

# Dental Caries and Blood Disorders

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## ABSTRACT

Blood is a fluid tissue comprising cellular elements. It acts as second line of defence. Any abnormal increase or decrease may lead adverse effect on health. Oral cavity acts as first line of defence and any abnormality or disease can lead to systemic and oral complications. Commonly seen oral diseases are caries, periodontitis, gingivitis and oral cancers. Dental caries accounts for about 31.5%-89% of prevalence in Indian population. Caries can result in sever destruction of tooth structure or extraction of tooth in severe cases. It may also lead to spread to other tooth if not addressed well in time. Leading to loss of diet and worsening the overall health of an individual due to lack of nutrition.

**Keywords:** Blood, Periodontitis, Gingivitis, Oral cancers

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## INTRODUCTION

The World Health Organization (WHO) states that health of oral cavity plays a crucial role in maintaining health and wellbeing, of an individual as well as it plays a very important role in determining overall health of every single individual. Examination of oral cavity reveals details about general health and well-being. Health of oral cavity, ultimately reflects and supports the health of our whole body. Links between oral health and general health-the case for actions by dental health services. Victoria explains that the health of oral cavity and systemic health are inextricably related. It is well known that chronic diseases are closely associated with poor oral health. Many oral disease conditions and severe systemic diseases share common risk factors as oral cavity acts as first line of defence in body. Problems with general health can aggravate oral health conditions. Caries, periodontitis, gingivitis and oral cancer are the most frequent oral diseases and are greatest threat to oral health. In cancer cells increased cellular proliferative activity during transformation causing alteration of biochemical content of cells [1].

The oral cavity acts as niche for the most diverse and extensive bacteria in the body, not just those associated

with dental caries and periodontitis, but also those causing general health issues. Explicitly or implicitly, infection of any kind has a negative effect on our bodies, at any location. The severe infection persists for longer time and increases the possibility of systemic health compromise and infection. A serious infection can negatively affect the immune system and interfere with its ability to fight off other infections and diseases. The severity, type and duration of an infection can all have an impact on the immune system. Pulpitis and periapical infection occur as a result of dental caries. Caries causing organisms penetrate through the enamel and dentin to reach the pulp. To avoid this eradication of these microbes from the infected root canals must be done meticulously. Untreated decay can become so advanced that the tooth must be extracted. According to Thomas McGuire, dental caries can affect a person's overall health. For instance, tooth loss leads to difficulty with mastication and consequently, can affect digestion. Moreover, its presence can interfere with mastication. Dental caries does not have access to the systemic body but, it can contribute significantly to systemic health problems [2].

## LITERATURE REVIEW

Blood is unique tissue as it is comprising of fluid containing blood cell and plasma. They are classified in these groups based on the function and morphology of each cell. Blood cells are formed in the bone marrow. Erythrocytes are major cellular component which are biconcave shaped and has oxygen carrying capacity. Leukocytes or WBC plays a major role in defending the body against infective microorganisms and foreign bodies.

These cells provide defence against various infections. Blood comprises a greater number of red blood cells ranging from 4 to 6 million cells per microliter, than white blood cells which comprises of 4 to 11 thousand cells per microliter. However, increase or decrease in these may affect the overall health of an individual. Dental caries is an irreversible microbial disease that affects the calcified tissues of the teeth and is characterized by demineralization of the inorganic component and destruction of the organic component, thereby causing a high incidence of caries. Salivary flow, formation of biofilm, diet, the substrate and poor oral hygiene influences the occurrence of caries. Saliva has cleansing action on the tooth surface, anticariogenic, buffering capacity, proteolytic activity, antibacterial and controls demineralization and remineralization and other mechanism helps in preventing caries [3]. Reduced salivary secretion leads to decrease in anticariogenic and proteolytic activity. Dental plaque is defined clinically as hard, yellow-greyish coloured substance that cannot be removed easily and adheres to the intraoral hard surfaces, including sound tooth structure, as well as removable and fixed restorations. Increased level of plaque causes bacterial accumulation and periodontal diseases which leads to higher incidences of caries. Plaque containing accumulation of *S. mutans*, *S. aureus*, Actinomycosis, *Nisseria*, *Streptococcus* and other species, drop in pH below 5.5 resulting in subsurface and surface demineralization [4].

## DISCUSSION

### Blood disorders

**Thalassemia:** Thalassemia is a group of hereditary deficiencies that results in synthesis of polypeptide chains of the haemoglobin molecule. They are for 2 major type  $\alpha$ -thalassemia and  $\beta$ -thalassemia. Thalassemia has adverse effects on the patient's physical health as well as has a psychosocial impact on the family and diseased individual. Thalassemia's are classified as homozygous or heterozygous types based on their clinical and genetic defect. Thalassemia  $\beta$ -thalassemia, also known as Cooley's anaemia, exhibits the most aggressive clinical symptoms. Whereas  $\alpha$ -thalassemia appears to be mild and clinically asymptomatic [5]. Individuals with thalassemia major have severe anaemia, requiring blood transfusions at regular intervals. Frequent blood transfusion is expensive, resulting in increased financial load of an individual. Various structural and physical changes take place in thalassemia patients. Transfusion therapy may leads to iron overload-related. The most common oral structural alterations that appear in thalassemia disease are enlargement of maxilla, high zygomatic bone placement, retracted upper lips, proclination of the anterior teeth mostly maxillary, increased spaces between the teeth, overbite, open bite and malocclusion. Furthermore, poor oral hygiene and inadequate diet intake, as well as lack of knowledge also contribute to the higher incidence of caries. A similar study shows that the higher incidence of dental caries in thalassemia patients may be due to decreased

Immunoglobulin A (IgA) levels in saliva, increasing the microbial population, thus significantly contributing to the higher caries incidence. Not only reduced IgA level contributes to higher incidences of caries, but negligence also plays important role in such individuals. As, they are more interested in complicated physical health issues and seek dental care treatment when the individual is in agony. Thalassemia is associated with increased levels is associated with higher dental caries experience [6].

Medically compromised individuals and individuals with thalassemia are more likely to suffer from active dental disease. Life-threatening diseases cause patients to overlook basic dental care, including oral hygiene. In addition to poor oral hygiene, inadequate diet intake, lack of knowledge and lack of motivation, the prevalence of caries is also increased by poor oral hygiene and poor oral hygiene, compromised salivary flow, increased level of plaque and calculus. This may lead to increased untreated dental caries which may result in increased diseased tooth [7].

**Sickle cell disease (SCA):** Sickle cell disease (SCA) is a hereditary hemoglobinopathy. The prevalence of sickle cell disease is almost 10%. It is caused due to production of abnormal haemoglobin, called Haemoglobin S (HbS) which binds with the red blood cell. The sickle cell disease occurs due to point mutation in the gene coding the  $\beta$  chain resulting in a single amino acid substitution *i.e.*, valine for glutamic acid in the  $\beta$  globin chain. The red blood cells become sickle-shaped instead of normal disc or biconcave shape. Sickle cell disease is the most common disease in Brazil and African descendants. The disease is characterized as chronic haemolytic anaemia, sickle cell crises, bacterial infections, gradual tissue degeneration and organic function, which may shorten life expectancy up to 6-8 years, mainly due to multiple organ failure [8]. Sickle cell disease results in renal, pulmonary, musculoskeletal, cardiovascular, orthopaedic, oral and various other manifestations. In case of sickle cell anemia, patients are associated with high risk of perioperative complications like obstruction of microcirculation by sickled RBCs, chest pain, cough, fever, infections after being operated, congestive heart failure, cerebrovascular accident and acute kidney injury. Common oral manifestations described in SCD patients, are lower salivary flow, mental nerve neuropathy, increased levels of plaque and deposition of calculus, radiographic abnormalities, hypo mineralization of the enamel, delayed tooth eruption, dental caries, malocclusion, hypercementosis. The role of dentist plays important role in sickle cell disease patients as they are at higher risk of dental complication due to change in the dental structure, medication containing sucrose and increased susceptibility to infections it increases invariably with poor oral hygiene [9].

Patients with sickle cell disease show varying manifestations of clinical symptoms and hospitalization episodes, as well as blood transfusions, which can lead to dental disease. Also, the ingestion of medicines which alter salivary pH, along with poor oral hygiene leading to higher plaque and calculus index, suggest a greater

tendency to form dental caries. Concluding that patients with sickle cell anaemia have higher prevalence of caries compared to the normal individual.

**Iron deficiency anaemia:** Iron is an essential nutritional element which helps in carrying oxygen. In the absence of iron, haemoglobin cannot be synthesized, which results in iron deficiency anaemia. The disease has become a major public health issue globally both in developing and industrialized nations. According to the World Health Organization, iron deficiency is a prominent nutritional deficiency both in developing and developed countries. Its deficiency might result in various systemic as well as long-and short-term effects that are irreversible dysfunction of the developing central nervous system in children as well as in adults [10]. Dysfunction of the developing central nervous system in children as well as in adults leads to learning and memory inabilities, reduced motor skills and exaggerated anxiety in children. Iron deficiency anaemia results in various oral manifestation specially in children as early childhood caries. Early childhood caries can also be the result of premature birth. Various literature stating the association between early childhood caries and iron deficiency anaemia are available. Destruction of salivary gland functioning in children with iron deficiency results in reduced buffering capability as result of reduced salivary secretions and reduced salivary pH and thereby increasing caries. The individuals suffering from iron deficiency anaemia in early stages of like are more likely to suffer from caries resulting in early loss of molars affecting the diet of an individual leading to various dietary disorders and malnutrition due to poor nutrition. Also, the reciprocal relation stands true in case of iron deficiency anaemia. Tang et al., and Shaoul et al, in one of the studies stated that the iron deficiency in children lead to higher incidences of caries as a result of inadequate diet or diet with higher cariogenic food intake such as high carbohydrate diet, beverages etc [11].

Conclusively, individual suffering from iron deficiency anemia should take adequate care of their oral hygiene to prevent higher incidences of the oral diseases such as caries and periodontitis. These incidences are higher in children below 5 years of age, so proper balanced diet which provides adequate nutrition and dietary habits should be modified in prevalent individual which will also help in reducing the oral health disorders.

**Leukaemia:** It is white blood cells related disorder which occurs due to increased immature or abnormal leucocytes. It is malignant progressive disorder which begins in the white blood cells forming sites such as in bone marrow and other organs. It occurs due to the proliferation of a clone of abnormal blood cells with impaired differentiation, regulation and programmed cell death (apoptosis). The systemic manifestations are solitary, scattered or grouped lesions on torso, extremities and head are more common and less frequently on palmoplantar surfaces [12]. The oral manifestation of leukaemia are bleeding gums, ulceration on oral mucosae, petechiae, bone loss and gingival enlargement and secondary infections may occur as a

result or reduced immunity such as fungal infections due to candidiasis, herpes simplex virus infection. Other common dental manifestations are increased caries on cervical region of tooth, tooth pain, mobility and early exfoliation of teeth due to destruction of alveolar bone and periodontal ligaments in severe cases of leukemia. The increased incidence of dental caries is due to reduced oral hygiene, decreased salivation which reduces the cleansing in oral cavity, changes in oral microflora and modification of diet. The treatment should motivate the patient to maintain adequate oral hygiene, use of dentifrices containing fluoride (pea sized amount) the patients should also be advised to consume least sticky food, diet rich in carbohydrates and dietary sucrose and he/she should opt for frequent dental visits. Other than maintaining good oral hygiene care should be taken like drug formulations contain sugar should be use in such a way so that cariogenesis is significantly decreased. In children, sugar-containing medications should not be taken immediately before bedtime.

**Von willebrand disease:** Von Willebrand Disease (VWD) is the most common heterogenous genetic coagulation abnormality which occurs due to low levels of Von Willebrand factor or its failure of action in blood clotting. The normal estimated clotting time is about 2-8 minutes whereas it increases in VWD. VWD patients had more mucosal bleeding, with VWF levels having a big impact on how much bleeding they experience. Dental caries is the most common dental disease. Dental plaque on the tooth surface is important factor for developing caries. When carious lesions are not treated well within time, the chances of the lesion to extend deep into the dentin and enamel, leading to the need for a deep restoration or extraction of the tooth increases [13]. There by affecting the diet and overall health of an individual. Those with VWD are at higher risk. Extensive treatment complications can occur, during dental treatment including extractions and administration of local anaesthesia as they may result in excessive blood loss if not treated carefully. The treatment is such cases should be performed by a skilled dentist. Due to lack of skills and information as well as the awareness these patients either do not receive adequate treatment or are left untreated in both cases causes ill-effect on overall oral health and hygiene of an individual. Because of the higher risk of treatment in VWD patients, preventative dentistry and oral health education are critical factors in reducing the need for expensive and intense dental treatments. Such cases can be treated well with proper knowledge and skills along with educating the patient about the need of good oral hygiene and regular dental visits. This can be established with the help of haematologist, dentist and the patient.

**Haemophilia:** Haemophilia also known as royal disease. Haemophilia is a chromosomal bleeding disorder linked to X chromosome and caused by a deficiency of either of two coagulation factor (factor VIII or factor IX). Haemophilia based on the factors are classified in two types: Haemophilia A due to deficiency of factor VIII and haemophilia B due to factor IX. Haemophilia A and B can

be further divided into three types mild, moderate and severe based on the activity of factors. Haemophilia A occurs more commonly in males with incidences of roughly 80%-85% [14]. Haemophilia B have comparatively less incidences 10%-15%. The individuals with congenital coagulation disorders are at higher risk for dental caries and these patients have other oral diseases as they are hesitant to use daily oral hygiene measures to prevent bleeding episodes. The other complication that may arise during dental treatment are administration of local anaesthesia because of the abundant vasculature and the likelihood for hematoma development in the retromolar or pterygoid regions, inferior alveolar blocks necessitate factor replacement. Few investigations of the oral cavity in haemophilia patients have revealed a significant prevalence of dental problems and poor oral hygiene due to fear of prolonged bleeding after dental interventions and are left untreated or with minimal intervention which results in increased chances failure of treatment provided. Patients with hereditary bleeding problems must prioritise their dental health. Multiple dental visits as well as regular consultation with haematologist, physician and a dentist can guide the patient at times [15].

### CONCLUSION

Dental caries is caused due to various factors one the major factor being poor oral hygiene. In haematological diseases the oral hygiene status of the individual is compromised due to physical and psychological condition of an individual. Which leads to increased plaque and calculus which causes increased risk of caries. The other factors are reduced salivary flow in many of the haematological diseases. Saliva has cleansed action and the pH help in maintain adequate oral health. But significant decrease as seen in the cases of haemophilia as well as von Willebrand disease causes increase in biofilm deposition. The incidences of caries are comparatively higher than that of a normal healthy individual. The caries can lead to loss of tooth structure or extraction of tooth in case of extensive caries. Both affecting the diet and improper mastication leading to further complications. The individuals with haematological disorders can reduce the incidences by following methods:

- Follow basic dental prophylactic measures, such as brushing two a day with fluoride-containing toothpaste and using a pea-size amount.
- Changing the diet if the intake of sugar is higher, as well as avoiding the use of sugar-containing medications shortly before bedtime.
- It is important to scale at adequate intervals when a patient has less movement in case of severe conditions to avoid plaque and calculus formation.
- Application of fluoride in cases of children who are suffering from early childhood caries or rampant caries.
- Minimally invasive and less traumatic treatments are recommended such as lasers for detection and treatment of caries.

- Awareness about the bleeding disorders and improving skills of the dentist.
- Regular dental visits and consultation with haematologist, general physician as well as dentist.

This will help in maintaining the oral health of an individual suffering from blood disorder and avoiding further dental complication which may cause systemic effect.

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