

## ORAL MANIFESTATIONS OF NUTRITIONAL DISEASES IN CHILDREN

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### ABSTRACT

Examination of the oral cavity can reveal signs and symptoms of immunologic diseases, endocrinopathies, hematologic conditions, systemic infections, and nutritional disorders. Iron deficiency anemia is present particularly in developing countries and characteristic oral manifestations include mucosal pallor, atrophic glossitis, and candidiasis. Vitamin D deficiency rickets occur in children between 3 months and 2 years old, as well as in teenagers during growth spurts which require high levels of calcium and phosphorus. The occurrence of cavities is also enabled by enamel dysplasia caused by malnutrition in the first years of life, this being a location of choice for the occurrence of cavities. Oral manifestations of malnutrition include aphthous stomatitis and atrophic glossitis caused by anemia and avitaminoses. The oral cavity plays an important part in many physiological processes represented by digestion, respiration and phonation. Oral signs frequently precede general symptoms. Physicians should be familiar with the relationship between systemic and oral health.

**Key words:** oral manifestation, nutritional, disease

### INTRODUCTION

Examination of the oral cavity can reveal signs and symptoms of immunologic diseases, endocrinopathies, hematologic conditions, systemic infections, and nutritional disorders. Careful examination should include the assessment of mucosal changes, periodontal inflammation and bleeding, and general condition of the teeth. Identifying these oral findings may enable early diagnosis and treatment. Physicians should be familiar with the relationship between systemic and oral health.

#### Iron Deficiency Anemia

Iron deficiency anemia is a major public health problem and the main deficiency disease affecting children's growth, development and infection resistance, and is associated with a high mortality rate in children below the age of 2. [1] Iron deficiency anemia affect approximately 25% of the world's population, particularly children between 4 and 24 months old, young teenagers, as well as pregnant and

breastfeeding women. Iron deficiency anemia affects 43% of preschoolers worldwide, particularly in developing countries, where anemia rates are four times higher than in developed countries. Prevalence rates vary depending on the sanitary and socio-economic conditions and the morbidity rate. [3] In Romania, iron deficiency anemia (one of the most frequent types of anemia) occurs in approximately 40% of children up to the age of 5 and in 30% of pregnant women. [2,3]

#### General Clinical Manifestations:

Anemia occurs most frequently during the first years of life. Clinical manifestations include pallor, asthenia, inappetence, cephalalgia, and tachycardia, paresthesias, and attention deficit. [1,6] Fingernails become more brittle, flattened, and sometimes become concave (koilonychia). Dysphagia has an irregular rate of occurrence and is caused by the atrophy of the pharyngeal mucosa. [1,6]

**Oral manifestations of iron deficiency anemia** (Fig. 1) **include** mucosal pallor, atrophic glossitis, and candidiasis. Pallor of the buccal mucosa and gums occurs as a result of decreased levels of hemoglobin and oxygen in the tissues. <sup>[2, 4, 7, 8]</sup> The general atrophy of the mucosa can also be noted, including that of the dorsal surface of the tongue. The tongue develops characteristic features of atrophic glossitis with dark red patches and depapillation. The filiform papillae of the anterior two-thirds of the lingual mucosa are the first to be affected by atrophy. <sup>[2, 5, 8]</sup>

In severe cases, the fungiform papillae are also affected, so that the tongue becomes completely smooth. This generalized atrophy can lead to erosions and even ulcerations with chronic persistent forms. <sup>[1, 2, 4]</sup>

Atrophic glossitis is a nonspecific finding that can occur in association with iron deficiency anemia, pernicious anemia/vitamin B complex deficiencies, and various other conditions. Oral candidiasis is another major complication of iron deficiency anemia. These chronic lesions can be an important factor in the occurrence of oral mucosa carcinoma, particularly in older patients. <sup>[2]</sup> Angular cheilitis occurs in the oral commissures, with the related ulcerative patches extending beyond the mucosal-cutaneous junction and thus being associated with the occurrence of bleeding and pain when opening the mouth. <sup>[2, 5, 8]</sup>

In less severe cases, the patient may present with burning mouth syndrome (glossodynia), while the occurrence of erosions and ulcerations are associated with burning and pain, which prevent the normal alimentation of the child and thus create a vicious circle. <sup>[2]</sup>

Iron deficiency may also lead to atrophy of oral mucosa, because iron is essential to the normal functioning of oral epithelial cells, and in an iron deficiency state, oral epithelial cells turn over more rapidly and produce an atrophic or immature mucosa. <sup>[9]</sup>

### **Plummer-Vinson (Paterson-Kelly) Syndrome**

The Plummer-Vinson syndrome, also called *sideropenic dysphagia* or *sideropenic nasopharyngopathy*, is a pathologic condition that occurs in long term iron deficiency anemia. In this syndrome, iron deficiency anemia is associated with the existence of symptoms and features of dysphagia, atrophic glossitis and fingernail dystrophy (koilonychia). Dysphagia occurs due to muscle degeneration, as well as due to esophageal rings – thin, ring-shaped folds of the mucosa, that partially block the transport of foods through the esophagus. The common clinical features include sore and depapillated red strawberry tongue, dry mouth, spoon-shaped fingernails and angular cheilitis. Atrophy leads to changes in the oral, pharyngeal and upper-esophageal mucosa. The general symptoms include pallor, palpitations, fatigue and shortness of breath (dyspnea). Many of the patients with this syndrome are edentulous, having lost their teeth early on. Patients frequently report sensations of “throat spasms”. <sup>[10]</sup>

Oral and periodontal surgical interventions should be avoided on account of the risks of bleeding and delayed healing. When hemoglobin levels drop below 10 g/dl, hypoxia impairs the interactions between the cellular components of blood, particularly platelets and endothelial cells, reducing their hemostatic capacity. <sup>[7]</sup>

### **Vitamin D Deficiency Rickets**

Rickets is a general nutritional condition affecting the organism during rapid growth, caused by vitamin D deficiency and leading to impaired metabolism of phosphorus and calcium with deficiencies in skeletal mineralization and excessive accumulation of osteoid tissue during the growth process which leads to bone deformities. <sup>[11, 12]</sup>

Vitamin D deficiency rickets occurs in children between 3 months and 2 years old, as well as in teenagers during growth spurts which require high levels of calcium and phosphorus. In Europe, around 50–70% of young children show signs of rickets, while 40% of teenagers present with hypovitaminosis D. In developing countries, the prevalence of hypovitaminosis D varies

largely from one region to another (from 30 to 90%). There is a high prevalence in children in China and Mongolia, but the highest can be found in Africa. Risk factors for hypovitaminosis D in developing countries are the same as those reported in western countries and include age extremes, females, winter season, skin pigmentation (African population), malnutrition, lack of sun exposure, high coverage clothing style, as well as obesity. In Romania, 40% of children show signs of this disorder.<sup>[12]</sup>

#### General Clinical Manifestations:

Clinical manifestations range from the mild ones such as anxiety, nocturnal hyperhidrosis, unprovoked irritability, difficult breathing (dyspnea), muscle cramps, paresthesias in the extremities, sensation of lump in one's throat associated with palpitations, colic abdominal pain, abdominal meteorism, inappetence, precocious satiety, physical and mental asthenia, lack of emotional consistency, and impaired concentration. Severe manifestations of hypocalcemia include seizures, muscle contractures, screaming for no apparent reasons, glottic spasm, tremor and signs of intracranial hypertension in newborns.



Figure 1. Oral manifestations in iron deficiency anemia.

The orthodontist should be aware of the effect of his therapy on the dental development in these patients.

Subsequent manifestations includes growth retardation that is also known as rachitic dwarfism. Specific bone modifications include the thickening of extremities, rachitic rosary (thickening of the chondrocostal junctions), thoracic deformities (protrusion of the sternum and ribs – pectus carinatum), Harrison's groove, deformities of the limbs, and bone fractures. Cranial deformities include the asymmetric prominence of the frontal and parietal bones, occipital flattening – plagiocephaly, craniotabes – softening of the occipital bone which has the consistency of a "celluloid ball" upon palpation (this feature has no clinical relevance until the age of 3 months), delayed fontanel closure beyond the age of 18 months or, in some cases, craniosynostosis. Distended abdomen occurs as a result of low muscle tone.<sup>[11]</sup>

**The oral manifestations of vitamin D deficiency rickets** (Fig. 2) include delays in dental development and eruption, as well as enamel hypoplasia with high risk of dental cavities.<sup>[11]</sup> Sometimes teeth erupt irregularly, are underdeveloped, fragile and have precocious cavities. Hypophosphatemic rickets can be considered in patients with recurrent abscesses that develop for no apparent reason.



Figure 2. Oral manifestations in hypophosphatemic rickets

#### Protein-Energy Malnutrition (PEM)

Malnutrition is a chronic disorder of the state of nutrition caused by the imbalance

between the intake of nutrients (energy and/or protein) and the nutrients that the body needs to ensure its harmonious growth and development and the performance of its specific function. Malnutrition presents itself as low body weight reported to age, and its chronic forms feature low body weight reported to height. In addition to the major nutrient deficiencies, it also includes deficiencies of vitamins and mineral salts – which account for iron deficiency anemia, rickets, and avitaminoses.<sup>[13]</sup> Over 3 million children die every year due to malnutrition – that is over 50% of all under-five mortality rates<sup>[14]</sup>, and even an estimated 70% of worldwide mortality rates for children up to the age of 4.<sup>[14]</sup>

In 2015, WHO reported a 17.6% worldwide occurrence rate of malnutrition with maximum prevalence in developing countries.<sup>[15]</sup> In Romania, one child in three is malnourished. Statistics of the Ministry of Health showed that 6,360 new cases of protein-energy malnutrition were recorded in 2009 in children under the age of 2, and 1,553 cases were recorded in the first quarter of 2010.<sup>[13]</sup>

Children with long term nutritional deficiencies have an insufficient linear growth compared to children in the same age group. The deficiency is associated with a chronic insufficient intake of proteins, micronutrients and energy, such inadequate and often poverty-related nutritional features leading to side effects such as frequent illness or infections. If this deficit is not recovered during the first years, it will have a long term negative impact on the cognitive health and development of the child and, subsequently, the individual.<sup>[16]</sup>

#### **Clinical manifestations:**

Protein-energy malnutrition (PEM) is frequent in children under the age of 5 due to the increasing energy intake requirements and their susceptibility to bacterial and viral infections. The depressed cell immunity caused by malnutrition enables a high sensitivity to infections, which accentuates the initial deficit, such that the infections is frequently the cause of death.<sup>[17]</sup>

The signs and symptoms of marasmus vary depending on the importance and duration of the energy deficiency.<sup>[18]</sup>

Clinical signs and symptoms of PEM include poor weight gain, slowing of linear growth and behavioral changes: irritability, apathy, decreased social responsiveness, anxiety, and attention deficits. The most common and clinically significant micronutrient deficiencies and their consequences include the following:

- Iron deficiency: fatigue, anemia, decreased cognitive function, headache, glossitis, and nail changes;
- Iodine deficiency: goiter, developmental delay, and mental retardation;
- Vitamin D deficiency: poor growth, rickets, hypocalcemia, delayed dental eruption;
- Vitamin A deficiency: night blindness, xerophthalmia, poor growth, and hair changes, hypoplasia/dysplasia of dental enamel;
- Folate deficiency – glossitis, anemia (megaloblastic), and neural tube defects
- Zinc deficiency: anemia, dwarfism, hepatosplenomegaly, hyperpigmentation and hypogonadism, acrodermatitis enteropathica, diminished immune response, and poor wound healing.<sup>[19]</sup>

**Oral manifestations of PEM include** recurrent aphthous stomatitis and atrophic glossitis caused by anemia and avitaminoses. Vitamin A deficiency leads to the atrophy of the salivary glands along with xerostomia, which reduces the defense capacity of the oral cavity and leads to a lack of mucosal lubrication, loss of the buffer function of saliva, therefore to the occurrence of cavities.<sup>[20,21]</sup>

The occurrence of cavities is also enabled by enamel dysplasia caused by malnutrition in the first years of life. Periodontal disease develops more rapidly in malnourished patients because of the limited defense capacity of their organism, thus leading to premature tooth loss. Necrotizing ulcerative gingivitis is a severe form of periodontal disease with major risks.<sup>[21]</sup>

## Conclusions

The oral cavity plays an important part in many physiological processes represented by digestion, respiration and phonation. It can be associated with a “mirror” of the entire organism because systemic disorders are accompanied by oral manifestations. Oral signs frequently precede general symptoms.

This is why it is important that dentists recognize these oral features and refer the patient for additional testing, guide him/her to other departments or even diagnose severe systemic disorders. The overall state of health of the entire organism is reflected in the state of health of the oral cavity and vice versa

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