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Research Paper

Actinic Keratosis Treatment by Fractional Ablative CO2 Laser Medical City Teaching Hospital Baghdad, Iraq

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ABSTRACT:

BACKGROUND:

Actinic keratoses are precancerous lesions related to excessive ultraviolet exposure, representing an emerging issue around skin diseases. They have a potential risk for developing squamous cell carcinoma and present cosmetic problems.

OBJECTIVE:

To evaluate the effectiveness and side effects of Fractional Ablative CO2 laser in treating AKs.

PATIENTS AND METHODS:

This study is an interventional single-centre study performed in Baghdad Dermatology Center, Baghdad/Iraq, from February 2022 to October 2023. Any patient with actinic keratosis lesion consulting the centre was included in the study. For each patient, a thorough history was taken regarding the duration, symptoms, history of SCC, occupation (indoor or outdoor), medical illnesses and drug history. Lesions were diagnosed clinically in most cases, but biopsy was done for suspicious cases. The lesions were treated with CO2 laser fractional ablation mode (DEKA device). At 2 and 4 weeks, the lesions were assessed for remaining lesions and side effects.

RESULTS:

A total of 93 lesions from 16 patients, 11 males and five females, mean age 63.6 years, skin photo-types 2/3, were included in the study. They were treated with (1-4) sessions with 1-month intervals according to the lesional response. Only topical anaesthesia was used, which was enough to control pain during the procedure. The number of lesions was reduced with each session, and at the end of four months, there were only 37 out of 93 lesions, and all these were reduced in size. The grading of the remaining lesions was also reduced at the end of the study. We had 20 lessons in grade 3, while in the end, only nine lesions remained in grade 3. Patients reported reasonable satisfaction rates. Side effects, including pain and erythema, were minimal and transitory.

CONCLUSION:

The ablative fractional CO2 laser is an effective modality to treat AKs, especially for scalp and facial lesions, with few side effects.

KEYWORDS: fractional CO2 laser, actinic keratosis

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INTRODUCTION:

Actinic keratosis (AK) is a common skin disorder that manifests as a keratotic papule or large plaque caused by sunlight exposure. (1) It is often considered a precancerous skin lesion, although the risk of becoming an invasive SCC is very low. Lesions are usually found on the face, scalp, and dorsal surfaces of the hand. People chronically exposed to sunlight, aged people, and patients with suppressed immune systems are more vulnerable to AKs. (2)

AKs present as erythematous macules, papules, or plaques, usually with poorly defined borders, and adherent dry scales may cover them. Sometimes, they are better identified by palpation than visual inspection and can present varying degrees of hyperkeratosis. (3) The incidence of AKs is likely underestimated. It is difficult to reliably measure the burden of AKs in individuals and populations.(4)

Numerous therapeutic approaches are available for the treatment of AKs. Surgical and destructive methods such as curettage with or without electrodesiccation and cryosurgery are commonly used. In addition, local non-invasive treatments such as imiquimod and 5-fluorouracil are increasingly used. Moreover, the use of tazarotene, Cox inhibitors, ingenol mebutate, chemical peels, and different types of lasers has increased in recent years. (5)

AIM OF THE STUDY:

To evaluate the effectiveness and side effects of fractional Ablative CO2 laser in treating AK.

PATIENTS AND METHODS:

The study is an interventional therapeutic study conducted at the Center of Dermatology, Medical City Teaching Hospital Baghdad, Iraq, between February 2022 and October 2023. Sixteen patients with multiple AK lesions enrolled in the study, which was approved by the Scientific Council of Dermatology, Iraqi Board for Medical Specializations. Before enrollment, each patient provided written informed consent.

The inclusion criteria included Men and women with clinical and/ or histological diagnosis of actinic keratosis. Patients must be 18 years or older. The exclusion criteria included patients with contraindications to the use of CO2 laser, such as isotretinoin use within the previous six months, patients with active cutaneous bacterial or viral infection in the area to be treated, patients with a history of keloid formation or hypertrophic scarring, patients with collagen vascular disease, patients with prior radiation therapy to the treatment area, the use of chemical peel or dermabrasion within 6 months. Pregnant or lactating women were also excluded.

The diagnosis of AKs was made by clinical and dermoscopic examination, and in suspicious cases, it was supported by histopathology. After the patient was fully explained about the nature of the treatment, a history was taken regarding the age, occupation, duration of AKs, symptoms, previous treatments, history of SCC or BCC, any medical conditions, and drug history. The number, site, and size of lesions were determined, and induration noted. Photographs were captured by REALME mobile with a 100MP OIS camera. The lesions were treated with CO2 laser ablation mode (10.600 nm). The device used was DEKA SmartXide.2.CO2-fxl laser (DEKA. Italy).

Topical lidocaine gel 2% was applied for half an hour without occlusion to the area. The gel was removed immediately before treatment. The following parameters were selected: Power:15watts, Dwell time:600ms, Dot spacing:150 mm. Fluence:18.48J\cm 2. Pulse energy: 46.2 mJ. Density: 38.5%.

The number of passes varied between (1 and 4) for each session, depending on the response of the lesion. The endpoint was the appearance of chamois yellow skin colour, and pin-point bleeding was seen when the skin was cleaned with saline gauze.

Subjects were then instructed on proper wound care according to the "open method" technique, which included applying fucidin cream three times daily for one week, avoiding sun and cosmetics in the immediate post-procedural period, and correctly applying sunblock. Patients were also instructed to wear hats when they were outside.

The lesions were assessed after 2 and 4 weeks, partially responsive lesions were retreated, and complications were recorded. The maximum number of sessions was 4. Sessions were done at 4-week intervals. Then, the patients were seen 4 weeks after the last session for final assessment. All patients were followed for 6 months for recurrence.

The therapeutic outcomes were assessed according to the following: The researcher grading, Assessment by an independent observer(dermatologist), Patients' degree of satisfaction was recorded. The dermatological evaluation by the researcher was done using the Olsen grading system. [6]: Grade 1=only palpable., not visible lesions, grade 2=palpable and visible lesions, and grade 3=hyperkeratotic lesions. Independent observer evaluation of improvement was rated according to standardised digital photography comparing pictures before and after treatment according to 0=no change, 1=mild improvement (0-25%), and moderate improvement (25-50%), good improvement (50-75%), very good improvement (75-100%).

The patient's degree of satisfaction was scored using objective patient satisfaction: 0 = unsatisfied, 1 = slightly satisfied, 2 = satisfied, and 3 = very satisfied.

RESULTS:

The study included 20 patients, with four individuals opting to discontinue their participation in the study for various reasons. Consequently, the study was completed with a remaining cohort of 16 patients, encompassing 93 actinic keratosis lesions. The average age of the sample was 63.6 years (± 7.6), comprising 11 males (68.8%) and five females (31.3%). Most participants were workers, with 12 individuals (75%), followed by three employees (18.8%) and one housewife (6.3%). Regarding skin type, 9 participants (56.3%) had type II, while 7 participants (43.8%) had type III.

The face was the most affected area, with 8 cases (50%), followed by the scalp with 6 cases (37.5%), and the remaining 2 cases (12.5%) in other regions (see Figure 1). In most lesions, 47 (50.5%) underwent four treatment sessions. Additionally, 8 cases (8.6%) received three sessions, 31 cases (33.3%) had two sessions, and 7 cases (7.5%) were treated with one session.

At baseline, most lesions were categorised as Olsen Grade 2 (51.6%). There was a notable shift by the fourth month, with 60.2% of lesions achieving Grade 0, indicating resolution.

Conversely, the proportion of Grade 2 lesions decreased to 21.5% by the fourth month (Table 1). The number of lesions for each patient decreased from 5.8 (2.6) to 2.3 (3.3) after the fourth session (Table 5).

Table 1: Grades of actinic lesions at different timelines of the study.

	Grade 0	Grade 1	Grade 2	Grade 3
Baseline (N=93)	0 (0.0%)	25 (26.9%)	48 (51.6%)	20 (21.5%)
At 1 months	23 (24.7%)	20 (21.5%)	35 (37.6%)	15 (16.1%)
At 2 months	32 (34.4%)	18 (19.4%)	30 (32.3%)	13 (14.0%)
At 3 months	44 (47.3%)	15 (16.1%)	24 (25.8%)	10 (10.8%)
At 4 months	56 (60.2%)	8 (8.6%)	20 (21.5%)	9 (9.7%)

Table 2 shows that the average number of lesions was 5.8 before treatment. After the first session, the mean number of lesions decreased to 3.6. Following the second session, the average dropped to 2.7; after the third session, it was 2.4. Finally, after the fourth session, the mean lesions decreased to 2.3. The associated p-value, which indicates statistical significance, is less than 0.001.

Table 2: The number of lesions for each patient at different time-lines of the study.

Characteristic	Mean ± SD
Number of lesions before treatment	5.8 ± 2.6
Number of lesions after 1st session	3.6 ± 2.9
Number of lesions after 2nd session	2.7 ± 3.5
Number of lesions after 3rd session	2.4 ± 3.6
Number of lesions after 4th session	2.3 ± 3.3
P-value	**< 0.001**

The reported side effects include erythema in 37.5% (n=6) of participants, scarring in 25.0% (n=4), post-inflammatory hyperpigmentation (PIH) in 50.0% (n=8), and induration in 18.8% (n=3).

Evaluation by the independent observer showed that six individuals (37.5%) showed very good improvement, 3 showed good improvement (18.75%), 3 showed moderate improvement (18.75%), 2 showed mild improvement (12.5%), and 2 showed no change (12.5%).

Regarding patient satisfaction, 8 (50.0%) were very satisfied, 4 (25.0%) were satisfied, 2 (12.5%) were slightly satisfied, and 2 (12.5%) were unsatisfied.

The following images show the before and after treatment improvements.

Figure 1 A sixty-year-old female with multiple actinic keratosis lesions on her face (grade 2) undergoes three CO2 laser treatment sessions. A. Before treatment B. After treatment.

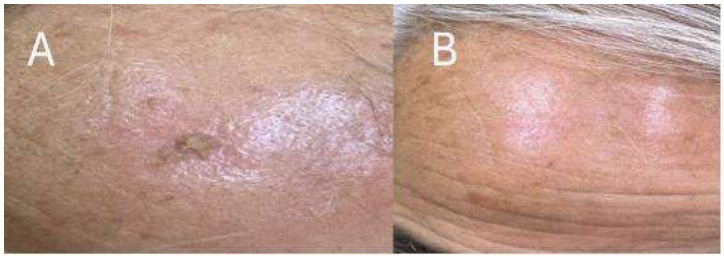

Figure 2 :A sixty-year-old female with multiple actinic keratosis lesions (grade 2) on her face undergoes three sessions of CO2 laser treatment. A. Before treatment B. After treatment.

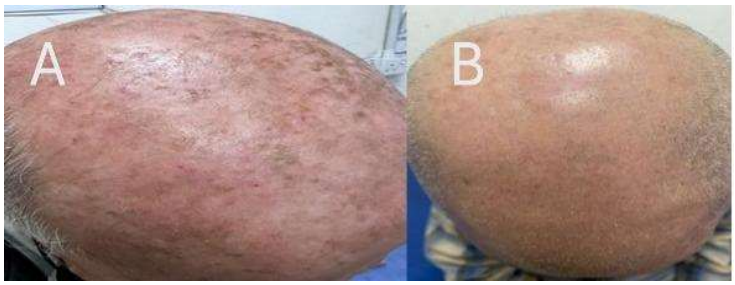

Figure 3 :A seventy-year-old male with multiple AKs (grade 3) on his forehead was treated with a single session of CO2. A. before treatment. B. after treatment.

DISCUSSION:

Actinic keratosis (AK) is one of the most common skin disorders, presenting as keratotic papules or plaques primarily due to long-term exposure to ultraviolet (UV) radiation. It is seen mainly on sun-exposed skin areas, especially on the face, scalp and dorsal parts of the hands. [7,8] The risk of progression from AK to invasive squamous cell carcinoma (SCC) is low; however, the presence of AK is associated with considerable cosmetic concern for the patient and drives many patients to seek simple yet effective treatment. [8, 9] The at-risk demographic includes chronic sun-exposed individuals, those over 65 years of age, and those who are immune-compromised and need to be monitored efficiently and controlled as a pre-malignant disease. [9,10]

Recent progress in laser technology has led to the use of ablative fractional lasers and non-ablative fractional lasers for actinic damage treatment (AKs). These lasers can resurface skin (ablative fractional CO2 and Erbium: YAG) and manage dozens of lesions at once, making them an attractive option for the management of actinic damage. [11, 12] This combination of treatment modalities evokes an individualised and comprehensive approach to AK, as we hope to ultimately address the individualised needs of all patients with this potentially precursory stage to more severe forms of skin cancer.

The present study evaluated the effectiveness and safety of ablative fractional CO2 laser for treating AK lesions. Several studies have evaluated the effects of CO2 laser in treating AKs. However, the number of patients in this study differed; for example, Zane et al. performed a prospective randomized controlled clinical trial to compare CO2 laser ablation with cryotherapy in treating AK lesions on 200 patients [13]. While Stephane et al., in a randomized controlled, split-face study, used CO2 laser in treating AKs in 9 patients [14]. On the other hand, Emanuele et al. performed a comparative randomized study using ablative CO2 laser in 30 male patients [15]. The number of sessions was also different; Zane et al. used a single CO2 session, Stephane et al. treated their patients with a single CO2 laser session, and Emanuele et al. treated their patients with three sessions. In the present study, patients were treated with 1-4 sessions according to response.

Regarding the laser parameters, Zane et al. used a CO2 laser with a power of 2.3 watts. At the same time, Stephanie et al. used 70 mjoule per pulse with a power of 9 watts and density 4. Emanuele et al. used a power of 20 watts, dwell time of 700msec and spot spacing of 55 mm. These differences made comparing the results of these studies challenging. For example, Zane et al. achieved a cure rate of 71.6% (73 of 102 patients) three months after cryotherapy and 65.3% (64 of 98 patients) after laser ablation. Stephane et al. noticed decreased development of new lesions following treatment. At 1 month, there was an average of 0.9 versus 2.1 new lesions in the treated versus untreated sides, respectively. At 3 months, there was an average of 1.9 versus 3.7 new lesions in the treated versus untreated sides, respectively. In the study by Emanuele et al., the

response was graded according to the sessions; the number was reduced with each session up to 3 sessions, and the overall reduction was more than 75%.

In the present study, it was noticed that the number of lesions was reduced with each session. At the end of four months, only 37 out of 93 lesions were reduced in size. The grading of the remaining lesions was also reduced. First, there were 20 lesions in grade 3; in the end, only nine remained in grade 3. In the current study, AKs on the hands were resistant to treatment, with no significant improvement at the end of sessions. At the same time, facial and scalp lesions showed a favourable response.

We used 15 watts of power, less than Emanuele et al. but more than Zane et al. and Stephanie et al. The dwell time was 700 msec (like Emanuele et al.), and the spacing was 150 mm (more than Emanuele et al.).

In our study, only topical anaesthesia was used, which was enough to control pain during the procedure. After the session, patients complained only of minimal pain. The other side effects, such as erythema and scaling, disappeared within a few days. Other workers also stated that the pain was mild and had transitory side effects. [14,15]

CONCLUSION:

Fractional ablative CO2 laser is a moderately effective treatment method for AKs, especially on the face and scalp. This can be explained as an accurate energy delivery method depending on the selective photothermolysis principles to micro-thermal zones. CO2 laser precisely removes thin layers of skin with minimal heat damage to the surrounding structures. Treating AK with an ablative fractional CO2 laser is recommended as these lesions carry a small malignant potential and are cosmetically important.

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Conflict of interest: Nil.

Authors' contributions: For clarity, all authors contributed equally to the paper in all of the following roles: conceptualization, data curation, formal analysis, funding acquisition, investigation, methodology, project administration, resources, software, supervision, validation, visualization, writing (original draft), and editing.

Ethical approval: The ethical committee of the Center of Dermatology and Venereology at Baghdad Teaching Hospital/ Medical City, Baghdad, Iraq, approved the research, and verbal consent was obtained from all patients and parents in the case of children for their images and clinical information.

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