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Treatment of Melasma in Fitzpatrick Skin Type III and IV by Picosecond Laser

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Original Article

ABSTRACT

***Background**: Melasma is a common acquired pigmentation disorder characterized by symmetrical , blotchy brownish pigmentation.Picosecond laser is a new modality for pigmented skin disorders which has an extremely short pulse duration. **Objective**: To determine the effectiveness and safety of picosecond laser in treatment of melasma in patients with Fitzpatrick skin type III and IV whom failed to respond to conventional treatment. **Patients and Methods**: In this therapeutic interventional study 15 patients (2 male and 13 female) were enrolled with Fitzpatrick skin type III and IV who had mixed type melasma (epidermal and dermal) diagnosed by wood's lamp ,each received 5 sessions of picosecond laser. MASI score has been used for follow up of the patients which was calculated at first and fifth sessions. **Results**: The mean MASI score before picosecond laser treatment was (8.16 ± 3.572 SD) and at fifth session was (3.026 ± 2.44 SD) , it decreased by (5.134) which is statistically significant. We noticed a slightly better response to therapy in fitzpatrick skin type III than IV compared by the drop in MASI score. Majority of the candidates (73.33%) were very satisfied with the results. The only side effect noticed was mild erythema with out pain or burning sensateion which faded away within few hours. **Conclusion**: We Found that melasma patients of Fitzpatrick skin type III and IV who fail to respond to topical therapy can get benefit from picosecond laser and it's a safe way of treatment*

***Keywords:** Melasma, pathophysiology, Fitzpatrick Skin ,Treatment, Laser and light therapy, Picosecond Laser*

1. INTRODUCTION

Melasma is a common acquired disorder characterized by symmetric, hyperpigmented patches with an irregular outline, occurring most commonly on the face. [(1)] It's also called chloasma, or the "mask of pregnancy," when it occurs in pregnant women. The condition is much more common in women than men, though men can get it too [(2)]. The pathophysiology of melasma is multi factorial and complex. The pigmentation is due to overproduction of melanin by the pigment cells, melanocytes, which is taken up by the keratinocytes (epidermal melanosis) and deposited in the dermis (dermal melanosis, melanophages)[(3)].

Known triggers for melasma include: Sun exposure and sun damage , Visible light and ultraviolet rays contribute to abnormal pigmentation. Pregnancy, the pigment often fades a few months after delivery .Hormone treatment including oral contraceptive pills containing oestrogen and progesterone, hormone replacement, intrauterine devices and implants are a factor in about a quarter of affected women.[(4)]. Light to dark brown or brown–gray patches with irregular borders appear primarily on the face. The areas of hypermelanosis are distributed symmetrically in three classic patterns: (1) centrofacial (most common), involving the forehead, cheeks, nose, upper lip (sparing the philtrum and nasolabial folds), and chin; (2) malar, affecting the cheeks and nose; and (3) mandibular, along the jawline.[(1)] The diagnosis of melasma is essentially clinical, and poses no greater difficulties, Wood's lamp examination (340 to 400nm) highlights the difference in pigmentation of the affected skin. [(5)] Melasma has classically been subdivided into four types based upon the primary location of the pigment: epidermal, dermal, mixed, or indeterminate (e.g. in patients with very dark skin pigmentation)[(1)]. The severity of facial melasma can be estimated by using colorimetry, mexametry, and the MASI score (Melasma Area and Severity Index)[(4)] . Therapeutically, a sunblock with broad-spectrum UVA (even visible light) coverage should be used daily, Bleaching creams with hydro- quinone are the gold standard and are moderately efficacious, containing 2% to 4% hydroquinone. Tretinoin cream may be added to increase efficacy. The combination of hydroquinone and tretinoin, administered with a topical corticosteroid, has been called "Kligman's formula" and is the most effective topical regimen available to treat melasma. Methimazole, azelaic acid, kojic acid, vitamin C, and arbutin are other therapies with minimal to moderate efficacy ' Oral tranexamic acid may play a role as a systemic agent in treating refractory melasma ' Various surgical procedures,

such as peels and light-based treatments, have been proposed as effective for melasma, but results are mixed. Peels with glycolic acid, salicylic acid, trichloroacetic acid (TCA), and tretinoin 1% have not reproducibly enhanced the efficacy of 4% hydroquinone and can cause hyperpigmentation if irritation ensues [(6)]. Laser and light therapy represent an alternative third line approach to treat melasma and maybe particularly beneficial for patients with melasma refractory to topical therapy or chemical peels or when the patient wants an accelerated pace of improvement.as the chemical peels these accelerate the removal pathways for melanin but do not target the melanin production itself [(7)]. Melanin has a broad absorption spectrum (630–1100 nm) allowing a variety of lasers and light sources to be used, Melanosomes have a short thermal relaxation time (50–500 nanoseconds),Longer wavelengths penetrate deeper to target the dermal pigment, but melanin absorption is better with shorter wavelengths [(8)]. The five broad categories of lasers and light therapy are intense pulsed light , picosecond laser, Q-switched lasers, non ablative fractionated resurfacing and ablative fractionated resurfacing lasers [(7)].

The main mechanism of the laser is to transmit high peak, photo-thermal energy into the skin, which specifically targets the melanin pigment resulting in so-called “selective photothermolysis”. Fractional 1550/1540 nm nonablative laser therapy is the only laser treatment for melasma that has been approved by the FDA, and it has shown promising results, Given the risk for hyperpigmentation, some authors suggest using lower fluences, variable pulses, and pretreating all patients with hydroquinone for up to 6 weeks before laser therapy, especially in patients with a history of PIH [(8)].

Energy delivery in the picosecond range may achieve more selective photothermolysis of fragmented melanin granules from previous repetitive laser treatments and lower fluence can be used, which should decrease adverse effects while keeping the peak energy substantially higher than that typically produced by QS lasers [(7)]. Generation of heat is often considered the key factor in post-laser hyperpigmentation, picosecond lasers that deliver energy in exceptionally short pulse durations, minimize photothermal effects and offer patients the benefit of little to no downtime in contrast to other laser treatment options which can have significant periods of associated erythema or peeling [(9)].

2. PATIENTS and METHODS

In this therapeutic interventional study 15 patients , 2 males and 13 females ,with their ages ranging between 26 to 44 years (mean 35.7±4.97) were included. The duration of their melasma was between 1 to 4 years (mean 2.26± 0.863). They were of Fitzpatrick skin type III (46.67%) and Fitzpatrick skin type IV (53.33%). The distribution of Melasma in 11 of them were centrofacial (73.3%) and in the other four was Malar (26.67%).

*Inclusion criteria***:**

1. Age above 18
2. Fitzpatrick skin the 3 and four Mixed type melasma (epidermal and dermal) diagnosed by wood's lamp
3. Melasma that has failed to respond to conventional topical therapy
4. Written and verbal informed consent
5. Willing and able to comply with study instructions and return to the clinic for required visits.

Exclusion criteria:

1. Age below 18 years
2. Pregnancy
3. Lactation
4. Taking oral contraceptives or any hormonal contraception
5. Receiving topical therapy within 2 months of the study
6. Receiving any chemical peels or lasers within 6 months of therapy
7. Any photosensitive disorders
8. Active skin cancer near the area of melasma
9. Active infection

Study protocol

After been diagnosed on base of history , clinical examination , wood's light and dermoscopy as melasma, the area of melasma has been cleaned with disinfectant and received treatment in form of picosecond laser (picoway resolve dual wave - Syneron Candela) with 0.5 J/cm2 , spot size of 6 mm and 3 passes . No topical anesthesia was. Each participant received 5 sessions of picosecond laser each session one month apart, photographs has been taken before treatment and at each session.

Cooling the area with ice packs has been done for 10 minutes and sunscreen cream put on the whole face.The patient has been advised to use sunscreen cream with SPF 50 daily and protect from sun light in between the sessions.

MASI score (melasma area and severity index) was applied for follow up of the patients and it has been calculated at session one and five.

A scale has been used to assess the degree of patient satisfaction after the last session.

Statistical analysis:

The data analysis was done using SPSS-22.Thestatistical significance of differences in patient groups was assessed by Chi-square test. Continuous variables were expressed as mean± SD. P value less than 0.05 was considered statistically significant.

3. RESULTS

The study included 15 patients aged 26 to 44 years (mean 35.7 ± 5.0) , two out of 15 were male (13.33%) and 13 were female (86.67%). They were of Fitzpatrick skin type III (46.7%) and Fitzpatrick skin type IV (53.3%). The Sociodemographic characteristics are shown in. (**Table 1**). As a result of our thesis we found a significant decrease in mean MASI (melasma area and severity index) score of the patients after 5 sessions of treatment and follow up , the mean MASI score before therapy at session one was (8.16 ± 3.57) and at fifth session was (3.03 ± 2.45) which means it decreased by (5.134) and this result was statistically significant, ($P<0.05$). We noticed that there was a slightly better response in patients with Fitzpatricktrick skin type III who has a drop in MASI score by 5.27 compared to skin type IV which was 5.31.There was not a significant difference in those who has greater time of sun exposure during their work and those who are not both responded equally. Regarding those with malaria melasma distribution, response noticed earlier and patients were more satisfied with the results (**Tables 2,3&4)**, Images of one of our patient who received therapy are demonstrated in (**Figure 1**) showing the changes after treatment. Regarding patient satisfaction ; 9 patients (60%) were very satisfied, 5 patients satisfied (33.3%) and only one patient (6.67%) was unsatisfied, (**Figure 2**)

As immediate side effect the patients developed mild erythema at sites of treatments which faded within hours , no other early or late Side effects were detected.

Table 1. Socio-demographic characteristics of patients (n = 15)

Variables		Value
Age , mean ± SD		35.7 ± 5.0
Gender n (%)	Male	2 (13.3)
	Female	13 (86.7)
Marital state n (%)	Unmarried	1 (6.7)
	Married	14 (93.3)
Pregnancy n (%)	None	1 (6.7)
	One	2 (13.4)
	Two	4 (30.8)
	Three	5 (38.5)
	Four	2 (13.4)
Occupational sun exposure n (%)	Yes	3 (20.0)
	No	12 (80.0)

Table 2. Comparison of Melasma area and severity index before and after therapy

Session	No. of patients	Mean	SD
MASI score before	15	8.16	3.57
MASI score after	15	3.03	2.45
P. value < 0.05, significant			

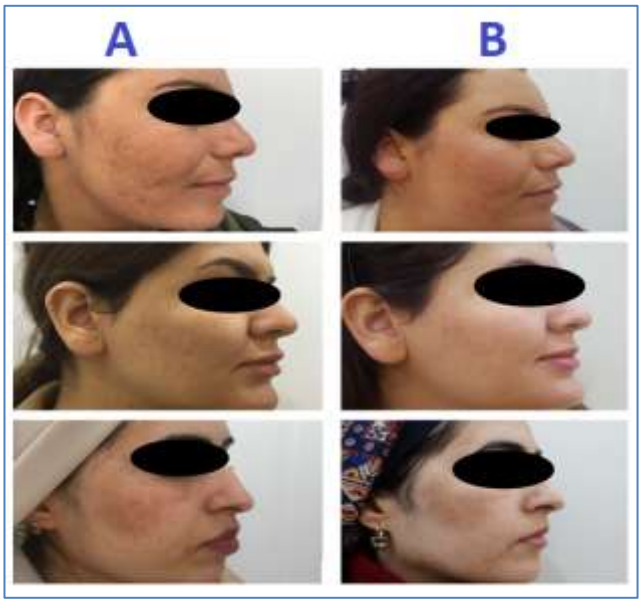

Figure 1. Images of patients received therapy , A : Before, B : After

Table 3. MASI score in skin type III and IV

Skin type	Mean MASI score	
	Before	After
Type-3	7.26	1.99
Type-4	8.95	3.94

Table 4. MASI score before and after therapy in relation to Melasma distribution

Distribution of melasma	Mean MASI score	
	Before	After
Centrofacial	9.06	3.29
Malar	6.36	2.5

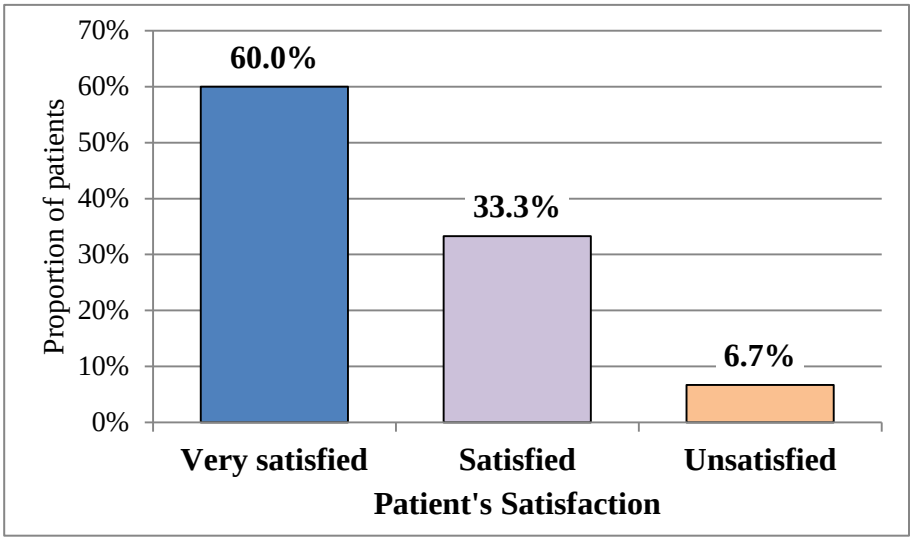

Figure 2. Patient satisfaction after follow up of fifth session laser therapy

4. DISCUSSION

Melasma is a dysregulation of the homeostatic mechanisms that control skin pigmentation and excess pigment is produced. Traditional treatment approaches with topical medications and chemical peels are commonly used but due to the refractory and recurrent nature of melasma, patients often seek alternative treatment strategies such as laser and light therapy.[7]

In our study which included 15 patients , majority were female (86.67%) as this pigmentation disorder known to be more common in female than male.

For follow up of the patients we used melasma area and severity index (MASI score) the mean before treatment was (8.16 ± 3.572 SD) then at 5th session decreased to (3.026 ± 2.44 SD) , this result is compatible with Niwat Polnikorn and Emil Tanghetti (December 2020 American Society for Dermatologic Surgery) in which also MASI scare decreased from 8.63 (66.04SD) to 3.16 (63.23SD) after 6 month of follow up.

If we compare our results to Thep Chalermchai & Paisal Rummaneethorn (2018 journal of Cosmetics and laser therapy) who used a fractional 1,064 picosecond laser we find the two results very close to ours, as in their study the MASI scores decreased by 4.18 ± 2.0 SD while ours decreased (5.134). Our study also achieved a better result in comparison to Jordan V. Wang,Mitalee P.christman and Georgina Ferzli (November 2020 journal of Cosmetic

dermatology) whom used 1927nm fractional thallium laser with tranexamic acid and maximum drop in MASI score was 3.5 in 90 days follow up as the subjects experienced recurrence of the melasma between 90 to 180 days which we didn't find to happen during our thesis besides of the burning , dryness and roughness the patients felt after therapy during their study while in ours there was only mild erythema. In the past decade, the use of 1064 nm QS-Nd:YAG laser with a flat-top beam profile for melasma treatment has been reported by various authors. Although the use of 1064 nm QS- Nd:YAG laser for the treatment of melasma has showed promising clinical results, post-laser hypopigmentation with insufficient recovery time due to short treatment interval or over treatment involving high fluence were reported [(11)]. We found majority of the patients to be very satisfied with the results (73.33%) and no one complained of worsening of their condition.

we found the only side effects after therapy to be mild erythema which stayed less than one hour , no burn sensation neither hypo or herperpigmentation were detected.

Finally As a conclusion we find picosecond laser to be an effective and safe method to treat melasma in Fitzpatrick skin type III and IV who fail to respond to topical therapy without any noticeable early or late Side effects how ever we suggest more researches with a larger sample sizes and longer period time of follow up and as it is a novel type of laser device we couldn't reach enough articles to compare our results with which we find a limitation in our study.

5. CONCLUSIONS

In conclusion, picosecond laser wa an effective and safe method to treat melasma in Fitzpatrick skin type III and IV who fail to respond to topical therapy without any noticeable early or late side effects however we suggest more researches with a larger sample sizes and longer period time of follow up.

Ethical Clearance: Ethical clearance and approval of the study are ascertained by the authors. All ethical issues and data collection were in accordance with the World Medical Association Declaration of Helsinki 2013 for ethical issues of researches involving humans, informed consent obtained from all patients. Data and privacy of patients were kept confidentially.

Conflict of interest: Authors declared none

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