Clinical Considerations in the Management of Inflammatory Periodontal Diseases in Children and Adolescents

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ABSTRACT

Periodontal diseases and conditions, as defined by The 1999 International Workshop for Classification of Periodontal Diseases and Conditions presented some significant paradigm shifts based on evidence that the transition from plaque-associated reversible gingival diseases to periodontitis can occur in children and adolescents with characteristics which were previously thought to be typical of adult periodontitis. The purposes of this paper are to present the periodontal diseases and conditions described in the 1999 workshop sponsored by the American Academy of Periodontology, review the risk factors for the development of periodontal diseases in the pediatric and adolescent populations, and present appropriate clinical periodontal assessment and management for these age groups.

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Children, adolescents, and young adults are not exempt from periodontal diseases. Distinct groups of diseases based on the 1999 International Workshop for Classification of Periodontal Diseases and Con-ditions[1] occur in young populations, namely: gingivitis; periodontitis as a manifestation of systemic diseases; aggressive periodontitis (formerly called early onset periodontitis); chronic periodontitis (formerly called adult periodontitis); and necrotizing periodontal diseases. Several notable changes from previous periodontal classifications were made at the 1999 Workshop. The reader is referred to the *Annals of Periodontology*[1] for comprehensive coverage of the most recent periodontal classification. One of the major changes is the acceptance that adult (chronic) periodontitis, as well as early onset (aggressive) periodontitis, can occur at any age. This paradigm change is a result of several studies that have successfully demonstrated that the transition from plaque-associated reversible gingival diseases to periodontitis can occur in children and adolescents, with characteristics typical of adult periodontitis.[2-4]

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PREVALENCE OF PERIODONTAL DISEASES

It is a rather daunting task to summarize available literature regarding the prevalence rates of periodontal diseases in the young population due to the lack of uniformity of study design and differences in examination methods, diagnostic criteria, and study samples. Despite these limitations, a review conducted by Albandar and Tinoco[5] provides useful information pertaining to the global prevalence rates of periodontitis in the 11- to 25-year-old age groups. They concluded that a low level of periodontitis

has been reported among Caucasians in West European and North American populations in this age group. Chronic periodontitis appears to be 10 times more prevalent than aggressive periodontitis. In North America, the estimated prevalence rate of chronic periodontitis is 2% to 5% and less than 1% for aggressive periodontitis. The prevalence for aggressive periodontitis is higher among Africans and African Americans (1-3%) compared to Caucasians (<1%), Hispanics (<1-1%) and Asians (<1-1%). The same is true for chronic periodontitis. A prevalence rate of 1% to 3% was reported in Caucasians, 8% to 20% in Africans and African Ameri-cans, 5% to 10% in Hispanics, and 5% to 8% in Asians.

RISK FACTORS

Potential risk factors for developing periodontal diseases in the young population include: gender[6-10]; race[9,11-13]; level of oral hygiene; family's socioeconomic level; and other environmental factors.[14-16] Clinicians, however, should be cautious not to make over-generalizations regarding these risk factors. Gender associations, for example, can be complicated. Surveys conducted in Chile[7] and among the Saudi population[8] revealed that juvenile periodontitis occurs more frequent in females. In Switzerland, on the other hand, the ratio of females to males diagnosed with juvenile periodontitis was found to be 1:1.[11] By contrast, a national survey of the oral health of 5- to 17-year-old US children conducted between 1986 and 1987 showed that males were more likely (4.3:1) to have generalized juvenile periodontitis than females.[11] This US survey further suggested that gender association seem to interact with race. African American males were 2.9 time more likely to have localized juvenile periodontitis compared to African American females. Caucasian females, however, were more likely than Caucasian males to have the disease.

Several systemic diseases, a significant number of which are genetic disorders, are associated with periodontal destruction in children and adolescents (Table 1).[1] Although periodontitis in the primary dentition is usually insignificant, young children with rare and profound systemic diseases, such as Papillon-Lefevre syndrome, hypophosphatasia, and leukocyte adhesion deficiency, are at risk from severe generalized periodontitis during or immediately after eruption of the primary teeth.[17] It should be noted that several case reports have suggested that severe and generalized periodontal destruction may also occur in primary dentitions of otherwise healthy individuals.[18-20] It is suspected that these conditions may have a genetic basis.[18,19]

Significant systemic stress such as malnutrition may also have an impact on the periodontium. Psoter et al[21] reported that children who experienced severe malnutrition during early childhood or continuing nutritional stress which resulted in delayed growth had reduced stimulated and unstimulated salivary flow rates, indicating diminished salivary function, into adolescence. This compromise in exocrine gland function may have important implications regarding systemic antimicrobial defenses. Since periodontal disease is essentially a result of an inflammatory response, it is possible that this compromise in antimicrobial defense may render malnourished children and adolescents at risk for developing the disease.

Recently, the relationship between diary product intake and periodontitis has been investigated.[22] Initial findings indicate a possible beneficial effect of routine intake of lactic acid foods on periodontal disease in adults. It would be extremely interesting to determine whether low intake of diary products by children or some specific groups of children would pose an increased risk of development of periodontal disease.

Numerous studies have investigated the relationship between diabetes and periodontal diseases. Readers are referred to an excellent review[23] and meta-analysis[24] regarding this topic. Although most studies involve the adult population, there have been some that included children.[25,26] A study from a cohort of 700 6- to 18-year-olds

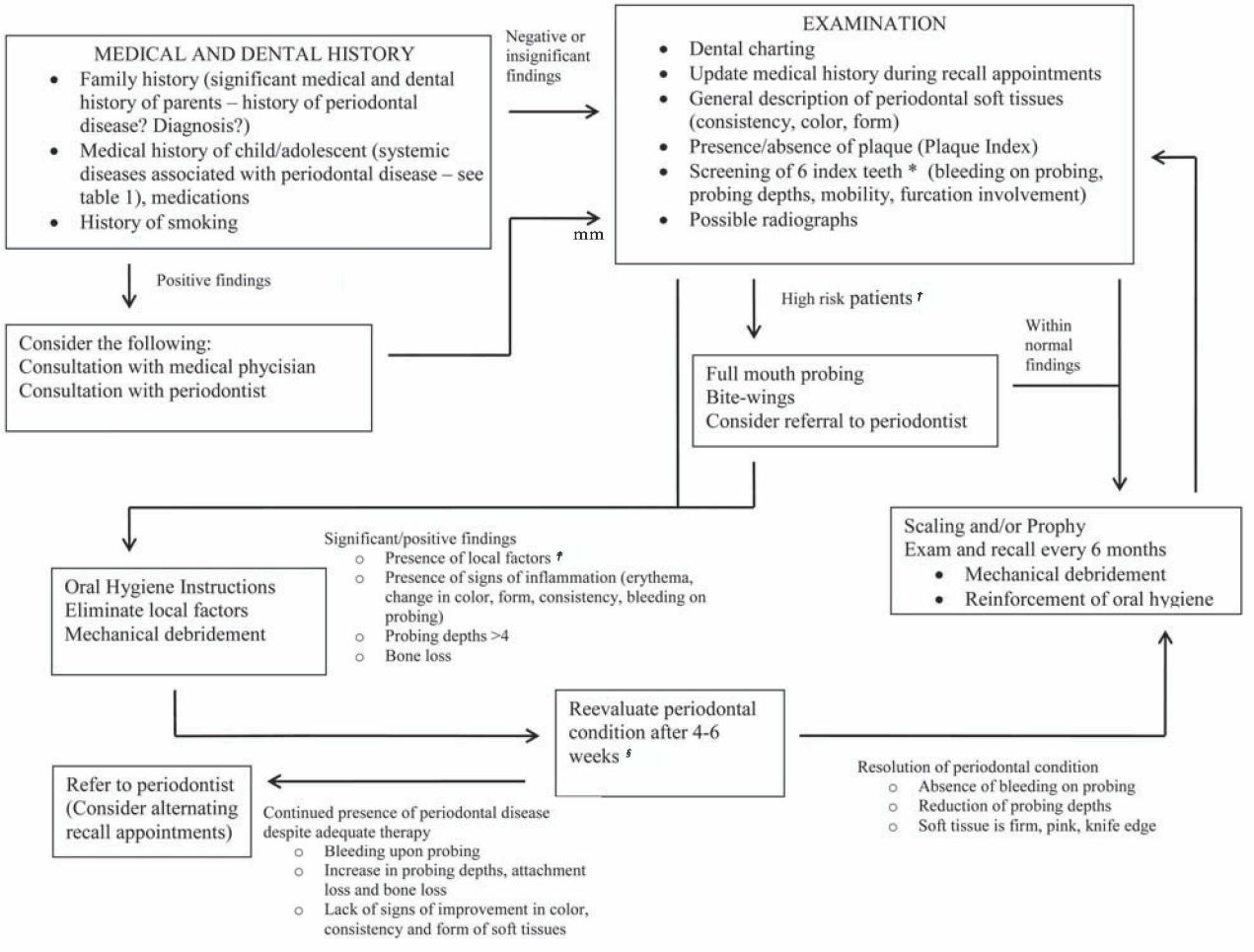
Table 1. Risk Factors

Risk factors associated with periodontal disease in children and adolescents

Systemic factors	*Local factors*
• Hormones	• Calculus
• Medications	• Subgingival restoration margins
• Systemic diseases (diabetes mellitus, HIV/AIDS, leukemia, vitamin C deficiency, Leukocyte disorders, Papillon-Lefevre syndrome, Down syndrome, hypophosphotasia, Ehlers-Danlos syndrome)	• Margin discrepancies
• Smoking	• Overhanging restorations
• Others (malnutrition, socioeconomic factors, race, gender)	• Fixed and removable orthodontic appliances
	• Tooth malpositions/irregularities
	• Mouth-breathing
	• Local anomalies such as enamel projections, enamel pearls, proximal and palatogingival grooves, cemental tears

conducted by Lalla et al.[27] convincingly demonstrated an association between diabetes and an increased risk for periodontal destruction even very early in life. Out of the 350 diabetic patients included in this study, 325 (93%) had Type 1 diabetes and the rest had Type 2. Without differentiating between Type 1 and Type 2 diabetes, the authors reported a statistically significant difference in periodontal destruction between diabetic and nondiabetic subjects (odds ratio=1.84-3.72) The effect of diabetes on periodontal destruction remained significant, even when the 6- to 11-year-old and 12- to 18-year-old subgroups were analyzed separately. The authors strongly suggested that oral screenings and periodontal prevention/treatment programs should be considered as a standard of care for young individuals with diabetes. Similarly, Lal et al[28] reported that diabetic children had

Figure 1. Suggested clinical protocol in the periodontal management of children and adolescents.



** Six index teeth: primary dentition=55, 51, 65, 75, 71, 85 A,E,J,K,O,T; permanent dentition=16, 11, 26, 36, 31, 46 3,8,14,19,24,30.*

† High-risk patients: diabetes; Down syndrome; HIV/AIDS; leukemia; leukocyte disorders; Papillon-Lefevre syndrome; hypophosphotasia; and Ehlers-Danlos syndrome.

‡ Local factors: calculus; margin discrepancies; overhanging restorations; tooth malpositions/teeth irregularities; and local anomalies such as enamel projections, enamel pearls, proximal and palatogingival grooves, and cemental tears.

§ Although there is a wide range of time deemed to be acceptable to perform a re-evaluation after periodontal therapy, a consensus from the American Academy of Periodontology World Workshop[81] reported that a 4- to 6-week interval was usually adequate to assess the response to initial therapy. It has been documented that significant reduction in the severity of periodontitis is seen 1 month after the hygienic phase of periodontal therapy.[82] In addition, one should allow adequate time not only for the epithelium to heal and re-establish but for the granulation tissue to mature and be replaced with collagen fibers. Biagini[83] observed precisely oriented collagen fibers 4 to 8 weeks after treating advanced periodontal disease. Lastly, it has been demonstrated that a subgingival microbiota containing large numbers of pathogenic bacteria repopulate within 4 to 8 weeks.[84] These studies were all done in the adult population. Needless to say, there is a need to verify whether the recommended time frame for re-evaluation based on these studies is also appropriate for the younger population. Whether it is for the adult or young population, there are clinical situations where intervals need to be shorter to longer. Readers are referred to an excellent commentary regarding the determination of the appropriate time for re-evaluation.[85]

35% and 57% more gingival bleeding, around both primary and permanent teeth respectively, compared to nondiabetic children. Furthermore, it was demonstrated in this study that the number of teeth with gingival bleeding had a very modest, but statistically significant, association with mean HbA1c, body mass index for age percentile, and duration of diabetes. Most recently, a study[29] evaluating 6- to 18-year-olds with type I diabetes in Serbia confirmed that periodontal disease is more prevalent in diabetic children. They further demonstrated that in young patients with type I diabetes, the presence of diabetes, along with its duration and metabolic control, influences the prevalence of gingival inflammation and its progression to periodontitis.

Although not all studies have reported an overwhelming association between periodontal destruction and parameters such as duration of diabetes and mean HbA1c,[30] there is no doubt that there is sufficient body of evidence supporting the need to implement periodontal prevention and treatment programs for young patients with diabetes. The American Diabetes Association, for example, recommends an oral examination as one of the components of the initial diabetes visit for children and adolescents.[31] It has also been suggested that treatment of periodontal disease, at least in adults, may have a beneficial effect on metabolic control.[32,33] Further studies are needed to confirm whether this benefit holds true for the young population. Nevertheless, given the vast literature regarding the inter-relationship of diabetes and periodontal disease, dental clinicians should implement periodontal screening, prevention, and treatment programs for all young diabetic patients.

Another systemic condition worth mentioning is human immunodeficiency virus (**HIV**) infection. It is well documented that the first clinical expression of HIV infection is manifested in the oral cavity, several of which affects the periodontal tissues.[34] In fact, the EC-Clearinghouse on Oral Problems Related to HIV infection and WHO Collaborating Centre on Oral Manifestations of the Immunodeficiency Virus considers 3 periodontal disease entities to be strongly associated with HIV infection: linear gingival erythema, necrotizing gingivitis and necrotizing periodontitis.[35] In children, there seems to be varying reported prevalence of oral HIV lesions, ranging from 38% to 73% in Brazilian children,[36,37] 54% in Americans,[38] 49% in Northern Thai,[39] and 42% in African children.[40] These differences could be due to racial, social, and geographical variations in disease presentations. The most common sign of HIV infection in children is pseudomembraneous candidiasis.

Other common oral manifestations include herpes simplex, gingival erythema, parotid enlargement, and recurrent aphthous ulceration.[41] HIV-positive children have significantly more oral soft tissue lesions.[42] Some investigators,[43] however, suggest that in a medically well-controlled HIV population, the patients have similar periodontal findings to the general population, with the exception of the prevalence of linear gingival erythema. Further research is needed to gain further insight on the relationship of HIV and periodontal disease in children.

Other systemic factors that may affect the periodontium include medications and hormones. Membrane ion-channel blockers,[44] anti-epileptic drugs,[45] antihypertensive calcium antagonists,[46] and cyclosporin[47] are medications that have been shown to cause gingival enlargement. A recent publication[48] provides an extensive analysis of pediatric systemic disease, corresponding prescribed medications, and their effect on gingival enlargement. Readers are referred to this article for an excellent description of the morbidity and risks related to drug-associated gingival overgrowth as well as recommendations for treating the side effects of chronic diseases and conditions in pediatric patients.

The effect of hormones on the periodontium and the inflammatory process has been investigated, primarily in women. Some have assessed the effect of oral contraceptives on the gingiva[49] and fluctuations in gingivitis with phases of the menstrual cycle.[50] Others have shown increased inflammation during pregnancy.[51] In the younger population, there is some evidence that puberty is often accompanied by increased gingival inflammation.[52] This heightened response to plaque has been attributed to the concentration of circulating sex hormones.[53] It has been suggested that sex hormone levels may alter the inflammatory response to plaque, which results in gingivitis.[54] An alternative explanation for increased gingivitis during puberty is the fact that this is a period of mixed dentition where erupting and exfoliating teeth present many sites for plaque retention. Oral hygiene[55] also cannot be ignored as a significant factor in the increased inflammation during puberty.

NECROTIZING PERIODONTAL DISEASES

Necrotizing periodontal disease (**NPD**), which is a collective term referring to both necrotizing ulcerative gingivitis (**NUG**) and necrotizing ulcerative periodontitis (**NUP**), is another condition that has been demonstrated to occur in the young population. NUG is characterized by pain, spontaneous bleeding, necrotic ulceration, presence of a pseudomembrane, swelling of lymph nodes, fetid odor, fever, and malaise.[56] NUP has many of the same clinical features of NUG but also includes loss of soft periodontal tissue and bone.[57] It has been suggested that NUG and NUP may be clinical manifestations of 2 different stages of the same disease; hence, they are collectively termed necrotizing periodontal diseases.[1] In industrialized countries, NPD appears to be associated with poor oral hygiene[58-60] and is more common in Caucasians[58,59,61] and smokers.[59-64] It is also found more frequently in HIV-seropositive individuals.[65]

Necrotizing periodontal diseases rarely occur before adolescence in industrialized countries. The prevalence of NPD in the US Caucasian population was estimated at 4% to 5% of 15- to 35-year-olds, based on a study in the

early 1980s of US dental school patients.[61] In 1986 and in the early 1990s, however, it was reported that NPD was rare in the US military population[59,66] and among Danish military trainees was a mere 0.001%.[67] On the other hand, in some developing countries, the prevalence of NPD among 2- to 6-year-olds was as high as approximately 12%[3] and has been linked to poor oral hygiene,[69-72] malnutrition,[69-71] and preceding debilitating illness.[69,70,73] A study conducted in Nigeria reported that 28% of children younger than 12 years old were affected by NPD and that bony sequestration was a frequent complication.[72]

GINGIVITIS

Unlike periodontitis, gingivitis is relatively common in the young population. Its prevalence, severity, and extent seem to increase with age, beginning in the primary dentition, and reaching a peak at puberty, followed by a limited decline in adolescence.[74-76] In a 5-year longitudinal study, Parfitt[77] demonstrated that, with increasing age, the prevalence and severity of gingivitis increased to reach a peak at 11 and 13 years old, respectively. After puberty, the severity of gingivitis declined more rapidly than the prevalence. The peak levels in age revealed that mean gingivitis scores occurred earlier in girls than boys (10.5 vs 13.5 years). Studies have indicated that, in the young population, the lingual surfaces of molars and proximal surfaces generally are most frequently affected by gingivitis.[78,79]

CLINICAL RECOMMENDATIONS

Current diagnostic criteria used to assess the presence of periodontal diseases include, but are not limited to: clinical measurements of periodontal attachment loss; radiographic assessment of alveolar bone loss; age; and presence of systemic diseases.

Despite the fact that periodontal diseases are among the most frequent diseases affecting children and adolescents, there still seems to be a lack of uniform protocol followed by dental clinicians in the assessment, diagnosis, and treatment of periodontal conditions in the young population. Current recommendations include: examination of gingival tissues; assessment of oral hygiene; detection of calculus; and periodontal probing of selected sites, particularly after the eruption of the permanent teeth.[80] Radiographic examination and assessment of deficiencies in the width of attached gingiva as well as areas of recession have also been recommended. The summary of the AAP position paper on periodontal diseases of children and adolescents[17] emphasizes the importance of children receiving periodontal examination as part of routine dental visits, since early diagnosis ensures the greatest chance for successful treatment. Although it is clear that early detection and proper therapy are of paramount importance in reducing the destruction caused by periodontal diseases, there are still certain questions that need to be addressed to help guide the clinician when managing pediatric patients. These include: What should a periodontal examination include? When should it be conducted and how often? When should you refer to a periodontist? We suggest a clinical protocol in the periodontal management of children and adolescents demonstrated in Figure 1.

CONCLUSION

The impact of periodontal disease on systemic health and well-being has been a topic of interest for the past few years. As the knowledge and science behind the relations between periodontal diseases and systemic conditions increase, the dental profession needs to become more aware and astute in diagnosing and treating various periodontal diseases. This should hold true for both the adult and pediatric population. This article reviewed some important periodontal considerations that a dental clinician should keep in mind in the management of children and adolescents.

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