



ORAL LINEA ALBA: PREVALANCE, CLINICAL CHARACTERISTICS, ETIOLOGY, DIFFERENTIAL DIAGNOSIS, AND MANAGEMENT

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ABSTRAK

Linea alba oral merupakan perubahan linear berwarna putih yang bersifat jinak pada mukosa bukal dan umumnya terjadi sepanjang bidang oklusal. Meskipun umumnya tidak bergejala dan tidak berbahaya, penampilannya secara klinis dapat menyerupai lesi mukosa oral putih lainnya sehingga pengenalan yang tepat penting selama pemeriksaan gigi rutin. *Narrative review* ini bertujuan untuk mendeskripsikan karakteristik klinis, prevalensi, faktor etiologi, diagnosis diferensial, gambaran histopatologis, signifikansi klinis, dan penatalaksanaan linea alba oral. Data dikumpulkan melalui penelusuran literatur pada PubMed, Google Scholar, dan ScienceDirect menggunakan kata kunci terkait linea alba dan lesi putih mukosa oral. Literatur yang relevan diseleksi berdasarkan kriteria inklusi dan eksklusi, kemudian dianalisis menggunakan teknik sintesis naratif secara deskriptif dengan membandingkan temuan antar sumber. Hasil telaah menunjukkan bahwa linea alba terutama berhubungan dengan tekanan mekanis dan gesekan berulang antara mukosa bukal dan gigi yang berdekatan. Perilaku parafungsi, termasuk mengisap pipi, menggigit pipi, clenching, dan bruksisme, dapat meningkatkan paparan mekanis dan berkontribusi terhadap perkembangan lesi. Secara klinis, kondisi ini ditandai dengan perubahan linear berwarna putih yang menetap, tidak dapat dihapus dengan penggosokan, dan sesuai dengan bidang oklusal. Diagnosis diferensial meliputi morsicatio buccarum, keratosis akibat gesekan, leukoedema, leukoplakia, oral lichen planus, white sponge nevus, dan kandidiasis. Secara histopatologis, linea alba menunjukkan perubahan keratotik reaktif yang jinak tanpa displasia epitel. Penatalaksanaan umumnya bersifat konservatif dengan berfokus pada pemberian reassurance dan eliminasi faktor mekanis yang berkontribusi. Pengenalan yang tepat penting untuk mencegah prosedur diagnostik dan perawatan yang tidak diperlukan sekaligus memastikan evaluasi yang tepat terhadap lesi oral putih yang atipikal.

Kata kunci: *linea alba; mukosa bukal; diagnosis diferensial; lesi mukosa oral*

ABSTRACT

Oral linea alba is a benign white linear alteration of the buccal mucosa that typically occurs along the occlusal plane. Although generally asymptomatic and harmless, its clinical appearance may overlap with other white oral mucosal lesions, making accurate recognition important during routine dental examination. This *narrative review* aims to describe the clinical characteristics, prevalence, etiological factors, differential diagnosis, histopathological features, clinical

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significance, and management of oral linea alba. Data were collected through literature searches of PubMed, Google Scholar, and ScienceDirect using keywords related to linea alba and white oral mucosal lesions. Relevant literature was selected based on predetermined inclusion and exclusion criteria and analyzed using descriptive narrative synthesis by comparing findings across the selected sources. The literature indicates that linea alba is primarily associated with recurrent mechanical pressure and friction between the buccal mucosa and adjacent teeth. Parafunctional behaviors, including cheek sucking, cheek biting, clenching, and bruxism, may increase mechanical exposure and contribute to lesion development. Clinically, it is characterized by a persistent, non-scrapable white linear alteration corresponding to the occlusal plane. Differential diagnosis includes morsicatio buccarum, frictional keratosis, leukoedema, leukoplakia, oral lichen planus, white sponge nevus, and candidiasis. Histopathologically, linea alba demonstrates benign reactive keratotic changes without epithelial dysplasia. Management is generally conservative, focusing on reassurance and elimination of contributing mechanical factors. Accurate recognition is important to prevent unnecessary diagnostic procedures and treatment while ensuring appropriate evaluation of atypical white oral lesions.

Keywords: *linea alba; buccal mucosa; differential diagnosis; oral mucosal lesions*

INTRODUCTION

Oral linea alba is a benign mucosal alteration characterized by a horizontal white linear finding on the buccal mucosa, typically corresponding to the level of the occlusal plane. It is recognized as a normal anatomical or reactive variation of the oral mucosa rather than an independent pathological disorder (Souza et al., 2024). The condition is generally located along the inner surface of the cheek and follows the anatomical relationship between the buccal mucosa and the dentition. Its characteristic configuration has been described as a horizontal white or whitish line that may extend from the oral commissure toward the posterior teeth along the occlusal level (Anura, 2014; Ferreli et al., 2019; Koray & Tosun, 2019). Because of this consistent anatomical relationship, linea alba represents an important finding to recognize during routine intraoral examination.

Linea alba is generally regarded as a benign and clinically uncomplicated oral mucosal variation. It is commonly described as an asymptomatic, nonulcerated, whitish linear alteration of the buccal mucosa and may occur on one or both sides of the oral cavity (Glick et al., 2021; McKinney et al., 2024). Its appearance may range from a relatively subtle white line to a slightly raised or wavy linear alteration, while the surrounding mucosa may retain a relatively normal texture (Koray & Tosun, 2019; Langlais et al., 2020). These characteristics provide the basic clinical framework for recognizing linea alba as a distinct mucosal finding rather than interpreting every persistent white alteration of the buccal mucosa as pathological.

Recognition of linea alba is clinically relevant because benign oral mucosal variations may be mistaken for disease when their characteristic features are not recognized. Oral mucosal examination requires clinicians to distinguish normal anatomical variations from lesions that may require further investigation, thereby reducing the possibility of unnecessary diagnostic procedures or treatment (Souza et al., 2024). A case report by Kumar et al. (2016) demonstrated that an otherwise typical linea alba may cause considerable patient concern because of its white appearance and may be incorrectly interpreted as a potentially serious oral lesion. Similarly,

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Anisuzzaman et al. (2019) emphasized the importance of recognizing linea alba as a natural anatomical alteration of the oral cavity and distinguishing normal variations from pathological conditions.

From a clinical perspective, accurate recognition of linea alba should therefore begin with an understanding of its characteristic anatomical setting and general appearance. Its horizontal orientation along the occlusal plane, location on the buccal mucosa, and generally benign clinical nature provide an essential basis for subsequent clinical assessment (Ferrelli et al., 2019; Glick et al., 2021). Although the lesion itself is usually uncomplicated, its white appearance places it within the broader clinical context of white oral mucosal findings, making appropriate recognition important during oral examination (McKinney et al., 2024). A clear understanding of linea alba as a benign mucosal variation consequently provides the foundation for discussing its clinical characteristics, differential considerations, histopathological features, clinical significance, and management in the subsequent sections of this review.

METHOD

This literature review was conducted through the identification, selection, review, and analysis of scientific literature related to oral linea alba, particularly publications discussing its clinical characteristics, anatomical features, diagnostic considerations, histopathological features, differential diagnosis, and clinical management. Literature searches were conducted using electronic databases and scientific search platforms, including PubMed, Google Scholar, and ScienceDirect. The search strategy used combinations of keywords such as “linea alba,” “linea alba buccalis,” “oral linea alba,” “oral white lesions,” “frictional keratosis,” “buccal mucosa,” “oral mucosal variations,” “differential diagnosis of white oral lesions,” and “linea alba management.”

The inclusion criteria were: (1) publications discussing oral linea alba or normal and benign white variations of the oral mucosa; (2) publications providing information relevant to the clinical characteristics, anatomical features, diagnosis, histopathological characteristics, differential diagnosis, prevalence, or management of linea alba; (3) publications written in English or Indonesian; (4) publications available as full-text scientific literature; and (5) publications obtained from relevant scientific databases or academic sources. Publications from the last 10 years were prioritized to provide updated information, while older publications were retained when they provided foundational information that remained relevant to the discussion of oral linea alba and related mucosal conditions. The literature included original research articles, cross-sectional studies, case reports, review articles, clinical references, book chapters, and scientific reference books.

The exclusion criteria included publications that were unrelated to oral linea alba or the clinical distinction of benign white lesions of the oral mucosa, duplicate publications, publications without sufficient relevant information, and sources that did not contribute to the clinical, diagnostic, histopathological, differential diagnostic, or management aspects discussed in this review. Publications concerning other oral white lesions were included only when their information was relevant to establishing the differential diagnosis or clinical distinction of linea alba.

The literature selection process involved screening the retrieved publications based on their titles, abstracts, and relevance to the objectives of the review, followed by assessment of the available full-text content. Publications that met the predetermined inclusion criteria were retained

for further analysis. Based on this selection process, a total of 19 scientific publications and reference sources were included in the final analysis. The selected literature comprised publications specifically discussing linea alba as well as broader literature addressing oral mucosal variations, traumatic and frictional lesions, benign white oral lesions, and the epidemiology of oral mucosal conditions. The final sources were published between 2014 and 2026, with recent publications prioritized while foundational sources were retained because of their clinical relevance.

The selected literature was organized according to the main topics discussed in the review. Information concerning the clinical presentation, anatomical characteristics, diagnostic considerations, histopathological findings, differential diagnosis, clinical significance, and management of linea alba was extracted and critically compared across the selected sources. The findings were subsequently synthesized descriptively to provide an integrated overview of oral linea alba and its clinical relevance.

This review did not involve the collection of primary patient data, clinical examinations, experimental procedures, or interventions. Therefore, the analysis was based exclusively on previously published scientific literature and relevant reference materials. Since no primary data involving human participants were collected, this literature review did not require ethical approval or informed consent.

RESULTS AND DISCUSSION

Results

Table 1. Summary of Key Literature on Oral Linea Alba

No .	Author (Year)	Type of Sourced	Main Aspect Discussed	Main Aspect Discussed
1.	Ferrelli et al. (2019)	Case report	Clinical characteristics, etiology, histopathology, diagnosis, and management	Linea alba presented as an asymptomatic, slightly raised white linear lesion along the occlusal plane. Histopathology showed hyperparakeratosis, an altered granular layer, regular acanthosis, and vacuolated cells without epithelial dysplasia. Chronic friction between the teeth and buccal mucosa was identified as the underlying mechanism.
2.	Glick et al. (2021)	Randomized controlled trial	Clinical characteristics, etiology, diagnosis, differential diagnosis, and management	Linea alba is described as a benign variant of frictional keratosis, generally bilateral, asymptomatic, and nonulcerated. It appears as a white hyperkeratotic line at the occlusal plane and is associated



				with low-grade trauma, friction, and sucking trauma. Diagnosis is primarily clinical and treatment is generally unnecessary.
3.	Maheswaran et al. (2026)	Review article	Clinical presentation, differential diagnosis, histopathology, biopsy, and management	Linea alba is a benign reactive hyperkeratotic lesion associated with repetitive mechanical irritation. Histopathology may demonstrate hyperkeratosis/hyperparakeratosis, acanthosis, vacuolated cells, and occasional dyskeratotic cells without epithelial dysplasia. Differential diagnoses include leukoplakia, leukoedema, oral lichen planus, white sponge nevus, and candidiasis.
4.	McKinney et al. (2022)	Clinical review / reference chapter	Epidemiology, clinical features, histopathology, differential diagnosis, and management	Linea alba is a benign white lesion of the buccal mucosa that may occur unilaterally or bilaterally. It may be associated with cheek-sucking and negative pressure. Histopathology demonstrates hyperkeratotic changes without dysplasia. Diagnosis is primarily clinical and treatment is generally unnecessary.
5.	Anisuzzaman et al. (2019)	Cross-sectional study	Prevalence, demographic distribution, and etiological factors	The study evaluated linea alba buccalis in 500 patients and described it as a normal oral mucosal variation associated with pressure, frictional irritation, and sucking trauma. It provides epidemiological evidence for the occurrence of linea alba in a dental patient population.
6.	Souza et al. (2024)	Review article	Clinical characteristics and histopathology	Linea alba is associated with pressure or suction trauma in the occlusal region and appears as a raised white line, generally

					bilaterally. Histopathologically, hyperorthokeratosis may cover otherwise normal mucosa.
7.	Langlais et al. (2020)	Textbook / clinical atlas	Clinical location, diagnosis	morphology, etiology, and	Linea alba is described as a raised white wavy line along the occlusal plane, generally bilateral, asymptomatic, and non-scrapable. Pressure, friction, bruxism, clenching, and sucking trauma may contribute to its development. Its characteristic clinical appearance generally permits clinical diagnosis without specific treatment.
8.	Kumar et al. (2016)	Case report	Clinical diagnosis, awareness, management	significance, patient and	The case demonstrates that linea alba may be mistaken for a potentially serious white oral lesion. Correct clinical recognition can prevent unnecessary investigation and treatment. Management focuses on eliminating mechanical irritants, patient reassurance, and follow-up.
9.	Femilian et al. (2022)	Cross-sectional study	Prevalence and mechanical/parafunctional factors		Linea alba buccalis was identified in 38 of 101 participants (37.62%). The study associated the lesion with pressure, frictional irritation, and sucking trauma, while parafunctional activity such as bruxism was considered a possible contributing factor.

The literature summarized in Table 1 indicates a consistent clinical description of oral linea alba as a benign, reactive white mucosal alteration that occurs predominantly along the occlusal plane of the buccal mucosa. Across case reports, clinical references, review articles, and observational studies, linea alba was generally characterized as an asymptomatic, nonulcerated, non-scrapable, white or whitish linear lesion that may appear raised or slightly wavy and may occur unilaterally or bilaterally. The findings also consistently associate its occurrence with repetitive mechanical irritation, including friction between the teeth and buccal mucosa, cheek-sucking, clenching, bruxism, and pressure or suction trauma. Epidemiological findings further support its occurrence as a relatively common oral mucosal variation, with Anisuzzaman et al. (2019)



reporting its presence in a population of 500 patients and Femilian et al. (2022) identifying linea alba buccalis in 38 of 101 participants (37.62%).

The reviewed literature also demonstrates that the diagnosis of linea alba is primarily based on its characteristic clinical appearance and anatomical location, while histopathological examination is generally reserved for cases with atypical features or diagnostic uncertainty. Histopathological findings reported in the literature include hyperkeratosis or hyperparakeratosis, acanthosis, alteration of the granular layer, and vacuolated epithelial cells, without evidence of epithelial dysplasia. The consistency of these findings supports the benign nature of linea alba and distinguishes it from potentially pathological white oral lesions. Nevertheless, the literature emphasizes the importance of differential diagnosis because its white appearance may resemble conditions such as leukoplakia, leukoedema, oral lichen planus, white sponge nevus, and candidiasis. Overall, the evidence indicates that recognition of the characteristic anatomical and clinical features of linea alba is essential to avoid misdiagnosis, unnecessary biopsy, or inappropriate treatment, with management generally focusing on reassurance and elimination of potential mechanical irritants.

Discussion

Prevalance

Linea alba is encountered in different clinical populations, although its reported prevalence varies between studies. This variation may reflect differences in population characteristics, age groups, clinical settings, examination methods, and criteria used to identify and classify oral mucosal variations. Among adolescents aged 13–18 years, linea alba was reported in 5.3% of the examined population, whereas a study of normal oral mucosal variations in a dental college population reported a prevalence of 7.8% (McKinney et al., 2024); (Anisuzzaman et al., 2019). Other clinical studies have reported higher frequencies. A study conducted among patients attending an oral disease clinic reported linea alba in 21.3% of the examined patients, while previous studies cited in the same report documented prevalence values of 14.39% and 29.2% in other populations (Ftri et al., 2024); (Chauhan et al., 2018); (Gupta et al., 2023). These findings indicate that linea alba is a relatively frequent finding in oral examination, while also demonstrating that its prevalence cannot be represented by a single universal value. For example, in a general dental practice population in Slovenia, linea alba was identified in 38 of 2,395 patients, corresponding to 1.58% of the total sample and 5.89% of patients with oral mucosal lesions (Kansky et al., 2018). Among adolescents aged 13–18 years, linea alba was reported in 30 patients (1.9%), including 27 healthy adolescents and 3 adolescents with systemic disease, further illustrating that reported occurrence may differ across age and clinical populations (Amadori et al., 2017). In a study of 226 elementary school children, cheek biting/linea alba was recorded in 45 cases (19.9%), although the study grouped cheek biting and linea alba together; the authors classified cheek biting/hyperkeratosis among normal variations of the oral mucosa (Wahyuni et al., 2021). Differences in prevalence should therefore be interpreted according to the characteristics and methodology of each study rather than considered as evidence of a uniform occurrence across all populations.



Etiology

The principal etiological basis of linea alba is repetitive mechanical irritation of the buccal mucosa. Mechanical pressure and chronic friction between the mucosa and adjacent teeth are consistently described as important mechanisms in its development. Ferreli et al. (2019) describe linea alba as a frictional keratosis resulting from chronic irritation caused by friction between the teeth and the buccal mucosa along the occlusal plane. Similarly, Souza et al. (2014) describe the condition in relation to pressure or suction trauma between the vestibular surfaces of the teeth and the buccal mucosa in the occlusal region. Glick et al. (2021) also describes linea alba as a variant of frictional keratosis associated with low-grade trauma resulting from friction or sucking trauma involving the buccal surfaces of the teeth. These descriptions support a mechanical model in which repeated, relatively low-grade forces acting at the same anatomical site produce a persistent mucosal alteration. Thus, the development of linea alba is more appropriately associated with cumulative mechanical exposure than with a single episode of acute trauma.

Although mechanical contact may occur as part of normal occlusal and masticatory function, repetitive oral behaviors may increase the frequency or intensity of mucosal exposure to mechanical forces. Sucking trauma is one such mechanism, as inward movement of the cheeks can increase contact between the buccal mucosa and the facial surfaces of the teeth. Anura (2014) described linea alba as developing along the occlusal plane in association with the negative pressure generated when the cheeks are sucked inward. Similarly, Anisuzzaman et al. (2019) associated linea alba with pressure, frictional irritation, and sucking trauma from the facial surfaces of the teeth. These findings indicate that the mechanical environment of the buccal mucosa may be influenced not only by ordinary tooth–mucosa contact but also by repetitive oral habits that increase local pressure or friction.

Parafunctional habits should therefore be considered as potential contributing mechanisms when evaluating linea alba. Behaviors such as cheek sucking, clenching, and bruxism may increase the frequency or magnitude of mechanical interaction between the teeth and buccal mucosa. Ftri et al. (2024) described continuous irritation, frictional trauma, sucking trauma, and clenching as factors associated with the development of linea alba. In addition, linea alba has been reported in association with pressure, frictional irritation, and sucking trauma in individuals in whom centric bruxism was also considered as a possible contributing factor (Femilian et al., 2022). Langlais et al. (2020) similarly identify pressure, bruxism, clenching, and sucking trauma among factors associated with linea alba. These associations should not be interpreted to mean that parafunctional activity is required for the development of every lesion; rather, such habits may contribute by increasing the cumulative mechanical stress imposed on the buccal mucosa.

Clinical Presentation and Lesion Characteristics

Linea alba is commonly identified during routine intraoral examination and is generally presented as an asymptomatic finding of the buccal mucosa. Patients typically do not report pain, ulceration, bleeding, or functional disturbance, and the lesion may be discovered incidentally during dental examination. A case report by Kumar et al. (2016) described a young adult who presented because of concern regarding an elevated white lesion on the buccal mucosa, although clinical examination demonstrated an asymptomatic linea alba without associated signs or symptoms. Similarly, linea alba has been described as a predominantly asymptomatic mucosal





finding that is often recognized because of its visible white appearance rather than because of subjective symptoms (Anura, 2014). The clinical context may therefore involve either incidental identification during routine examination or patient concern regarding the appearance of a white line on the inner cheek. When obtaining the clinical history, relevant oral habits should be considered, particularly behaviors that may increase mechanical contact between the buccal mucosa and the dentition. Such history may include cheek sucking, cheek biting, clenching, or other repetitive oral behaviors, as these may contribute to the mechanical environment in which linea alba develops (Anisuzzaman et al., 2019); (Femilian et al., 2022).

The characteristic location of linea alba is the buccal mucosa at the level of the occlusal plane. The lesion generally follows a horizontal course corresponding to the occlusal line of the teeth and may extend from the oral commissure toward the posterior teeth. Koray and Tosun (2019) describe it as a horizontal streak on the buccal mucosa extending from the commissure toward the posterior teeth, positioned at the level of the occlusal plane. Anura (2014) similarly describes linea alba as a bilateral raised white line extending from the commissure to the last molar teeth along their occlusal line. The relationship with the occlusal plane is a particularly important clinical feature because the lesion is characteristically positioned at the same level as the surfaces of the teeth that repeatedly contact or exert pressure on the buccal mucosa. This anatomical correspondence helps distinguish the lesion from white mucosal alterations that occur independently of the occlusal line.

Linea alba may occur unilaterally or bilaterally, although bilateral involvement is commonly described. The lesion is typically present on both sides of the buccal mucosa and may follow the occlusal level of the bicuspid and molar teeth (Koray & Tosun, 2019). The condition is similarly described as usually bilateral and as an asymptomatic, nonulcerated white hyperkeratotic line coinciding with the level of the occlusal plane (Glick et al., 2021). The extent of the lesion is variable but generally follows the dentition rather than extending randomly across the mucosa. It may extend horizontally from the region of the commissure toward the posterior teeth, and the lesion may be more apparent within dentulous areas. A reduced overjet of the posterior teeth has also been associated with greater prominence of the lesion, further emphasizing the relationship between the clinical appearance of linea alba and the local anatomical configuration of the dentition (Koray & Tosun, 2019).

Visually, linea alba is characterized by a whitish, linear appearance that may be slightly raised and may have a wavy or scalloped configuration. Koray and Tosun (2019) describe the lesion as a whitish, linear, filament-like plica formation that runs horizontally and is parallel to the occlusal level of the bicuspid and molars. Langlais et al. (2020) describe linea alba as a raised white wavy line of variable length and prominence, generally approximately 1–2 mm in width and extending horizontally along the buccal mucosa. The lesion may therefore appear as a relatively thin, continuous or slightly irregular white line rather than as a broad, diffuse white plaque. Its prominence can vary, and the lesion may appear more conspicuous in areas where mechanical contact with the dentition is greater. The horizontal and linear configuration remains one of its most characteristic visual features.

On palpation, the surface of linea alba may retain a texture similar to that of the surrounding mucosa. Koray and Tosun (2019) specifically report that palpation should produce a tactile sensation of normal mucosal texture, despite the visible whitish linear alteration. This finding is

clinically relevant because the lesion does not necessarily present as a markedly indurated or nodular abnormality. Instead, the principal clinical alteration is the visible linear whitening along the occlusal plane. The lesion is also generally nonulcerated and asymptomatic, consistent with its benign reactive nature (Glick et al., 2021). In this context, the combination of a linear white appearance, an anatomical relationship with the occlusal plane, absence of ulceration, and preservation of relatively normal mucosal texture provides a characteristic clinical profile.

The white appearance of linea alba is associated with the mucosal response to repeated mechanical exposure. McKinney et al. (2024) explain that negative pressure associated with cheek sucking can stretch the tissue and make it appear less vascular, contributing to its white appearance. Other sources describe the lesion in terms of friction-related epithelial thickening or hyperkeratotic change resulting from repeated interaction between the buccal mucosa and the teeth (Langlais et al., 2020); (Glick et al., 2021). Thus, the visible white coloration should be interpreted in conjunction with the lesion's location and mechanical context rather than as an isolated feature. The characteristic occlusal-plane distribution and linear configuration are particularly important when documenting the lesion clinically.

With respect to surface adherence, linea alba is characteristically described as a white lesion that cannot be rubbed off. Langlais et al. (2020) specifically note that the lesion cannot be rubbed off, distinguishing it clinically from removable white material such as a pseudomembranous coating. The lesion should therefore be documented as a firmly adherent white mucosal alteration rather than a superficial deposit. This feature, together with its horizontal orientation and location along the occlusal plane, forms an important part of the clinical description. However, the available sources do not provide a standardized clinical grading system for the exact consistency, border definition, or degree of adherence of linea alba; these characteristics should consequently be documented descriptively according to the individual clinical examination rather than assigned unsupported standardized values.



Figure 1. White Line on Occlusal (Kumar, 2016)



Figure 2. White Line on Buccal Mucosa (Kumar,2016)



Figure 3. Linea Alba Bukalis (Anisuzzaman,2019)

Differential Considerations

The differential consideration of linea alba is important because several benign and potentially significant white oral mucosal lesions may present with overlapping clinical features. The characteristic horizontal distribution of linea alba along the occlusal plane is an important clinical clue, but the diagnosis should be established by considering the lesion's location, morphology, surface characteristics, symmetry, and relationship with local mechanical factors. Linea alba is typically an asymptomatic, nonulcerated white linear lesion of the buccal mucosa that coincides with the occlusal plane, whereas other white lesions may demonstrate different patterns of distribution, surface morphology, or clinical behavior (Glick et al., 2021); (McKinney et al., 2024). Maheswaran et al. (2026) identified leukoplakia, leukoedema, oral lichen planus, white sponge nevus, and candidiasis among the conditions that may be considered in the differential diagnosis of linea alba. A careful clinical history and intraoral examination are therefore important because the identification of a benign mucosal variation should be based on its characteristic clinical pattern rather than on the presence of a white appearance alone.

Morsicatio buccarum represents one of the closest clinical considerations because it is also associated with repetitive mechanical trauma of the buccal mucosa. Both conditions may occur in relation to habitual oral behavior and involve the buccal mucosa. However, linea alba characteristically presents as a relatively smooth, horizontal white line corresponding to the

occlusal plane, whereas morsicatio buccarum produces irregular white plaques with a characteristically shredded, ragged, or macerated surface. Morsicatio is associated with chronic nibbling or chewing of the mucosa and may demonstrate areas of erythema or ulceration, features that are not characteristic of uncomplicated linea alba (Glick et al., 2021). McKinney et al. (2024) similarly describe morsicatio buccarum as shredded oral mucosa associated with parafunctional habits, while linea alba presents as a white line on the buccal mucosa and may be associated with cheek-sucking behavior. Thus, the regular linear configuration and direct correspondence with the occlusal plane favor linea alba, whereas an irregular, shredded surface and a history of repetitive biting favor morsicatio buccarum.

Frictional keratosis is another important consideration because linea alba itself is described as a friction-related keratotic alteration. The distinction is primarily clinical and anatomical. Linea alba has a characteristic linear distribution along the occlusal plane, whereas frictional keratosis may appear as a more localized or irregular thickened white area at a site exposed to chronic mechanical irritation. McKinney et al. (2024) and Souza et al. (2024) describe frictional keratosis as a consequence of repeated trauma that produces mucosal thickening and keratinization, with possible causative factors including sharp or irregular teeth, orthodontic appliances, dentures or prostheses, and other sources of chronic irritation. Therefore, identification of a specific local irritant and an atypical distribution for the occlusal line may favor frictional keratosis rather than uncomplicated linea alba.

Leukoedema may also enter the differential diagnosis because it commonly affects the buccal mucosa bilaterally and can appear as a white or grayish-white alteration. The principal clinical distinction is the response to stretching of the mucosa. Leukoedema has an opalescent, filmy gray-white appearance that characteristically diminishes or disappears when the buccal mucosa is stretched, whereas linea alba remains as a localized white linear alteration along the occlusal plane (Glick et al., 2021). The broader and more diffuse appearance of leukoedema also contrasts with the relatively discrete horizontal configuration of linea alba. These clinical differences make mucosal stretching a useful examination maneuver when a bilateral white buccal mucosal alteration is encountered (McKinney et al., 2024). Leukoedema is therefore more consistent with a diffuse alteration of the buccal mucosa, whereas a sharply localized horizontal line at the occlusal level supports linea alba.

Oral leukoplakia is an important differential consideration because it may present as a persistent white, non-scrapable mucosal lesion and may therefore initially resemble other keratotic alterations. However, leukoplakia is generally characterized by a white plaque that cannot be explained by another definable condition and does not characteristically follow the horizontal occlusal line. In contrast, linea alba has a highly characteristic linear distribution at the occlusal plane and is associated with a recognizable mechanical context (McKinney et al., 2024). Maheswaran et al. (2026) specifically include leukoplakia among the differential diagnoses of linea alba, emphasizing the need to distinguish this potentially significant lesion from benign friction-related alterations. A white lesion that is irregular, extends beyond the expected occlusal plane, lacks an identifiable mechanical explanation, or demonstrates atypical clinical features should therefore not be automatically classified as linea alba. Such findings warrant further clinical assessment rather than immediate attribution to a benign mucosal variation.



Oral lichen planus can enter the differential diagnosis when bilateral white lesions are observed in the oral cavity. However, its characteristic clinical pattern differs from the simple horizontal line of linea alba. Oral lichen planus commonly presents as bilateral reticular white striae with a lace-like or network pattern and may also occur as white plaques or erosive lesions. In contrast, linea alba is characteristically a horizontal white line corresponding to the occlusal plane (Glick et al., 2021). Maheswaran et al. (2026) also identify oral lichen planus as a differential consideration for linea alba. When clinical findings demonstrate a reticular, plaque-like, or erosive pattern rather than a localized occlusal-plane line, oral lichen planus should therefore be considered rather than assuming that the lesion represents linea alba.

White sponge nevus should be considered particularly when white lesions are diffuse, bilateral, and involve multiple mucosal sites. Unlike linea alba, which is characteristically limited to a horizontal line along the buccal mucosa at the occlusal plane, white sponge nevus usually presents as diffuse, thickened, soft white plaques involving the buccal mucosa and may also affect other oral mucosal surfaces. White sponge nevus is an inherited condition and is generally recognized relatively early in life, providing additional contextual information when distinguishing it from an acquired localized mucosal alteration (Glick et al., 2021). Maheswaran et al. (2026) likewise include white sponge nevus among the differential diagnoses of linea alba. Therefore, diffuse involvement, extension beyond the occlusal plane, involvement of multiple mucosal sites, or a relevant familial context should prompt consideration of white sponge nevus.

Pseudomembranous candidiasis is another white oral lesion that can be readily differentiated from linea alba on the basis of its surface characteristics. Candidal lesions typically appear as thick, white, plaque-like deposits that can be removed by rubbing or gentle scraping, often leaving an erythematous underlying mucosal surface. In contrast, linea alba presents as a persistent, firmly adherent white linear alteration rather than a removable superficial deposit (Maheswaran et al., 2026); (Langlais et al., 2020). The ability to remove the white material is therefore particularly useful when candidiasis is included in the differential diagnosis. A removable white coating should not be considered characteristic of linea alba and instead warrants consideration of superficial or pseudomembranous processes.

Histopathological Findings

Histopathological examination of linea alba demonstrates a benign reactive alteration of the oral epithelium, predominantly characterized by increased keratinization. The microscopic appearance is consistent with the response of the buccal mucosa to repeated low-grade mechanical irritation rather than with a primary neoplastic process. McKinney et al. (2024) describe linea alba histologically as hyperkeratotic tissue with a potentially reduced granular layer, with no evidence of epithelial dysplasia. A similar description is provided by Ferreli et al. (2019), who reported hyperparakeratosis with an altered or absent granular layer in two patients with clinically diagnosed linea alba. These findings provide a histological correlate for the clinically observed white appearance of the lesion.

More detailed microscopic findings have been reported in the context of reactive keratotic changes. Maheswaran et al. describe linea alba as demonstrating hyperkeratosis or hyperparakeratosis with variable thickness of the granular layer. The epithelium may show regular acanthosis accompanied by vacuolated cells within the upper spinous layers and occasional dyskeratotic cells, while the surface keratin may exhibit fissuring and clefting (Maheswaran et al.,



2026)(5). These epithelial alterations remain organized and reactive rather than showing the architectural and cytological abnormalities associated with epithelial dysplasia. Thus, the histopathological profile is principally one of epithelial keratinization and reactive epithelial adaptation.

Ferrel et al. (2019) provide additional detail from direct histopathological examination of linea alba lesions. In their reported cases, the epithelium demonstrated hyperparakeratosis, an altered granular layer, regular acanthosis, and vacuolated cells in the upper spinous cell layer, together with some dyskeratotic cells. Importantly, no epithelial dysplasia was identified. Neither inflammatory infiltrates nor fungal elements were observed in the examined specimens, further supporting the interpretation of linea alba as a benign reactive mucosal alteration rather than an infectious or inflammatory lesion.

The absence of epithelial dysplasia is an important histopathological characteristic of linea alba. Both McKinney et al. (2024) and Maheswaran et al. (2026) report an absence of dysplastic change in linea alba. Maheswaran et al. (2026) further describe the lesion as a benign reactive hyperkeratotic alteration and emphasize that epithelial dysplasia is consistently absent. This feature is clinically relevant because a persistent white oral lesion that demonstrates epithelial dysplasia would not be consistent with an uncomplicated linea alba and would require a different diagnostic interpretation.

The histopathological findings of linea alba should also be understood within the broader spectrum of frictional keratoses. Müller (2019) describes frictional keratosis as a reactive white lesion resulting from persistent mechanical rubbing, chewing, or sucking of the oral mucosa against the teeth. Histologically, the degree and pattern of epithelial keratinization may vary according to the intensity and duration of trauma. Because linea alba is regarded as a friction-related keratotic alteration, these findings provide a broader pathological framework for understanding its epithelial response. However, the histopathological features of frictional keratosis are not entirely specific to linea alba and should therefore be interpreted together with the characteristic clinical location and morphology of the lesion.

The microscopic appearance of linea alba also provides useful information when distinguishing it from other white oral lesions. Hyperkeratosis may occur in several conditions, including leukoplakia and other reactive keratotic lesions, and therefore hyperkeratosis alone is not pathognomonic for linea alba. In oral leukoplakia, for example, histopathological findings may range from hyperkeratosis and epithelial hyperplasia to varying degrees of epithelial dysplasia (Glick et al., 2021). By contrast, the reported absence of dysplasia in linea alba, together with its characteristic clinical distribution along the occlusal plane, supports its benign reactive interpretation (Ferrel et al., 2019); (Maheswaran et al., 2026).

Histopathological examination is consequently not considered necessary for a clinically typical linea alba. The diagnosis is generally established on clinical grounds when the lesion demonstrates its characteristic anatomical location and appearance. Histological assessment becomes more relevant when the lesion presents with atypical characteristics or when a potentially significant white lesion cannot be excluded clinically. Maheswaran et al. (2026) note that lesions with the characteristic location and appearance of linea alba do not ordinarily require biopsy, whereas biopsy may be considered when lesions persist after removal of suspected irritants or

demonstrate atypical features. Histopathology in such circumstances serves primarily to exclude other pathological processes rather than to confirm a unique microscopic signature of linea alba.

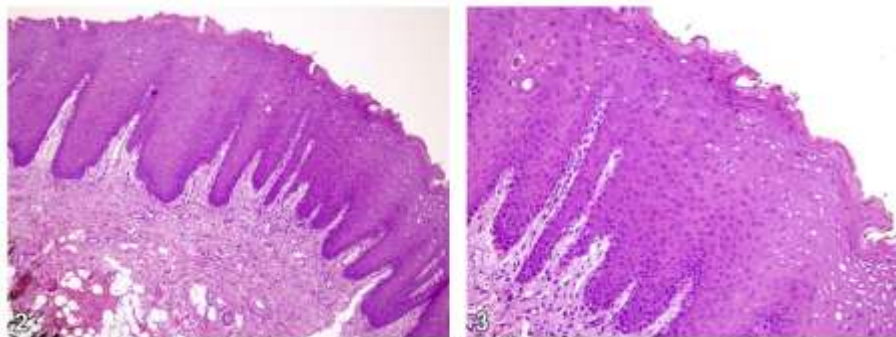


Figure 4. Histopathology of linea alba buccalis showing hyperparakeratosis and acanthosis (Ferrelli et al., 2019)

Clinical Significance and Management

Linea alba is clinically significant primarily because of its benign nature and its potential to be mistaken for a pathological white oral lesion. Although the lesion presents as a persistent white alteration of the buccal mucosa, it is generally considered a normal or reactive anatomical variation rather than a premalignant or malignant disorder. Glick et al. (2021) describes linea alba as a variant of frictional keratosis that is usually bilateral, asymptomatic, nonulcerated, and located at the level of the occlusal plane. The diagnosis is generally established from the characteristic clinical presentation and history rather than from an assumption that every persistent white lesion represents disease. This distinction is clinically important because recognition of a typical linea alba can prevent unnecessary diagnostic procedures and treatment.

An important aspect of the clinical significance of linea alba is the anxiety that may arise when patients or clinicians interpret the white lesion as potentially malignant. Kumar et al. (2016) reported a case of a 22-year-old man who presented with elevated white patches on the buccal mucosa and had previously undergone evaluation because of concern about oral cancer. Clinical examination demonstrated an asymptomatic linea alba without ulceration or other pathological signs, and unnecessary investigations and treatment were discontinued after the lesion was correctly recognized. This case illustrates the importance of clinical recognition and appropriate patient education. Accurate identification of linea alba can provide reassurance while preventing unnecessary medication, invasive investigation, or treatment for a benign mucosal variation.

The management of linea alba is therefore predominantly conservative. No specific treatment is generally required when the lesion demonstrates the characteristic clinical features of linea alba. This conservative approach is consistent with observations in oral mucosal screening, in which normal mucosal variations were considered appropriate for non-pharmacological management through patient consultation, communication, and education rather than disease-directed treatment (Wahyuni et al., 2021). Glick et al. (2021) states that no treatment is necessary for either linea alba or morsicatio and that cessation of the causative habit can result in spontaneous regression. Similarly, Anura (2014) reports that no treatment is required for linea alba and that the white streak may disappear spontaneously in some individuals; when a sharp-edged tooth



contributes to local irritation, correction of the sharp edge may be considered. The primary clinical approach is consequently observation and reassurance rather than direct removal of the lesion.

Although treatment of the lesion itself is unnecessary, management should address identifiable sources of chronic mechanical irritation. Maheswaran et al. (2026) recommend identification and elimination of causative irritants and behavioral modification when habitual behaviors contribute to the lesion. Relevant measures may include counseling regarding cheek biting, behavior modification, and stress-reduction strategies when appropriate. Local dental factors should also be addressed; ill-fitting prostheses may require adjustment or replacement, while orthodontic appliances may need modification if they produce excessive mucosal irritation. Kumar et al. (2016) similarly describe management as removal of the causative irritant, including cessation of cheek-biting or aggressive oral hygiene practices and adjustment of orthodontic components, uneven teeth, dentures, or other appliances that contribute to repeated trauma.

The response of the lesion to removal of mechanical irritation may also provide useful clinical information. Because linea alba is a reactive alteration associated with repetitive mechanical exposure, modification or elimination of the relevant habit or irritant may result in reduction or spontaneous regression of the lesion. Glick et al (2021) specifically notes that cessation of the associated habit can lead to spontaneous regression. Follow-up can therefore be used to assess whether the lesion changes after the suspected source of irritation has been addressed. Kumar et al. (2016) also recommend follow-up after removal of the suspected irritant to determine whether clinical improvement occurs. Persistence does not automatically indicate malignancy, but failure to resolve despite appropriate management should prompt reconsideration of the diagnosis.

Biopsy is not routinely indicated when the lesion exhibits the typical clinical characteristics of linea alba. Maheswaran et al. (2026) state that lesions with characteristic locations and appearances do not require biopsy, while biopsy should be considered when a lesion persists despite removal of suspected irritants, demonstrates atypical features, or occurs in a patient with significant risk factors such as tobacco use. This approach is consistent with the principle that the diagnosis of a typical linea alba is primarily clinical. When the lesion deviates from the expected presentation, histopathological examination may instead be used to exclude other white oral mucosal disorders.

The distinction between conservative management and unnecessary intervention is particularly important because linea alba has no malignant potential. Maheswaran et al. (2026) describe the condition as having an excellent prognosis and emphasize that its absence of malignant potential supports a conservative observational approach once the diagnosis has been established. Accordingly, surgical removal or laser ablation is not indicated for an uncomplicated linea alba. The appropriate management is directed toward patient reassurance, elimination of contributing mechanical factors, modification of relevant oral habits, and clinical follow-up when indicated.

CONCLUSION

Linea alba is a benign oral mucosal finding characterized by a white linear alteration of the buccal mucosa that typically corresponds to the occlusal plane. Its recognition relies primarily on its characteristic clinical appearance and anatomical distribution, supported by an understanding of the mechanical and behavioral factors that may contribute to its development. Although its

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appearance may overlap with other white oral lesions, appropriate clinical assessment allows linea alba to be distinguished from conditions requiring further investigation. Histopathological findings, when indicated, are consistent with a benign reactive keratotic alteration without epithelial dysplasia. Consequently, management is generally conservative, with emphasis on reassurance and addressing contributing mechanical or habitual factors rather than treating the lesion itself. Accurate recognition is therefore important to prevent unnecessary diagnostic procedures and treatment while maintaining appropriate evaluation of lesions that present with atypical clinical features.

Future research should focus on larger epidemiological studies involving diverse populations to provide more comprehensive data on the prevalence and distribution of linea alba. Further studies are also needed to clarify the relationship between linea alba and potential contributing factors, including cheek-sucking, bruxism, clenching, and other mechanical or behavioral habits. In addition, prospective clinical studies and standardized diagnostic criteria may help improve the distinction between linea alba and other white oral mucosal lesions and determine when histopathological examination is clinically warranted. Such research could strengthen the evidence base for accurate diagnosis and appropriate conservative management of linea alba.

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