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Accumulation of plaque and gingival inflammation in an adolescent with compromised nutritional status

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Abstract

Background: Adolescence is a critical transitional phase between childhood and adulthood, during which individuals frequently seek greater independence in their dietary and oral hygiene practices.
Case Description: The subject of this case is a 13-year-old male. Notably, extensive accumulation of plaque and tartar has resulted in generalized gingival inflammation. The patient's growth is within normal limits, evidenced by a HAZ score 1. Additionally, he is classified as overweight with a BMIZ-score of 1.08, indicating a risk of obesity, as reflected by a BMIZ-score percentiles of 86%. A thorough analysis of a three-day dietary log reveals a DQI-A score of 34%. Intraoral examination identifies two active carious lesions on teeth 16 (ICDAS code 04) and 26 (ICDAS code 05), with findings corroborated by spectroscopy using a Caries Scan Pro device. The recorded data concerning plaque accumulation includes an OHI-S with a debris index (DI-S) of 2.33 and a calculus index (CI) of 1.5; PCR at 100%; and PFS at 0%. Concerning gingival inflammation, the PBI is recorded at 3, and the GI measures 1.79. Supragingival scaling to remove plaque and tartar was executed successfully, and polishing was done utilizing Air Flow technology. Following this, an educational and motivational session emphasizing oral hygiene was conducted. The patient received a tailored preventive program aimed at reducing plaque accumulation, enhancing oral hygiene practices, and modifying dietary habits through regulating carbohydrate intake.
Conclusion: Compromised nutritional status correlates with heightened plaque accumulation, thus elevating the risk of caries development and gingival inflammation.

Keywords: gingivitis, adolescents, caries, overweight

Introduction

Adolescence represents a transitional phase between childhood and adulthood, characterized by substantial alterations in physical, cognitive, emotional, social, and sexual development. During this period, adolescents demonstrate increasing independence from their parents, assuming responsibility for their nutrition and personal hygiene. The interrelationship between oral health, dietary habits, and nutritional status is significant. Adequate nutrition is vital for the growth, development, and preservation of oral structures. (1)
In recent years, there has been a significant increase in the accessibility and promotion of processed carbohydrate foods, sodas, and energy drinks among adolescents.(2) The adverse health effects of poor dietary habits during childhood and adolescence were examined. The influence of parental

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role models is significant in shaping children's food preferences. (3,4) The rising consumption of fast food, dining at restaurants, frequent intake of carbonated soft drinks and energy beverages, elevated stress levels, and reduced physical activity represent significant contemporary issues among the youth. Such alterations in dietary habits result in the intake of excessive amounts of fats, including saturated fats, trans fats, and added sugars. (5) There exists a deficiency in the consumption of essential micronutrients, including calcium, iron, zinc, potassium, as well as vitamins A, D, C, and folic acid. Nutritional deficiencies may adversely impact the human body's resilience, healing processes, and the functionality and integrity of the oral mucosa. (6)
Like dental caries, periodontal diseases possess a multifactorial and infectious ethology, manifesting when the virulence of the bacterial component surpasses the defences of the host's defences. Nutritional factors exert a subtle influence on the maintenance of periodontal health. They can modify the host's susceptibility to disease and/or influence its progression. Even in a healthy periodontium, nutrients are constantly required to sustain tissue health. (7) Conditions inducing xerostomia may exacerbate the risk of developing caries and periodontal disease. (4)

Case description

The patient is a thirteen-year-old male exhibiting complete permanent dentition, accompanied by a significant accumulation of plaque and tartar. Generalized gingival inflammation has been identified. (Fig. 1, 2, 3) Clinical methodologies were employed to evaluate the extent of the carious process, utilizing indices such as the DMFT and DMFS for the severity and activity of the diagnosed carious lesions, with the ICDAS system and instrumental techniques including spectroscopy (CarieScan Pro device). The OHI-S, PCR, and PFS indices were implemented to determine the degree of plaque accumulation, while gingival inflammation was assessed using the PBI and GI indices. Additionally, an analysis of a three-day food diary facilitated the evaluation of the dietary quality of the child in question, resulting in a DQI-A score.

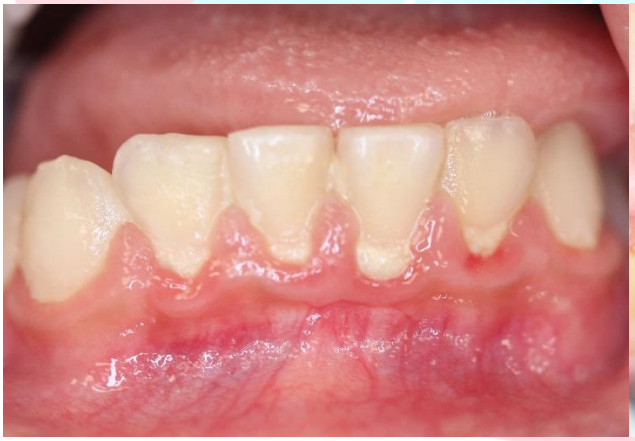

Fig. 1. An adolescent exhibiting significant plaque and tartar accumulation in the anterior region of the lower jaw

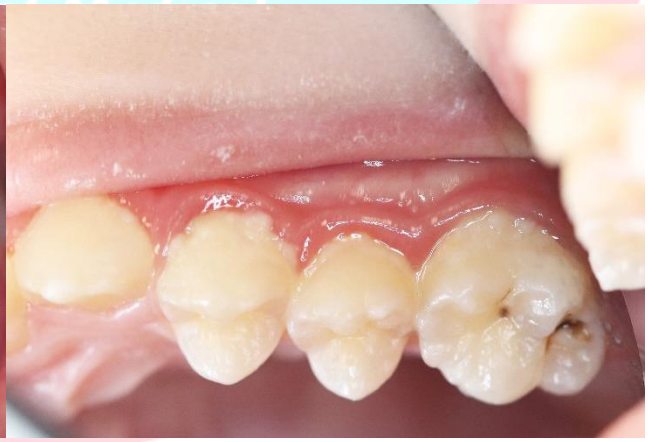

Fig. 2. Plaque accumulation and gingival inflammation are localized in the distal area of the left upper jaw

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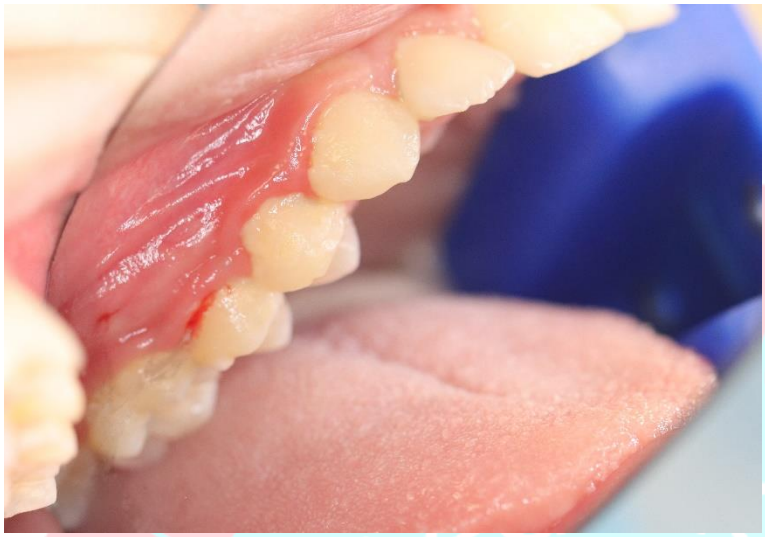

Fig. 3. Plaque accumulation and gingival inflammation are localized in the distal area of the right upper jaw

The patient exhibits normal growth, as indicated by a height-for-age Z-score (HAZ-score) of 1. Additionally, the patient is classified as overweight, evidenced by a Body Mass Index Z-score (BMIZ-score) of 1.08, which places them at risk of obesity, with a BMIZ-score percentile of 86%. Furthermore, an analysis of a three-day food diary utilizing the Diet Quality Index for Adolescents (DQI-A) reveals that the adolescent belongs to a category characterized by low dietary quality, reflected by a DQI-A score of 34%. Intraoral examination reveals the presence of two active carious lesions located on teeth 16 (Fig. 4), identified by ICDAS code 05, and 26, identified by ICDAS code 04. (Fig. 5)

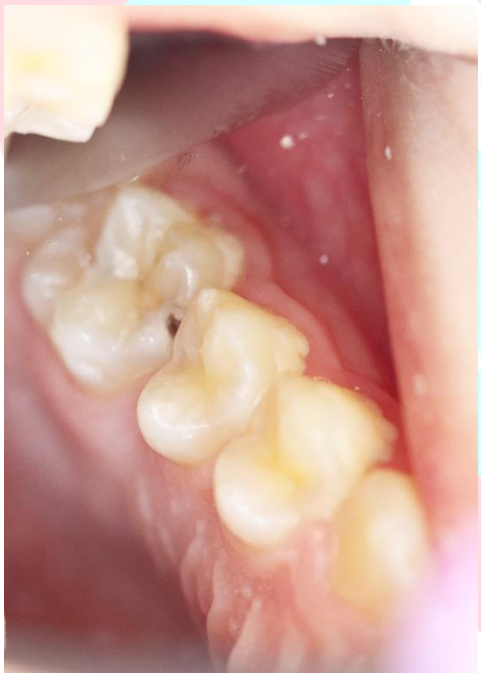

Fig. 4. Active carious lesion was observed on tooth 16, classified in accordance with ICDAS code 05

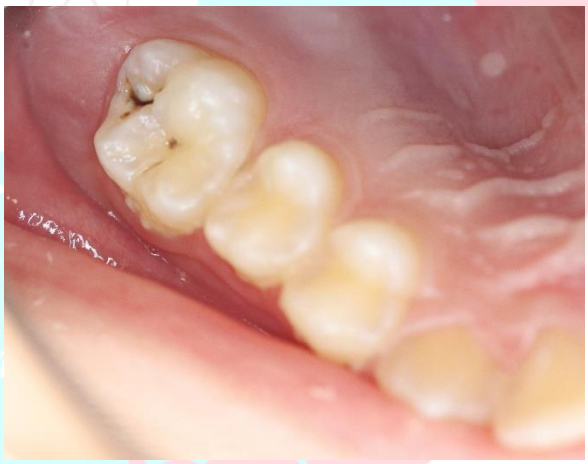

Fig. 5. Active carious lesion was observed on tooth 26, classified in accordance with ICDAS code 04.

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The lesions were documented utilizing spectroscopy (Caries Scan Pro), where the diagnoses were substantiated: for tooth 16, the device registered a value ranging from 51 to 90 accompanied by three yellow lines, whereas for tooth 26 LCD, a value between 91 and 99 and four yellow lines were indicated by the LED display. The recorded metrics concerning plaque accumulation include OHI-S (DI-S = 2.33; CI = 1.5), PCR (100%), and PFS (0%). Regarding the extent of gingival inflammation, the recorded indices are PBI = 3 and GI = 1.79. The patient's oral hygiene regimen employs a manual toothbrush and fluoride toothpaste (1450 ppm), with brushing primarily occurring in the morning for less than one minute. The patient does not utilize supplementary oral hygiene products, and preventive dental examinations are conducted every 2 to 3 years.

A procedure for the cleaning of supragingival plaque and tartar was conducted, concluding with Air Flow polishing. A motivational and educational presentation was delivered to adolescents concerning oral hygiene products, brushing techniques, the application and frequency of oral hygiene practices, and the consumption of carbohydrate-rich foods and beverages. During subsequent appointments, carious lesions were meticulously cleaned and restored using composite material, The newly treated teeth positions 17, 27, 37, and 47 underwent silanization to inhibit the onset of caries. Furthermore, an individualized prophylactic program was developed for the patient, aimed at minimizing plaque accumulation, enhancing oral hygiene, and modifying dietary habits by regulating carbohydrate intake.

Discussion

Individuals aged 10 to 24 constitute 24% of the global population. (8) Over the past two decades, there has been a noticeable increase in the incidence of overweight and obesity among adolescents. (9,10) In a study conducted by Tishukaj et al. (11), it was concluded that the prevalence of overweight and obesity is more significant in males than in females. Physical and psychosocial changes significantly influence the nutritional requirements, dietary habits, and behavioral modifications in adolescents. These patterns of behavior are discernible throughout the adolescent stage. Consequently, various nutritional disorders, such as obesity, anorexia nervosa, bulimia nervosa, and dyslipidemia, may arise. Such disorders can manifest during puberty, yet they also have implications for health in adulthood. (12,13)

The frequency of snacks, the buffering capacity of saliva, the utilization of fluoride toothpaste (14), both past and present dental experiences, oral hygiene practices, accessibility to dental services, psychosocial issues (15,16), the socioeconomic status of adolescents and their parents (17), as well as tobacco use (18,19) are well-documented risk factors contributing to the emergence of dental caries among adolescents. The trend of substituting main meals with snacks has intensified, and the consumption of beverages has reached unprecedented levels (20,21). The habitual practice of frequent snacking alongside the intake of sugary foods correlates with an increased incidence of overweight (22) and dental caries (23). Moreover, it is noted that females exhibit marginally superior oral hygiene behaviors in relation to their consumption of sugar-sweetened beverages and the frequency of tooth brushing when compared to their male counterparts. (24,25)

The frequent consumption of food outside the home has been demonstrated to affect the dietary quality of adolescents adversely. (26) The prevailing food environment is marked by an abundance of inexpensive, energy-dense food options. (27) Excessive caloric intake plays a central role in the

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development of obesity. (28) Proper oral hygiene in school-aged children is crucial for their comprehensive development and oral health. (29) A study by Frisbee et al. (30) established a significant correlation between oral hygiene practices and overweight status. Adolescents exhibiting impaired nutritional status tended to prefer manual toothbrushes and displayed a significantly lower frequency of using dental floss. Furthermore, Panagiotou et al. (31) concluded in their research that overweight and obese children showcase a predisposition to plaque accumulation, dental caries, gingival inflammation, and diminished salivary flow and buffering capacity when compared to their normal-weight counterparts. This research substantiates a significant relationship between oral hygiene practices and excess body weight. (30)

A study conducted in 2023 by Ali and Ahmed (32) indicated that 61% of adolescents engage in tooth brushing in the morning. In contrast, only 21% undertake this activity at night before retiring for bed. Additionally, a 2020 investigation involving Romanian adolescents revealed that over one-third (33.7%, n = 219) of teenagers infrequently or never engage in nighttime tooth brushing. (33) Furthermore, research by Sbricoli et al. (34) demonstrated that many adolescents utilize manual toothbrushes, with electric toothbrushes being comparatively uncommon and ultrasonic toothbrushes completely absent from usage. Numerous studies have indicated that ultrasonic toothbrushes offer superior efficacy to manual ones. (35,36,37,38,39)

Research indicates markedly elevated gingival inflammation scores ($p < 0.001$) among overweight adolescents. (40,41,42)

Conclusion

Excess body weight and the risk of obesity are correlated with heightened plaque accumulation, which subsequently elevates the likelihood of developing dental caries and gingival inflammation. Poor oral hygiene habits and irregular visits to the dental office increase the risk of developing these oral diseases.

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