

REVIEW ARTICLE

Periodontal diseases in children affected by systemic disorders: a review

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ABSTRACT

Periodontal diseases are inflammatory diseases, which adversely impact the tissues around the teeth. The current review aimed to investigate the prevalence of periodontal diseases in children. Scientific articles linked to the present topic were obtained using an online searching process. The searching process included several scientific websites such as Google Scholar and PubMed. We obtained 18 articles that matched with the current subject and were written in English. Out of those 18 articles, six were excluded as they were published before 2000, or did not focus on the present topic, or were written in a language other than English; therefore, only 12 papers were included. Periodontal diseases are a type of inflammation affecting tooth-supporting tissues, including root cementum, periodontal ligament, alveolar bone, cementum, and gingiva. Among children, periodontitis treatment with systemic diseases is a big challenge that needs effective collaboration with other medical specialists. The inflammatory response of patients with the systematic disorder decreased by the uptake of antibiotic therapy, and the results are not expected. Additionally, several side effects with oral manifestations are associated with medications for the treatment, including oral mucositis. Therefore, the dentist, when treating patients with periodontal diseases, should manage/control the microbial dental plaque and offer proper treatment.

Keywords: Periodontal diseases, periodontitis diseases, histological diseases, genetic diseases, children.

Introduction

Periodontal diseases are inflammatory diseases affecting tooth-supporting tissues, including root cementum, periodontal ligament, alveolar bone, cementum, and gingiva [1]. Periodontitis can also be identified as loss of periodontal tissues from the tooth attachment as well as alveolar bone height [2]. The gingiva is the soft tissue surrounding the tooth, and gingivitis occurs due to gingival inflammation [2]. According to most of the epidemiologic studies, it was indicated that the prevalence of periodontal disease is lower among children compared to adults [3,4].

Gingivitis or periodontitis are considered to be the most common periodontal diseases which result from the presence of subgingival tooth surfaces, calculus on supra-gingival, and the presence of bacterial plaque [5]. In the initial stage, the periodontal diseases start as gingivitis, which progresses to periodontitis only in some individuals. In children, periodontitis is classified as aggressive periodontitis, periodontitis, dental plaque, necrotizing periodontal diseases, and chronic periodontitis [5].

In children, plaque-associated gingivitis is reversible by removing the plaque and is considered the most common form of periodontal disease [6]. To initiate the periodontal diseases, the presence of both periodontal pathogens and microbial dental plaque is essential [7]. The severity and progression of the periodontitis is affected by the host defense and systematic diseases [7]. Several pathogens of periodontitis are found in the periodontal pockets, such as *Prevotella intermedia*, *Capnocytophaga sputigena*, *Eikenella corrodens*, and *Actinobacillus actinomycetemcomitans* [7,8]. In most cases, premature tooth loss is considered to be one of the aggressive forms of periodontal diseases in children and might

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be associated with most of the disabilities and chronic diseases that adversely impact the immune system [9]. Hematological disorders and genetic disorders are the most common categories of systemic diseases in children [10]. Hematological disorders include several diseases, such as leukemias and acquired neutropenia [10]. The genetic disorders include leukocyte adhesion deficiency syndrome, familial and cyclic neutropenia, Chédiak-Higashi syndrome, Down syndrome, Papillon-Lefèvre syndrome, and Histiocytosis syndromes [2].

Materials and Methods

Scientific articles linked to the present topic were obtained by using an online searching process. The searching process included different scientific websites such as Google Scholar and PubMed, using several keywords such as periodontal diseases, periodontitis diseases, histological diseases, genetic diseases, and children. We obtained 18 articles that matched with the current subject and were written in English. Of those 18 articles, six were excluded as they were published before 2000, or did not focus on the present topic, or were written in a language other than English; therefore, only 12 papers were included, and they were published till 2020.

Discussion

Hematological disorders

Leukemia

Leukemia occurs due to uncontrolled white blood cells' proliferation infiltrating the tissues and results in the liver, lymph nodes, and spleen' enlargement. Leukemias are classified according to their type, acute or chronic, into monocytes, lymphocytes, and granulocytes [11]. Although acute leukemia is less likely to exhibit oral lesions, it is considered most common in children [12]. According to epidemiological studies, acute myeloblastic and lymphoblastic leukemia resemble about 50% of the most malignant diseases infected [6]. Both acute myeloblastic leukemia and acute lymphocytic leukemia have initial signs, such as oral gingival ulceration, bleeding, and swelling [6].

Regarding acute lymphocytic leukemia', the symptoms are rare, such as tooth mobility [12]. Chemotherapy is the proper technique for treating leukemia, especially acute leukemias, which gives a good response [13]. Before chemotherapy, dental examination must be conducted for the patients to eliminate any periodontal infection' sources through periodontal therapy. To prevent gingival bleeding and bacteremia, mechanical debridement and plaque control must be involved in the treatment of leukemia [14].

Neutropenia

Neutrophils are the first line of defensive/attacking mechanisms against infections [15]. In the peripheral blood, polymorphonuclear leukocytes' numbers are less

than 1,000/mm³ in infants and less than 1,000/mm³ or 1,500/mm³ among children [16].

Chronic benign neutropenia

This type is commonly observed among infants and children <4 years old, and the incidence rate is almost 3.9/100,000 births, and it is characterized by noncyclic neutropenia [2,17]. The neutrophils present in the epithelium might help/collaborate with the bacteria under maintained physiological conditions [18]. Patients with these conditions might have lymphadenopathy, and sepsis that arises from weak response to the infection, otitis media, pneumonia, and upper respiratory infections [19]. According to the neutropenia severity, oral ulcerations and chronic gingivitis could be recurrent [19,20]. The severity of oral infection gradually decreases when the patient becomes older [19,20]. The granulocyte colony-stimulating factor is a maintenance therapy of chronic benign neutropenia. Calculus with regular professional cleaning and control of dental plaque are effectively considered among the periodontal treatments [18].

Genetic disorders

Leukocyte adhesion deficiency syndrome

It is a condition in which the white blood cells have a defect in the adhesion receptors. Phagocytosis abnormalities resulted when the defects occurred in the glycoproteins adhesion molecules' expression. Another defect occurred in the neutrophil's ability [21]. Leukocyte adhesion deficiency syndrome has three major types: Types I, II, and III. Type 1 is the most common and occurs due to a mutation in membrane β 2 integrin, while type II has a defect in the ligands' expression for selectins, and the third one is type III, which has defects in the abnormalities of platelet aggregation [18].

Familial and cyclic neutropenia

The number of circulating neutrophils decreases every 21 days due to Elastase, Neutrophil Expressed (ELANE) mutation encoding neutrophil elastase [22], and its incidence rate is approximately from 0.5 to 1 case/million [7]. Patients who exhibited this syndrome suffer from malaise, anorexia, fever, sepsis, pharyngitis, headache, lymphadenopathy, and oral ulcerations [17]. Patients with severe periodontal disease should carry out a therapy of cyclic neutropenia. Hematopoietic stem cell transplantation is the only curative treatment [23]. Effective removal of calculus and dental plaque should occur monthly, and antibiotics may be given during the neutropenic episodes to prevent oral infections [24].

Chédiak-Higashi syndrome

This autosomal disorder occurs due to a mutation in the regulator gene of the lysosomal [25], which is characterized by abnormal giant granules in the leukocytes. So, when the hydrolytic enzymes' content

decreases in the neutrophils, an intracellular killing will occur to the phagocytosed bacteria [7]. Also, another feature of this mutation is the reoccurrence of infections in several organs, muscle weakness, abnormalities of the bleeding, and lymphoproliferative disorders [26]. The most common oral manifestation are oral ulcerations, severe gingivitis, and early onset periodontitis [17]. It was reported that bone marrow transplantation is the most effective treatment; so, it could decrease periodontal disease' predisposition [17,26]. Patients with severe periodontal destructed tissues might need tooth extraction [17]; thus, the response and the outcome in these severe cases are unsatisfiable / unsuccessful [26].

Down syndrome

It is an autosomal congenital syndrome that occurs due to a chromosomal aberration, resulting from the trisomy of chromosome 21. Both morphological features and mental retardation are considered the most common manifestations [27]. Most infants (40%), especially those with the acute leukemia type, have Down syndrome, and suffer from heart diseases [28]. Children with Down syndrome exhibit some features, such as hormonal disturbances, growth retardation, neuropsychiatric disorders, and obesity [7]. There are several symptoms that are related to Down syndrome, such as "V"-shaped palate, mouth breathing with drooling, microdontia, lower lip everted, angular cheilitis, hypodontia, fissured tongue, microdontia taurodontism, bruxism, spacing, and delayed eruption [29]. Periodontal anomalies include severe periodontitis, tooth mobility, frequent loss of teeth, marginal gingivitis, and acute necrotizing gingivitis [29].

Papillon-lefèvre syndrome

It is a rare skin disorder that is characterized by hyperkeratosis in palms and soles of feet and is a rapidly progressive periodontitis that results in the early loss of the primary and permanent teeth. This disease occurs due to gene mutation encoding for Cathepsin-C, which works as a key enzyme to activate the immune and inflammatory cells' protease enzyme [30]. Intracranial calcification, mental retardation, and recurrent pyogenic infections belong to the most common features of this disease [31]. This mutation impacts microbial pathogens' neutrophil responses and increases polymorphonuclear leukocytes Polymorphonuclear leukocytes (PMNs)' amounts at periodontal inflammation sites. Immune alliteration, the presence of *Aggregatibacter actinomycetemcomitans*, and a disturbed epithelial function led to aggressive periodontitis and loss of premature, primary, and permanent teeth [7]. The rapid destruction of the periodontal tissues occurs due to primary teeth eruption, and the gingiva becomes inflamed [7].

Langerhans cell histiocytosis (Histiocytosis X)

It occurs due to the abnormal proliferation of the bone marrow. There are three forms of Histiocytosis X, which are as follows: Letterer-Siwe disease, Eosinophilic granuloma, and Hand-Schüller-Christian disease.

Eosinophilic granuloma is mostly benign. The Hand-Schüller-Christian disease occurs among children or young adults. The third clinical form, Letterer-Siwe disease, is present in children below the age of 3 years [30]. The most common clinical signs and symptoms among these children are loss of alveolar bone, periodontitis, oral mucosal necrosis, ulceration, and premature loss of teeth. The destruction of lamina dura causes a radiographic appearance of floating teeth [32]. A combination of surgery, corticosteroids, chemotherapy, antimetabolic drugs, and chemotherapy, and radiotherapy are the preferred treatments [31]. There are some common drugs to be used during these disorders, such as methotrexate, cyclophosphamide, and vincristine [33].

Conclusion

Periodontal diseases are a type of inflammatory diseases affecting tooth-supporting tissues, including root cementum, periodontal ligament, alveolar bone, cementum, and gingiva. Among children, periodontitis treatment with systemic diseases is a big challenge that needs effective collaboration with other medical specialists. Reduced inflammatory response of patients with the systematic disorder is decreased by the uptake of antibiotic therapy, and the results are not expected. Additionally, several side effects of oral manifestations are associated with medications for the treatment, including oral mucositis. Therefore, the dentist, when treating patients with periodontal disease, should manage/control the microbial dental plaque and offer proper treatment.

List of Abbreviations

ELANE Elastase, Neutrophil Expressed
PMNS Polymorphonuclear leukocytes

Conflict of interest

The authors declare that there is no conflict of interest regarding the publication of this article.

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Consent for publication

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