Using an Erbium:YAG Fractional Laser Skin Resurfacing

Wajeha Abdle Daim Zobaa
Department Of Physics laser College of science for women University of Babylon

Abstract :

Er:YAG laser has recently been used in the fractional resurfacing of photo-aged skin. Our study evaluate the results after 1-5 session of fractional resurfacing with Er:YAG. Eight patients participated in the study, with various lesions (wrinkle, acne scars, Senile lentigo, skin's pigmentation) with an average age of 40 years, skin types IV. Some were photographed before and after, after three days , seven day after from session , some refused the photograph .

The wavelength 2.940 µm Er:YAG system used fractional spot 250 µm, Fluence: (2-160J/cm^2) and interval (0.25 -2)s. two patients received only one treatment and other's patients received 2-5 treatment . Postoperative side effects were evaluated.

All patients completed the study. The succeeding treated rate for all cases ,which were in the study , from excellent to good improvement of the degree of their lesions , 92% of the patients, were satisfied with results treatment and there were no side effects except for in phototype IV patient.

الخلاصة

تم استحدام(Er:YAG Fractional laser) كمقشر للجلد, تم تقيم نتائجنا بعد 1−5 جلسات لليزر التقشير . 8 مرضى شاركوا في هذه الدراسه و بحالات اذى مختلفه (تجاعيد ,اثار حب الشباب ,شامات الشيخوخه ,تصبغات جلديه) ومتوسط العمر لهم كان 40 سنه تم تصوير الحالات قبل وبعد والبعض صور بعد 3ايام و في اليوم السابع بعد الجلسه , والبعض للاسف رفض التصوير .

الطول الموجي للنظام 2.940 µm و البقعه الجزئيه المستخدم للنظام 250 مايكروميتر وسيل الطاقه (2-160J/cm^2) والفاصله الزمنيه s (0.25-2)

اثنان من الحالات خضعت لجلسه علاج واحده والباقي خضعوا لعلاج من 2−5 جلسات , قيمت الاثار الجانبيه مابعد العلاج . اكملت الدراسه لكل الحالات . قدرت نسبة نجاح العلاج لكل الحالات الذي تم دراستها من ممتاز الى جيدة , 92% كانوا مقتنعين بالعلاج ولم تسجل أي اثار جانبيه لهذا النوع من الجلد للمرضى. .

Introduction:

The use of lasers for cosmetic purposes has revolutionized the field of cosmetic surgery. It has not only given several new options to physicians and patients but also brought affordability to a large new group of patients **.**

Laser skin resurfacing (LSR) is one of the popular procedures to remove or reduce the effects of aging.[Khatri , Ross , Grevelink , ect., 1999]

Er: YAG fractional laser 2.940 µm principle: Er: YAG Laser with wave length 2.940 µm is a solid pulsed laser machine. It has high absorption peak to water at this wave length, the skin will be quickly heated when cast on with Er:YAG laser, instantly peeling off pathological tissues.

Fractional laser skin rejuvenation has recently gained a lot of interest due to the fact that the remaining healthy tissue around the fractional damage spots can act as healing centers.

Er-YAG Fractional laser resurfacing only treats part of the skin leaving uninjured skin areas around the treatment site that act as a barrier promoting quicker healing and faster recovery.[Kaufman , Hibst . 1996]

It can be used to ablate/remove many benign, pre-malignant and malignant cutaneous lesions. [Walsh , Deutsch ., 1989]

It is an effective way to drastically improve skin laxity and texture, reduce or remove wrinkles, dermal le sions acne scarring, skin rejuvenation, increase the elasticity of skin permanently, rhinophyma,to remove unsightly skin lesions, discolored pigmentation of the skin. Epidermal lesion can be removed without damaging the dermis, minimizing the risk of scarring, and fewer side effects when compared to the CO_2 laser resurfacing,[Karsai, , Czarnecka, , Jünger, ect, (2010)].

Excellent results in just one treatment and the results are maintained for years to come. [Beier , Kaufman 1999].

The special properties of the this laser are due to its wavelength in the infrared region, at 2.94µm, which is absorbed by water 16 times more than the CO_2 laser ,with a pulse duration of 250 µm, a typical short-pulse ablates 5-20 µm of tissue with minimal residual thermal damage compared to the pulsed CO_2, which removes 50-100 µm, This property makes it an ideal tool for tissue ablation. Each pass of Er:YAG laser removes a thin layer of skin and the depth of ablation can be controlled by altering the effective fluence. [Jacob , Dover , 2001, Alora , Arndt., 2001, Ammirati , Giancola , Hruza . ,2002], .

The laser sends impulses into the skin which only affect parts of the skin. This is made possible by splitting the laser beam into several hundred partial rays which are barely discernible to the naked eye This serves to trigger skin renewal and collagen formation,[Levy , Trelles , Lagarde , ect., 2001].

Material and Methods

Pre-treatment

They were pretreated with Hydrodream 150mg for five day starting the day before treatment **.**

The areas to be treated were routinely cleaned and sterilized before treatment and some were photographed

Analgesia was obtained by ice-cooling, the radiation field and surroundings were completely disinfected with isopropyl alcohol and a 0.05% solution of chlor-hexidine gluconate.

Methods:

In this work used laser ER-YAG fractional mention product details in Table (1). And standard specification in Table 2,[Aletta,Hadrian.,Gerald,ect,2009]

The Er:YAG laser used in this study has a fractional handpiece (MCL30 Dermablate, Asclepion Laser Technologies, Jena, Germany). The device has a 2.94 µm wavelength and a 250µs fractional spot .

Fluence were chosen according to skin tone, lesion size, degree of wrinkle, thickness and area to be treated and adjusted according to the immediate reaction during treatment. No anesthetics were used.

Eight patients, six females and tow males, who underwent Er:YAG fractional laser fro treatment for various indications. All treatments were done by one of the physician at a private dermatology clinic ,Dr.Ghanam Al-homdani, in Al- Monsur center of cosmetic laser in (14-Ramthan street , Baghdad).

These patients were treated between August 2010 and April 2011. The youngest patient was 27 and oldest was 52 years old, with a mean age of 40 year with Fitzpatrick skin type IV Table 4, [Andrews , 1980], with various lesions were enrolled in this study wrinkles around eye were treated in three patients one of this cases illustrated in figure1 .

Acne scars on the left check and right were treated in one patients figure2. epidermal lesion (Senile lentigo on nose and chin) were treated in two patients one of this cases illustrated in figure 3 (Senile lentigo on chin).

Skin's pigmentation (on nose and hands) were treated in two patients illustrated in figure 4, 5 .

Selection of parameters: 81J/cm^2 according to the depth of wrinkles
144J/cm^2 according to the dermal lesions acne scarring .
150 J/cm^2 according to the skin's pigmentation.
60J/cm^2 according to the Senile lentigo.

Selection of parameters: burst interval : 2 seconds to all treatments .

Post- treatment

A treated lesion was disinfected with a 0.05% solution of chlorhexidine gluconate, in which as far as possible the lesion was not rubbed. After that, using Fucicort cream three times for seven days and ointment containing antibiotic drugs and/or steroid-antibiotic drugs was applied.

Table 1 [Aletta Eberleina, Hadrian S,ect 2009]

Laser Type	Fractional Er:YAG laser
Q-Switch	No
Style	Stationary
Certification	AG
Place of Origin	Jena, Germany
Brand Name	Asclepion
Model Number	MCL 30 Dermablate
application	skin resurfacing, laser peel, scar and wrinkle removal
Handpiece	1 - 6 mm in 1 mm steps
Weight	105 kg
User Interface:	8.0" color TFT touch screen
Electrical power	220VAC, 50/60Hz
Dimensions	900(H)mm×350(W)mm×950(D)mm
Laser class	4

Table 2 [Aletta Eberleina, Hadrian S,ect 2009]

Laser Type	Fractional Er:YAG Laser
Wavelength	2.94µm
Pulse energy	Up to 1.5 J
Pulse length	400 µs
Interval	0.25-2.0 s
Pulse width	300s
Repetition Rate	1-4 Hz
spot size of fractional spot	250 µm
Fluence	1-160 J/cm²
Control system	8.0" color TFT touch screen
Cooling system	Closed Cycle Water to Air Heat Exchanger
Spot size	1-2-3-4-5-6-8 mm and fractional

Table (3) Type of skin. [Andrews , 1980]

Skin type	Baseline skin color	Sunburn and tanning history
I	White	Always burns, never tans
II	White	Always burns, tans minimally
I I I	White	Burns moderately, tans gradually
VI	Olive	Minimal burning, tans well
V	Brown	Rarely burns , tan darkly
IV	Dark brown	Never burns, tans darkly black

Table 4: Clinical results to the patients

Patient No	Age	sexes	diseases	sites	anesthesia	Improvement of lesion .	Side effects	Final results
1	52	F	wrinkle	Around eyes	-	Partial response	Nile	good
2	51	F	wrinkle	Around eyes	-	Complete response	Nile	excellent
3	48	F	wrinkle	Around eyes	-	Partial response	Nile	good
4	27	M	Acne scaring	Left cheek and right	-	Complete response	Nile	excellent
5	4 6	F	Senile lentigo	On chin	-	Partial response	slight	good
6	40	M	Senile lentigo	On nose	-	Complete response	Nile	excellent
7	42	F	skin's pigmentation	On nose	-	Complete response	Nile	excellent
8	45	F	skin's pigmentation	On hands	-	Complete response	Nile	excellent

Before b-after 3 session a- c- After 4 session

Figure. 1 Wrinkle around eye, 5 treatment session , woman, 48 years old, skin phototype IV,(a) before and (b-c) after . Observe the better skin condition and fewer lines and no wrinkles at the -2 month assessment point.


a- After b- Before

Figure. 2- Acne scars right cheek , 4 treatment session , young man , 27 years old, skin phototype IV,(a) before and (b) after). Observe the better skin condition and no acne scare at the 2-month assessment point.

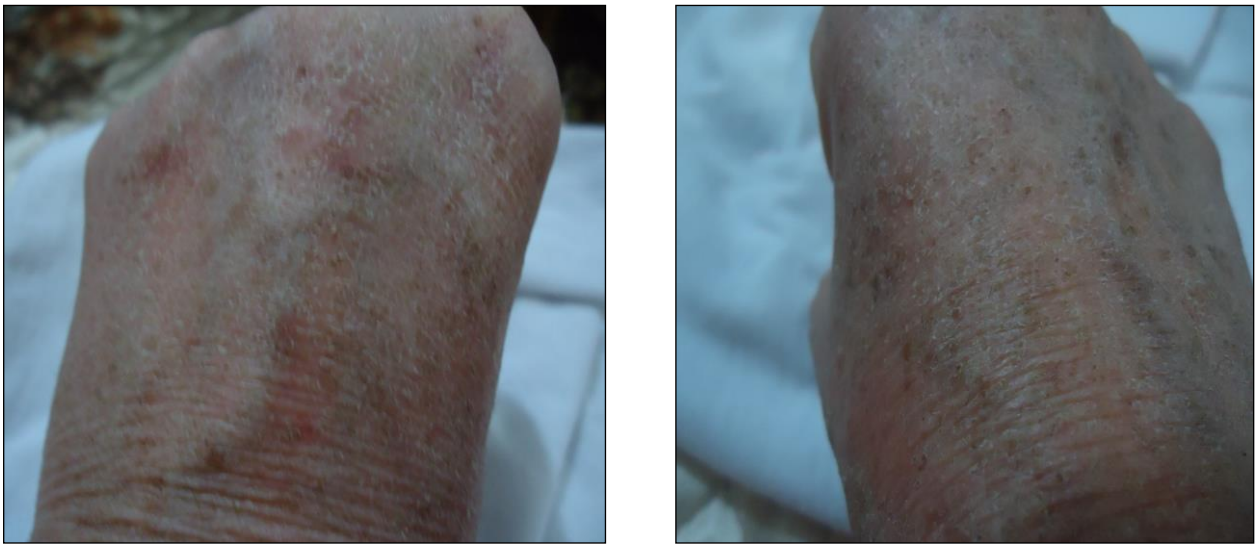

a-After b-before

Figure. 3- epidermal lesion (Senile lentigo) on chin ,1 treatment session , woman, 46 years old, skin phototype IV,(a) before and (b) after , observe the better skin condition and with out any trace to the lesion at the 2-month assessment point.


a- After b- Before

Figure.4- skin's pigmentation on nose, 3 treatment session , woman, 42 years old, skin phototype IV,(a) before and (b) after). Observe the better skin condition and with out any trace to the pigmentation at the 2-month assessment point.

Figure(5 -a) show the skin's pigmentation on both hands before treatment .



Figure(5 -b) left and right hands after 3days treatment , show the scabbing and erythema

Figure(5 -c) left hand in 7day treatment, notice that scabbing start to fall

Figure(4 -d) skin's pigmentation on hands , 4 treatment session , woman, 45 years old, skin phototype IV,(a) before and (d) after . Observe the better skin condition and with out any trace to the pigmentation at the 2 month assessment point.

Result and discussion

Fractional resurfacing with Er:YAG laser in only one treatment session can achieve effective skin rejuvenation, with effects on both the epidermis and dermis.

it is another safe and effective device that can be used to remove cutaneous lesions. The recurrence rate is low and the risk of complications is minimal

In our study, all assessments showed obvious improvement after the first treatment, with continued improvement after each successive treatment. The majority of adverse effects were limited, such as mild, brief, post-treatment erythema and petechiae. No post inflammatory hyper pigmentation was noted .

All lesions were removed successfully at the time of treatment. There were two patients who had recurrence and needed further treatment. No complications were noted, except for one case of slight hyperpigmentation in a woman with phototype IV skin .

Side effects, such as pain, discomfort, fine scabbing, and erythema, are well tolerated and accepted by patients .

Wrinkles and scars (including acne scars) are effectively softened and eliminated. Pore size is reduced and the skin's pigmentation becomes more even, which also helps to improve the appearance of the skin. The signs of the treatment are practically invisible by 3 to 7 days afterwards. Even one session will lead to remarkable results; for deeper lines or scars additional treatment sessions can follow after several weeks.

Table 3 illustrate the subjective assessment of the results achieved at the 2-month assessment point. Increased improvement in all grades was seen at the final, excellent results were for the Senile lentigo on chin case 5 figure 3 and case 6, and excellent results were for the acne scars on the left check case 4, figure 2 compared with wrinkle .

In case 1 and case 3 without photo we notice good result for treating wrinkle, where the case needs others session and at least six months after the end of last session clinical observation, to give collagen enough period to be stimulated.

In figure (1a-c) case 2 , excellent result for treating wrinkle .

Excellent results were figure(4) and(5-a-c) on nose and on both hands cases 7,8 of the skin's pigmentation. 92% from the patients, were satisfied with results treatment

and no patient refused to finish the treatment , there were no side effects except for in phototype IV patient .

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