

Leukoplakia and Erythroplakia

Oral precancerous lesions • clinical morphology and histologic significance

Clinical description → epithelial histology → cancer risk

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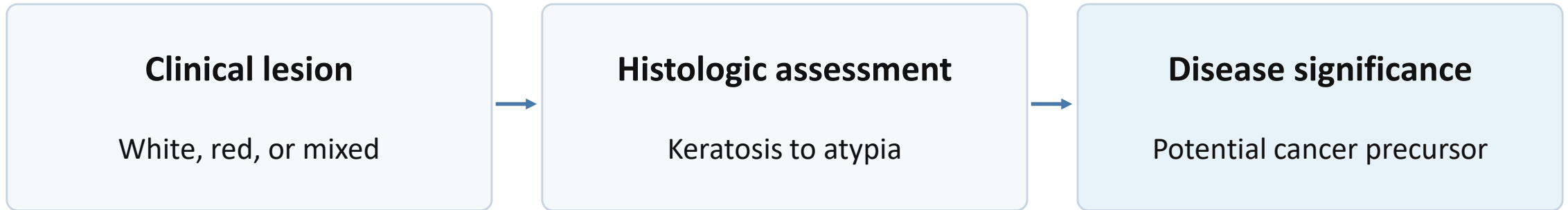
Learning objectives

- Define leukoplakia, erythroplakia, and mixed red–white lesions using their clinical features.
- Explain exclusion-based diagnosis, anatomic distribution, and typical associations.
- Interpret the range of epithelial abnormalities and their implications for biopsy.

Diagnostic principle

Clinical appearance $\neq$ histologic diagnosis

The oral precancer spectrum



Clinical reasoning

The surface appearance raises suspicion; Tissue examination resolves the epithelial diagnosis.

A clinical label is not a tissue diagnosis

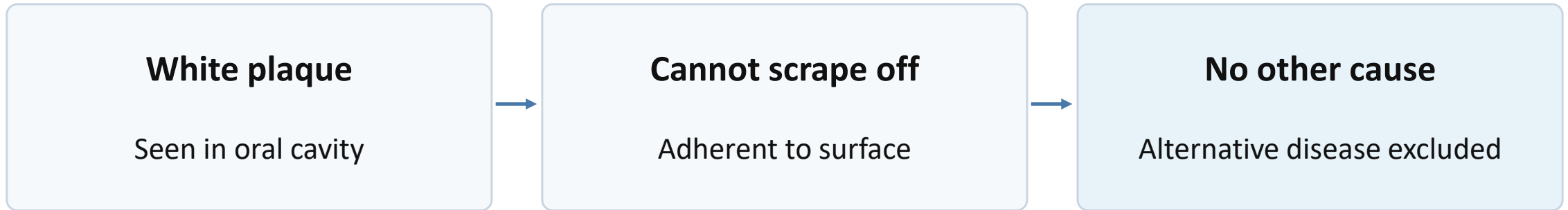
Clinical description

- Leukoplakia: An otherwise unexplained non-scrapable white plaque.
- Erythroplakia: A red, often velvety and slightly depressed area.

Interpretation

- Biopsy may reveal an orderly, keratotic epithelium.
- Alternatively, it may show dysplasia, carcinoma in situ, or invasion.

Leukoplakia: Definition in practice



Clinical reasoning

Robbins quotes the WHO definition as an exclusion-based clinical category.

“No apparent reason” is essential

- Not every oral white patch is leukoplakia.
- An obvious irritant-associated plaque is excluded from the clinical category.
- Recognizable entities such as lichen planus or candidiasis are also excluded.

Diagnostic principle

The definition requires ruling out explanations, not simply observing whiteness.

Scrapability is a useful first discriminator

Clinical description

- Non-scrapable: Compatible with the clinical morphology of leukoplakia.
- Persistence after gentle attempted removal warrants further assessment.

Interpretation

- Scrapable white material suggests another process; Candidiasis is a major example.
- Scrapability alone cannot assign a complete pathologic diagnosis.

White plaques: The clinical exclusion problem

Presentation	Clue	Interpretive point
Leukoplakia	White, non-scrapable	Diagnosis after exclusion
Candidiasis	White oral fungal disease	Not leukoplakia when identifiable
Lichen planus	Reticulate, lacelike keratosis	A distinct recognized disorder
Irritation-related plaque	Obvious mechanical association	Excluded when attributable

Interpretation

A visible white lesion must be placed in its clinical context.

Candidiasis is not leukoplakia

- Oral candidiasis is a defined infection of the mucosa.
- The Robbins leukoplakia definition specifically excludes candidiasis.
- A definitive clinical interpretation depends on recognizing the underlying process.

Diagnostic principle

White color is not the deciding criterion.

Oral lichen planus is a distinct mimic

- Lichen planus may cause reticulate, lacelike white keratotic lesions.
- Its recognizable pattern differs from an otherwise unexplained plaque.
- If the diagnosis is lichen planus, the lesion is not classified as leukoplakia.

Diagnostic principle

The clinical morphology can be white without satisfying leukoplakia.

Hairy leukoplakia: Similar name, different lesion

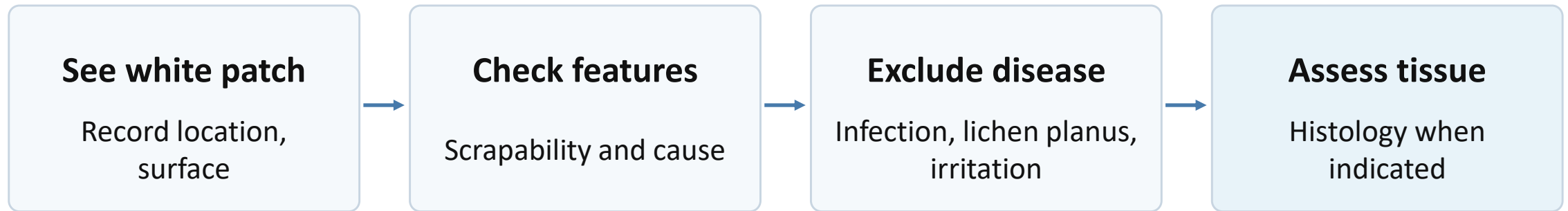
Clinical description

- EBV-related lesion classically affecting lateral tongue.
- Fluffy or hairy, hyperkeratotic and non-scrapable in immunocompromised people.

Interpretation

- Etiology and histology are distinctive: EBV-related ballooning changes.
- Do not group it automatically with idiopathic potentially malignant leukoplakia.

Practical classification of a white lesion



Clinical reasoning

This is a reasoning schematic, not a substitute for a clinical protocol.

Frequency of oral leukoplakia

~3%

Approximate worldwide population prevalence as quoted by Robbins

- This is prevalence of the clinical lesion.
- It is not the percentage that will transform into cancer.

Premalignant lesions among leukoplakias

5–25%

Share described as premalignant in the
Robbins text

- This range concerns the proportion of lesions classified as premalignant.
- It must not be relabeled as a follow-up malignant transformation rate.
- Histologic evaluation is critical because risk is heterogeneous.

Typical age and sex distribution

**40–70
years**

Usual age range; Approximately 2:1
male predominance

- The lesions may also be observed at other adult ages.
- These patterns characterize the reported population, not a diagnostic rule.

Tobacco exposure: Different forms

Exposure named	Examples	Interpretation
Smoked tobacco	Cigarettes	Common antecedent
Smoked tobacco	Pipes	Common antecedent
Smoked tobacco	Cigars	Common antecedent
Smokeless tobacco	Certain forms	Common antecedent

Interpretation

The source characterizes the origin of these lesions as multifactorial.

Why tobacco is relevant

Exposure history

Identify antecedents



Clinical plaque

White / red / mixed



Histologic check

Look for atypical epithelium

Clinical reasoning

Association does not mean every lesion has one identifiable cause.

Multifactorial origin: Avoid oversimplification

- Both lesion types as multifactorial.
- Tobacco is common but not a universal antecedent.
- The clinical appearance alone does not prove a particular causative exposure.

Diagnostic principle

A complete assessment avoids attributing every white plaque to smoking.

Favored oral sites for leukoplakia

Site	Clinical implication
Buccal mucosa	Inspection of the cheek lining
Floor of mouth	Attention to mucosa beneath tongue
Ventral tongue	Inspect the inferior tongue surface
Palate	Evaluate palatal mucosa
Gingiva	Examine attached oral mucosa

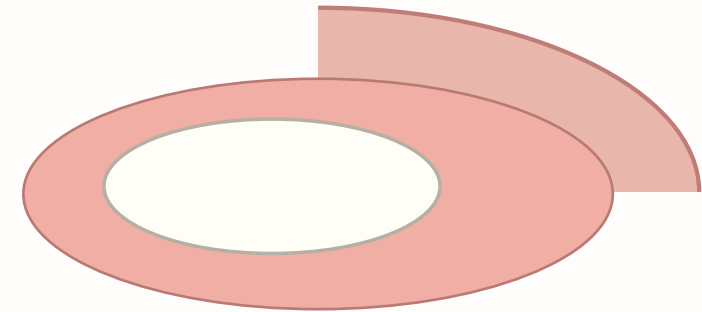
Interpretation

The lesion may also occur elsewhere in the oral cavity.

White patches may be solitary or multiple

- The number of plaques varies across presentations.
- Single or multiple lesions both fit the description.
- The distribution should be recorded rather than assumed from the name.

Oral mucosal surface (schematic)

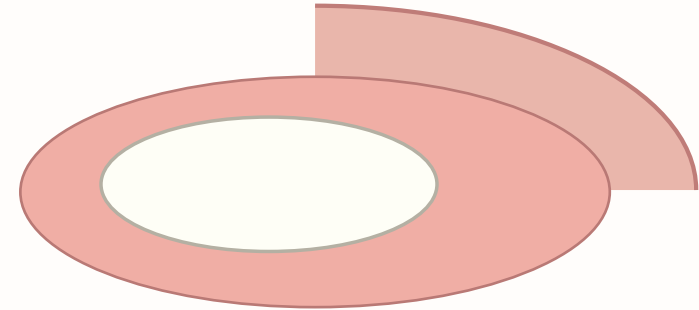


Non-scrapable white plaque

Sharp demarcation can be a useful clue

- Leukoplakia often has clearly delimited margins.
- The border helps define the extent of the visible plaque.
- A sharply outlined lesion is not necessarily histologically benign.

Oral mucosal surface (schematic)

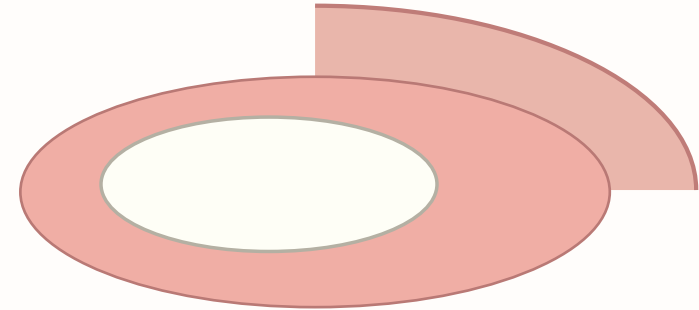


Non-scrapable white plaque

A smooth white plaque is still leukoplakia

- Some plaques are only slightly thickened.
- The surface may be clinically smooth rather than irregular.
- Thickness does not by itself resolve the presence of dysplasia.

Oral mucosal surface (schematic)

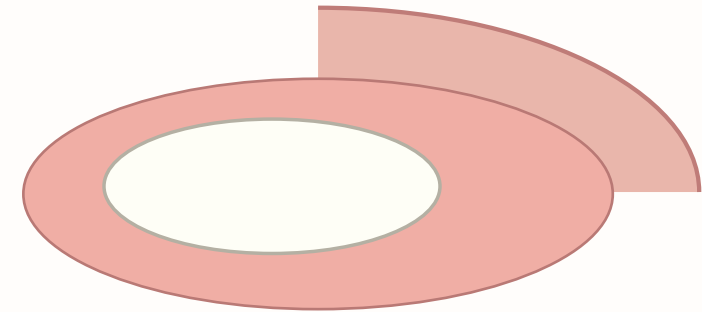


Non-scrapable white plaque

Wrinkled and fissured white plaques

- A leukoplakic plaque may show wrinkling or surface fissures.
- These are variations within its reported gross appearance.
- Clinical appearance alone cannot assign epithelial grade.

Oral mucosal surface (schematic)

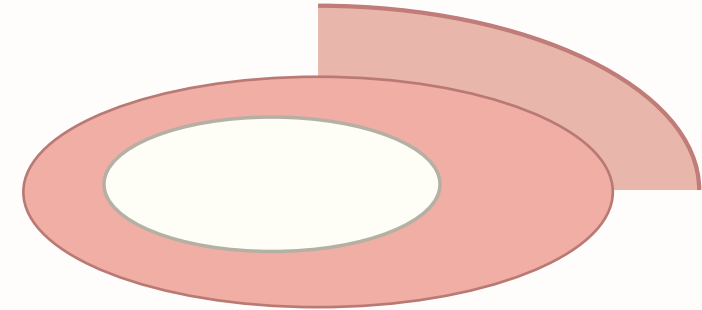


Non-scrapable white plaque

Raised, corrugated, and verrucous plaques

- Some leukoplakias are elevated above adjacent mucosa.
- A corrugated or verrucous surface is a recognized morphology.
- Biopsy is needed to determine the epithelial pathology beneath the surface.

Oral mucosal surface (schematic)



Non-scrapable white plaque

Leukoplakia is morphologically heterogeneous

Pattern	Surface or contour	What is not established
Smooth	Slightly thickened	Histologic grade
Wrinkled	Folds or fissures	Presence of carcinoma
Verrucous	Raised, corrugated	Invasive status
Multiple	Separated white plaques	Whether all foci are equivalent

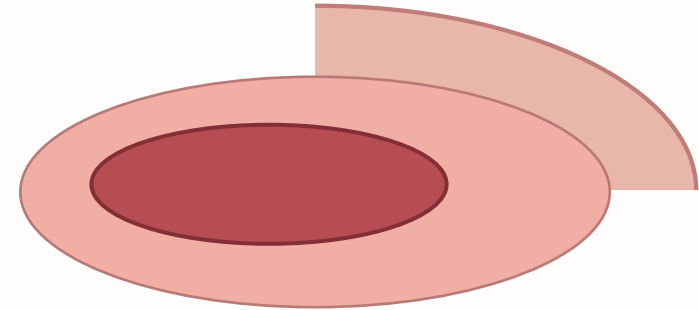
Interpretation

External appearance cannot replace epithelial assessment.

Erythroplakia: A red velvety area

- Less common than leukoplakia in the Robbins description.
- Red, velvety appearance, sometimes with erosion.
- The red lesion has a much greater association with serious epithelial atypia.

Oral mucosal surface (schematic)

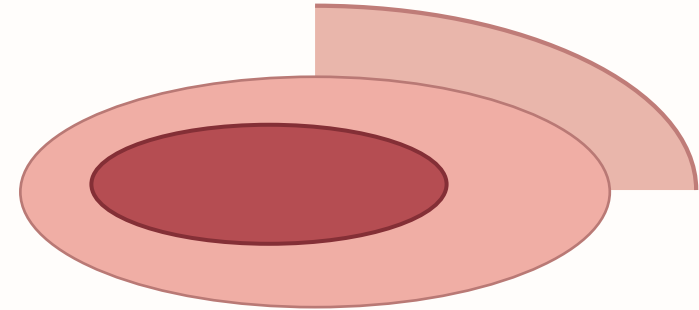


Flat / slightly depressed red area

Erythroplakia may be flat or depressed

- The lesion commonly remains level with adjacent oral mucosa.
- It may also be slightly below the surrounding surface.
- A red, non-elevated lesion can still conceal high-grade pathology.

Oral mucosal surface (schematic)

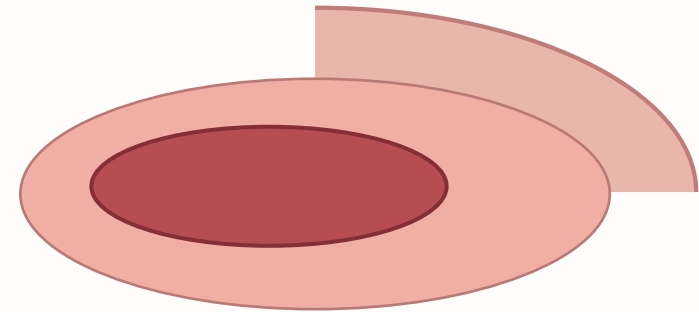


Flat / slightly depressed red area

Surface erosion in erythroplakia

- An eroded component may accompany the red lesion.
- Erosion is part of the gross description, not proof of invasion.
- The mucosa should be sampled rather than judged by color alone.

Oral mucosal surface (schematic)

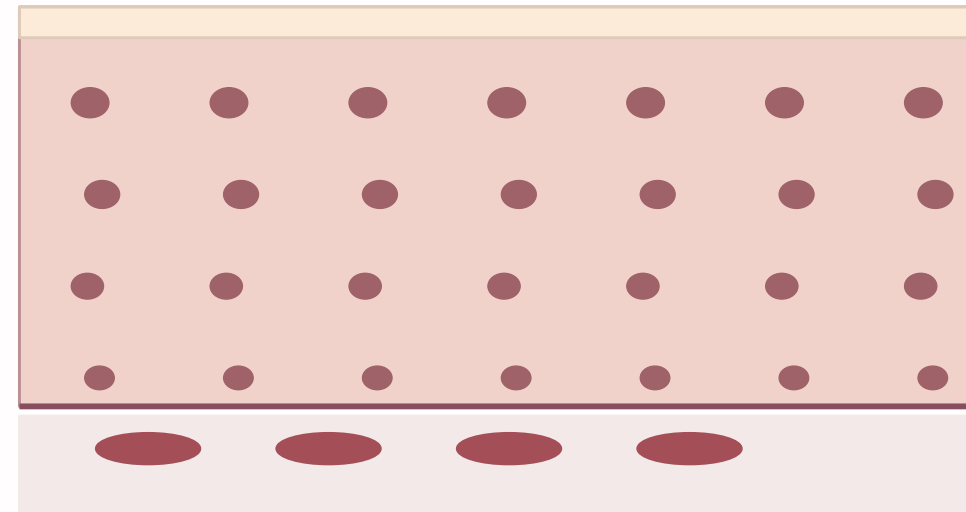


Flat / slightly depressed red area

Why erythroplakia appears red

- A prominent subepithelial inflammatory reaction may be present.
- Vascular dilatation increases the visible redness.
- Epithelial atypia can accompany this striking vascular background.

Schematic epithelium • not a micrograph

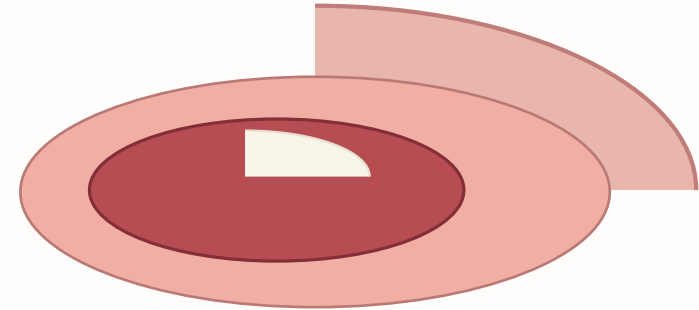


Dilated subepithelial vessels

Speckled erythroplakia mixes white and red

- Mixed lesions show features of both lesion categories.
- Robbins calls these intermediate forms “speckled erythroplakia.”
- A single field can therefore contain contrasting surface appearances.

Oral mucosal surface (schematic)



Intermixed red and white areas

Clinical red–white spectrum

Clinical description

- Predominantly white: Leukoplakia.
- May be smooth, fissured, or raised.

Interpretation

- Predominantly red: Erythroplakia.
- Speckled forms display intermixed red and white.

Leukoplakia vs erythroplakia

Dimension	Leukoplakia	Erythroplakia
Color	White	Red
Typical texture	Smooth to verrucous	Velvety; May be eroded
Profile	More common	Less common
Histology	Broad spectrum	Usually markedly atypical
Implication	Biopsy to establish grade	Especially high concern

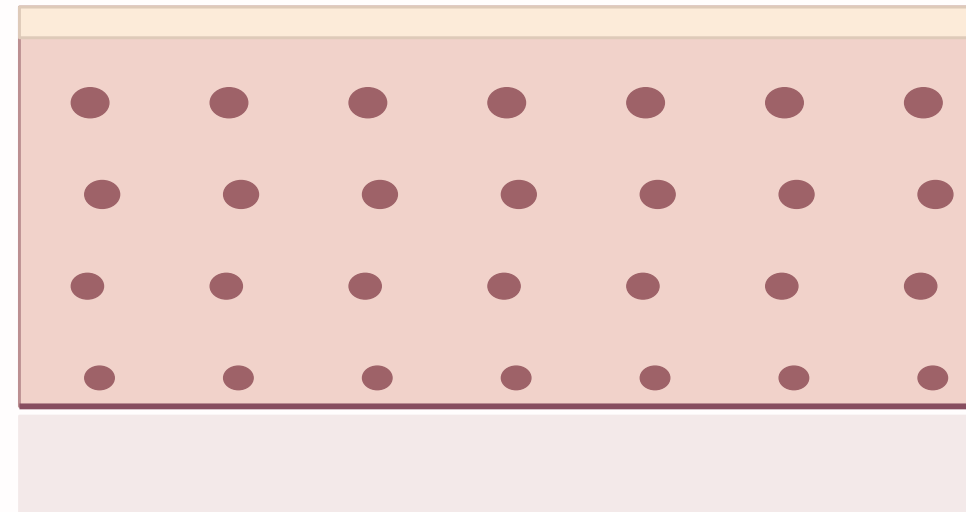
Interpretation

These are clinical tendencies, not absolute diagnostic criteria.

Normal oral stratified epithelium: Orientation

- A layered squamous epithelium matures toward its surface.
- Its basement membrane separates epithelium from underlying tissue.
- The orderly reference pattern is necessary to understand dysplasia.

Schematic epithelium • not a micrograph

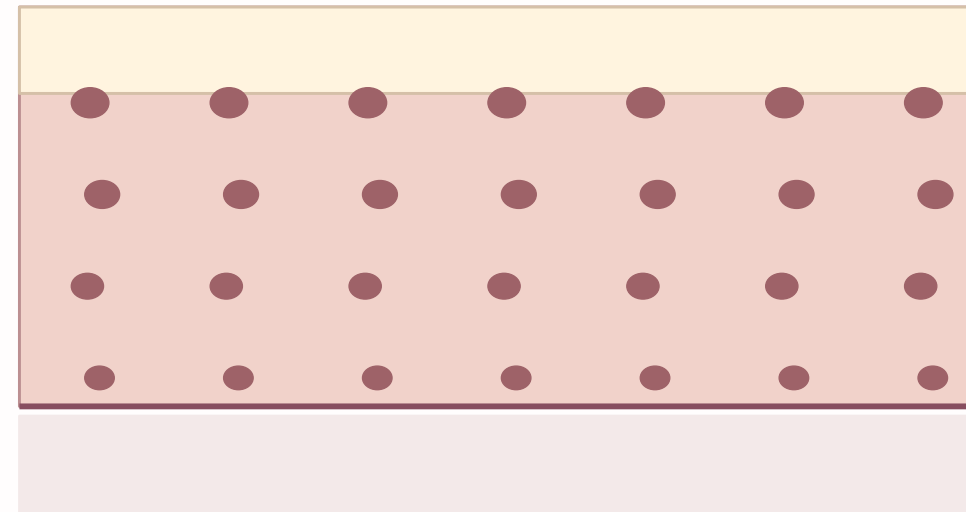


Stratification and maturation

Hyperkeratosis: A surface-layer abnormality

- Increased keratin as one end of the leukoplakia spectrum.
- The surface material contributes to the clinically white plaque.
- Keratosis may overlie an otherwise orderly epithelium.

Schematic epithelium • not a micrograph

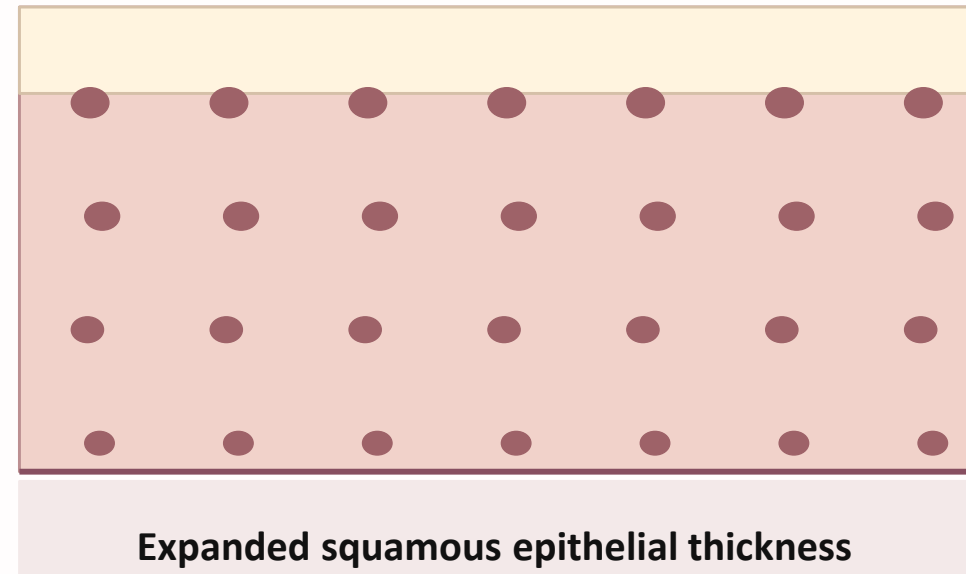


Thickened surface keratin layer

Acanthosis: A thickened squamous epithelium

- Acanthosis represents expansion of the epithelial thickness.
- It may coexist with overlying hyperkeratosis.
- An acanthotic epithelium can still show orderly maturation.

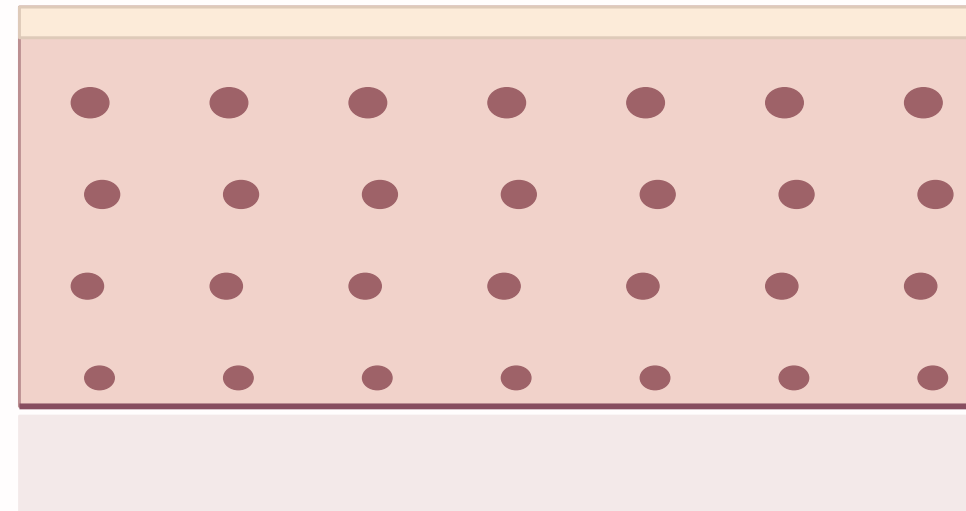
Schematic epithelium • not a micrograph



Orderly maturation is distinct from atypia

- Some leukoplakias show thick but organized mucosal epithelium.
- The distinction rests on the cellular pattern, not simply its thickness.
- This is one benign end of the microscopic range.

Schematic epithelium • not a micrograph

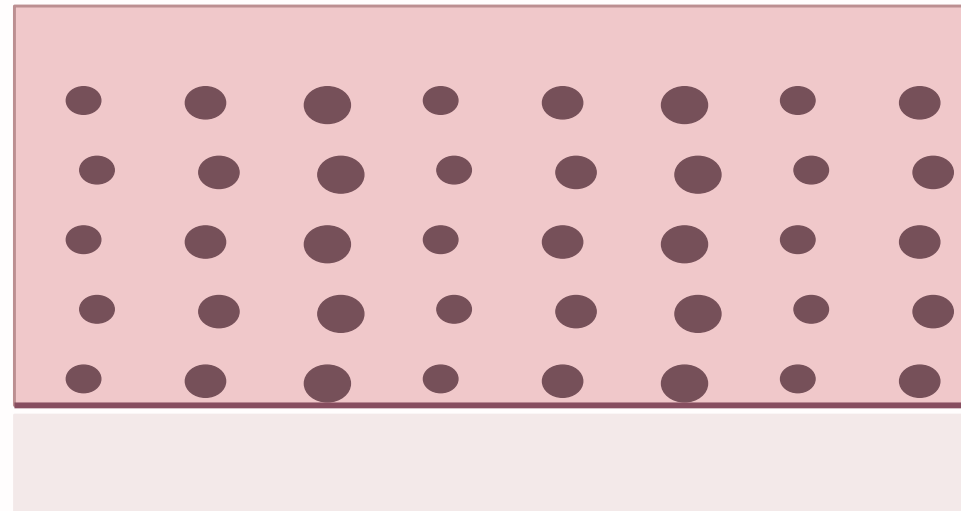


Stratification and maturation

Dysplasia disrupts epithelial organization

- Markedly dysplastic leukoplakias depart from orderly squamous maturation.
- Atypical morphology is assessed in an adequate tissue sample.
- Gross thickness and white color alone cannot determine this finding.

Schematic epithelium • not a micrograph

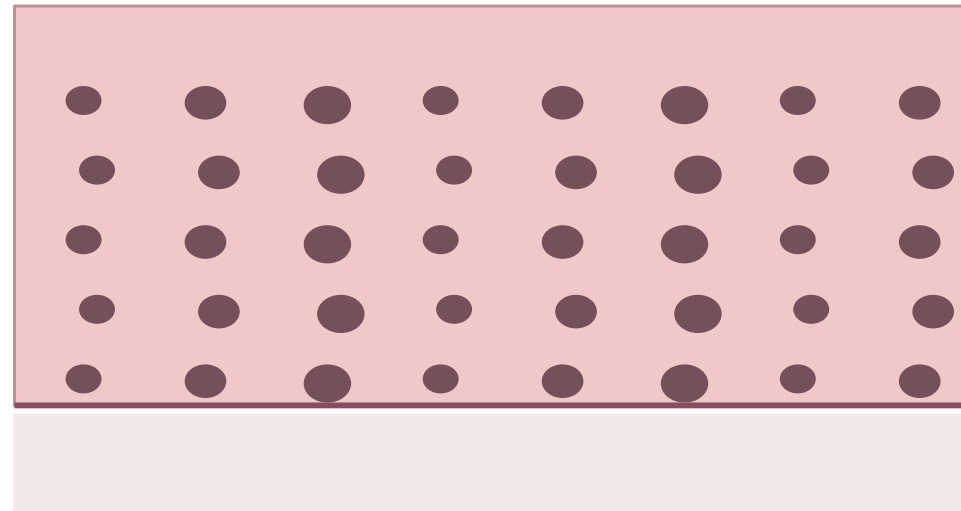


Loss of orderly maturation

Carcinoma in situ: Severe intraepithelial change

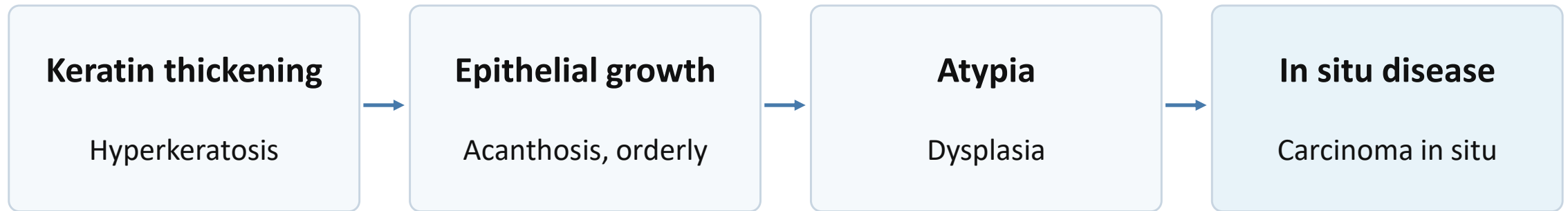
- Leukoplakia sometimes merging into carcinoma in situ.
- The atypical cells remain on the epithelial side of the basement membrane.
- Intraepithelial carcinoma must not be confused with stromal invasion.

Schematic epithelium • not a micrograph



Basement membrane intact

Leukoplakia: The histologic breadth



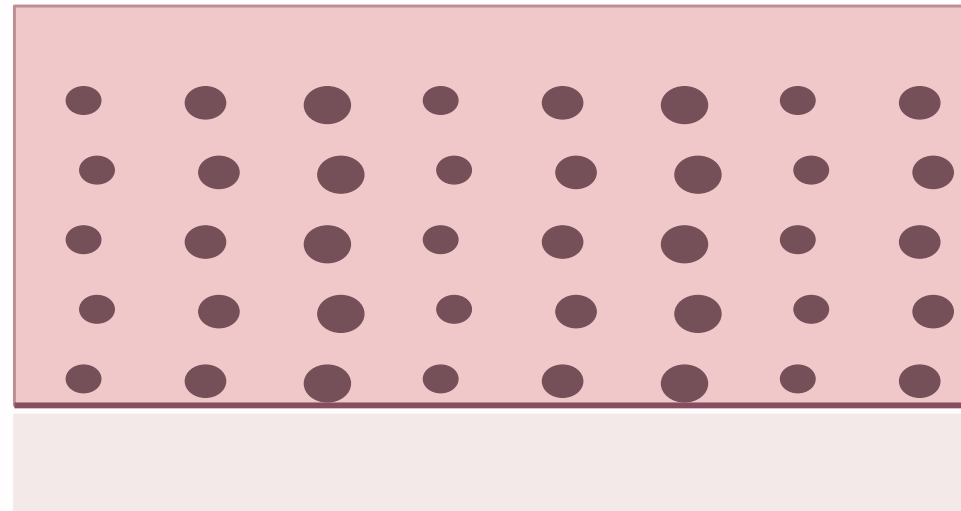
Clinical reasoning

Illustrates the spectrum of possible findings, not obligatory progression.

Erythroplakia rarely matures normally

- Orderly epithelial maturation is unusual in erythroplakia.
- Most lesions show major epithelial abnormalities at evaluation.
- This difference underlies its greater clinical concern.

Schematic epithelium • not a micrograph



Loss of orderly maturation

Histology of erythroplakia

~90%

Severe dysplasia, carcinoma in situ, or minimally invasive carcinoma

- This as a proportion of lesions at histologic evaluation.
- It is NOT a prospective risk of later malignant transformation.
- It emphasizes the need for tissue confirmation.

Prevalent carcinoma $\neq$ future transformation

Clinical description

- At biopsy: A lesion can already contain severe dysplasia, carcinoma in situ, or invasion.
- The ~90% erythroplakia statistic concerns findings already present.

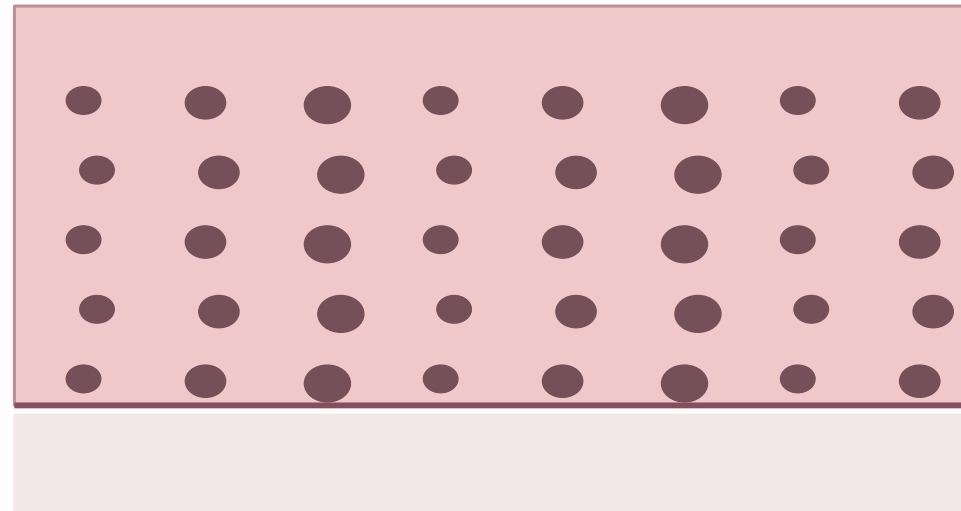
Interpretation

- Follow-up risk: Later development of invasive carcinoma after an initial diagnosis.
- Robbins does not supply a numerical longitudinal transformation rate in this passage.

Carcinoma in situ versus invasion

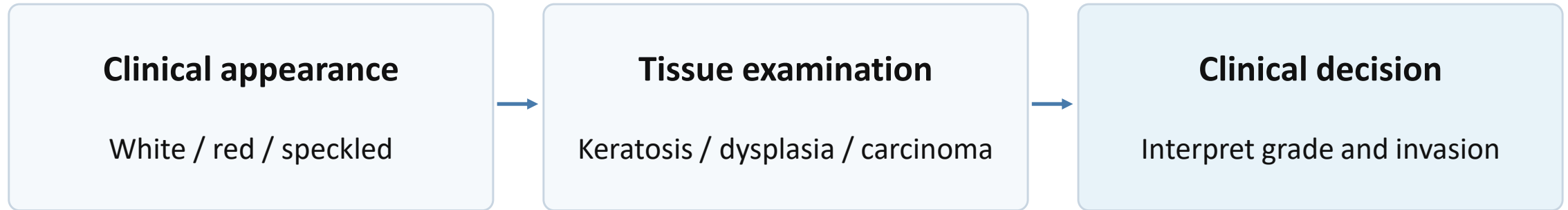
- Carcinoma in situ is confined to the epithelium.
- Invasion means malignant epithelial cells have crossed the basement membrane.
- Robbins explicitly includes minimally invasive carcinoma within the erythroplakia findings.

Schematic epithelium • not a micrograph



Basement membrane intact

The two axes of clinical assessment



Clinical reasoning

Keep the clinical descriptor and the pathologic conclusion separate.

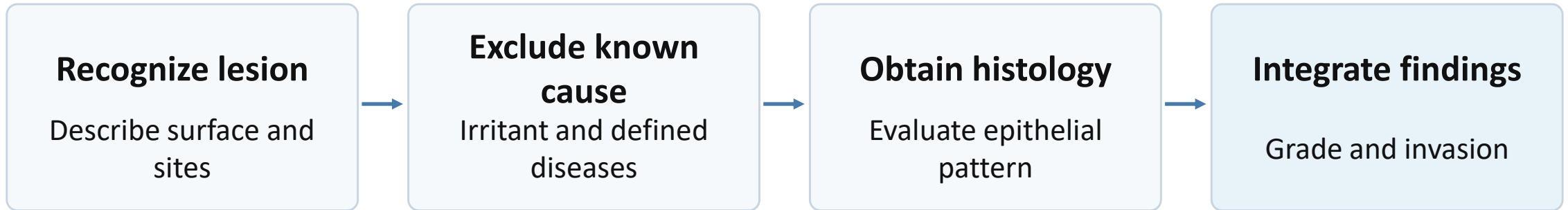
Why all unexplained leukoplakias matter

- Robbins advises considering every leukoplakia precancerous until histologic assessment.
- Only tissue assessment separates benign reactive morphology from dysplasia or carcinoma.
- A clinically unremarkable white surface can be histologically important.

Diagnostic principle

The wording describes an initial safety stance, not certainty that every plaque is dysplastic.

Biopsy resolves the diagnostic uncertainty



Clinical reasoning

Conceptual workflow derived, not a patient-specific treatment guideline.

Clinical pattern cannot grade dysplasia

- White plaques range from orderly hyperkeratotic mucosa to carcinoma in situ.
- Red lesions tend to show marked atypia but still require histologic confirmation.
- Do not assign a microscopic grade from a clinical photograph alone.

Diagnostic principle

Visible color and microscopic severity are different dimensions.

A pathology report answers distinct questions

Question	Pathologic observation
Is the epithelium thickened?	Hyperkeratosis and acanthosis
Is maturation preserved?	Orderly versus dysplastic change
Is carcinoma in situ present?	Marked intraepithelial atypia
Is invasion present?	Relation to basement membrane

Interpretation

This is a conceptual checklist, not a mandated reporting dataset.

Interpret a mixed lesion with caution

- Red and white zones can coexist within a lesion.
- The combined clinical label does not establish an identical microscopic pattern throughout.
- Histologic assessment remains necessary for the clinically suspicious region.

Diagnostic principle

Color differences identify areas to evaluate, but do not prove grade.

Case 1 • A removable white coating

Hypothetical clinical scenario

A patient has white oral material that is readily wiped away during examination.

- Does the lesion meet the Robbins definition of leukoplakia?
- Which defining feature fails?

DISCUSSION

No. Leukoplakia requires a non-scrapable plaque; Investigate a defined alternative such as candidiasis.

Case 2 • Lacelike white striae

Hypothetical clinical scenario

A patient has bilateral reticulate, lacelike keratotic changes of the oral mucosa.

- Which recognized entity is specifically excluded?
- Why is a white appearance insufficient?

DISCUSSION

A typical lichen-planus pattern does not qualify as otherwise unexplained leukoplakia.

Case 3 • Lateral tongue with EBV pattern

Hypothetical clinical scenario

An immunocompromised patient shows confluent, fluffy, hyperkeratotic patches on the lateral tongue.

- Which similarly named disorder belongs in the differential?
- What etiologic association distinguishes it?

DISCUSSION

Hairy leukoplakia: An EBV-related disorder, rather than idiopathic potentially malignant leukoplakia.

Case 4 • A smooth persistent white plaque

Hypothetical clinical scenario

An otherwise unexplained, smooth, non-scrapable white patch remains visible on the buccal mucosa.

- Is its smoothness reassuring enough to exclude dysplasia?
- What determines epithelial pathology?

DISCUSSION

No. Even smooth leukoplakia requires appropriate tissue assessment to distinguish keratosis from atypia.

Case 5 • A red velvety gingival plaque

Hypothetical clinical scenario

A sharply visible red, flat, velvety plaque involves gingival mucosa and is not a recognized inflammatory disorder.

- Which clinical category is most concerning?
- What broad set of epithelial diagnoses is common?

DISCUSSION

Suspicious for erythroplakia; Severe dysplasia, in situ carcinoma or minimal invasion in ~90% of biopsied lesions.

Case 6 • One lesion, two colors

Hypothetical clinical scenario

An oral plaque contains contiguous red and white areas with a heterogeneous surface.

- What term describes the mixed appearance?
- Does color alone tell whether the lesion invades?

DISCUSSION

Speckled erythroplakia; Histology, not color, determines dysplasia, carcinoma in situ, or invasion.

Case 7 • Histology without disorderly maturation

Hypothetical clinical scenario

A biopsy shows hyperkeratosis over a thickened epithelium that still matures in an orderly manner.

- Which end of the Robbins microscopic range is illustrated?
- Does the clinical label require severe dysplasia?

DISCUSSION

This fits the hyperkeratotic/acanthotic orderly end of the leukoplakia spectrum; Severe dysplasia is not obligatory.

Case 8 • Marked atypia but intact interface

Hypothetical clinical scenario

Biopsy of a suspicious oral plaque shows marked full-thickness epithelial atypia without stromal infiltration.

- Why is the basement membrane important?
- Which epithelial diagnosis is conceptually supported?

DISCUSSION

Carcinoma in situ: A high-grade intraepithelial process, differentiated from invasion by confinement above the basement membrane.

Synthesis: Appearance → tissue → meaning

Clinical observation	Possible histology	Teaching implication
Non-scrapable white	Hyperkeratosis to in situ disease	Do not assume benignity
Red, velvety, flat	Usually severe atypia or carcinoma	High-priority histology
Mixed red–white	Variable epithelial abnormality	Describe heterogeneous surface
Recognized mimic	Different specific disorder	Exclude before leukoplakia label

Interpretation

Lesion labels are starting points in diagnosis.

Five principles to retain

- Leukoplakia is an exclusion-based diagnosis of a non-scrapable white plaque.
- Erythroplakia is less common and substantially more ominous.
- Both may be associated with tobacco; Neither is explained by one factor alone.
- White lesions range from orderly keratosis to carcinoma in situ.
- Erythroplakia commonly harbors severe atypia or early carcinoma.

Diagnostic principle

Do not confuse initial histology proportions with longitudinal transformation risk.

References and source boundaries

- Robbins, Cotran & Kumar. Pathologic Basis of Disease. 11th ed. 2026. Chapter 16, Head and Neck, pp. 667–668.
- Primary text: “Leukoplakia and Erythroplakia” and the displaced morphology continuation immediately preceding the squamous-cell carcinoma discussion.
- Earlier oral-cavity sections used only to distinguish candidiasis, lichen planus, and EBV-related hairy leukoplakia.
- Clinical scenarios and drawings in this lecture are instructional constructions, not patient records, specimens, or published study figures.