

# Comparison the efficacy of ablative CO<sub>2</sub> laser and fractional CO<sub>2</sub> laser on the healing of cutaneous leishmaniasis scars

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## Abstract

**Background:** The aim of this study is to compare ablative CO<sub>2</sub> laser with fractional CO<sub>2</sub> laser on healing of the wound and the size of cutaneous leishmaniasis scars.

**Materials and Methods:** This prospective randomized clinical trial study was done on 120 patients in two groups evaluated in Sedigheh Tahereh Hospital in Isfahan.

The patients in case group underwent one session ablative CO<sub>2</sub> laser for treatment of leishmaniasis scars and the patients in control group underwent six 3-weeks interval sessions fractional CO<sub>2</sub> laser for treatment of leishmaniasis scars. All cases were evaluated from size and other aspects of scar by a questionnaire, and before and 6 months after photos were evaluated by blinded dermatologist. The data collected in the check list was then analyzed by *t*-test and Chi-square with SPSS 20.

**Results:** There were 60 people in case group and 60 in control group. The mean age was 27.21 ± 11.2. Our results show that fractional CO<sub>2</sub> laser is better than ablative CO<sub>2</sub> laser in various aspect of treatment of leishmaniasis scars (*P* < 0.05).

**Conclusions:** Fractional CO<sub>2</sub> laser is better than ablative CO<sub>2</sub> laser in variants aspect of treatment of leishmaniasis scars.

**Key Words:** CO<sub>2</sub> ablative laser, fractional CO<sub>2</sub> laser, leishmaniasis scars, treatment

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## INTRODUCTION

Leishmaniasis is one of the six important diseases of the tropical diseases research list of World Health Organization (WHO).<sup>[1]</sup>

Cutaneous leishmaniasis (CL) is the most common type with 1.5 million involvements annually. Almost 60% of the cases have been reported from countries such as Iran, Afghanistan, Pakistan, Iraq, and Saudi Arabia.<sup>[2]</sup> It is one of the native diseases and major health problems in Iran, which is hyper endemic in some regions, and we can see the scars in 70% of their population especially in Isfahan province.<sup>[3-5]</sup> The main host of this disease is *Rhombomysopimus*, which is widely distributed in these regions, and these animals are related to the leishmaniasis spreading. Responsible organisms are *L. major* and *L. tropical* and the main vectors are *phlebotomus Serjanti* and *Ansari*.<sup>[3-5]</sup> Preventive actions such as controlling the

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rodents have not been yet successful.<sup>[3,4]</sup> The disease will reappear after a week to 3 months. Incubation period as a red papule on the sandfly biting site, which is gradually improved to make a plaque or nodule and usually changed to a developing wound with violet margins during 6-12 months, when the ulcers heal they leave permanent scars. Majority of the wounds will be healed spontaneously with various duration in different people; that is why the topical methods are used for simple wounds and systemic use of pentavalent antimonial drugs is limited to disabling or malformed wounds, which are not easily healed such as lower limbs, distal or joints, mucosal or cartilage wounds, or the scars induced by leishmania brasiliensis.<sup>[6]</sup> Failure rate of this method is 10-15% with regular applications.<sup>[7]</sup> Leishmaniasis scars are among atrophic types that are mainly caused by skin inflammation associated with collagen damage, dermal atrophy, erythema, fibrosis, and hyperpigmentation.

Despite self-healing nature of this disease, the scar that remains due to the disease can induce many psychosocial problems for patients. CL scar is an atrophic scar that is formed due to dermal atrophy and destruction of collagen following acute inflammatory reaction.<sup>[8]</sup>

Treatment of these scars is usually difficult due to skin tissue returning to the normal situation. Collagen damage and continues stimulation of collagenesis may lead to good treating results, although collagen reformation may take 12-18 months.<sup>[9]</sup> For the most atrophic scars, it needs a few laser pulses for treatment. There are several treatment methods for CL treatment. Carbon dioxide (CO<sub>2</sub>) laser complications include erythema, edema, and treatment site secretion related to cellular damages. Other induced complications may be milia, acne cellular and viral infections, hypopigmentation, and hyperpigmentation. The rare complications are hypertrophic scarring, disseminated infection, and ectropion.<sup>[10]</sup>

Fractional photothermolysis was introduced by Huzaira and colleagues in 2003 for the first time. It was taken to account as a distinguished improvement in use of laser for treating the atrophic scars.<sup>[11,12]</sup> This method is also used in treatment of hypopigmented or hyperpigmented lesions, renewing and removing surgical scars, etc.<sup>[11,13]</sup> Tissue removing used in this method stimulates the collagen remodeling and formation of new collagen can treat the atrophic acne scars.<sup>[10,14]</sup> The low depth of necrosis with the possibility of further heat deposition in the dermis reduces the pain without reducing its efficacy.<sup>[10,15,16]</sup> The high sensitivity in this method without lesion to the horned layer of the skin (stratum corneum) accelerates the tissue repairing.<sup>[13]</sup> Because only a

fraction of skin is treated during a single session, it requires a series of fractional resurfacing (typically 3-6 treating durations) at 2-4 weeks intervals for the best clinical improvement, which is affected by age, sex, race, and type of skin.<sup>[11,12]</sup> The aim of this study is to compare the efficacy of ablative CO<sub>2</sub> laser and fractional CO<sub>2</sub> laser in treating the leishmaniasis scar.

## MATERIALS AND METHODS

This prospective randomized clinical trial study was conducted on referred patients to the central research center of skin diseases and leishmaniasis from June 2010 to September 2011 in Isfahan, Iran.

Sample size was calculated as 60 cases in each group with further rate of 10% considering to the exclusion probability and incomplete treatments. Leishmaniasis scar was diagnosed clinically by a dermatologist. Patients were randomized by simple randomization.

Exclusion criteria were: pregnancy, lactation, colloid scar, treatment with immune system inhibitors, use of isotretinoin or fillers for the past 6 months, use of dermabrasion or skin resurfacing for the past 12 months, and skin types of IV to VI. Patients were divided into two groups after filling in the written consents. One group underwent ablative CO<sub>2</sub> laser after applying the topical anesthetics on scar site with pulsed CO<sub>2</sub>, duration: 10ns, frequency: use of 20 kHz, and power: 25Kw for one session. The patients were visited at the beginning of the treatment and after 3 and 6 months. Final evaluation was done in the sixth month. Second group was treated with laser fraxel in each session by energy: 25, one pulse, pass: 1, dotcycle: 6, with the system of (Qray FRX, Dosis M and M). The skin of all patients was cleaned before treatment with a mild cleanser and alcohol 70%, the patients and the physicians wear eye guard during the laser application, which was performed by an expert dermatologist. After conclusion of each session, the site of operation was covered by a combination of hydrocortisone and zinc oxide with the application of postlaser repairing cream four or five times a day during the first week.

Patients were followed in the first, third, and sixth months after treatment with the final evaluation in the sixth month. Photos were taken before treatment in each session by Canon, Digital txus, 803 mega pixels, 6015 camera in Novin laser center, Isfahan, Iran. Patients filled the questionnaires containing information such as age, sex, address, telephone number, scars site, and size, which was calculated by millimeter papers (multiplication of the two biggest perpendicular diameters of the scar) and registered by

a cooperative physician. The range of improvement was evaluated by an independent dermatologist regarding the reduction of the scar depth in comparison to the before status on the basis of the below mentioned scale by comparing before and 6 month later photos.

### Standard quartile grading

- Score 0 < 25% (mild improvement)
- 25% < score 1 < 50% (moderate improvement)
- 50% < score 2 < 75% (good improvement)
- Score 3 < 75% (very good improvement)

In each session, the surface of scar was estimated by multiplying the biggest scar diameter and its perpendicular diameter to compare and using checkered paper to estimate surrounding of the scar shape. The quantitative four-point scale used included:  
 0 = unchanged size  
 1 = the scar size became a bit small  
 2 = the scar size became very small  
 3 = the scar is almost removed

This evaluation was done by physician and patients (on comparing the photos). The obtained information of each group was analyzed by SPSS 20 separately with the use of Chi-square, Kruskal–Wallis test, and Kaplan–Meier plot analysis and paired *t*-test was conducted to inter groups' comparisons.

## RESULTS

In this study, we evaluated 60 scars in CL patients. The case group was treated with ablative CO<sub>2</sub> laser and the control with laser fraxel.

The mean age of the patients was 27.21 ± 11.52 years (the lowest was 6 and the highest was 45 years). More than half of the patients were male (51%) and the rest female (49%).

The range of CL scars improvement by the two treatment methods in first, fourth, and sixth month after treatment are shown in Table 1. In the first month, there was 6.7% improvement in ablative CO<sub>2</sub> laser group and 10% in laser fraxel. Chi-square

**Table 1: Comparison the cutaneous leishmaniasis scars improvement between two groups in the first, fourth, and sixth month**

Group	First (%)		Fourth (%)		Sixth (%)	
	With	Without	With	Without	With	Without
CO <sub>2</sub> laser	(67)	(93.3)	(36.73)	(63.3)	(46.7)	(53.3)
Fractional CO <sub>2</sub> laser	(10.0)	(90.0)	(43.3)	(43.3)	(76.6)	(23.3)
<i>P</i> value	4	56	22	38	28	32
	6	54	26	26	46	14

test showed that there was no significant difference between these two groups in the first month (*P* = 0.2). In the fourth month, there was 36.73% improvement in ablative CO<sub>2</sub> laser group and 49.2% in laser fraxel. Ablative CO<sub>2</sub> laser treated group improved 44.7% in the sixth month and laser fraxel group showed 76.7% improvements. Chi-square test showed that there was a significant difference between the range of scar improvement in the two groups in the fourth and sixth month (*P* < 0.05) [Table 1].

Pretreatment evaluation of the mean primary sizes of CL scars showed values of 2.3 ± 0.3 cm in ablative CO<sub>2</sub> laser group and 3.4 ± 0.4 cm in fractional CO<sub>2</sub> laser group [Figure 1].

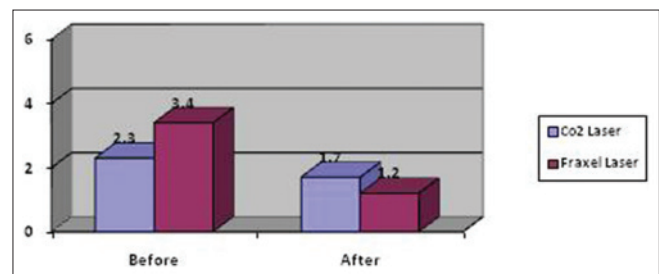
The mean size of CL lesions did not show a significant differences before treatment, which means that the scars size were initially the same (*P* value = 0.5).

In ablative CO<sub>2</sub> laser group, the mean scars size was 1.7 ± 0.7 cm after treatment and it was 1.2 ± 0.2 cm for fractional CO<sub>2</sub> laser group. T-test showed that the mean of the remaining scars size was significantly different between the two groups (*P* = 0.001) [Table 2].

Evaluating the side effects of these two methods revealed that there were two cases (6.7%) of erythema in ablative CO<sub>2</sub> laser group and four cases (13.3%) in fractional CO<sub>2</sub> laser group (*P* = 0.3).

## DISCUSSION

This study aimed to determine and compare the efficacy of ablative CO<sub>2</sub> laser and fractional CO<sub>2</sub> laser in improving the acute CL scar. There are many studies about the efficacy of CO<sub>2</sub> on treatment of



**Figure 1:** The mean values of the primary scars size before and after treatment

**Table 2: The mean values of the primary scars size before and after treatment**

Scar size Group	Before	After
Laser CO <sub>2</sub>	2.3±0.3	1.7±0.7
Fractional CO <sub>2</sub> laser	3.4±0.4	1.2±0.2
<i>P</i> value	0.5	1.001

different scars but, as we know, there are only a few studies on treating the leishmaniasis scar in the world.

The results of our study showed that the range of improvement has a significant difference between the two groups from the fourth month but not in the early months, which is mentioned in various studies. In a study by Nilfrooshzadeh *et al.* in 2008, the improvement range of CL scar treated by ablative CO<sub>2</sub> laser was reported as 44.87%.<sup>[16]</sup> Biotech *et al.* in 2006 concluded that the improvement range of atrophic acne scars treated by laser fraxel was 92% with at least side effects.<sup>[17]</sup> Hedelund *et al.* in a study on the efficacy of fractional CO<sub>2</sub> laser in acne atrophic scars improvement reported values of 92% with at least complications.<sup>[18]</sup> It has reported a successful treatment of a 25-year-old female patient with an atrophic scar from CL on her nose with fractional CO<sub>2</sub> laser after 10 treatment sessions with an improvement range of 90%.<sup>[19]</sup> In a study by Ahmed *et al.* to evaluate the efficacy and safety of CO<sub>2</sub> fractional laser in the treatment of acne scars, 20 patients with mild to moderate atrophic acne scars were registered and subjected to monthly fractional CO<sub>2</sub> laser resurfacing for six sessions in which 71% patients showed variable degree of improvement, which is near to our results.<sup>[20]</sup>

Weiss *et al.* in a study to evaluate the efficacy of ablative fractional laser for nonacne atrophic scarring reported that in all subsequent follow-up visits, the mean patient scores remained in the 26-50% improvement range. At 1 and 3 months after the final treatment, the mean investigator scores for skin atrophy correlated with a 51-75% improvement.<sup>[21]</sup>

Chapas *et al.* showed that CO<sub>2</sub> ablative fractional laser correlating to at least 26-50% improvements in texture, atrophy, and overall improvement were noted in all patients with quantifiable objective improvement in the depths of acneiform scars that ranged from 43% to 79.9% with a mean level of improvement of 66.8%.<sup>[22]</sup>

Therefore our results are in concordance with these achieved results. This study showed that in addition to the faster improvement in fractional CO<sub>2</sub> laser treatment method, the scar size has also become smaller. On the basis of our results in comparing the efficacy of these methods, fractional CO<sub>2</sub> laser is more efficient with the same complications.

Consequently, according to this and other conducted studies in this field, it seems that fractional CO<sub>2</sub> laser is more suitable to treat CL scars than ablative CO<sub>2</sub> laser.

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