

Revisiting Pediatric Oral Lesions: An Updated Diagnostic Tree Approach

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Abstract

Pediatric oral lesions include a wide spectrum of lesions involving teeth, oral mucosa, and jaws, ranging from developmental anomalies and odontogenic conditions to infections, reactive lesions, ulcerations, syndromic disorders, and tumors. Clinical presentation in children is often variable due to eruption changes, oral habits, and age-related tissue response, making diagnosis challenging. This review revisits common pediatric oral lesions and proposes an updated diagnostic tree approach based on key clinical parameters such as pain, onset, morphology, color, and site to streamline differential diagnosis and support timely management and referral.

1. INTRODUCTION

Pediatric oral lesions encompass a broad and diverse spectrum of lesions affecting the teeth, oral mucosa, and jaws in children. These lesions may arise from developmental disturbances, odontogenic and non-odontogenic origins, infections, reactive or inflammatory processes, immunologic conditions, and benign or malignant neoplasms. The oral cavity in children is in a constant state of transition due to growth and development, making it a unique and dynamic environment where disease presentation often differs significantly from that seen in adults.¹

One of the defining characteristics of pediatric patients is the continuous process of tooth eruption and exfoliation, which not only alters the local anatomy but also influences the occurrence and appearance of various lesions. Additionally, the presence of mixed dentition, developing alveolar bone, and relatively higher vascularity of tissues can modify the clinical behavior of pathologic conditions. Oral habits such as thumb sucking, tongue thrusting, lip biting, and bruxism further contribute to the development of certain lesions or modify existing ones.

The clinical presentation of oral lesions in children is often variable and, at times, misleading. Lesions may present with subtle signs, atypical morphology, or rapid progression. Moreover, similar clinical appearances among different pathologies frequently lead to diagnostic dilemmas. Factors such as limited communication ability, fear, and lack of cooperation in young patients can further complicate thorough history taking and clinical examination. In addition, systemic conditions and syndromic associations may manifest initially in the oral cavity, emphasizing the importance of a comprehensive and vigilant diagnostic approach.²

Accurate and timely diagnosis of pediatric oral lesions is crucial to prevent disease progression, minimize morbidity, and ensure proper growth and development. Delayed or incorrect diagnosis may lead to complications such as pain, infection spread, disturbance in tooth development, or even life-threatening conditions in rare cases. Therefore, clinicians must rely on a structured and systematic method of evaluation rather than isolated clinical findings.³

In this context, the use of key clinical parameters such as pain, onset, morphology, color, and site can significantly aid in narrowing the differential diagnosis. A diagnostic tree approach based on these parameters provides a logical, stepwise framework that simplifies clinical decision-making and enhances diagnostic accuracy. This review aims to revisit common pediatric oral lesions and propose an updated, clinically applicable diagnostic tree to facilitate early recognition, appropriate management, and timely referral when required.

2. UNIQUE CONSIDERATIONS IN PEDIATRIC ORAL LESIONS

2.1 Age-Related Anatomical and Physiological Variations

The oral cavity in children undergoes continuous growth and development, resulting in distinct anatomical and physiological characteristics compared to adults. Pediatric patients exhibit smaller jaw size, developing alveolar bone, and relatively larger pulp chambers with higher vascularity.

The oral mucosa is thinner, more permeable, and less keratinized in certain areas, making it more susceptible to trauma, infections, and irritants. Additionally, the immune system in children is still maturing, which can influence the progression and severity of oral diseases. These variations often lead to altered clinical presentations and require careful interpretation during diagnosis.⁴

2.2 Influence of Tooth Eruption and Shedding

Tooth eruption and exfoliation are dynamic processes unique to the pediatric population and significantly impact oral lesions. Eruption-related changes may mimic pathological conditions, such as eruption cysts, gingival inflammation, or localized swelling. Similarly, the mixed dentition phase can create diagnostic confusion due to spacing, mobility, and transitional occlusion. Shedding of primary teeth may be associated with transient discomfort or soft tissue changes that can be mistaken for disease. Therefore, distinguishing physiological changes from pathological lesions is critical in pediatric diagnosis.⁵

2.3 Role of Oral Habits and Environmental Factors

Children are more prone to developing oral habits such as thumb sucking, tongue thrusting, lip biting, and bruxism, all of which can contribute to the development or modification of oral lesions. These habits

may lead to conditions like traumatic ulcers, keratosis, malocclusion, and gingival changes.⁴ Environmental factors, including dietary patterns (high sugar intake), poor oral hygiene, and exposure to infectious agents, further influence the occurrence of dental caries, gingival diseases, and mucosal lesions. Socioeconomic status and parental awareness also play a significant role in disease prevalence and progression.⁶

2.4 Differences in Tissue Response Compared to Adults

Pediatric oral tissues demonstrate a distinct response to injury and disease due to higher cellular turnover, increased vascularity, and greater regenerative capacity. Inflammatory reactions in children may be more rapid yet less localized, sometimes presenting with diffuse swelling or exaggerated responses. Healing tends to occur faster; however, disease progression can also be rapid if left untreated.⁷ Additionally, certain lesions that are self-limiting in children may appear more aggressive clinically, while some serious conditions may initially present with subtle signs. These differences necessitate a cautious and well-structured classification to avoid misinterpretation. (Figure 1)

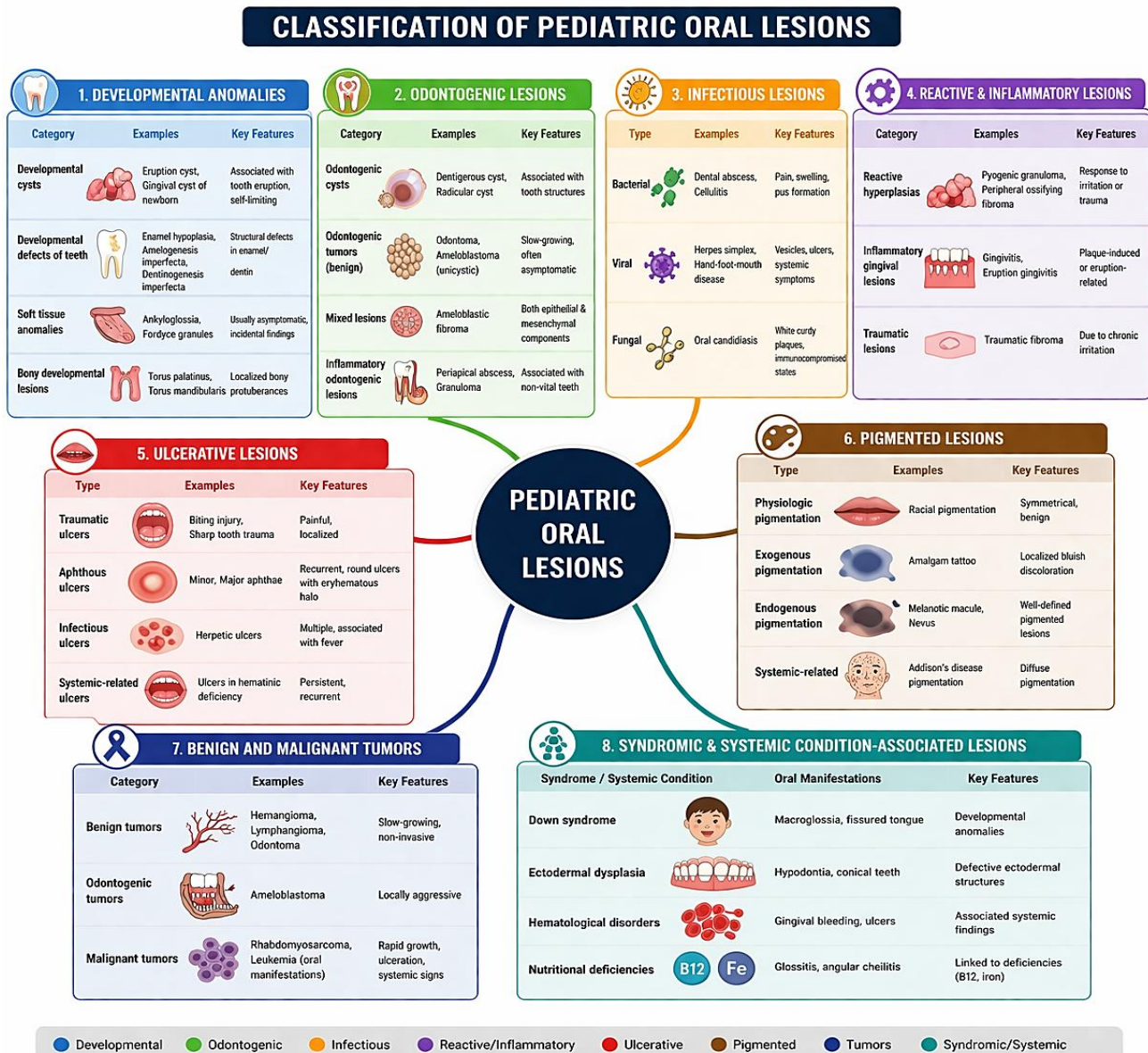


Figure 1. Classification of Pediatric Oral Lesions (Arora S, 2026)

3. THE DIAGNOSTIC ALGORITHM TREE

3.1 Pain

Pain is one of the most important initial clinical indicators in evaluating pediatric oral lesions. Painful lesions are often associated with inflammatory or infectious conditions such as dental abscesses, herpetic infections, or traumatic ulcers. These lesions typically present with acute onset and may interfere with eating, speaking, or oral hygiene practices. In contrast, painless lesions are more commonly developmental, cystic, or neoplastic in nature, such as odontomas, eruption cysts, or benign tumors.⁸ However, the absence of pain does not always indicate a benign condition, as some serious pathologies may remain asymptomatic in early stages. Therefore, pain should be interpreted in conjunction with other clinical features.

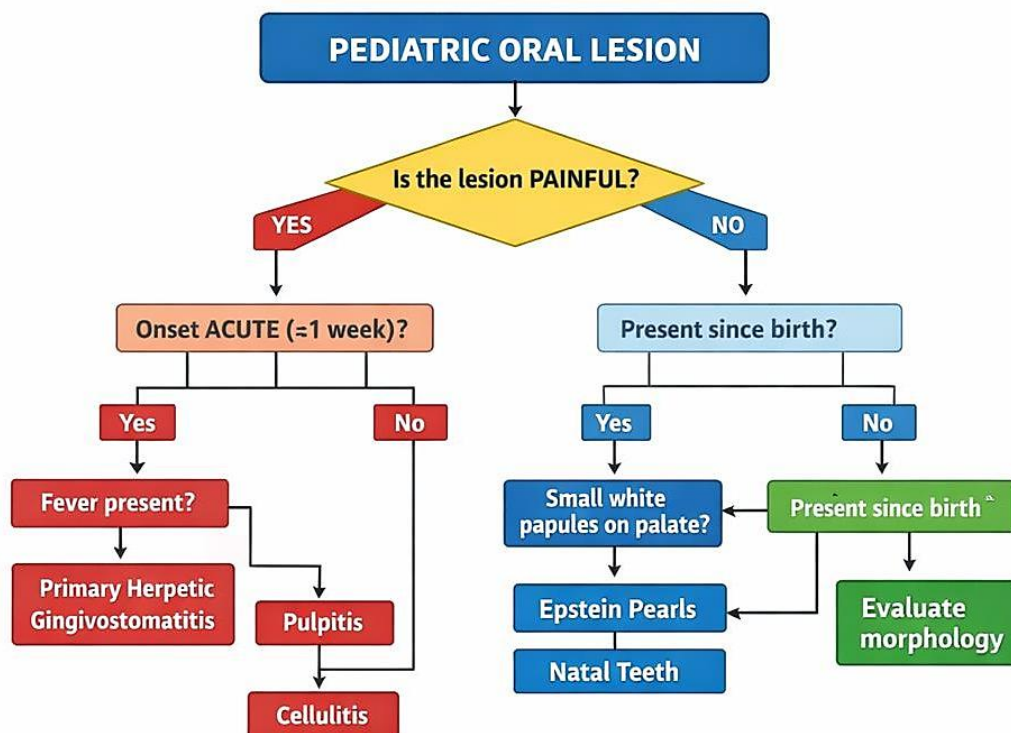


Figure 2. Diagnostic workflow of Pediatric Oral Lesions based on Pain

3.2 Onset

The duration and onset of a lesion provide valuable diagnostic clues. Acute lesions usually develop rapidly and are often associated with infections, trauma, or allergic reactions. Examples include herpetic stomatitis, aphthous ulcers, and acute abscesses. Chronic lesions, on the other hand, tend to persist over a longer duration and may indicate developmental conditions, benign growths, or long-standing inflammatory processes. Chronicity without resolution should raise suspicion for more serious conditions, including neoplastic changes, and warrants further investigation.⁹

3.3 Morphology

Morphological characteristics help in narrowing down the differential diagnosis. A macule represents a flat, non-palpable discoloration, while a papule is a small, raised lesion. (Fig. 4) Vesicles are fluid-filled lesions often seen in viral infections, which may rupture to form ulcers.(Fig 5). Ulcers are common in pediatric patients and may arise from trauma, infection, or systemic conditions. (Fig. 6). Swellings may be localized or diffuse and can indicate cysts, tumors, or inflammatory processes. (Fig. 7) Careful assessment of lesion morphology, including size, shape, surface texture, and consistency, is essential for accurate diagnosis.

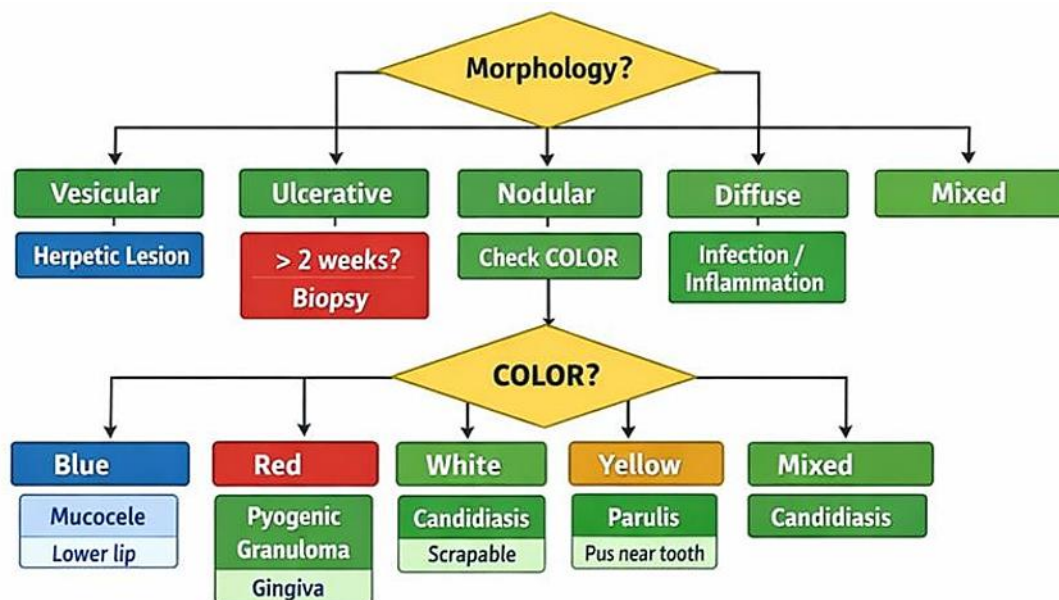


Figure 3. Diagnostic workflow of Pediatric Oral Lesions based on Morphology



Figure 4. Macule



Figure 5. Vesicle



Figure 6. Ulcer



Figure 7. Swelling

3.4 Color

Color is a key visual parameter that significantly aids in clinical diagnosis. White lesions may indicate keratosis, candidiasis, or leukoplakia-like conditions. Red lesions often suggest inflammation, infection, or vascular lesions such as hemangioma. Pigmented lesions may be physiological or pathological, including melanotic macules, nevi, or systemic conditions like Addison's disease. Mixed red and white lesions may indicate more complex or potentially premalignant conditions. Color assessment should always be correlated with other parameters to avoid misinterpretation.¹⁰

3.5 Site

The anatomical location of a lesion provides important diagnostic insight, as certain conditions show site predilection. Gingival lesions are often inflammatory or reactive in nature, such as gingivitis or pyogenic granuloma. Tongue lesions may include developmental anomalies, ulcerative conditions, or nutritional deficiencies. Palatal lesions may be associated with infections or trauma, while lip lesions commonly result from habits or environmental exposure. Jaw lesions are more likely to be odontogenic cysts or tumors and often require radiographic evaluation. Recognizing site-specific patterns helps in refining the differential diagnosis and guiding further investigations. (Table 1)

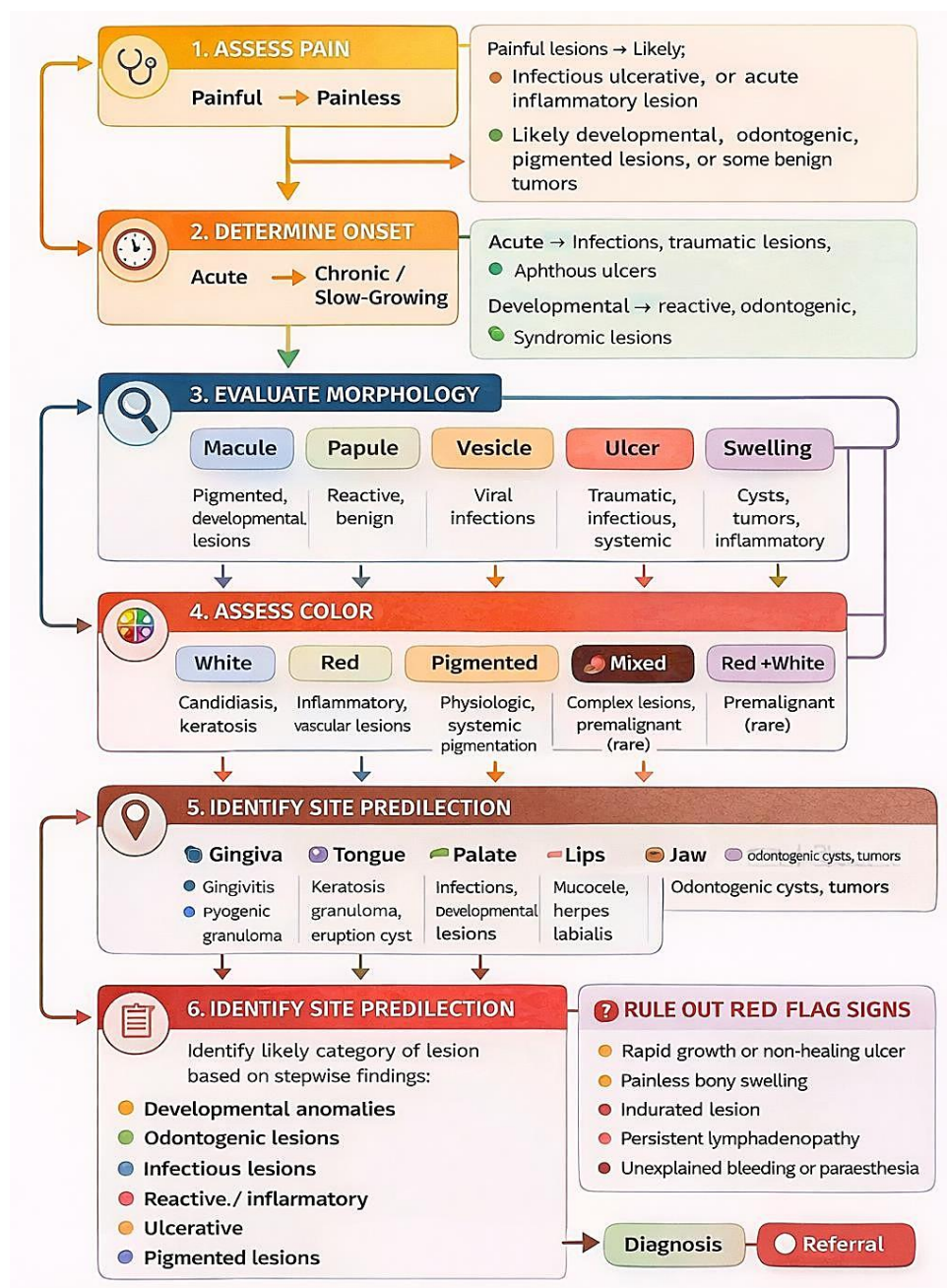


Figure 8. Stepwise Diagnostic Algorithm for Pediatric Oral Lesions

Table 1. Investigations And Diagnostic Aids In Pediatric Oral Lesions

Investigation	Specific Tests	Indications	Key Findings	Clinical Utility
Radiographic Evaluation	Intraoral periapical radiograph (IOPA), Bitewing radiograph, Orthopantomogram (OPG), Cone Beam Computed Tomography (CBCT), Occlusal radiograph	Jaw swellings, caries, delayed eruption, cysts/tumors	Radiolucent lesions (cysts, abscess), radiopaque lesions (odontoma), mixed lesions	Determines lesion origin, extent, relation to teeth, IAN canal, sinus
Histolesions	Incisional biopsy, Excisional biopsy, Fine Needle Aspiration Cytology (FNAC)	Persistent lesions, suspected tumors, unclear diagnosis	Cellular architecture, dysplasia, neoplastic cells, inflammatory infiltrate	Gold standard for definitive diagnosis
Microbiological Tests	Gram staining, Culture & sensitivity test, Potassium hydroxide (KOH) mount, Viral PCR, Tzanck smear	Suspected bacterial, fungal, viral infections	Identification of organisms (Candida, HSV, bacteria)	Guides specific antimicrobial/antiviral therapy
Adjunctive Diagnostic Tools	Pulp vitality tests (thermal/electric), Toluidine blue staining, Exfoliative cytology, Salivary diagnostics, Diascopy	Early lesions, vascular lesions, pulp status, screening	Tissue staining patterns, cell morphology, blanching response, salivary markers	Helps in early detection, differentiation, and monitoring

4. ROLE OF MULTIDISCIPLINARY CARE IN MANAGEMENT

Management of pediatric oral lesions often requires a multidisciplinary approach to ensure comprehensive and effective care. Collaboration between pediatric dentists, oral pathologists, and pediatricians is essential, with each contributing to diagnosis, treatment, and overall child health. Additional specialists such as oral surgeons, orthodontists, dermatologists, or oncologists may be involved in complex cases. This coordinated approach enhances diagnostic accuracy, supports appropriate treatment planning, and ensures holistic management, particularly in lesions with systemic or syndromic associations.

4.1 Referral Guidelines to Pediatric Dentist

Timely referral is critical in the management of pediatric oral lesions to prevent complications and ensure appropriate care. Referral to a pediatric dentist is indicated for specialized dental management, including

behavior guidance, management of odontogenic infections, developmental anomalies, and lesions requiring operative or surgical intervention. Cases involving complex dental conditions, recurrent lesions, or those affecting growth and occlusion should also be referred.

4.2 Referral Guidelines to Pediatrician

Referral to a pediatrician is warranted when oral lesions are suspected to have systemic involvement or when associated signs such as fever, malaise, weight loss, lymphadenopathy, or hematological abnormalities are present. Conditions such as recurrent ulcers, candidiasis in immunocompromised children, or oral manifestations of systemic diseases require medical evaluation and interdisciplinary coordination. Additionally, any lesion accompanied by red flag signs such as rapid progression, non-healing ulcers, unexplained bleeding, or paraesthesia should prompt urgent referral for further investigation.

A well-coordinated referral system between dental and medical professionals ensures early diagnosis, appropriate intervention, and improved overall health outcomes in pediatric patients.

5. CONCLUSION

Pediatric oral lesions present a wide and complex spectrum of conditions that often exhibit overlapping clinical features and variable presentations due to the dynamic nature of the developing oral cavity. Accurate diagnosis in children is further challenged by factors such as ongoing growth, tooth eruption, oral habits, and limited patient cooperation. Therefore, reliance on isolated clinical findings may lead to misinterpretation or delayed diagnosis.

The stepwise diagnostic algorithm proposed in this review, based on key clinical parameters like pain, onset, morphology, color, and site provides a structured and practical approach to systematically evaluate pediatric oral lesions. By integrating these parameters, clinicians can effectively narrow differential diagnoses, identify the likely category of lesion, and make informed decisions regarding management and referral.

In addition, the appropriate use of diagnostic aids, including radiographic evaluation, histolesions, microbiological tests, and adjunctive tools, further enhances diagnostic accuracy and supports evidence-based clinical practice. Recognition of red flag signs remains critical to ensure timely identification of potentially serious conditions requiring urgent intervention.

Overall, this clinically oriented approach simplifies the diagnostic process, improves early detection, and facilitates optimal management of pediatric oral lesions. Future advancements, including the integration of artificial intelligence and standardized diagnostic protocols, may further refine and support clinical decision-making in pediatric oral lesions.

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