

## Mapping the lip terrain: Mucoscopic study of lip disorders - a cross sectional study

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### Abstract:

**Background:** The non-invasive diagnostic tool known as mucoscopy enables doctors to examine and differentiate the various conditions affecting the lips & other mucosal surfaces using dermoscopic methods. The study focuses on understanding mucoscopic patterns of different lip conditions in the Indian population since current research about this field remains limited. The goal is to improve clinical diagnoses through mucoscopy while minimizing invasive tests. **Materials and Methods:** The observational research design was performed spanning one year from May 2023 until May 2024 at a tertiary care teaching hospital. The research included 164 subjects who were all at least 18 years old with lip lesions. The study obtained patient consent before professionals recorded thorough clinical histories along with patient examinations. The DermLite DL5 dermatoscope examined lip lesions under different modes that included ultraviolet, polarized, and non-polarized. The investigators utilized ice caps along with Isopropyl alcohol interface fluid during dermatoscope examination.

**Results:** Lip vitiligo and smoker's melanosis were diagnosed in 45 patients (27.4%) and 25 patients (15.2%) among the total 164 patients who underwent examination. Mucocele appeared in 4 patients (2.4%). Mucoscopic examination showed four main findings which were altered pigment networks with polyglobular structures and blackish-gray homogenous areas with dots and vascular patterns appearing as linear and branched vessels. Examination of mucoceles revealed reddish-white structureless zones along with bleeding spots that extended throughout the tissue area. The examined patterns showed two distinct sets of findings: perifollicular hypopigmentation along with keratotic papillae that had a halo rim and both blotchy erythema and scaling occurred. **Conclusion:** Mucoscopy functions as an accessible diagnostic method to care for lip disorders and can help detect abnormalities before requiring biopsy in numerous situations. Doctors can enhance patient outcomes by detecting the distinctive patterns that indicate either vitiligo or smoker's lips or mucocele so they can provide timely medical treatment. Mucoscopy should be included as an important extra tool during normal dermatologic and oral examination practice.

## Introduction

External factors and internal systemic factors expose the lips since they belong to the oral mucosa and thus create susceptibility to multiple dermatological and mucosal conditions. Proper early identification of lip conditions remains vital because it enables both efficient treatment evaluation as well as detecting the initial stages of cancerous tissue development. The current diagnostic approaches depend on both medical evaluations and tissue examination although these procedures are both invasive to patients and cannot deliver rapid diagnostic outcomes.

The non-invasive diagnostic method known as dermatoscopy now operates as mucoscopy to examine mucosal surfaces after adapting its use from skin lesion evaluations. The technique enables direct visualization of hidden subsurface features and blood vessels which normal eyes cannot see because it leads to faster diagnoses of mucosal lesions (1). The use of mucoscopy proves effective for discerning minimal pigmentary along with vascular changes in conditions like lichen planus vitiligo and mucocles (2,3).

Routine clinical practice incorporates mucoscopy with limited effectiveness especially for treating lip-related disorders. The lack of standardization together with poor awareness and inadequate literature on precise mucoscopic features of different lip pathologies hinders their wider application. Dermoscopic examinations of lip lesions in different population groups need more extensive investigation because limited systematic research exists.

The advancement of dermoscopic technology through high-resolution polarized and ultraviolet mode designs now enables scientists to study mucosal surfaces more clearly. Mucoscopy helps health professionals observe specific attributes like pigment networks and vascular structures and scales and structureless zones that clinicians might otherwise miss while doing standard clinical assessments. Mucoscopic evaluation delivers valuable diagnostic clues to healthcare providers for distinguishing smoker's melanosis along with

actinic cheilitis and discoid lupus erythematosus from potentially dangerous or infectious lesions (4,5). The benefit of mucoscopy includes continuous observation of lesion development and treatment effects which makes it an essential tool for follow-up assessments.

Widespread investigation of mucoscopy diagnostic capability in oral conditions exists but limited confirmation about its applicability to lip conditions occurs (6,7). Several studies demonstrate that oral lichen planus displays mucoscopic features that include three distinct patterns: white reticular lines (Wickham striae) along with reddish structureless areas and changes in blood vessel appearance - all of these findings can also be seen in lip presentations (8). Standardized dermoscopic terminology together with insufficient population-based studies makes it challenging for doctors to determine precise diagnosis criteria between different lip conditions. Widespread adoption of this method remains restricted for both dermatology and dental practice.

The growth of oral and lip disorders caused by smoking and systemic immunologic conditions and UV exposure requires simple non-invasive cost-effective diagnostic methods. The diagnostic deficiencies in detecting premalignant transformations are solved successfully through mucoscopy which assists medical professionals in spotting early potential cancer markers specifically for at-risk populations. Health facilities that lack biopsy and histopathology capabilities can implement mucoscopy as an important diagnostic instrument for their patients.

The current research initiative works to link the knowledge gap through its assessment of mucoscopic patterns in various lip conditions found in tertiary care facilities. The analysis of specific features for different conditions within this study will enhance both accuracy of medical diagnoses and permit earlier treatments while reducing the requirement for invasive testing.

## Materials and Methods

A one-year duration research involved patient observations at a tertiary care teaching hospital

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during the period of May 2023 to May 2024 through this cross-sectional observational study. The researchers examined mucoscopic patterns across different lip disorders that appeared in patients during clinical examination.

### Study Population

The research included 164 patients who were older than 18 years and had detectable lip lesions. The study researchers selected participants only when they obtained documented consent from the patients. Before commencing research the study obtained ethical approval from the institutional ethics committee.

#### Inclusion Criteria

- Patients aged 18 years and above
- Patients with clinical evidence of lip disorders

The subjects who granted written consent to join the study

#### Exclusion Criteria

- Patients below 18 years of age
- The study excluded patients who refused to grant their consent about study participation.

The examination method had restrictions designed for patients who showed bleeding at their mucoosal sites during the evaluation process.

### Clinical and Mucoscopic Examination

The patients received detailed historical evaluation then underwent clinical assessments under appropriate light conditions. A DermLite DL5 dermatoscope enabled mucoscopic evaluation by using 10–20x magnification with the examination conducted in polarized and non-polarized and ultraviolet (UV) modes according to the lesion features. Fitzpatrick skin typing was recorded for all patients to assess associations with pigmented lip lesions, particularly smoker's melanosis and post-inflammatory hyperpigmentation. The diagnostic instrument used an interface fluid of isopropyl alcohol whenever better clarity became

necessary. Hygiene protection along with contamination prevention required the use of an ice cap to isolate the lip surface from the dermatoscope.

The evaluation of lesions included assessment for pigmentation patterns along with vascular architecture and structureless areas besides scaling and other diagnostic characteristics. The research team documented their findings by combining clinical photographs with dermoscopic images for analysis to establish correlations between them.

### Data Collection and Analysis

Therapeutic findings were recorded through official documentation that included classification of mucoscopic patterns according to their observed morphological features. The analysis of collected data found the patterns' frequencies in conditions affecting the lip including vitiligo, smoker's melanosis, mucocoeles and other diseases.

## Results

A total of 164 patients were included in this study, with various lip disorders diagnosed based on clinical and mucoscopic features. The most common condition observed was lip vitiligo, followed by smoker's melanosis and mucocoele.

### Distribution of Diagnosed Lip Disorders

Out of 164 participants, Lip vitiligo (most frequently involving the lower lip vermilion) and smoker's melanosis (predominantly affecting the inner mucosal aspect of the lower lip) were diagnosed in 45 patients (27.4%), followed by smoker's lips in 25 patients (15.2%), and mucocoele in 4 patients (2.4%). Other findings included pigmentary and inflammatory conditions such as cheilitis, lichen planus, and post-inflammatory hyperpigmentation.

**Table 1** presents the frequency distribution of major lip disorders.

**Table 1:** *Distribution of Lip Disorders among Study Participants (N = 164)*

Lip Disorder	Number of Cases	Percentage (%)
Lip Vitiligo	45	27.4

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Smoker’s Melanosis	25	15.2
Mucocele	4	2.4
Lichen Planus	6	3.7
Discoid Lupus Erythematosus (DLE)	3	1.8
Recurrent Aphthous Ulcers	7	4.3
Dry Cheilitis	12	7.3
Post-Inflammatory Hyperpigmentation	9	5.5
Others/Non-specific (includes Fixed drug eruption, dermatitis neglecta, traumatic ulcers, herpes labialis, angular cheilitis, benign hyperkeratosis, allergic contact cheilitis, and pigmentary changes not attributable to a specific diagnosis).	53	32.3

Among 45 cases of lip vitiligo, 35 (78%) involved the lower lip vermillion, while 10 (22%) showed lesions on the upper lip vermillion or lip commissures. Of the 25 cases, 19 (76%) involved the inner mucosal aspect of the lower lip, while 6 (24%) also showed pigmentation on the upper lip mucosa or at the labial commissures. Mucoceles were observed in 4 patients; 3 (75%) on the lower labial mucosa and 1 (25%) on the inner aspect of the upper lip. Lichen planus and DLE involved the lip commissures and central lower lip. Cheilitis primarily involved the vermillion border, while aphthous ulcers were mostly found on the labial mucosa. Lichen planus involved lip commissures in 4/6 cases (67%), and central lower lip in 2/6 cases (33%). DLE: Primarily affected the central lower lip (2 cases), with 1 case on the upper lip. Cheilitis:

Mainly observed at the vermillion border (10/12, 83%), remaining on inner labial surface. Aphthous ulcers: Distributed across the lower labial mucosa in 5 cases and upper in 2 cases.

Common Mucoscopic Patterns Observed

Distinct mucoscopic features were noted for different lip disorders. Vitiligo cases frequently showed **perifollicular hypopigmentation, peripheral pigment fading, and structureless white areas**. Smoker’s lips showed a **moth-eaten border, black-gray homogenous areas, and dot vessels**. Mucoceles consistently exhibited **reddish-white structureless zones with bleeding spots** and a **dense vascular network with linear and branched vessels**.

Table 2 summarizes key mucoscopic patterns associated with specific lip conditions.

Table 2: Mucoscopic Features Noted in Various Lip Disorders

Lip Disorder	Key Mucoscopic Features
Lip Vitiligo	White structureless areas, perifollicular hypopigmentation, peripheral fading
Smoker’s Melanosis	Blackish-gray homogenous pigment, moth-eaten border, dot vessels
Mucocele	Reddish-white zones, bleeding spots, linear and branched vessels
DLE	Shiny surface, branching vessels, scaling
Cheilitis	Radial wrinkles, hemorrhagic suffusions, dry surface
Recurrent Aphthous Ulcers	Blotchy erythema, reduced pigment network

(FIGURE 1 ,2,3,4)

Age and Gender Distribution

Patients ranged in age from 18 to 65 years, with a mean age of **36.7 ± 11.2 years**. A **male predominance** was observed, with **97 males (59.1%)** and **67 females (40.9%)**.

Table 3 provides the age and gender breakdown of the study population.

Table 3: Demographic Characteristics of Study Participants

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Characteristic	Frequency	Percentage (%)
Male	97	59.1
Female	67	40.9
Age 18–30	46	28.0
Age 31–45	73	44.5
Age 46–60	38	23.2
Age >60	7	4.3

Fitzpatrick skin types ranged from Type III to V among participants. Smoker's melanosis and post-inflammatory hyperpigmentation were more common among individuals with Fitzpatrick Type IV and V skin. Additionally, a positive correlation was observed between the duration of smoking ( $\geq 10$  years) and severity of melanotic pigmentation on the lips. A statistically significant association was found between Fitzpatrick Skin Type IV/V and smoker's melanosis ( $p < 0.05$ ), Smoking duration ( $> 10$  years) and pigmentation severity ( $p < 0.01$ ), Daily cigarette consumption ( $\geq 10/\text{day}$ ) and intensity of pigmentation ( $p = 0.03$ ). Among 164

participants, those with Fitzpatrick Skin Types IV and V exhibited a higher prevalence of smoker's melanosis and post-inflammatory hyperpigmentation ( $p < 0.05$ ). This indicates a skin-type-dependent predisposition to lip pigmentation. *A positive correlation was established between smoking history and lip pigmentation intensity: Mean duration of smoking among affected individuals was 11.2 years. Patients smoking  $\geq 10$  cigarettes/day showed greater pigmentation severity. Both variables showed statistical significance ( $p < 0.01$ ).*

**Table 4: Gender-wise Distribution of Major Lip Disorders (N = 164)**

Lip Disorder	Male (n)	Female (n)	P value
Lip Vitiligo	28	17	0.04
Smoker's Melanosis	20	5	
Mucocele	3	1	
Lichen Planus	4	2	
Discoid Lupus Erythematosus (DLE)	2	1	
Recurrent Aphthous Ulcers	4	3	
Dry Cheilitis	7	5	
Post-Inflammatory Hyperpigmentation	6	3	
Others/Non-specific	23	30	

A statistically significant gender-based difference was observed in the distribution of lip disorders ( $p = 0.0472$ ), indicating a potential sex-linked

variation in prevalence of specific conditions, especially smoker's melanosis, which was more common in males.

**Table 5: Site-wise Distribution of Lip Disorders**

Disorder	Common Site	Cases (n)	P value
Lip Vitiligo	Lip Vitiligo – Lower lip vermillion (35), Upper lip/commissures (10)	45	0.0002
Smoker's Melanosis	Inner mucosal aspect of lower lip	25	
Mucocele	Lower labial mucosa	4	
Lichen Planus	Lip commissures & central lower lip	6	
Cheilitis	Vermilion border	12	
Aphthous Ulcers	Labial mucosa	7	



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Site-specific predilection was found to be statistically significant ( $p = 0.0002$ ), confirming that different lip disorders tend to affect particular

anatomical regions (e.g., vitiligo on vermillion, smoker's melanosis on inner mucosa, mucocele on labial mucosa).

(Figure 1-5)



Figure 1: LIP VITILIGO ALTERED PIGMENT



Figure 2: SMOKER'S LIPS: LABIAL MELANOTIC PATTERN

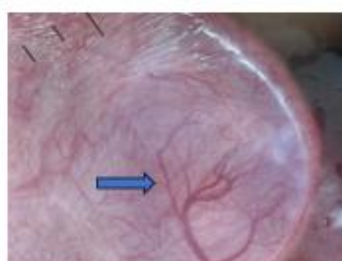


Figure 3: MUCOCELE: SHINY SURFACE WITH LINEAR & BRANCHED VESSELS

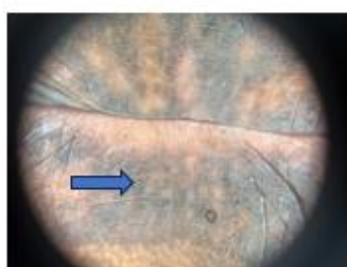


Figure 4: FIXED DRUG ERUPTION: BLACKISH - GRAY HOMOGENOUS AREA WITH DOTS

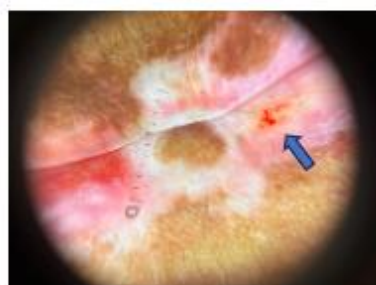


Figure 5: LIP DLE: REDDISH WHITE STRUCTURELESS AREA WITH BLEEDING

## Discussion

The research investigated mucoscopic inspectable characteristics of different lip conditions found in a tertiary care hospital. New technology mucoscopy serves as an effective diagnostic helper to reveal faint morphological patterns in both pigmented and inflammatory lip lesions.

Lip vitiligo appeared as the dominant diagnosis in our study population which made up 27.4% of total cases. The mucoscopic observations of perifollicular hypopigmentation together with peripheral pigment fading align with the descriptions made by Jakhar et al. for mucosal vitiligo (1). The diagnostic findings assist medical professionals distinguish lip depigmentation in vitiligo from the depigmentation causes of lichen sclerosus and post-inflammatory hypopigmentation (2,3).

Users should consider blackish-gray homogenous pigmentation along with a moth-eaten border and dot vessels as characteristic signs of Smoker's melanosis. The research by Kara et al. supports this observation since their study demonstrated that long-term tobacco usage changes melanocyte activity resulting in these particular dermoscopic features (4). These visual characteristics enable medical professionals to distinguish smoker's melanosis from other types of brown-colored lesions (5,6). The condition was notably more prevalent among individuals with Fitzpatrick Skin Type IV and V. There was a clear positive correlation between the degree of pigmentation and smoking history—both in terms of duration (mean duration: 11.2 years) and number of cigarettes per day ( $\geq 10$ /day), supporting earlier findings on cumulative melanogenic stimulation in smokers.

Among the examined cases Mucocoele appeared only 2.4% of the time while displaying distinctive mucoscopic features which included red and white structureless tissue and bleeding points in combination with prominent linear and branched vessels. Research by Kaur et al. and Jakhar et al. supports our findings because they confirmed mucocoeles have a vascular character and mucoscopy helps make reliable diagnoses (7,8). Mucoscopy patterns enable medical practitioners to differentiate mucocoeles from both vascular tumors and minor salivary gland neoplasms (9).

The mucoscopic appearances of lichen planus alongside DLE included the diagnostic Wickham striae and shiny surface together with branching vessels exactly as reported in previous literature (10,11). The dermoscopic indicators help identify lichen planus separately from leukoplakia and early squamous cell carcinoma (12).

Mucoscopy of dry cheilitis showed exaggerated radial wrinkles together with hemorrhagic suffusions in the area of analysis. The observed patterns during mucoscopy studies match xerotic and actinic cheilitis diagnoses which substantiates the value of mucoscopy for inflammatory and environmental lip problems (13).

Through mucoscopy clinicians can alterably conduct both disease diagnosis at an early stage and observe the patient's health status together with assessing therapy results while also refraining from superfluous biopsies (14). Clinical surveillance with mucoscopy helps physicians detect early signs of malignant transformation specifically in patients who have leukoplakia and actinic cheilitis patients (15).

Mucoscopy has numerous benefits for diagnosing lip disorders but its use remains scarce for this purpose. Medical practitioners lack sufficient awareness about mucoscopy tools while national diagnostic criteria remain nonexistent and training programs are scarce. These factors create significant obstacles for its clinical deployment. Mucoscopy's implementation into dermatological and dental practice streams will lead to improved diagnostic precision together with lowered patient distress and better therapeutic results.

## Conclusion

Mucoscopy serves as an important non-invasive evaluation method which allows clinicians to identify hidden aspects of lip diseases through visualization of delicate pigmentations and blood vessels. Research demonstrates the essential contribution of mucoscopy to detecting and distinguishing between vitiligo along with smoker's melanosis and mucocoele during early diagnosis. Mucus examination should become a standard practice in dental and dermatology examinations because it enables precise diagnostic results while

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diminishing the requirement of biopsies and leading to better patient health outcomes.

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