Assessment of treatment in melasma by picosecond laser at 108 Military Central Hospital

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Summary

Background: Melasma is a common acquired, chronic hypermelanosis, more common in women and dark skin types, less dangerous but greatly affects aesthetics. The picosecond laser have been used with good effectiveness on melasma. *Objective:* To evaluate the efficacy and safety of a picosecond laser (Picoplus, Lutronic, Korea) on patients with melasma. *Subject and method:* We conducted a comparative longitudinal descriptive study in 58 dermal and mixed melasma patients (100% females), middle-aged, with initial severe MASI underwent treatments in 108 Military Central Hospital from 7/2017 to 12/2018 with picosecond laser. *Result:* Good/excellent improvement 28.9%, fair 42.2% after 8 treatment sessions. All most patient was no side effect, only 3.4% patients had temporary burning sensation. *Conclusion:* Treatment of melasma using a picosecond laser is an effective and safe method. However, the disadvantage of the method is the multistage procedure.

Keywords: Melasma, picosecond laser, picoplus.

1. Background

Melasma originates from the Greek "melas", meaning black, and is described in Hippocrates' literature (470 - 360 BC) [1]. It is recognized as local bilateral areas of hyperpigmentation seen as light to dark brown patches on sun-exposed facial skin [2]. So far, the actual etiology and pathogenesis of melasma has not been fully understood. Various therapeutic modalities that have been used in attempting to treat melasma include topical bleaching agents, chemical peels and various laser treatment. From 1983, based on Anderson and Parrish's concept of selective photothermolysis (SP), Q-switched laser (nanosecond pulse width) has been an effective treatment of hyperpigmentation in common, especially in melasma . However, some undesirable events have reported as the mottled hypopigmentation (MH) and rebound hyperpigmentation (RH), it may involve excessive cumulative photothermal effects [4], [5]. In 2012, the picosecond laser was approved by the FDA for the treatment of tattoos and pigmentation. Laser picoseconds have extremely short pulse widths (picoseconds). Extremely high energy will cause selective destruction of target tissues through the photoelectric effect of plasma formation and shock shock formation, thereby limiting the thermal effects on pulsed tissues . As a result, many authors believe that picosecond lasers will produce better results in treating pigmented lesions, including melasma, with minimal side effects.

At present, there are few studies in the world to really evaluate the effectiveness of 1064nm picosecond laser in treating melasma. In Vietnam, researches on picosecond laser is still very limited.

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Therefore, we implemented research projects: *Assessment of treatment in melasma by picosecond laser at 108 Military Central Hospital.*

2. Subject and method

Subject

58 melasma patients were treated at 108 Military Central Hospital from 7/2017 to 12/2018.

Inclusion criteria: Patients diagnosed with melasma with complete management information; sufficient photographs before each treatment; adequate treatment (at least 5 treatments) and re-examination on time.

Exclusion criteria: Patients with a history of photosensitivity, skin diseases in the treatment area; pregnant or breast breeding; use of the oral contraceptives pill or hormone replacement therapy.

Study design: Intervention studies, cross-sectional descriptions, vertical monitoring, and self-comparison.

Laser treatment

Pico toning treated by 1064nm Nd:YAG (Pico Plus, Lutronic) with spot size 8mm, 0.65 – 0.8J/cm^2 pulse energy, 10Hz pulse repetition rate. Two to three passes were made over the entire hyperpigmentation area of the face with a 20 - 30% overlap. The clinical end point was immediate light lightening of hair follicles or reraly mild erythema without petechiae. Patients received 1-month intervals.

Assessment of response

Two blinded independent dermatologists reviewed the clinical photographs to determine the degree of improvement and scored the MASI, as well as any complications. The MASI at base were noted T1. The effectiveness of cross-sectional treatment in December 2018 was assessed by changing the MASI after 4th (T2) and 8th treatments (T3).

MASI calculation method:

MASI: Melasma area and severity index							
MASI = 0.3 A(f).(D(f)+H(f)) + 0.3 A(rm).(D(rm) + H(rm)) + 0.3 A(lm).(D(lm) + H(lm)) + 0.1 A(c).(D(c) + H(c))							
	0	1	2	3	4	5	6
A: Surface are involved		< 10%	10% - 29%	30% - 49%	50% - 69%	70% - 89%	90%-100%
D: Darkness of pigment	None	Slight	Moderate	Marked	Very marked		
H: Homogeneity of pigment	None	Specks	< 2cm patches	> 2cm patches	Homogeneous		
Site involved	F: Forehead Rm: Right malar Lm: Left malar C: Chin						

Melasma	**Mild**	**Moderate**	**Severe**	**Very severe**
MASI	< 5.5	5.5 - <8.7	8.7 - <13.1	13.1 - 48

Assessment of the treatment effect (by improving MASI):

Excellent: Compared with before treatment, MASI is reduced by ≥ 75%.

Good: Compared with before treatment, MASI was reduced by 50% - 74%.

Fair: MASI decreased by 25% - 49% compared to before treatment.

Poor: MASI was reduced by < 25% compared to before treatment.

Safety assessments

Any possible complications and side effects (erythema, edema, burning, petechiae, postinflammatory hypopigmentation, and hyperpigmentation...) were recorded at each visit.

Analysis method: Statistical analysis was made using SPSS® 16.0 software package. Descriptive statistics were presented as mean ± standard deviation. The statistical significance value was accepted as p<0.05.

3. Result

3.1. Characteristics of participants

Table 1. Patient characteristics (n = 58)

Sex	Female	58/58 (100%)
Age (years)	Mean	42.4 ± 5.42
	Min-Max	31 - 57
Skin type	III	8/58 (13.8%)
	IV	50/58 (86.2%)
Type of melasma	Dermal and mixed melasma	58/58 (100%)
Mean MASI score at basement	12.17 ± 4.43	

100% of patients in the study group were middle-aged women. In the research team, the skin type was mainly type IV (86.2%), and the most common melasma was dermal and mixed melasma occupied 100%.

Table 2. Patient's skin condition characteristics (n = 58)

Skin condition		n	%
Telangiectasias	Yes	21/58	36.2
Aging skin (very dry/ wrinkled/very loose)	Yes	12/58	20.7

Melasma may be related to many other skin aging conditions: 36.2% of patients had a combination with telangiectasias; and 20.7% of patients had aging skin.

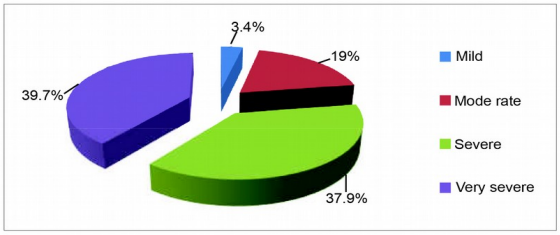

Figure 1. Classification of MASI levels before treatment (n = 58)

Patients were mainly concentrated in the severe and very severe pigmentation group, accounting for 77.6%.

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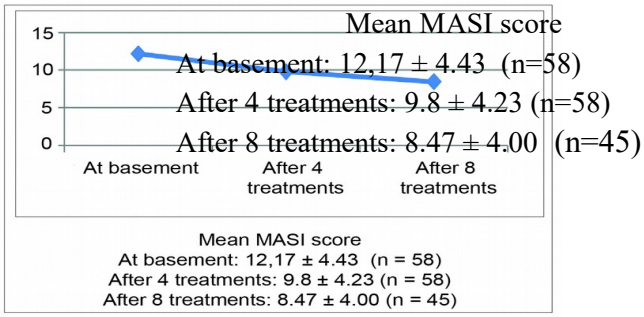

Figure 2. Mean MASI score after treatments

After evaluation, the mean MASI score gradually decreased from 12.17 ± 4.43 (n = 58) to 8.47 ± 4.00 (n = 45) after 8 picotoning treatments, MASI reduced approximately about 30.4%.

Table 3. Improvement level after treatments

Improvement level	After 4 treatments		After 8 treatments	
	n	%	n	%
Good/excellent (≥ 50%)	6	10.3	13	28.9
Fair (25 - 49%)	19	32.7	19	42.2
Poor (< 25%)	33	57	13	28.9
Total	58		45	
Not yet treated			9	

The more sessions, the better effects with increasing good/excellent improved from 10.3 to 28.9%.

Table 4. Side effects

Side effects	n	%
No side effect	*56*	96.6
Burning	2	3.4

Hyper/hypopigment	0	0
Total	***58***	***100***

Most patients in the study group showed no side effects after treatment (96.6%), and only 3.4% of patients had a burning sensation immediately after treatment.

4. Discussion

Patient clinical research group

The results in Table 1 shows that 100% of the patients in the study group were female (58/58), the average age was 42.4 ± 5.42 years, and the main skin type was Fitzpatrick IV (86.2%), dermal and mix type of melasma (100%). Our results are similar to those of Goh (1999), a retrospective study of the clinical characteristics of 205 melasma patients was performed at the Singapore Dermatology Centre. The results showed that the ratio of women to men was 21: 1, with an mean age was 42.3, and 90% of the skin types were III, IV [7]. All type of melasma in our study was dermal and mixed melasma (100%). Melasma can be of epidermal, dermal, or most commonly of mixed type (Shah et al 2019) [8].

Table 2 indicates that melasma may be related to some other skin aging conditions, for example: 36.2% of patients with telangiectasia; 20.7% with poor skin quality. Passeron et al (2018) [9] also provided evidence based on epidemiology, physiology, and histopathology that melasma is a skin aging lesion, so melasma can show other signs of skin aging, such as telangiectasia, age spots, dry skin, sagging skin ...

According to the MASI score, the severity of melasma is divided into 4 levels: Mild (< 5.5), moderate (5.5 - 8.7), severe (8.7 - 13.1), and very severe (> 13.1). The MASI score before treatment of patients in the study group were mainly concentrated in the severe group (37.9%) and the very severe group (39.7%) (Figure 1). Our results are similar to those of Seleit et al (2017), who studied 45 melasma patients in India, of whom 31.1% were severe melasma patients and 53.3% were very severe melasma patients [10].

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Figure 2 shows that the mean MASI score per treatment gradually decreased from 12.17 ± 4.43 (T_1, n = 58) to 9.8 ± 4.23 (T_2, n = 58) after 4 sessions, to 8.47 ± 4.00 (T_3, n = 45) after 8 treatments (because our study is a cross-sectional study, the sessions of patients will be *different);* the more treatment, the more improvement (T_1-T_2; T_1-T_3). The mean MASI score reduction significantly after 4, 8 treatments were 2.37 (T_1-T_2), 1.33 (T_2-T_3); it shows that the first 4 treatments was more effective than the second 4 following treatments. Chalermchai et al (2018) [11] conducted a randomized controlled study of 30 patients with derma and mixed melasma received fractional picosecond 1,064nm laser plus 4% hydroquinone cream on one randomly assigned side of the face; the results were compared to the use of hydroquinone cream only on the contralateral side. Treatment results were assessed by MASI scores at 4 weeks, 8 weeks, and 12 weeks after treatment (1 week intervals). The results showed that in half of the face, the combination of picosecond laser and topical cream was more effective, and the mean MASI score decreased from 9.46 to 3.52, with the most significant decrease in MASI is the first 4 treatments, and more than the second and the third 4 following treatments (shows in the gradient of the line chart over each 4 weeks in Figure 3 - we cited in the author's study).

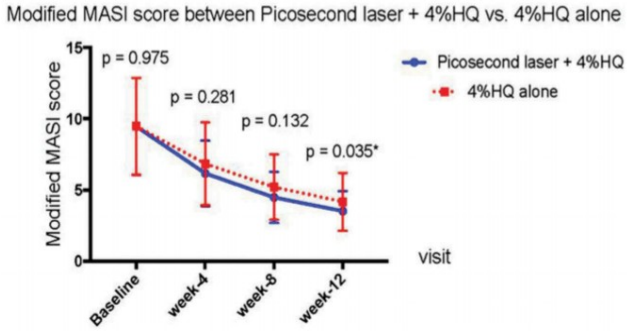

Figure 3. Improvement of MASI after 4 treatments (Chalermchai (2018))

This can be explained that the epidermal melanosis is more easily absorbed and destroyed by the laser than the dermal melanosis (which occurs after the basal cell layer in the inflamed skin is

destroyed; macrophages can then phagocytize the degenerating basal keratinocytes and melanocytes, both of which contain a large amount of melanin that can remain in the upper dermis for a long time [12]). Kang et al (2010) [13] believed that's the therapeutic outcome depended on the depth of melanin so that dermal or mixed type melasma is difficult to treat. Chalermthai et al also show that 50% improvement from the baseline of modified melasma area severity index score (MASI-50) at week 4, 8, and 12 gradually increased 33.3%, 70.0% and 76.6%. Similar to authors, our results after 4, 8 and 12 treatments, the proportion of good/excellent improvement increased, while the proportion of poor improvement decreased (Figure 2, Table 3). However, our patient improvements was less than Chalermthai because our initial melasma levels was more severe (mean MASI score was 12.17).

Ye Jin Lee et al (2017) [14] presented a case report of 2 patients with melasma and 1 patient with post-inflammatory hyperpigmentation (PIH) were treated with a picosecond laser (all patients had multiple previous low-fluence QSNY laser treatments but were no longer responding to such treatments). After 6.14 and 7 sessions, patient 1 showed fair improvement and patients 2 and 3 showed good improvement. Because the number of treatment require many sessions, our patients need to treat more.

Table 4 shows that most patients in the study group appeared to have no side effects after treatment (96.6%),only 3.4% of patients had a temporary burning sensation immediately after treatment and no one undergone hyper/ hypopigmentation. The result of Ye Jin Lee et al (2017) [14] showed that laser treatment was well tolerated with minimal downtime. No post-laser erythema, blistering, petechial or PIH was reported.

5. Conclusion

Picosecond laser is effective (good/excellent improvement 28.9%; fair 42.2% after 8 treatment sessions) and safe (96.6% without complications, 3.4% of patients had temporary burning sensation after treatment). However, it require many sessions of treatment.

Conflicts of interest: None.

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