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# Efficacy and safety of 1927 nm fractional Thulium fiber laser for the treatment of melasma: a retrospective study of 100 patients

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## ABSTRACT

**Background:** Melasma is an acquired hyperpigmentation of the skin that mostly affects areas exposed to the sun. The treatment of melasma can be challenging as it is prone to relapse. Recently, new laser and light-based treatment options have been used; one of these treatment modalities is the 1927 nm fractional Thulium fiber laser.

**Objective:** This study aimed to retrospectively evaluate the efficacy and safety of a 1927 nm fractional Thulium fiber laser for the treatment of melasma.

**Materials and methods:** This study retrospectively evaluated patients who were admitted to the dermatology outpatient clinic between September 2015 and March 2018 and treated with a 1927 nm fractional Thulium fiber laser. The MASI score was used to assess improvements of the lesions.

**Results:** The current study included a total of 100 patients who received 1927 nm fractional Thulium fiber laser treatment. Each patient received two treatments at one month intervals. The mean baseline MASI score was  $11.8 \pm 6.3$ , the mean MASI score after the first session was  $6.7 \pm 4.1$ , and the mean MASI score after the second session was  $3.4 \pm 3.8$ . The differences between these three MASI scores were significant, and the laser treatment had no major side effects.

**Conclusion:** Results of this study indicate that the 1927 nm fractional Thulium fiber laser is a safe and effective treatment option for melasma.

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## KEYWORDS

Melasma; 1927 nm thulium fiber laser; fractional laser

## Introduction

Melasma is a common skin disorder characterized by hyperpigmented macules and patches on the face. The disease mostly affects females (1), and is also known as chloasma, since it is often seen in pregnancy (2). The prevalence of melasma ranges between 1% and 50% (1). The exact etiology of melasma is still unknown, but its major etiologic factors include ultraviolet exposure, hormonal influences, genetic predisposition, and phototoxic drugs (1–3). Lesions caused by melasma typically occur on the forehead, malar areas, and chin, but can also rarely be seen on the neck, chest, and forearm (2). Melasma is categorized by the depth or location of the lesions. While centrofacial, malar, and mandibular areas indicate the location subtypes, epidermal, dermal, mixed, and indeterminate indicate the subcategories for the depth of involvement (2). The Wood's lamp can be useful for identifying these subcategories. Epidermal lesions are dark brown and have well-defined borders, dermal lesions are light brown or bluish in color and have ill-defined margins, while mixed-type lesions are dark brown and less uniform (4). Recently, some digital 3D cameras have become available that can be used to determine hyperpigmented lesions. Although many treatment modalities have been used, sun protection remains the mainstay of melasma treatment due to its high risk of recurrence (5). Other treatment options for the disease include topical hydroquinone, retinoids,

azelaic acid, corticosteroids, kojic acid or chemical peels, mesotherapy, and platelet rich plasma (PRP). Recently, lasers and light-based treatments have become alternatives for the treatment of melasma. There are five major categories of light therapy and lasers used for the treatment of melasma: intense pulse light (IPL), Q switched lasers, ablative fractional resurfacing lasers, non-ablative fractional resurfacing lasers, and picosecond lasers (2).

The major side effects of using lasers and light sources for the treatment of melasma include post-inflammatory hyperpigmentation (PIH) and recurrence (5). More recently, fractional lasers have been discovered as a better option than classical ablative lasers. The 1550 nm erbium doped fiber laser was the first generation of fractional lasers used for the treatment of melasma (4). Next, the 1927 nm Thulium fiber laser was introduced in 2009 for the treatment of hyperpigmentation. The thulium laser targets water instead of pigment molecules, and has less risk of PIH compared to traditional lasers. The 1927 nm wavelength delivers energy up to 200  $\mu\text{m}$  into the papillary dermis. Therefore, it is generally used for epidermal lesions (3). However, the target of the 1927 nm thulium laser is the dermo-epidermal junction. In this study, we aimed to determine the efficacy and side effects of the 1927 nm Thulium fiber laser for the treatment of melasma.

## Materials and methods

In this study, patients who were admitted to our dermatology outpatient clinic between September 2015 and March 2018 and received Thulium laser treatment for the diagnosis of melasma were evaluated retrospectively. All of the 100 patients in this study had only thulium laser treatment for melasma. All of these patients had a history of topical treatments such as retinoids, corticosteroid, hydroquinone and azelaic acid previously. Patients who were not receiving any topical treatments at least one month were enrolled in this study. The study protocol was approved by the corporate clinical ethics committee (BAU KAEK 2017-14/04), and the study was performed in accordance with the ethical principles of the Helsinki declaration. Obtained from the medical records archives for each patient were socio-demographic characteristics, clinical findings, previous treatments, and treatment parameters. The melasma area and severity index (MASI) scoring system was used to determine the patients' lesional intensities and to evaluate the disease and treatment. The MASI score is calculated by the assessment of three factors, including area of involvement (A), darkness (D), and homogeneity (H). To calculate the MASI score, the face is subdivided into four regions, including the forehead (f): 30%, right malar region (rm): 30%, left malar region (lm): 30%, and chin (c): 10%. First, the area of involvement is calculated for each region and given a numeric value of 0–60, where 0 = no involvement, 1 = 10% involvement, 2 = 10%–29% involvement, 3 = 30%–49% involvement, 4 = 50%–69% involvement, 5 = 70%–89% involvement, and 6 = 90%–100% involvement. Darkness and homogeneity are rated on a scale from 0 to 4 (0 = absent; 1 = slight; 2 = mild; 3 = marked; and 4 = maximum). The MASI score is calculated by multiplying the sum of these ratings for darkness and homogeneity by the value of the area of involvement for each of the 4 facial areas as follows: MASI total score =  $0.3A(f)[D(f)+H(f)] + 0.3A(lm)[D(lm)+H(lm)] + 0.3A(rm)[D(rm)+H(rm)] + 0.1A(c)[D(c)+H(c)]$ . The total score ranges from 0 to 48 (6).

Patients were photographed prior to treatment and 6 months following the last treatment session. Patients were contacted following treatment and asked about their satisfaction with the treatment, which was evaluated by a 5-point Likert scale (1: I am not satisfied at all, 2: I am not satisfied, 3: I am indecisive, 4: I am satisfied, 5: I am very satisfied) (7). The device used in this study was a 1927 nm wavelength fractionated thulium fiber laser (LavieenBnA<sup>®</sup>, Wontech, South Korea).

Before treatment, topical lidocaine & prilocaine cream (EMLA<sup>®</sup> 5% cream, Astra Zeneca, AB, Sweden) was applied to the face for 30 minutes under tegadermal occlusion in order to achieve topical anesthesia. The treatment was performed by an attending experienced physician using 3 passes of a 9–10 mJ/shot with a 23 × 23 mm squared tip, which gave 30–50% surface area coverage. During treatment, epidermal protection was provided via cold air, which was generated by the cooling system on the hand piece. Two treatment sessions were repeated the same way at 1 month intervals. Common side effects included erythema, edema, scaling, melasma flare, and PIH. Following treatment, erythema was controlled with an ice pack, and patients were given SPF 50 sunscreen and some emollient creams. The patients were informed about the

necessity of using SPF 50 sunscreen regularly and continuously during the treatment and follow-up. The patients were not given any other treatment during the study and follow up period. All of the patients returned for follow-up 6 months after the last laser treatment. Two blinded dermatologists assessed each patient's clinical improvement using the MASI score and patient photographs. Statistical analyzes were performed using the IBM SPSS 22.0 program. Mean, standard deviation, median, and the lowest/highest, frequency, and ratio values were used to express descriptive values. The distribution of variables was analyzed with the Kolmogorov Smirnov test, while the Wilcoxon test was used to analyze repetitive measurements. The Chi square test was used to analyze qualitative data, and the Fisher test was used in cases where the chi square test did not meet test requirements. The Spearman correlation analysis was to determine correlations between the data.

## Results

This retrospective study included a total of 100 patients who were diagnosed with melasma and underwent thulium laser treatment in our dermatology outpatient clinic between September 2015 and March 2018

The patient demographics are shown in Table 1. According to medical records, ninety seven of the patients (97%) were female, and the mean age of the patients was  $37.8 \pm 49.2$  years. Fifty eight (58%) of the cases had Fitzpatrick skin phototype IV and thirty five (35%) had Fitzpatrick skin phototype III.

The majority of the patients had lesions on their cheeks (92%). Other locations for lesions included the forehead (47%), chin (21%), and above the upper lip (19%). The mean duration of the lesions was  $4.7 \pm 3.2$  years, and the mean baseline MASI score was  $11.8 \pm 6.3$ .

All of the patients had a history of topical treatments (retinoid, corticosteroid, hydroquinone and azelaic acid), while some had a history of laser treatment as well. Each patient underwent two treatment sessions at a one month interval. The majority of the patients stated that they felt only a slight pain during the treatment, and none of the

**Table 1.** Patient demographics.

	Min-Max	Median	Mean $\pm$ sd./n-%
Age	19,0-57,0	37,0	37,8 $\pm$ 9,2
Sex			
Female			97 97,0%
Male			3 3,0%
Duration of melasma	1,0-15,0	4,0	4,7 $\pm$ 3,2
FP skin type			
II			11,0%
III			3535,0%
IV			5858,0%
V			66,0%
Location			
Forehead			47 47,0%
Above the lips			1919,0%
Cheek			9292,0%
Chin			21 21,0%
Adverse events			
Flare			2 2,0%
Erythema			6161,0%
Edema			1919,0%
Skaling			4949,0%
PIH			33,0%
MASI	1,2-26,4	11,2	11,8 $\pm$ 6,3
Patient satisfaction	1,0-5,0	4,0	4,1 $\pm$ 0,9

FP:Fitzpatrick skin type.

patients dropped out of the study due to pain. Temporary side effects included erythema (61%), scaling (49%), and edema (19%). Post-inflammatory hyperpigmentation (3%) and melasma flare (2%) were rarely observed. Two of the patients who developed PIH were treated with platelet rich plasma (PRP) and mesotherapy for five sessions, which improved their conditions.

The mean MASI score after the first session was  $6.7 \pm 4.1$ , which was significantly different than the MASI score prior to treatment ( $p < .005$ ). The mean MASI score after the second session was  $3.4 \pm 3.8$ , which was significantly different from the MASI score after one month of treatment ( $p < .005$ ) (Table 2). The mean MASI score six months after treatment was  $2.6 \pm 4.3$ , which was significantly different from the MASI score after the second treatment ( $p < .005$ ) (Figures 1, 2). There was a significant positive correlation between the duration of melasma and the MASI score at pretreatment, the first month after treatment, and the second month after treatment ( $p < .005$ ). The mean patient satisfaction score was  $4.1 \pm 0.9$ . There was a significant negative correlation between the patient satisfaction score and the MASI score after the second treatment and the MASI score at six months after treatment ( $p < .005$ ).

### Discussion

Melasma is an acquired pigmentary disease that is most commonly seen in females. It is typically located on the face and is characterized by irregular hyperpigmented macules (1). The treatment of melasma is a challenge due to recurrence and post-treatment hypo/hyperpigmentation (1,4).

The first step of melasma treatment is the elimination of risk factors, including the use of sun protection and avoiding topical or systemic photo-sensitizer agents. Topical treatment may improve the disease, but the lesions often come back. The second line of therapy is chemical peels, but they may cause PIH due to inflammation (2).

The third line of melasma therapy includes laser and light based treatments for refractory cases. Ablative and non-ablative fractionated lasers are the newer treatment options for melasma (2). Fractionated lasers create columns of micro-thermal damage surrounded by untreated skin areas. These unaffected areas lead to better response and more rapid recovery. Non-ablative fractional lasers target water-containing tissues, and therefore, they can cause coagulative damage. There are four non-ablative fractional lasers (wavelengths 1440nm, 1540 nm, 1550 nm, and 1927 nm). The 1927 nm thulium fiber laser has greater absorption and coefficient than the other non-ablative fractional lasers (2), and therefore, it can target



Figure 1. Before treatment (left) and six months after treatment (right).



Figure 2. Before treatment (left) and six months after treatment (right).

epidermal pigmentation (4). Previous studies and case reports have established the effectiveness of the 1927 nm thulium laser for the treatment of melasma (3–5), photoaging (8,9), disseminated superficial actinic porokeratosis (10), rejuvenation (11), lichen sclerosus (12), actinic keratoses (13), actinic cheilitis (14), sclerodermoid graft versus host disease (15), pattern hair loss (16), and seborrheic keratoses (17).

Polder and colleagues performed a pilot study of thirteen patients treated with a 1927 nm fractional thulium fiber laser. The patients underwent three to four treatment sessions with one month intervals. The baseline MASI score was 10.1, and one month after the final treatment, the MASI score was 5.0 (5). Massaki et al studied the use of the 1927 nm fractional thulium fiber laser in twenty melasma patients, and found that the MASI score decreased from 13.2 to 8.5 four weeks following a single treatment session (3). The results of our current study are similar to those of these published studies.

Kwon et al performed an animal study to clarify the effect of the 1927 nm fractional thulium fiber laser in the Yucatan mini pig. They utilized histopathologic analysis, and recommended that lower energy levels be used for epidermal lesions. They determined that longer pulse durations and higher power levels resulted in more focal and deeper effects (18).

Lee and colleagues histologically analyzed 25 melasma patients who were treated with a 1927 nm thulium fiber fractional laser. Results indicated decreased melanin along

Table 2. Blinded clinicians MASI scores.

	Min-Max	Median	Mean±s.d.	p*	p**
<b>MASI</b>					
Pre-Treatment	1,2-26,4	11,2	11,8 ± 6,3		
PT 1st month	0,3-19,2	6,4	6,7 ± 4,1	<b>0,000<sup>w</sup></b>	
PT 2nd month	0,0-19,4	2,4	3,4 ± 3,8	<b>0,000<sup>w</sup></b>	<b>0,000<sup>w</sup></b>
PT 6th month	0,0-21,2	1,2	2,6 ± 4,3	<b>0,000<sup>w</sup></b>	<b>0,000<sup>w</sup></b>

<sup>w</sup> Wilcoxon test

p\*Difference between baseline MASI/p\*\*Difference between previous treatment session MASI

the basal layer and slight collagen regeneration after three treatment sessions at three week intervals (19).

Although non-ablative fractional lasers have fewer side effects than classical ablative lasers, erythema and edema are the most frequent adverse events seen immediately after treatment with the 1927 nm fractional thulium fiber laser (3–5,20). Crusting, PIH, and scar formation are other rare adverse events (4,19). PIH is more frequently seen in darker skin types with an incidence of 11 – 33% (4). In our current study, 58% of the patients had Fitzpatrick skin type IV and 35% of the patients had Fitzpatrick skin type III; nevertheless, PIH was noted in just three patients, which improved with five sessions of platelet rich plasma (PRP) and mesotherapy. The low incidence of PIH in our current study may be due to the fact that the treatment sessions were performed by an experienced physician, and there was a relatively short duration of follow-up.

Recurrence of melasma after treatment has been reported in the literature. Some authors defined a slight melasma relapse after three, six, or ten months of treatment (3–5). In our current study, however, the MASI score continued to decrease at the six month follow-up. Following each treatment sessions and during 6-month follow up period patients were given at least SPF 50 sunscreen and mild skin care products such as cleansing gel and moisturizing cream. All patients were also informed about the importance of sun avoidance, including wearing sunglasses and hats, the use of daily broad-spectrum sunscreen with ultraviolet A (UVA) and ultraviolet B (UVB) protection of at least SPF50. The patients were not given any other treatment during the laser therapy and follow up period. In this study the follow up period is 6 months. The rates of recurrence of melasma or the incidence of PIH may increase during the longer follow up periods in new studies. This study has a small sample size, and therefore these results need to be validated in bigger sample population studies. In the literature, there are a few studies with smaller sample sizes and the rate of recurrence and PIH is variable. Overall, future investigations are necessary to support the results of this study and explain the rate of recurrence and the incidence of PIH after thulium laser therapy for melasma.

In conclusion, the current study was conducted with the largest number of patients thus far. The current study demonstrated that the 1927 nm fractional thulium fiber laser is effective and safe for the treatment of melasma, even in darker skin types. Further prospective, randomized, and controlled studies are needed to optimize the treatment parameters and to further evaluate the efficacy and safety of the 1927 nm fractional Thulium fiber laser for melasma.

## References

- Ogbechie-Godec OA, Elbuluk N. Melasma: an up-to-date comprehensive review. *Dermatol Ther (Heidelb)*. 2017;7:305–18. doi:10.1007/s13555-017-0194-1.
- Trivedi MK, Yang FC, Cho BK. A review of laser and light therapy in melasma. *Int J Women's Dermatol*. 2017;3:11–20. doi:10.1016/j.ijwd.2017.01.004.
- Niwa Massaki ABM, Eimpunth S, Fabi SG, Guiha I, Groff W, Fitzpatrick R. Treatment of melasma with the 1,927-nm fractional thulium fiber laser: a retrospective analysis of 20 cases with long-term follow-up. *Lasers Surg Med*. 2013;45(2):95–101. doi:10.1002/lsm.22100.
- Ho SGY, Yeung CK, Chan NPY, Shek SY, Chan HHL. A retrospective study of the management of Chinese melasma patients using a 1927 nm fractional thulium fiber laser. *J Cosmet Laser Ther*. 2013;15(4):200–06. doi:10.3109/14764172.2012.761346.
- Polder KD, Bruce S. Treatment of melasma using a novel 1,927-nm fractional thulium fiber laser: a pilot study. *Dermatologic Surg*. 2012;38(2):199–206. doi:10.1111/j.1524-4725.2011.02178.x.
- Pandya AG, Hynan LS, Bhole R, Riley FC, Guevara IL, Grimes P, Nordlund JJ, Rendon M, Taylor S, Gottschalk RW, et al. Reliability assessment and validation of the Melasma Area and Severity Index (MASI) and a new modified MASI scoring method. *J Am Acad Dermatol*. 2011;64(1):78–83.e2. doi:10.1016/j.jaad.2009.10.051.
- Likert R. A technique for the measurement of attitudes. *Arch Psychol*. 1932;140:1–55.
- Polder KD, Harrison A, Eubanks LE, Bruce S. 1,927-nm fractional thulium fiber laser for the treatment of nonfacial photodamage: a pilot study. *Dermatologic Surg*. 2011;37(3):342–48. doi:10.1111/j.1524-4725.2011.01884.x.
- Brauer JA, McDaniel DH, Bloom BS, Reddy KK, Bernstein LJ, Geronemus RG. Nonablative 1927 nm fractional resurfacing for the treatment of facial photopigmentation. *J Drugs Dermatol*. [Internet]. 2014;13(11):1317–22. <http://www.ncbi.nlm.nih.gov/pubmed/25607696>.
- Ross NA, Rosenbaum LE, Saedi N, Arndt KA, Dover JS. Disseminated superficial actinic porokeratosis improved with fractional 1927-nm laser treatments. *J Cosmet Laser Ther*. 2016;18(1):53–55. doi:10.3109/14764172.2015.1063657.
- Boen M, Wilson MJV, Goldman MP, Wu DC. Rejuvenation of the male scalp using 1,927 nm non-ablative fractional thulium fiber laser. *Lasers Surg Med*. 2017;49(5):475–79. doi:10.1002/lsm.22624.
- Mercuri SR, Brianti P, Foti A, Bartolucci M, Dattola A, Nisticò SP. Penile lichen sclerosus treated with 1927 nm thulium fiber laser and photodynamic therapy: a new possible therapeutic approach. *Photomed Laser Surg*. [Internet]. 2018 Jan 3;36:333–36. doi:10.1089/pho.2017.4386.
- Weiss ET, Brauer JA, Anolik R, Reddy KK, Karen JK, Hale EK, Brightman LA, Bernstein L, Geronemus RG. 1927-nm fractional resurfacing of facial actinic keratoses: a promising new therapeutic option. *J Am Acad Dermatol*. 2013;68(1):98–102. doi:10.1016/j.jaad.2012.05.033.
- Ghasri P, Admani S, Petelin A, Zachary CB. Treatment of actinic cheilitis using a 1,927-nm thulium fractional laser. *Dermatologic Surg*. 2012;38(3):504–07. doi:10.1111/j.1524-4725.2011.02262.x.
- Peters K, Jones IT, Goldman MP. Treatment of sclerodermoid graft-versus-host disease with the fractionated nonablative 1,927 nm thulium fiber laser. *Dermatologic Surg*. 2018;44(12):1659–60. doi: 10.1097/DSS.0000000000001505. [https://journals.lww.com/dermatologysurgery/Fulltext/publishahead/Treatment\\_of\\_Sclerodermoid\\_Graft\\_Versus\\_Host.98772.aspx](https://journals.lww.com/dermatologysurgery/Fulltext/publishahead/Treatment_of_Sclerodermoid_Graft_Versus_Host.98772.aspx).
- Cho SB, Goo BL, Zheng Z, Ho Yoo K, Kang J-S, Kim H. Therapeutic efficacy and safety of a 1927-nm fractionated thulium laser on pattern hair loss: an evaluator-blinded, split-scalp study. *Lasers Med Sci*. 2018;33(4):851–59. doi: 10.1007/s10103-018-2437-5.
- Polder KD, Mithani A, Harrison A, Bruce S. Treatment of macular seborrheic keratoses using a novel 1927-nm fractional thulium fiber laser. *Dermatologic Surg*. 2012;38(7PART 1):1025–31. doi:10.1111/j.1524-4725.2012.02427.x.
- Kwon IH, Bae Y, Yeo UC, Lee JY, Kwon HH, Choi YH, Park GH. Histologic analyses on the response of the skin to 1,927-nm fractional thulium fiber laser treatment. *J Cosmet Laser Ther*. 2018;20(1):12–16. doi:10.1080/14764172.2017.1358455.
- Lee HM, Haw S, Kim JK, Chang SE, Lee MW. Split-face study using a 1,927-nm thulium fiber fractional laser to treat photoaging and melasma in Asian skin. *Dermatologic Surg*. 2013;39(6):879–88. doi:10.1111/dsu.12176.
- Lee SM, Kim MS, Kim YJ, Won CH, Lee MW, Choi JH, Moon KC, Chang SE. Adverse events of non-ablative fractional laser photothermolysis: a retrospective study of 856 treatments in 362 patients. *J Dermatol Treat*. 2014;25(4):304–07. doi:10.3109/09546634.2013.777151.