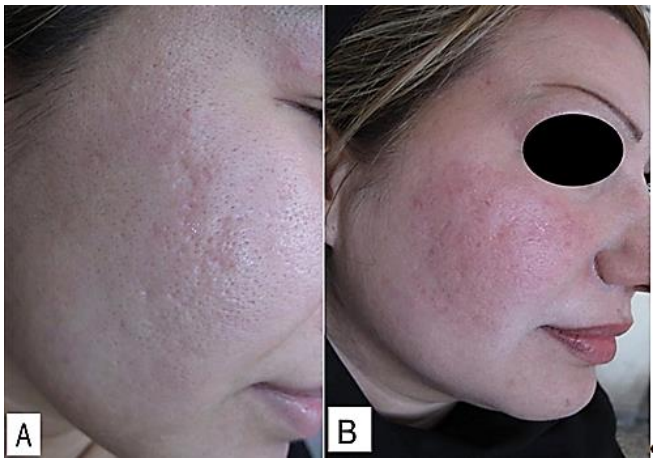


**Figure 1** Thirty-two years old female patient with acne scarring (A) before CO2 laser session and (B) 4 weeks after the session.

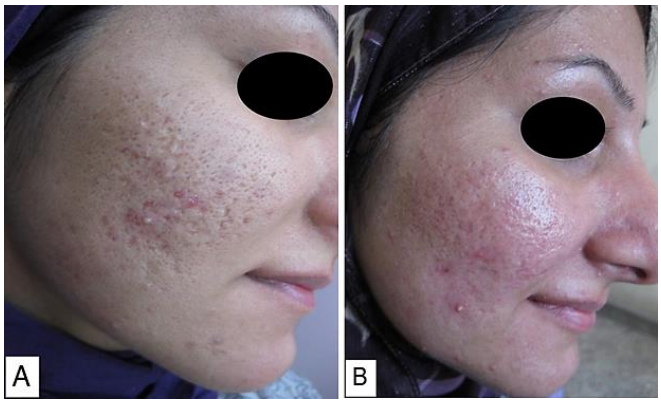


**Figure 2** Twenty-nine years old female patient with icepick and box scars with active acne lesions (A) before CO2 laser session and (B) four weeks after the session.

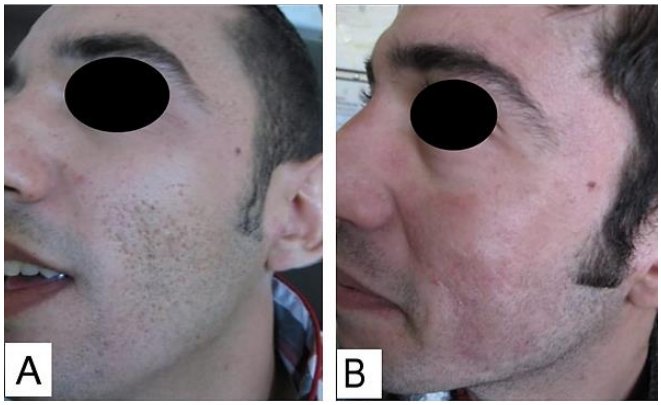


**Figure 3** Twenty-four-year-old male with icepick acne scarring (A) before HD session and (B) four weeks later.

HD has been used for many dermatological conditions with significant results.[9-16] This procedure has many benefits including requiring simple equipment, being easy to perform, inexpensive, needing one session, safe, effective and providing long-lasting outcomes without significant complications.

To the best of our knowledge, this is the first comparison study between CO2 laser therapy and HD in the treatment of acne scars. HD procedure that

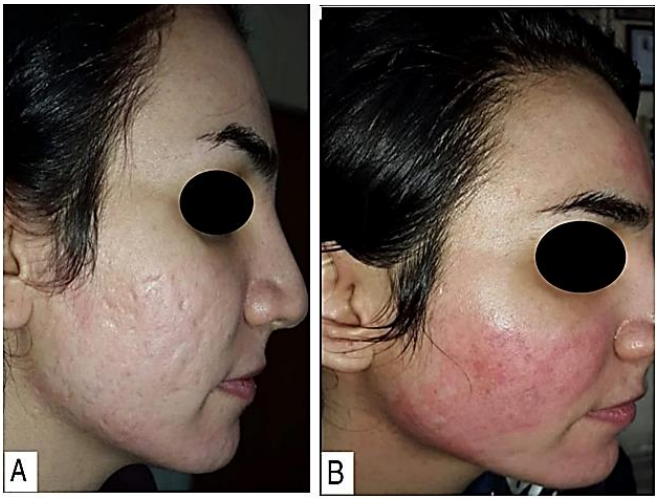


**Figure 4** Twenty-three-year-old female with boxcar acne scarring (A) before HD session, and (B) two weeks after the session.

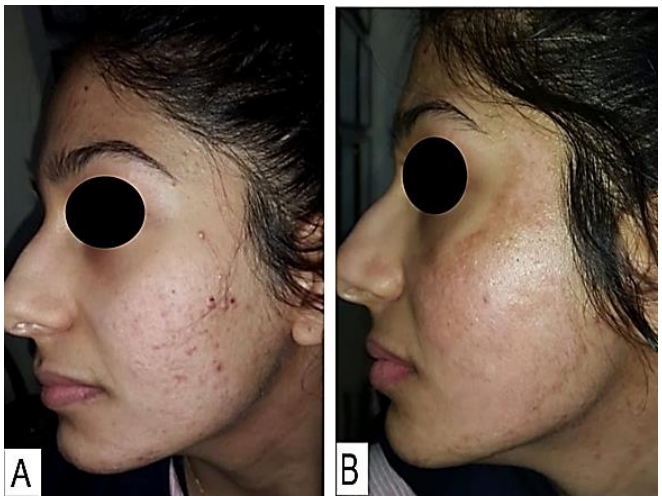


**Figure 5** Twenty-one- year female patient with acne scarring and active acne lesions (A) before HD session and (B) four weeks later.

applied in this study was based on our previous experience in the treatment of different types of scars including acne scars and many dermatological conditions.[9-16]

The face is the typical site for HD than chemical peeling or laser therapy because HD is less likely to cause pigmentary changes when used on the face duo to damage of melanocytes, the cells that produce melanin pigment. Chemical peeling or laser resurfacing when it applied to localized parts of the face, it often results in demarcated lines between treated and untreated sites. In contrast, with HD no demarcated lines were appeared after therapeutic session. The high concentration of sebaceous glands and dense vascular network on the face support wound healing.[11] Therefore, the face is the most ideal site for dermabrasion without the risk of hypertrophic scar or keloid.

In group A, 25% of patients had mild scarring, 50% had moderate scarring, and 25% had severe scarring. In contrast, in group B, 23% of patients had mild scarring, 49% had moderate scarring, and 28% had severe scarring. These primary distributions propose that both groups were comparable preoperatively in terms of scar severity.

Four weeks after the therapeutic session, the reduction rates showed that HD (group B) was more effective in achieving higher levels of scar reduction compared to CO2 laser (group A). In group A, 5% of patients revealed moderate reduction, 90% revealed marked reduction, and 5% revealed excellent reduction. However, in group B, 5% of patients revealed moderate reduction, 52% revealed marked reduction, and a remarkable 43% revealed excellent reduction. This proposes that HD may achieve more consistent and superior outcomes in scar reduction, especially in achieving excellent results. These results were comparable to other published studies.[12,26]

Fortunately, no important adverse effects were reported in both groups apart from 5% in group (A) and 2% in group (B) exhibiting transient post-inflammatory hyperpigmentation. Importantly, this pigmentation disappeared over time with topical therapy, suggesting that both HD and CO2 laser are relatively safe procedures but with less percent of pigmentary changes recorded in HD (group B). Interestingly, both groups showed stability in scar reduction and resolution of hyperpigmentation even eight weeks after treatment. This long-term stability proposes that both treatments offer a sustained scar treatment effect.

The results of this study showed that HD highly

effective method in the treatment of acne scars especially when an experienced dermatologist performs this procedure on suitable patients. The success of the HD depends mainly on the dermatologist's expertise and precise knowledge of how to achieve optimal results at the appropriate depth, thereby minimizing the risk of unwanted adverse effects.

## Conclusion

Overall, while both CO2 laser and HD are effective in reducing scar severity, HD may offer superior outcomes in terms of achieving greater scar reduction. HD was effective innovative non-costly technique for different types of acne scars using one session with no adverse effects while CO2 dermabrasion using single sessions is costly procedure that could be associated with more pigmentary changes than HD. Hence HD can replace CO2 laser.

The study was approved by the Ethics Committee of Al-Anbar Health Directorate, Fallujah Teaching Hospital (number: 732; date: 09/06/2023).

***Declaration of patient consent*** The authors certify that they have obtained all appropriate patient consent.

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***Conflict of interest*** The authors affirm that they have no conflicts of interest to disclose.

***Author's contribution***

**KES**: Have made substantial contributions to conception and design, acquisition of data, analysis and interpretation of data. Have been involved in drafting the manuscript and revising it critically for important intellectual content.

**RIJ**: Have made substantial contributions to conception and design, analysis and interpretation of data. Have been involved in drafting the manuscript, revising it critically for important intellectual content.

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