ORIGINAL RESEARCH PAPER
Volume - 15 | Issue - 08 | August - 2026 | PRINT ISSN No. 2277 - 8179 | DOI : 10.36106/ijsr
INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

DERMOSCOPY IN BIOPSY-PROVEN MELASMA: OBJECTIVE DERMOSCOPIC PATTERNS, HISTOPATHOLOGICAL CORRELATION, AND CLINICAL UTILITY

Dermatology

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ABSTRACT

Background: Melasma is a common acquired pigmentary disorder with chronicity, relapse tendency, and variable therapeutic response. Dermoscopy is a non-invasive in vivo tool that allows objective assessment of pigment distribution, follicular sparing, and vascular structures. Objective: To objectively document dermoscopic patterns in biopsy-proven melasma and correlate key dermoscopic findings with histopathological features.**Methods:** This hospital-based observational study included 63 patients with clinically suspected melasma that was confirmed histopathologically. Each patient underwent standardized clinical assessment, polarized dermoscopy, and lesional skin biopsy. Dermoscopic variables were recorded as predefined objective parameters: clinical subtype, pigment pattern, predominant color, perifollicular change, dots/globules, arcuate/annular structures, and telangiectasia.**Results:** The age of patients ranged from 18 to 52 years, with a mean age of 31.57 +/- 9.93 years. Centrofacial melasma was the most common clinical pattern, followed by malar and mandibular melasma. The reticuloglobular/pseudoreticular pigmentary pattern was the predominant dermoscopic morphology across clinical subtypes. Brown pigmentation predominated in malar (52.2%) and mandibular (57.1%) melasma, whereas mixed brown-gray pigmentation was most frequent in centrofacial melasma (45.7%). Telangiectasia was most frequent in centrofacial melasma (42.9%), followed by malar (30.4%) and mandibular (14.3%) melasma. Differences among clinical subtypes were not statistically significant ($P > 0.05$). Histopathology confirmed melasma in all cases and showed epidermal/basal hypermelanosis, variable dermal melanophages/pigmentary incontinence, and solar elastosis, with no atypical melanocytic proliferation.**Conclusion:** Dermoscopy provides an objective, repeatable method for assessing pigmentary and vascular components of melasma. The observed dermoscopic findings showed clinicopathological concordance with biopsy findings and support the use of dermoscopy for diagnosis, documentation, and follow-up of melasma.

KEYWORDS

Melasma; Dermoscopy; Histopathology; Reticuloglobular Pattern; Perifollicular Sparing; Telangiectasia

INTRODUCTION

Melasma is an acquired hypermelanosis that commonly affects sun-exposed facial areas and typically presents as symmetrical light-to-dark brown macules or patches. It is frequently chronic and relapsing, and its evaluation is clinically important because treatment response varies according to pigment depth and associated dermal or vascular changes.

Traditional assessment with clinical examination and Wood's lamp can be limited, particularly in darker skin phototypes. Dermoscopy provides enhanced visualization of epidermal and superficial dermal structures and can document pigment networks, perifollicular changes, dots or globules, and vascular components. Reported dermoscopic features of melasma include pseudoreticular or reticuloglobular pigmentation, brown/gray granules and globules, arcuate or annular structures, sparing of follicular and sweat gland openings, and telangiectasia [1-4].

Histopathology in melasma typically demonstrates epidermal/basal hypermelanosis, pigmentary incontinence or dermal melanophages, solar elastosis, and vascular/dermal changes, supporting the concept of melasma as more than a purely epidermal pigmentary disorder [6]. The present study was formatted to objectively describe dermoscopic findings in biopsy-proven melasma and correlate them with histopathological features.

MATERIALS AND METHODS

Study design and setting

This was a hospital-based observational study conducted in the Department of Dermatology, Venereology and Leprology at Mahatma Gandhi Medical College and Hospital, Jaipur. The study period was July 2022 to December 2023.

Study population

Patients of all age groups and both sexes presenting with clinically suspected melasma were considered for inclusion. Only histopathologically confirmed cases were included in the final analysis. The final study population comprised 63 biopsy-proven melasma patients.

Inclusion and exclusion criteria

Inclusion criteria were clinically suspected melasma with consent for dermoscopic evaluation and lesional biopsy. Patients with active cutaneous infection over the lesion, invasive procedures over the lesion in the preceding six months, topical application over the lesion within the previous seven days, or ongoing treatment for pigmentation disorders in the preceding six months were excluded.

Clinical assessment

Each patient underwent clinical examination and classification into centrofacial, malar, or mandibular melasma based on predominant anatomical distribution. Demographic variables and clinical subtype were recorded on a predefined proforma.

Dermoscopy protocol

Dermoscopy was performed using a handheld polarized dermoscope (DermLite DL3). Images were assessed under standardized parameters. Each dermoscopic feature was recorded objectively as present/absent or as a predefined categorical variable, as shown in Table 1.

Histopathological evaluation

Lesional skin biopsy was performed in all included patients after informed consent. Hematoxylin and eosin-stained sections were examined for objective histopathological variables including epidermal hypermelanosis, basal layer pigmentation, dermal melanophages /pigmentary incontinence, solar elastosis, and atypical melanocytic proliferation.

Statistical analysis

Continuous variables were expressed as mean +/- standard deviation and range. Categorical variables were expressed as frequency and percentage. Associations between dermoscopic features and clinical subtypes were analyzed using the chi-square test or Fisher's exact test, as appropriate. A P value < 0.05 was considered statistically significant.

Table 1. Objective operational definitions used for dermoscopic and histopathological assessment.

Domain	Variable	Objective recording	Interpretation
Clinical	Clinical subtype	Centrofacial / malar/mandibular	Anatomical distribution pattern
Pigment pattern	Reticuloglobular / pseudoreticular pattern	Present / absent	Organized pigment network with globules/granules
Pigment color	Predominant color	Brown / gray / mixed brown-gray	Brown: epidermal predominance; gray or mixed: dermal/ mixed component
Follicular change	Perifollicular sparing or accentuation	Present / absent	Sparing of follicular/eccrine openings supports melasma pattern
Additional pigment structures	Dots, globules, granules, arcuate /annular structures	Present / absent	Supports composite dermoscopic signature of melasma
Vascular	Telangiectasia	Present / absent	Objective marker of vascular component
Histopathology	Epidermal/basal hypermelanosis	Present / absent	Epidermal melanin increase
Histopathology	Dermal melanophages / pigmentary incontinence	Present / absent	Dermal or mixed component
Histopathology	Solar elastosis	Present / absent	Chronic photodamage
Histopathology	Atypical melanocytic proliferation	Present / absent	Exclusion of melanocytic neoplasia

RESULTS

Patient profile

A total of 63 histopathologically confirmed patients with melasma were included in the final analysis. The age of patients ranged from 18 to 52 years, with a mean age of 31.57 +/- 9.93 years. Centrofacial melasma was the most frequently observed clinical subtype, followed by malar and mandibular melasma.

Table 2. Objective summary of study population and diagnostic confirmation.

Parameter	Objective value	Format used
Total patients analyzed	63	n
Diagnostic status	Biopsy-proven melasma in all cases	n = 63
Age range	18-52 years	range
Mean age	31.57 +/- 9.93 years	mean +/- SD
Most common clinical subtype	Centrofacial melasma	categorical ranking
Other clinical subtypes	Malar, followed by mandibular	categorical ranking

Objectified dermoscopic findings

The reticuloglobular/pseudoreticular pigmentary pattern was the predominant dermoscopic morphology across clinical subtypes. The dermoscopic spectrum included brown pigmentation, mixed brown-gray pigmentation, perifollicular sparing or accentuation, brown dots/globules, arcuate or annular structures, and telangiectasia. These findings were recorded as objective categorical variables rather than descriptive impressions.

Table 3. Objectified dermoscopic findings by clinical subtype.

Clinical subtype	Predominant pigmentary finding	Value	Telangiectasia	Statistical inference
Centrofacial	Mixed brown-gray pigmentation	45.7%	42.9%	Not significant (P > 0.05)
Centrofacial	Brown pigmentation	41.4%	42.9%	Not significant (P > 0.05)
Malar	Brown pigmentation	52.2%	30.4%	Not significant (P > 0.05)
Mandibular	Brown pigmentation	57.1%	14.3%	Not significant (P > 0.05)

Note: Values are shown as percentages because subgroup-wise absolute denominators were not provided in the supplied text. Absolute n/N values should be inserted from the final master datasheet before journal submission.

Brown pigmentation predominated in malar melasma (52.2%) and mandibular melasma (57.1%). In centrofacial melasma, mixed brown-gray pigmentation was most frequent (45.7%), followed by brown pigmentation (41.4%). Telangiectasia was most frequently observed in centrofacial melasma (42.9%), followed by malar (30.4%) and mandibular (14.3%) melasma. Differences in pigment pattern, color distribution, perifollicular changes, and vascular findings among clinical subtypes were not statistically significant (P > 0.05).

Objectified histopathological findings

Histopathological examination confirmed the diagnosis in all 63 patients. Biopsy findings were consistent with melasma and included epidermal hypermelanosis with increased basal layer pigmentation, variable dermal melanophages/pigmentary incontinence, and solar elastosis. No atypical melanocytic proliferation was identified in any case.

Table 4. Objective histopathological findings and dermoscopic correlation.

Histopathological feature	Status in study	Objective interpretation	Dermoscopic correlation
Epidermal hypermelanosis / increased basal pigmentation	Observed as a diagnostic melasma feature	Epidermal melanin increase	Brown network, brown granules/globules
Dermal melanophages / pigmentary incontinence	Variable	Dermal or mixed pigment component	Gray or mixed brown-gray pigmentation
Solar elastosis	Observed as a melasma-associated feature	Chronic photodamage	Supports photoaging/vascular component
Atypical melanocytic proliferation	Absent in all cases	Benign non-neoplastic process	No dermoscopic suspicion of melanocytic neoplasia

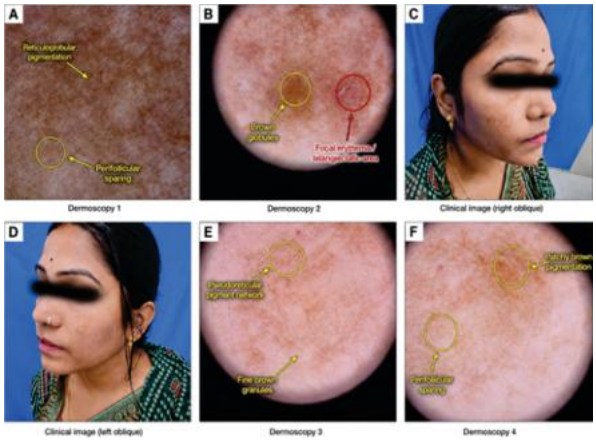

Figure 1. Representative clinical and dermoscopic findings in melasma.

Clinical photographs (C, D) demonstrate bilateral malar hyperpigmented macules/patches. Dermoscopic examination (A, B, E, F) reveals characteristic features of melasma, including **reticuloglobular/ pseudoreticular pigment network, brown globules/granules, patchy brown pigmentation, perifollicular sparing,** and **focal telangiectatic/ erythematous areas**. These findings support the diagnosis of melasma and indicate both pigmentary and vascular components.

Graphical Representation

The key dermoscopic findings are summarized graphically in Figures 1 and 2. Figure 1 shows the predominant pigmentary finding by clinical subtype, and Figure 2 shows the frequency of telangiectasia by clinical

subtype.

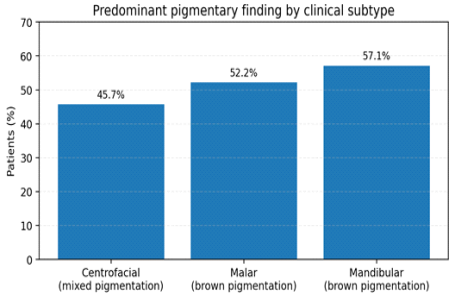

Figure 1. Predominant dermoscopic pigmentary findings across clinical subtypes of biopsy-proven melasma.

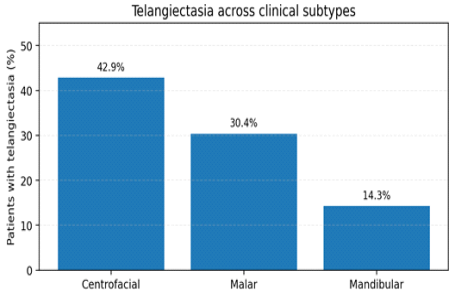

Figure 2. Frequency of telangiectasia across clinical subtypes of biopsy-proven melasma.

DISCUSSION

This study objectively evaluated dermoscopic and histopathological findings in 63 biopsy-proven melasma patients. The use of biopsy confirmation strengthens diagnostic validity and allows direct clinicodermoscopic-histopathological correlation.

The most consistent dermoscopic morphology in this cohort was the reticuloglobular/pseudoreticular pigmentary pattern. This finding is aligned with published descriptions of melasma, in which pseudoreticular pigmentation, brown or gray granules/globules, arcuate and annular structures, perifollicular or eccrine sparing, and telangiectasia are recognized features [1-4].

The color-based dermoscopic assessment helps objectify pigment depth. Brown pigmentation suggests a predominantly epidermal component, whereas gray or mixed brown-gray pigmentation suggests dermal melanophages or pigmentary incontinence. In the present cohort, malar and mandibular melasma more often showed brown pigmentation, while centrofacial melasma more frequently showed mixed brown-gray pigmentation. Although these trends may suggest differing pigment depth, the differences did not reach statistical significance.

Telangiectasia was most frequent in centrofacial melasma. This supports the concept that melasma may include a vascular component, especially in chronically sun-exposed facial areas. Recording telangiectasia as a binary objective variable is clinically useful because vascular prominence may influence treatment planning and monitoring.

Histopathology confirmed melasma in all patients. The presence of epidermal/basal hypermelanosis correlated with brown dermoscopic pigmentation, while dermal melanophages or pigmentary incontinence correlated with gray or mixed brown-gray pigmentation. Solar elastosis supported the role of chronic photodamage. The absence of atypical melanocytic proliferation in all cases reinforced the benign diagnosis and excluded melanocytic neoplasia.

Clinical Utility

- Objective documentation of pigmentary and vascular features at baseline.
- Stratification of epidermal, dermal, and mixed pigment components based on dermoscopic color.
- Differentiation from facial melanosis mimics such as exogenous ochronosis, lichen planus pigmentosus, Hori nevus, and lentigo maligna-like lesions.
- Selection of representative biopsy sites in atypical or refractory pigmentation.
- Serial follow-up of treatment response and early relapse detection.

Limitations

The study was single-center and included 63 patients. Subgroup-wise absolute denominators for all dermoscopic features were not available in the supplied text, so selected results are presented as percentages. Inter-observer variability for dermoscopic interpretation was not formally assessed. Longitudinal follow-up for treatment response was outside the scope of the present analysis.

CONCLUSION

Dermoscopy is a valuable, non-invasive adjunct for objective assessment of biopsy-proven melasma. The reticuloglobular/pseudoreticular pattern, brown or mixed brown-gray pigmentation, perifollicular sparing or accentuation, brown dots/ globules, arcuate/ annular structures, and telangiectasia form an objective dermoscopic profile of melasma. Histopathological confirmation in all cases showed epidermal/basal hypermelanosis, dermal melanophages/ pigmentary incontinence, and solar elastosis, with absence of atypical melanocytic proliferation. Incorporating dermoscopy into routine evaluation can improve diagnostic confidence, guide treatment selection, and provide a reproducible tool for follow-up.

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