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Iron Deficiency Anemia in Children and Its Impact on Oral Health: A Narrative Review

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Abstract

Iron deficiency anemia (IDA) is the most common micronutrient disorder affecting pediatric populations worldwide, particularly in developing nations. Rapid childhood growth alongside deficient diet, poor absorption, and recurrent infections leads to systemic complications like fatigue, developmental delay, and impaired immunity. Because oral tissues have rapid cellular turnover, the oral cavity is often the earliest site to manifest signs of iron deficiency. Common clinical findings include oral mucosal pallor, atrophic glossitis, angular cheilitis, recurrent aphthous stomatitis, xerostomia, and delayed tooth eruption. Furthermore, altered salivary defenses and compromised host immunity elevate susceptibility to early childhood caries (ECC), periodontal inflammation, and oral candidiasis. Pediatric dentists play an essential role in recognizing these manifestations during routine checkups, facilitating early hematological referral, and initiating preventive care. This narrative review summarizes current evidence regarding the pathophysiology, oral manifestations, diagnostic parameters, and dental management protocols of childhood IDA.

Keywords: Dental Caries, Iron Deficiency Anemia, Oral Manifestations, Oral Mucosa, Pediatric Dentistry, Xerostomia.

Introduction

Iron deficiency anemia (IDA) represents a leading public health issue, impacting nearly 40% of children aged 6–59 months globally [1, 2]. In developing countries like India, socio-economic challenges, inadequate nutrition, and infectious burdens keep prevalence high [1, 3]. Iron is vital

for oxygen transport, cellular metabolism, and neurocognitive development [4]. In children, high growth demands make iron reserves vulnerable to rapid depletion[4, 5].

Because oral epithelial tissues undergo rapid cellular turnover, systemic iron deficiency quickly manifests as mucosal atrophy and cellular compromise 6. Children often present with pallor, smooth tongue, angular fissures, and high caries incidence [6,7]. Recognizing that oral indicators often precede systemic diagnosis, pediatric dentists serve as crucial primary examiners for early detection and interdisciplinary management [8–10].

Etiopathogenesis and Systemic Mechanisms

- **Etiology:** Major pediatric causes include inadequate bioavailable dietary iron, exclusive breastfeeding beyond 6 months without rich solids, excessive unfortified cow's milk intake, impaired intestinal absorption (e.g., celiac disease), chronic blood loss, and recurrent infections [4, 5].
- **Pathophysiology:** Iron is absorbed in the duodenum via DMT-1 and exported into circulation via ferroportin, under the regulation of the hepatic hormone hepcidin [3,4]. Depleted stores lower hemoglobin synthesis, producing microcytic, hypochromic red blood cells and tissue hypoxia [3, 4].
- **Oral Impact:** Hypoxia suppresses epithelial maturation, impairs collagen synthesis, and compromises local mucosal and salivary immune defense (e.g., lower secretory IgA and lactoferrin) [6,7].

Oral Manifestations

Pediatric IDA characteristically manifests with several key oral signs [6, 8, 9:]

- **Mucosal Pallor:** Generalized pale color of the gingiva, buccal mucosa, palate, and tongue.
- **Atrophic Glossitis:** Papillary loss resulting in a smooth, red, and painful tongue with burning sensation.
- **Angular Cheilitis:** Maceration, fissuring, and secondary bacterial/candida infection at the commissures.
- **Recurrent Aphthous Stomatitis (RAS):** Increased frequency and severity of painful oral ulcers due to impaired mucosal repair.
- **Xerostomia & Altered Saliva:** Glandular hypofunction leading to reduced salivary volume and poor acid-buffering capacity.
- **Increased Caries & Enamel Defects:** Higher caries risk due to reduced salivary protection and possible enamel hypomineralization during tooth development[7].
- **Periodontal & Fungal Changes:** Plaque-induced gingivitis with bleeding and an elevated incidence of oral candidiasis.

Diagnosis and Hematological Evaluation

When characteristic oral lesions are observed, definitive confirmation requires laboratory correlation [3, 4]:

Diagnostic Test	Typical Findings in IDA	Clinical Relevance
Complete Blood Count (CBC)	Reduced Hb, HCT, MCV, MCH; Elevated RDW	Confirms microcytic hypochromic anemia picture
Peripheral Smear	Microcytosis, hypochromia, anisopoikilocytosis	Visual validation of altered erythrocyte morphology
Serum Ferritin	Low	Most sensitive and specific indicator of depleted iron stores
Serum Iron & TIBC	Low serum iron; Elevated TIBC	Reflects reduced circulating iron and increased binding capacity
Differential Diagnosis	Rule out Beta-thalassemia, ACD, Lead poisoning	Distinguishes IDA from other microcytic conditions

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Pediatric Dental Management Protocol

Management demands a coordinated medical-dental approach [8–10]:

- **Preventive Care:** Recall visits every 3–6 months, strict oral hygiene instruction, fluoride varnish application, and pit and fissure sealants [8, 10].
- **Lesion Management:** Topical soothing/protective gels for ulcers, antifungal/antibacterial ointments for angular cheilitis, and hydration for xerostomia.
- **Clinical Precautions:** Short morning appointments to minimize fatigue; defer elective invasive surgeries until severe anemia is medically stabilized.
- **Dietary Guidance:** Promote iron-rich foods (green leafy vegetables, pulses, eggs, lean meats) consumed alongside Vitamin C sources to enhance absorption, while limiting excess cow's milk and tannins with meals [4, 5].

Discussion & Conclusion

The oral cavity provides a visible window into systemic micronutrient deficiency [6]. Pediatric IDA not only affects mucosal integrity and causes patient discomfort, but also compromises salivary defense and tooth mineralization, predisposing children to severe early childhood caries and gingival inflammation [6,7]. While cross-sectional evidence strongly supports this clinical association, prospective studies are needed to further clarify direct causal pathways.

Conclusion: Early identification of oral signs by pediatric dentists allows prompt medical referral, preventing chronic systemic complications and restoring optimal pediatric oral health [8–10].

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