



Treatment of Striae Grvidarum as a Type of Striae Distensae Using Long Pulsed Nd:YAG Laser (1064nm) and Fractional CO₂ Laser (10600nm)

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Abstract: Striae distensae SD or stretch mark are frequent skin lesion that cause considerable aesthetic concern. The 1064nm long pulsed Nd:YAG Laser has been used to promote an increase in dermal collagen and is known to be a Laser that has a high affinity to vascular chromophores. Also by using fractional CO₂ Laser 10600nm as an effective modality in treatment of striae distensae SD. It works to stimulate fibroblast and enhance Collagen formation, which is important for newly generated skin tissue. **Objectives:** This study aims to verify the efficacy of long pulsed Nd: YAG Laser (1064nm) in the treatment of immature striae distensae (SD) and the efficacy of CO₂ fractional Laser (10600nm) in treatment of mature striae distensae SD. **Patient and methods:** Ten female patients with striae distensae (SD) in the abdomen formed during pregnancy period five of them had immature or recent type of striae were treated by long pulse Nd: YAG Laser 1064nm and the others five patient had mature type of striae were treated by fractional Co₂ Laser (10600nm). This study done in Laser medicine research clinic of institute of Laser for post graduate studies from July 2018 to the end of November 2018. The Age of patients range from 20-40 years old. The Laser parameter used for fractional Co₂ Laser (10600nm) was 18 Watts power. Pulse duration 1.3ms, interval 1ms, with distance 1.1mm, the procedure was done under topical anesthesia (EMLA) and the number of sessions done were three sessions of one month interval. The parameter used for long pulse ND: YAG Laser (1064nm) was (51.J) energy in the first session and (70.J) in the second, pulse duration (30ms) frequency (2Hz) with spot size (10mm) with two weeks interval between the sessions, three sessions were used for every patient. **Results:** The patient treated by fractional CO₂ Laser (10600nm) had a change in the shape and texture of striae distensae SD from first session, and there was noticeable change occurred in the second session regarding texture and color of striae that became faint. The patient treated with long pulse Nd:YAG(1064nm) had good result from the second session in which the S.D line became faint with change in texture. With no or mild side effect of treatment, 90% of all patient are fully satisfied with treatment only 10% of patient showed partial satisfaction. 10% of patient had hyperpigmentation. **Conclusion:** Striae can be treated by Laser as an effective and safe method with less side effect with good patient satisfaction by long pulse Nd: YAG Laser (1064nm) and fractional Co₂ Laser (10600nm) to treat immature and mature striae respectively.

Introduction:

Striae distensae SD: frequent undesirable skin lesions that result in considerable aesthetic concern (Goldman et al, 2008). They are two and half times frequent in women and affect up

to 90% of pregnant women. Known as stretch marks, which represent as linear dermal scars associated with epidermal atrophy, they are caused by progressing stretching of the skin, connective tissue due to changes in the contours of the body (Madi, 2017). These scar can be

observed in the abdomen and breast of pregnant women.

Recent or immature striae are defined as linear bands of smooth skin (Nigam, 1989) which are erythematous and may be itchy and slightly elevated. Such striae maintain their characteristics for a short period, usually 6-10 months post-delivery.

Most literature has described Striae distensae (SD) during pregnancy as striae gravidarum SG. In Acute phase which mean SD post-delivery can be raised and become symptomatic (Tsuji and Swabe, 1988). In later stage the striae become white, flat or depressed and are difficult to treat. This phase is called chronic phase or mature type which exist as hypopigmented dermal depressions as white wrinkled scars and can lead to psychological stress (Kim et al, 2008)

Aim of Study:

This study aims to treat common skin problems that affect women during pregnancy period which were presented either as linear, elevated, erythematous bands called immature Striae distensae (SD), or as white, depressed, wrinkled scars which called mature (SD) because of its cosmetic effect which can cause emotional and psychological stress by using two Laser modalities according to the type of Striae gravidarum (SG) in relation to its chronological

age "The Fractional CO₂ Laser was used to treat mature Striae distensae (SD) and the Long Pulsed Nd-YAG Laser was used to treat immature Striae distensae (SD).

Causes of Striae distensae (SD):

Striae distensae are commonly found.

- During pregnancy which called striae gravidarum (SG).
- After sudden gain or loss of weight.
- In Cushing disease.
- In association with prolonged use of strong systemic or topical corticoids.
- Due to rapid growth in adolescence (Hernandez and Perez, 2002).
- During puberty.

Some authors suggest that the presence of striae on the breast or thigh, family history, and race are significant predictive factors for development of striae gravidarum (Chang et al, 2004).

Type of striae:

In acute phase SD appear as red which is called striae Rubrae. (SR) that can be raised and become symptomatic. The chronic form of striae distensae is called striae Albae (SA) which exist as hypopigmented dermal depressions, (Arther janes and Richard, 2017), both type of SD shown in Figure (1).



Fig. (1): Types of SD.

Treatment of striae distensae SD:

The aim of treatment is the stimulation of Collagen production.

(A) Non Laser therapy

I. Topical agent:

1. **Retinoic Acid:** Is believed to increase tissue Collagen level through stimulation of fibroblasts, it can improve the appearance of early SD but has common side effect

including transient erythema and scaling of skin. (Rangelo et al, 2001)

2. **Centella asiatica:** Is implant used in Asian herbal medicine which contains Asiaticoside which stimulate fibroblast, it is used in the prevention of striae with reduction in the development and severity of striae with no side effect. (Elson, 1990)
3. **Hyaluronic acid:** Is also thought to increase Collagen production of fibroblast. (Draeos and Gold, 2010)

4. **Chemical peel treatment:** Chemical peel treatment involves the application of Trichloroacetic acid or glycolic acid GCA they are thought to induce an initial anti-inflammatory response if used in combination GCA combined with tretinoin and L-ascorbic acid and Trichloroacetic acid (TCA) combined with the use of sand abrasion or a post peel cream that all of which produce improvement in appearance of striae. (Draeos and Gold, 2010)
- II. **Radio frequency devise (RF):** A device deliver RF current to the skin which is converted to heat in dermis as a result of it electrical resistance and it will increase Collagen production (Suh and Chanq, 2007).
- III. **Percutaneous Collagen induction therapy:** Or needling therapy which increases Collagen and elastin production.(Aust and Knoblock, 2010)
- IV. **Platelet rich plasma PRP:** Is concentrated solution of platelet containing growth factors and cytokines injected intra dermally to increase Collagen level. (Aust and Knoblock, 2010)
- V. **IPL (Intense Pulse Light):** Consists of broad spectrum (515-1200nm) visible beam of high intensity light also used in treatment of SD will increase dermal Collagen level after treatment.

Laser therapy of SD:

1. Diode Laser: (1450nm) is anon fractional Laser has been shown to increase dermal Collagen.
2. Fractional non ablative Er: glass Laser (1540nm) also produce improvement of SD.
3. Pulsed dye Laser (PDL) (585nm) used as vascular Laser because of high affinity for hemoglobin, which present in the microvasculature of S.R, it can reduce the erythema of these lesion, and improvement in both Collagen and elastin. (Jimeenes and Flores, 2003)
4. Long pulse Nd:YAG (1064nm) used to treat immature striae distansae.
5. Fractional ablative carbon dioxide Lasers have primarily used in SD which reported clinical improvement with side effect of post inflammatory hyper pigmentation (PIH). (Jimeenes and Flores, 2003)

The CO₂ Laser has widely used for treating various epidermal and dermal lesion that CO₂ Laser enhances fibroblast replication; stimulate basic fibroblast growth factor secretion. The Tissue effect occurs only when light is absorbed. The three primary skin chromophores are water, hemoglobin and melanin. The chromophor exhibits characteristic bands of absorption at certain wave, for example the melanin is absorbed broadly across the visible and UV spectrum. The oxyhemoglobin and reduced hemoglobin in blood exhibit strong bands in UV, blue, green and yellow regions. Water has strong absorption in infrared region. Optical properties of the epidermis and dermis are different.

In pigmented epidermis, melanin absorption is usually the dominant process over the majority of optical spectrum (200-1000nm).

In dermis there is strong wave length dependent scattering by collagen fiber which attenuate penetration of light. This scattering varies inversely with wave length.

The depth of penetration increases with wave length about 1300nm, penetration decreased due to absorption of light by water. The most deeply penetration wave length are within far UV and far IR regions. (Kabir sardana 2014).

Type of Laser used in this study:

Carbon dioxide (CO₂)

The carbon dioxide (CO₂) laser emits light at a wavelength of 10 600 nm. Its photo thermal effect on tissue consists of the transformation of water into vapor, which leads to complete cell vaporization. However, as the CO₂ light only penetrates 0.3-1 mm into the target and, the thermal damage to the tissue beyond the vaporization area is minimal. As the laser light is in the mid-infrared band, visual control can be achieved by the addition of visible guiding beam, such as a helium-neon or diode laser to mark the aimed focal spot. (Markolf 2007)

In this study we use Fractional CO₂ Laser:

How does fractional CO₂ Laser work?

The Fractional CO₂ takes the CO₂ Laser beam and Fractionates that beam into thousands of

tiny little of light. These tiny shafts of light penetrate into the deeper layers of the skin. The skin then repairs those tiny shafts by pushing out the old damaged skin and replacing it with new skin. The collateral heat damage also helps to shrink existing Collagen. (Cibb and Cherney 2018) Second Laser used In our study is long pulse Nd:YAG Laser.

Nd:YAG Laser is a solid state laser capable of producing a near infra-red wave length 1064nm that penetrate deep into skin and is readily absorbed by hemoglobin and melanin chromospheres (Naeini et al, 2014). It is possible significantly caused a thermal effect in skin tissue such as large blood vessels and collagen. The Laser energy delivered using long pulses which converted into heat in the tissue.

So Nd:YAG Laser can treat amore superficial level by heating sub cutaneous skin in non-ablative manner and it stimulate new Collagen production.

The 1064nm wave length skin penetration and is often used for vascular alteration. Thus the combination of these quantities enables the photo thermal effect of the Nd:YAG Laser to effectively treat immature stria distensea.

The main contraindication for the use of long pulse Nd:YAG.

- Pregnancy.
- Presence of infectious or inflammatory lesion in the region

Patient and methods:

This study was done in the Laser medicine research clinics of institute of Laser for post graduate studies in Baghdad University beginning from July 2018 to the November 2018.

Patients and descriptions:

The study included ten female patients with Striae distensea. Five of them have Striae distensea of immature type (between 20 days -3 month) post delivery and the other five have mature type of SD between (2 years – 6 years) post delivery. Patient age range from 20 years old to the 40 years old with a mean age of 30 years old.

The patients come from my private clinic. Each patient was getting ready for the treatment by suitable type of Laser for her SD after full explanation and discussion regarding the nature of procedure and the advantages and side effect expected post therapy.

Inclusive criteria:

All patients chosen have the Striae distensea in the abdominal area formed during pregnancy.

Exclusive criteria:

Patients who had SD in other area of body as in thigh, arm, breast, buttock, back, due to many causes as puberty, obvious change in weight, Cushing disease and patient who taking steroid therapy.

Methods and procedure of fractional CO₂ Laser for mature SD.

The patient chosen for treatment with fractional CO₂ Laser 10600nm were five female patient had white color abdominal Striae.

The parameters which were used to treat mature SD:

- 18 watt power
- 23.4mj point energy
- 1.3ms Pulse duration
- 1ms interval
- With distance 1.1mm.

At the beginning topical anesthesia EMLA cream were put on the abdomen and dressing was done to the abdomen by Nylon for 60 minute before beginning of treatment. After about 60 minute the dressing was removed and the EMLA cream was wiped off with cotton and the area was cleaned by water and wiped it by sterile gauze. The safety appropriate goggles for CO₂ Laser were used as protective measure to both doctor and patient. The treatment was started by applying the hand piece in contact to skin and in perpendicular position to the abdomen, starting from upper part of SD line nearly at the level of umbilicus sequentially down word from the central part of the abdomen toward the flanks this done on right half and left half of the abdomen.

When the session was finished topical oily material was applied on the treated area called "Growth factor", which is serum-like material that was responsible for supporting the repair of damaged skin, making component that provides firmness and elasticity to the skin. The patient was advised to use topical sun block after 2 hours of treatment and then used it two time daily especially during exposure to heat and Sun. While the growth factor was used one time daily at night and this treatment was continued until the time of second session after 30 days. Also the patient used systemic antibiotics as Ciprofloxacin 500mg twice daily for 5 days with Acyclovir tablet 200mg twice daily for five days.

With analgesia as Brufen 400mg or Paracetamol 500mg on need for pain. Also we advise the patient to avoid direct exposure to heat, and not to use bath for 24 hours post treatment. The

treated area of the abdomen appeared red and rough. And the time taken by this procedure was about 20 minutes. To all patients and on all sessions, Digital photographs are taken before the treatment and immediately after the session also photographs were taken to the parameter on the screen.

Second session is done after 30 days from the first session by using the same steps and parameters of the first session. In the third session which was 30 days apart from second session. The power was increased to become 20 watts to have best result.

On follow up/ the total session used for fractional CO₂ Laser was three sessions of 30 days interval. After third session the striae become smooth in texture with faint color. The procedure done in special room, and the Laser used was fractional CO₂ Laser. "as shown in figure (2)".

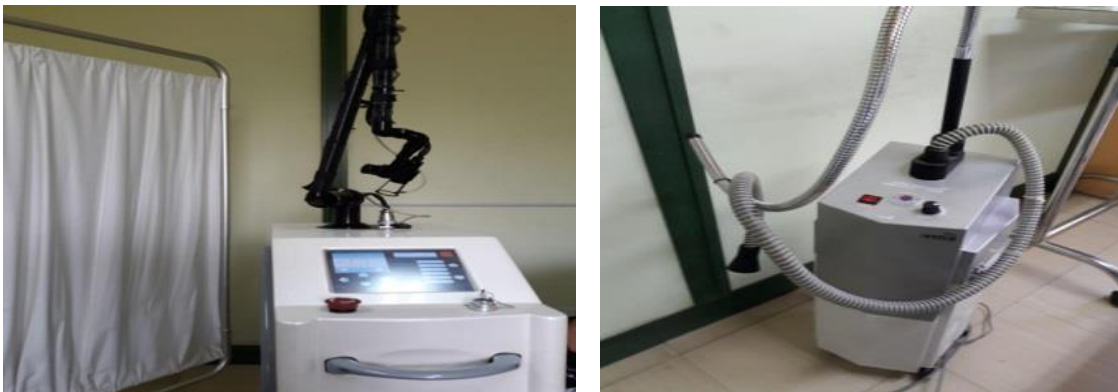


Fig. (2): Fractional CO₂ Laser device with Vacuum system

Methods and procedure of long pulse Nd:YAG Laser in treatment of immature Striae:

In this research five female patients with recent erythematous Striae with duration onset range from 20 days to 3 months post-delivery were treated. The long pulse Nd:YAG Laser 1064nm was used to treat recent SD with a parameters were used in first session as (Energy 51 joule, Pulse 20ms, Frequency 2 Hz, Spot size 10mm). Also cooling (cold air) was applied to cool and protect the epidermis as well as to decrease the discomfort during Laser treatment as shown in figure (3).

At first put EMLA was putted as topical anaesthesia on the site of Striae on abdomen of patient with dressing for about 30-60 minute. After about 60 minute removed the EMLA and start the treatment.

Everyone in the room was given a proper eye protection (goggles). A the long pulse Nd:YAG Laser 1064nm was used by putting the hand piece perpendicular to the Striae line on abdominal wall and move it on the line of Striae from one side to other side. When the session was finished, a moisture and hydrated cream was put on site of area which was treated by Laser. The patient was advised to use sun block

and to avoid exposure to Sun light and to direct heat.

In the second session which was two weeks after the first session these Parameters were used because the response is weak in the first session (Energy 70j, Pulse 30ms, Frequency 2Hz, Spot size 10mm).

To get best result in third session, the energy was increased to (80j) and the spot size decrease

to (4mm) to make the Laser light more focusing and be more effective. So the parameters in the third session become (80j energy, 4mm spot size, Pulse duration 30ms, Frequency 2Hz).

The total sessions were three sessions. The total time duration of the procedure was about 15-20 minutes. Photographic documentation was part of the routine before and after the treatment.



Fig. (3): ND:YAG device & Cooler device.

Results

The result obtained with the treatment of immature striae using 1064nm long pulse Nd:YAG Laser and treatment of mature striae by using 10600nm fractional CO₂ Laser, have proven satisfaction for both patients and doctors, that there is Marked improvement for texture and color of striae "as shown in figure (4)". Among treatment by long- pulse Nd:YAG, and with fractional CO₂ Laser there is no or mild side effect seen on the patient at time of procedure or post treatment as postoperative.

Regarding the side effect with treatment of CO₂ fractional Laser:

Pain:

From ten female patient Five of them were treated by fractional CO₂ Laser experienced mild tolerable pain and burning sensation through the procedure when put Laser to the

skin. This discomfort or burning sensation Last not more than 24 hours and can be relieved by simple analgesia as acetaminophen 500mg or Ibuprofen tablet 200-400mg.

Redness:

Observed in all patient treated with fractional CO₂ Laser which formed in first day post treatment and subside gradually within 30 days post treatment, with special care was needed after the treatment to keep the skin hydrated by using Sun block especially during exposure to heat and Sun.

Pigmentation:

In 90% of patient there is no pigmentation. The other 10% of patient which represent only one of 10 of the patients had hyperpigmentation [as shown in figure (5)], but this hyperpigmentation will subside after about one month. This patient was Diabetic and she was on insulin treatment.

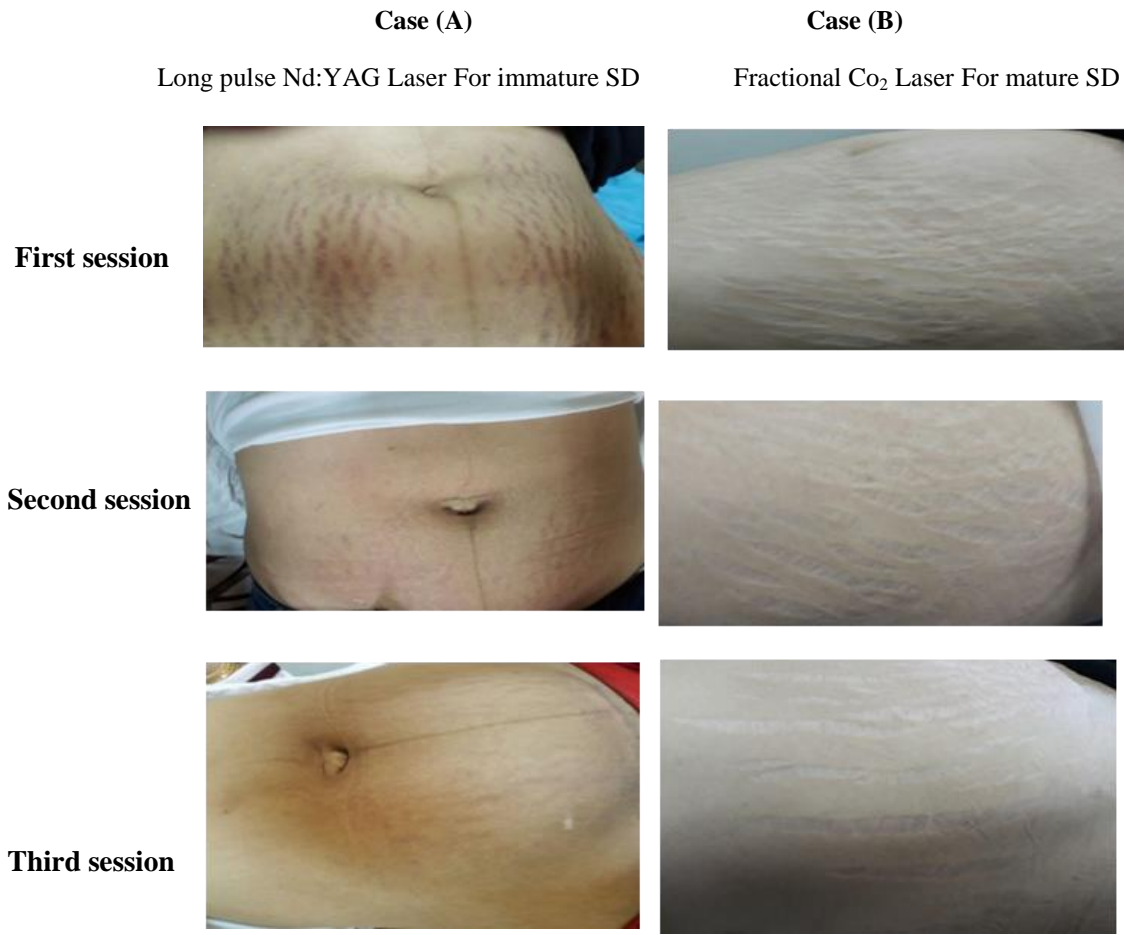


Fig. (4): Sequence of three sessions.



Fig. (5): hyperpigmentation

The following scale was used for result and satisfaction of patients:

If there is no improvement or improvement up to 30% the scale is poor when improvement was

between 30-70% the scale is good, and excellent if improvement is above 70%. This scale is about the improvement of patient observed by them and by doctor. So, the result of improvement is shown in Table (1).

Table 1: Improvement Result

Poor	1
Good	2
Excellent	7

The results of overall satisfaction are shown in Table (2).

Table 2: Overall satisfaction

No satisfaction	0
Partial satisfaction	1
Full satisfaction	9

So the net result shows that **90%**. Of patient are fully satisfy with treatment.

Discussion:

Striae distensae can have important Psychological consequences. So, several treatments have been proposed in an attempt to obtain aesthetic improvement of striae. Because it may cause great aesthetic dissatisfaction and have profound negative impact on self-esteem. In this study long pulse Nd:YAG 1064nm was used which demonstrated a clinical improvement of recent or immature striae (which look like erythematous linear bands) due to Laser's affinity for vascular target present in striae, the absorption of Laser by its target i.e. oxyhemoglobin leads to an improvement in the redness, also long pulse Nd:YAG induces formation of new Collagen this will lead to an improvement of the skin and consequently improve the appearance of immature striae. With the use of appropriate parameter and the number of sessions depending upon improvement judged by clinical appearance of SD and patient satisfaction. The SD became faint with smooth outline and decrease the elevation of ridges of striae. While when the patient had mature striae which is static, asymptomatic, flat white color fractional CO₂ Laser 10600nm was used for the treatment.

Fractional CO₂ Laser could stimulate fibroblast formation and activity and improve the lesion. Fractional Co₂ Laser worked by ablating a

treated area while the surrounding skin tissue is untouched, so it is less invasive with faster recovery time. So fractional CO₂ Laser reduced the risk of adverse effect by leaving an intact epidermal architecture surrounded each coagulated micro thermal treatment. CO₂ Laser destroyed the tissue by rapid heating and vaporizing intracellular water. And it destroyed the upper layer of skin with newly generated skin tissue that will be smoother in texture and appearance. About the case who had hyperpigmentation with fractional CO₂ Laser treatment and she had. Diabetic mellitus (DM) and she was on insulin therapy. I think the explanation for the hyperpigmentation is that the DM patient are more susceptible for infection due to slower healing process, also the DM cause hyperlipidemia and these lead to atherosclerosis with platelet aggregation which end to vascular injury then will cause infection and hyperpigmentation. So to prevent hyperpigmentation of skin due to DM, it is better to control the blood sugar to protect the endothelial lining of blood vessels and protect platelets. Also the post inflammatory hyperpigmentation PIH is a reactive hypermelanosis of skin as consequence of Laser application especially with fractional CO₂ Laser.

This study is supported by other studies about treatment of striae distensea by fractional CO₂ Laser in that study done by (Tabale et al, 2018). In which Twenty Four esthetic Iranian women with various severity of SD of pregnancy in 4 sessions treatment with fractional CO₂ Laser show clinical improvement assessed pretreatment and post treatment with photograph (MPHY et al, 2013).

The evaluation shows that fractional CO₂ Laser was an effective treatment and 83.3% show good improvement. From this there was no statistical difference about improvement related with severity of striae distensae and number of pregnancy.

Another study is about the comparison of fractional CO₂ Laser and combined use of PDL with fractional Co₂ Laser in treatment of striae Albae. These combinations showed more effective than fractional CO₂ Laser alone, and could be suggested as clinical option in treatment of striae albae. This study was done by Naeini et al, 2014. While about treatment of immature striae by using long pulse Nd:YAG

Laser, this study was compared with another study done by (ALBERTO GOLDMAN et al 2008). They conducted their study on twenty patients with immature striae and treated them by long pulse Nd:YAG Laser. The results were considered satisfactory to both patient and doctor, 55% of patient considered the result excellent. With low side effect some time patient had minimal edema and erythema post treatment.

The best result was observed after 3 sessions. With the parameter of fluencies between 80-100 j/cm² and spot size 2.5mm, a delay of 15-20ms and a frequency of 2.0Hz with 3-6 week interval.

They use cooling of striae prior and immediately after the use of Laser, such cooling should not be too long so as to avoid local vasoconstriction and consequent decrease of chromophores Oxyhemoglobin.

Conclusion:

The result obtained in this study indicate that the 1064nm long pulse Nd:YAG Laser used in treatment of immature striae and fractional CO₂ Laser 10600nm in treatment mature striae shows excellent effect with safe and easy method in which the 2 type of Laser used in outpatient clinic with no or mild side effect. The full clearance of the lesion is not obvious or we can say complete eradication of SD is not attainable. But there is good improvement after treatment with Laser.

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علاج Striae Grvidarum كنوع من Striae Distensae باستخدام ليزر Nd: YAG طويل

النبضة (1064 نانومتر) وليزر ثاني أكسيد الكربون التجزيئي (10600 نانومتر)

مها فؤاد عبد الأمة منال ابراهيم مزيعل

وزارة الصحة ، بغداد، العراق

الخلاصة: تعد تشققات الجلد من اكثر المشاكل التي تسبب للمرأة القلق لأنها تؤثر على المظهر العام. ويلعب الحمل دوراً هاماً في ظهور هذه التشققات. والتي تتكون نتيجة التمدد الشديد في الجلد وخصوصاً في منطقة البطن. وتكون على شكل خطوط حمراء تتحول بعد حوالي الـ 6 أشهر إلى خطوط بيضاء وذات حافات ملموسة وتسمى بالتشققات الناضجة. **الهدف في الدراسة:** هو تقييم كفاءة ليزر ثنائي أوكسيد الكربون التجزيئي 10600 نانومتر في علاج التشققات الناضجة. وفعالية ليزر الـ Nd:YAG ذو الومضة الطويلة 1064 نانومتر في علاج التشققات الحديثة ذات اللون الأحمر. **طريقة الدراسة:** تم اجراء الدراسة في عيادات الليزر الطبية والبحثية بمعهد الليزر للدراسات العليا من بداية شهر تموز 2018 ولغاية شهر تشرين الثاني وشملت الدراسة عشرة نساء تتراوح أعمارهم بين 20-40 سنة. خمسة منهن لديهن تشققات حديثة حمراء تم معالجتها بليزر Nd:YAG ذو الومضة الطويلة 1060 نانومتر مع استخدام التبريد اثناء العمل، أما الخمسة الاخرى لديهن تشققات بيضاء اللون تم معالجتها بليزر ثنائي اوكسيد الكربون التجزيئي 10600 نانومتر بقوة (18) وات. **النتائج:** أثبتت النتائج القدرة والكفاءة العالية لـ ليزر ثنائي أوكسيد الكربون التجزيئي في علاج التشققات القديمة وليزر Nd:YAG ذو الومضة الطويلة في معالجة التشققات الحديثة حيث لوحظ تغيير واضح بالمظهر الخارجي للتشققات من حيث الشكل واللون وكذلك الملمس ومنذ الجلسة الأولى للعلاج وقد عملت لهن ثلاث جلسات. مع حدوث اثار جانبية خفيفة بعد المعالجة كحدوث ألم خفيف وإحمرار طفيف. وسجلت مريضة واحدة حدث لها تصبغات جلدية اختفت بعد مرور شهر. سجل معظم المرضى رضا وارتياح بنسبة 90% . **الاستنتاج:** يمكن اعتبار تطبيق استخدام ليزر ثنائي اوكسيد الكربون التجزيئي وليزر Nd:YAG ذو الومضة الطويلة كعلاج عملي وفعال وآمين ومقبول ولكنه يحتاج الى تكرار عدد الجلسات للحصول على نتائج أفضل.