

*Full Length Research Paper*

# Iron deficiency anemia and oral health prospective - A review

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According to the World Health Organization, a normal hemoglobin level for an adult male is around 13.8 g/dl and for an adult woman is around 12.1 g/dl. When the hemoglobin level in the blood is below the lower extreme of the normal range for the age and sex of the individual, anemia is said to be present. Anemia is not a diagnosis; it is a symptom of some underlying condition or health even. Anemia is a global public health problem affecting both developing and developed countries with major consequences for human health as well as social and economic development. It occurs at all stages of the life cycle, but is more prevalent in pregnant women and young children. Of significance is the fact that India is among the countries with highest prevalence of anemia in the world. India has a population of more than a billion. As such, the country accounts for the largest number of anemic persons in the world. Overall, India contributes to about 50% of global maternal deaths due to anemia. The present review is an attempt to provide an overview of etiology, signs and symptoms of various types of anemias with emphasis on the oral manifestations, and their influence on the treatment plan of the dental health professional.

**Key words:** Anemia, hemoglobin level, symptom, India.

## INTRODUCTION

Iron deficiency anemia is the most common cause of anemia in India and throughout the world. This form of anemia develops when the amount of iron available to the body cannot complete the need of iron for the production of red blood cells. Iron deficiency anemia is a global public health problem, as compelling and harmful as the epidemics of infectious diseases.

According to WHO Report (2002), iron deficiency anemia was considered to be the most important contributing factors to the global burden of anemia. Children and women in reproductive ages are more at risk factor for developing iron deficiency anemia. According to Maternal Mortality in India (2008), 20% of all the maternal deaths are attributed to anemia during pregnancy (Suneeta, 2007).

## PREVALENCE OF IRON DEFICIENCY ANEMIA IN SOUTH ASIA (%)

Table 1 shows the prevalence of iron deficiency anemia in South Asia. In India, the prevalence of anemia is high

because of:

- Low dietary intake, which is less than 20 mg /day.
- Poor bio-availability of iron in Indian diet.

Adolescence is a crucial phase of growth in the life cycle of an individual. Due to rapid growth there is increase in iron requirement in both adolescent boys and girls. Though the exact prevalence has not been determined, at least 75-85% adolescent girls in India are anemic.

The rates of low birth weight, prematurity, neonatal and infant mortality among children born to undernourished adolescent women is high. In order to prevent high maternal mortality and high incidence of low birth weight children in India, there is a need to combat anemia during adolescence. This is the motive behind the 12 by 12 initiative by WHO (Suneeta, 2007).

## 12 By 12 Initiative (Suneeta, 2007)

A multi-pronged 12 x 12 initiative has been launched in

**Table 1.** Prevalence of Iron Deficiency Anemia in South Asia (%)

Country	Children < 5 years	Women 15-49 years	Pregnant women	Maternal deaths from anemia/year
Afghanistan	65	61	-	-
Bangladesh	55	36	74	2800
Bhutan	81	55	68	< 100
INDIA	75	51	87	22,000
Nepal	65	62	63	760
Pakistan	56	59	-	-
World total				50,000

the country for addressing the problem of anemia. The target groups are the adolescents across the country. The aim is to achieve hemoglobin level of 12 gm% by the age of 12 years by 2012. The initiative comprises health and nutrition education, weekly supplementation with iron folic acid tablet, parasite control through periodic deworming and appropriate immunization along with measures for capacity building. This initiative has been launched with the support of the Government of India, the Indian Council of Medical Research, World Health Organization, UNICEF, Federation of Obstetrics and Gynecological Societies of India and other professional bodies.

### Causes

Iron deficiency anemia develops under 4 conditions:

1. Excessive blood loss.
2. Increased demands for red blood cells.
3. Decreased intake of iron.
4. Decreased absorption of iron.

### Iron metabolism (Provan, 1999; DeMaeyer and Adiels-Tegman, 1985; Demir et al., 2004)

Iron plays a pivotal role in many metabolic processes. The average adult contains 3-5 grams of iron, of which two-thirds is in the oxygen carrying molecule hemoglobin. A normal diet provides about 15-mg of iron daily, of which 5-10% is absorbed, mainly in the duodenum and upper jejunum. The acidic conditions help the absorption of iron in the ferrous form. Absorption is helped by the presence of other reducing substances, such as hydrochloric acid and ascorbic acid. The body has the capacity to increase its iron absorption in the face of increased demand, for example, in pregnancy, lactation, growth spurts and iron deficiency. Once absorbed from the bowel, iron is transported across the mucosal cell to the blood, where it is carried by the protein transferrin to develop red blood cells in the bone marrow.

Iron stores ferritin. Ferritin is a labile and readily accessible source of iron. In a day, about 1-mg of iron is excreted from the body in urine, feces and sweat. Menstrual losses account to an additional 20-mg per month. In pregnancy, the increased requirement of iron of

around 500-1000-mg per month, contribute to the higher incidence of iron deficiency in women of reproductive age (Lozoff et al., 2003; McIntyre and Long, 1993).

### Risk factors of iron deficiency anemia

1. Age: Adolescents, postmenopausal women.
2. Sex: Increased risk in women.
3. Reproduction: Menorrhagia.
4. Renal: Haematuria.
5. Gastrointestinal tract: Appetite or weight changes, changes in bowel habits, bleeding from rectum, melaena, gastric or bowel surgery.
6. Drug history: Aspirin and non-steroidal anti-inflammatory drugs.
7. Social history: Diet, especially vegetarians.
8. Physiological: Pregnancy, infancy, adolescence, breastfeeding.

### Clinical features of iron deficiency anemia

Iron in hemoglobin binds with oxygen and carries it throughout the body to vital organs. When there is inadequate iron, there is inadequate oxygen. Oxygen-deprived organs cannot function properly and may even fail if deprived of oxygen rich blood for a prolonged length of time. Headache, dizziness, drowsiness, shortness of breath, and syncope occur when too little oxygen is available to the heart and the brain. This lack of oxygen can also cause tachycardia and chest pain (Provan, 1999).

Fatigue and weakness is a common experience for people with iron deficiency anemia. Weakness is due to the body straining to acquire more oxygen and muscles being stressed to function without sufficient blood flow. Then they become progressively weaker and eventually may begin to spasm. Twitching, flinching, or an uncontrollable urge to move the legs, a condition called as Restless Legs Syndrome, are common symptoms of iron deficiency anemia. Restless legs syndrome is a prevalent disorder affecting between 5 to 15% of the adult population.

Pallor or pale skin is often observed in a person with anemia. The person may have a ghostly pale appearance. The areas that will be pale include the conjunctiva, cheeks, tongue, fingernail beds, and the



**Figure 1.** showing koilonychia (spoon-shaped nails)

palms of the hands. Paleness occurs as the body diverts oxygen-rich blood from less vital areas to the heart, lungs, and brain.

On examination, skin, nail and other epithelial changes may be seen in chronic iron deficiency. Atrophy of the skin occurs in about one third of patients and nail changes such as spoon-shaped nails. This is known as koilonychia, which may result in brittle, flattened nails (Figure 1).

Although uncommon, oesophageal and pharyngeal webs can also be a feature of iron deficiency anemia. Pica, or the desire to eat nonfood items such as glue, hair, paint, clay, or dirt, is a symptom of iron deficiency that can be seen in any age. Pica is most often seen in children.

### **Oral manifestations**

Oral manifestations of iron deficiency anemia include angular cheilitis, atrophic glossitis or generalized oral mucosal atrophy. The glossitis has been described as a diffuse or patchy atrophy of dorsal tongue papillae, giving a smooth, glazed appearance of the tongue. This is often accompanied by tenderness or a burning sensation.

Some investigators have suggested that iron deficiency predisposes the patient to candidal infection, which results in changes seen at the corners of the mouth and on tongue.

Lactoferrin is a protein contained in body fluids such as saliva, tears, and vaginal secretions. It provides a defense function because it binds with iron and withholds the iron from pathogens such as *Candida*. When lactoferrin levels are low, *Candida* can proliferate on the free iron. This is one of the reasons for the soreness of the tongue.

### **Laboratory investigations (McIntyre and Long, 1993)**

A full blood count and film should be assessed. These

will confirm the anemia. Recognizing the indices of iron deficiency is usually straightforward. The following findings are seen:

- Reduced haemoglobin concentration.
- Reduced mean cell volume.
- Reduced mean cell haemoglobin.
- Reduced mean cell haemoglobin concentration.

Some modern analyzers determine the percentage of hypochromic red cells. The blood film shows microcytic hypochromic red cells. Hypochromic anemia occurs in other disorders, such as anemia of chronic disorders, sideroblastic anemias and in globin synthesis disorders, such as thalassaemia (McIntyre and Long, 1993).

To differentiate the type, further haematologic assays may be necessary. Historically, serum iron and total iron binding capacity, that is, TIBC, were used in the diagnosis of iron deficiency anemia.

### **Serum ferritin level**

Haematologic assays demonstrate reduced serum ferritin concentration in straight forward iron deficiency. As an acute phase, however, the serum ferritin concentration may be normal or even raised in inflammatory or malignant disease (Punnonen et al., 1997).

A prime example of this is found in rheumatoid disease, in which the active disease may result in a spuriously raised serum ferritin concentration masking an underlying iron deficiency caused by gastrointestinal bleeding after non-steroidal analgesic treatment. In cases where ferritin estimation is likely to be misleading, the soluble transferrin receptor (sTfR) assay may aid the diagnosis (Provan, 2005). Transferrin receptors are found on the surface of red cells in greater numbers in iron deficiency. Unlike serum ferritin, the level of sTfR does not rise in inflammatory disorders, and hence can help to

**Table 2.** Diagnosis of Iron Deficiency Anemia

Reduced haemoglobin	Men <13.5 g/dl, women < 11.5 g/dl
Reduced MCV	< 76 femtoliters (76–95 femtoliters)
Reduced MCH	29.5 ± 2.5 pg (27.0–32.0 pg)
Reduced MCHC	32.5 ± 2.5 g/dl (32.0–36.0 g/dl)
Blood film	Microcytic hypochromic red cells
Reduced serum ferritin	Men <10 µg/L, premenopausal women <5 µg/L, postmenopausal women <10 µg/L
Elevated percentage of hypochromic red cells	> 2%

**Table 3.** Characteristics of anemia associated with other disorders

Variable	Iron deficiency	Chronic disorders	Thalassaemia trait (α or β)
Degree of anaemia	Any	Seldom < 9.0 g/dl	Mild
MCV	↓	↓	↓ ↓
Serum ferritin	↓	↑	N
sTfR	↑	N	↑
Marrow iron	Absent	Present	Present

differentiate between the anemia due to inflammation and iron deficiency (Punnonen et al., 1997).

### **Bone marrow sampling**

Bone marrow aspirate may be carried out to demonstrate absent bone marrow stores.

### **Diagnosis of iron deficiency anemia**

Tables 2 and 3 show the diagnosis of iron deficiency anemia.

### **Treatment**

Effective management of iron deficiency relies on:

- (i) Appropriate management of the underlying cause, for example, gastrointestinal or menstrual blood loss.
- (ii) Iron replacement therapy.

Oral iron replacement therapy, with gradual replenishment of iron stores and restoration of hemoglobin, is the preferred treatment.

Oral ferrous salts are the treatment of choice and usually take the form of ferrous sulphate (200-mg) three times daily. Alternative preparations include ferrous gluconate and ferrous fumarate. All three compounds, however, are associated with a high incidence of side effects, including nausea, constipation and diarrhoea. These side effects may be reduced by taking the tablets after meals. Modified release preparations have been developed to reduce side effects, but in practice these prove expensive and often release the iron beyond the sites of optimal absorption (Provan, 1999, 2005). Effective iron replacement therapy should result in a rise in

haemoglobin concentration of around 0.1-g per deciliter. But this varies from patient to patient. Once the hemoglobin concentration is within the normal range, iron replacement should continue for 3-months to replenish the iron stores (Provan, 2005).

### **Failure to respond to oral iron therapy**

The main reason for failure to respond to oral iron therapy is poor compliance. However, if the losses, for example, bleeding, exceed the amount of iron absorbed daily, the haemoglobin concentration will not rise as expected. The presence of underlying inflammation or malignancy may also lead to poor response to therapy. Occasionally, malabsorption of iron, such as that seen in coeliac disease, may lead to a failure to respond to the therapy (Provan, 1999, 2005).

### **Intravenous and intramuscular iron preparations**

Parenteral iron may be used when the patient cannot tolerate oral supplements, for example, when patients have severe gastrointestinal side effects or if the losses exceed the daily amount that can be absorbed orally. Intramuscular iron sorbitol injection was used as a parenteral iron replacement for many years. Generally, around 10-20 deep intramuscular injections were given over 2-3-weeks. However, side effects were common and included pain, skin staining at the site of injection and arthralgia. Newer intravenous iron preparations which include iron hydroxide sucrose and iron dextran, can be given intramuscularly (Provan, 1999, 2005).

### **Prevention**

When absorption from the diet is likely to be matched or

exceeded by losses, extra sources of iron should be considered. Examples include prophylactic iron supplements in pregnancy or after gastrectomy, or encouragement of breastfeeding.

### Dental consideration

Dental patients presenting with symptoms of anemia or oral signs suggestive of this condition should have a complete blood count, including differential blood count. If significantly lowered hemoglobin values are obtained, the patient should be referred to his or her physician for a more thorough medical history, laboratory diagnosis, and treatment (William and Martin, 2003, 2008).

Elective oral surgical or periodontal procedures should not be performed on patients with marked anemia because of the potential for increased bleeding and impaired wound healing. When hemoglobin levels fall below 10 g/dL, the low oxygen tension affects the rheologic interactions between the cellular components of blood, mainly platelets and endothelium, decreasing their ability to clot effectively (William and Martin, 2003, 2008). General anesthesia should not be administered unless the hemoglobin is at least 10 g/dL. The patient should never be treated with iron until the cause of the microcytic hypochromic anemia is found and corrected or until a thorough search for the cause has proved unsuccessful.

### CONCLUSION

Various blood disorders, ranging from anemia to malignancies, can have oral manifestations. Several types of anemia present very characteristic oral, clinical and radiological features. This signifies the role of the dental health professional for diagnosis and dental management of patients with anemia. Bleeding disorders may be related to nutritional deficiencies which can lead to failure in normal haemostatic mechanisms. These disorders are usually the result of abnormalities of platelets, blood vessels, plasma coagulation factor or the fibrinolytic system. These types of anemia must be detected early and affected patients should be referred promptly to a physician for diagnosis and treatment before invasive dental procedures are performed.

In conclusion, it is apparent that a thorough knowledge of oral manifestations of anemia becomes important. For this, a detailed history, clinical examination and screening tests play a vital role in the diagnosis of anemia. Hence, since the dental health professional may be the first person to recognize the presence of anemia, his role in the multidisciplinary approach in the diagnosis and

management of the various types of anemias cannot be underestimated.

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