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Review Article

Exploring the link between childhood stress and oral diseases

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ABSTRACT

Childhood stress, particularly as a consequence of adverse childhood events such as physical, emotional, or psychological abuse, has emerged as a significant determinant of long-term health outcomes, including oral health. This narrative review examines the intricate interplay between early-life stress and the development of oral diseases in children, elucidating the psychobiological mechanisms that underpin these associations. Stress activates the hypothalamic-pituitary-adrenal axis, resulting in elevated cortisol levels, which, over time, can dysregulate immune responses and promote chronic inflammation. These physiological alterations critically compromise the oral cavity's defensive mechanisms, thereby increasing susceptibility to conditions such as dental caries, periodontitis, and oral soft tissue lesions. Empirical studies have established a robust correlation between elevated salivary cortisol levels and the presence of chronic periodontal disease, suggesting that psychological stress plays a crucial role in the progression of oral inflammation and tissue destruction. Furthermore, stress-induced behaviors, including bruxism, poor dietary habits, and inadequate oral hygiene practices, exacerbate the risk of oral diseases. Bruxism, in particular, has been extensively documented in children exhibiting psychological distress and is associated with temporomandibular joint disorders and dental attrition. Children exposed to adverse childhood events are also more prone to developing early childhood caries; if left untreated, early childhood caries can lead to long-term oral complications, including malocclusion, altered facial growth, and compromised masticatory function. This review also addresses the socioeconomic and environmental factors that contribute to the burden of stress and oral disease, highlighting the impact of parental stress and family adversities. The evidence underscores a robust, multifactorial relationship between early-life stress and adverse oral health outcomes. A comprehensive understanding of these associations is essential for the development of integrated preventive strategies that encompass both psychological and dental care. The early identification of at-risk children, coupled with the implementation of multidisciplinary interventions, may effectively mitigate the long-term implications of childhood stress on oral health and overall well-being.

Keywords: Stress, Adverse childhood events, Dental caries, Periodontitis, Bruxism

INTRODUCTION

Children who experience repeated physical or emotional abuse tend to have a lasting trauma during their childhood. The persistent abuse of children by either parents or caregivers results in childhood trauma. There is a significant association between childhood trauma and diseases that adults suffer from.[1] For instance, adults with

childhood trauma are more prone to developing cardiovascular diseases or depression.[2] This link is attributed to the alteration in an individual's response to stress and recovery from it that results from childhood trauma. Childhood trauma affects the coping mechanisms to stressors, in addition to emotional regulation. It is suggested that adults with childhood trauma react in an exaggerated negative manner to stressors.[1] Furthermore, children who experienced punishment or refusal grow up as adults with low resilience, high stress levels, increased psychological stress responses, and increased psychological difficulties.[3-5] These psychological effects are attributed to the alteration of cortisol and heart rate responses to psychological stress. The alterations of cortisol and heart rate result from stress that an individual has experienced early in life. Additionally, childhood trauma has a long-term effect on the response and recovery of the sympathetic nervous system.[1] The impact of stress on children can cause appendicitis, leukemia, rheumatoid arthritis, and acute and recurring upper respiratory tract infections, in addition to oral diseases.

Moreover, children with adverse events in life are more prone to be ill and hospitalized.[6] One of the most common childhood diseases is dental caries, which is attributable to poor oral hygiene and poor dietary habits. For instance, in China, children who suffer from early childhood caries account for 66%. The decayed, missing, and filled teeth (DMFT) index was 3.5. Additionally, 97% of carious lesions in deciduous teeth are not treated properly. The American Academy of Pediatric Dentistry defines early childhood caries as the presence of one or more decayed, missing, or filled tooth surfaces in a primary tooth in a child of 71 months of age or younger. The complications and consequences of dental caries, if left untreated, can significantly affect the permanent dentition. Additionally, it can lead to this functional occlusal contact asymmetric mastication, compromised facial growth, malocclusion, and dental-facial deformities.[7]

Furthermore, interproximal caries can lead to a decrease in the mesiodistal crown width and the dental arch length, which negatively affects occlusal stability, chewing ability, and causes dental crowding and tooth displacement.[7-9] Additionally, the presence of severe cavitation in primary teeth leads to a change in the oral microenvironment, which results in severe cavitation during adulthood.[7,10] Severe cavitation can lead to pulpal involvement and periapical lesions, which can affect the normal eruption sequence of the successors.[7] Stress can have detrimental effects on oral hygiene practices and dietary habits in children, leading to an increased risk of early childhood caries.

REVIEW

This narrative review is based on a comprehensive literature search conducted on May 11, 2025, using ScienceDirect, PubMed, Wiley Library, Dynamed, MDPI, Oxford Academic, BMC, and Cochrane databases. The research utilized Medical Subject Headings (MeSH) terms and relevant keywords, such as stress and its effect on the oral cavity, to identify studies that examined stress and its impact on the changes in the oral cavity.

A manual search was also conducted using Google Scholar, and the reference lists of identified papers were reviewed to locate additional relevant studies. No restrictions were applied regarding publication date, language, participant age, or type of publication, ensuring a broad and inclusive exploration of the available literature.

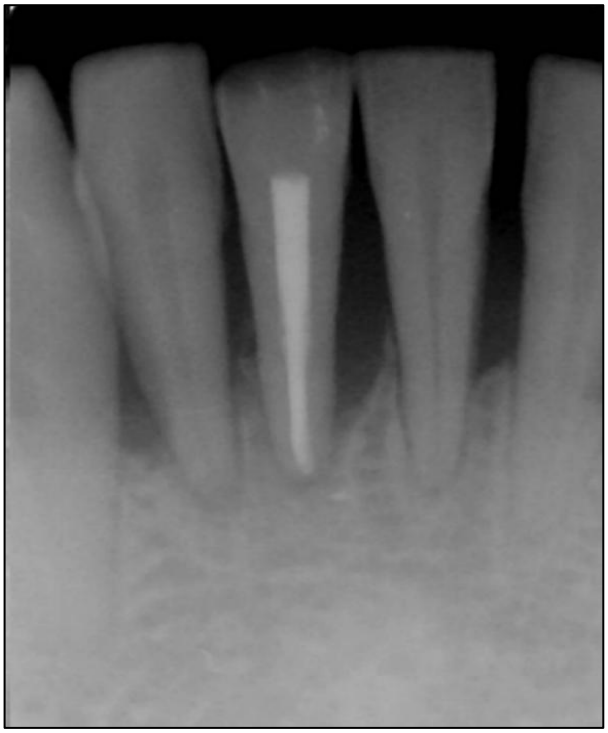

Figure 1: A radiographic image of chronic periodontitis in the lower anterior teeth.[24]

Figure 2: Early childhood caries in the upper anterior teeth.[28]

DISCUSSION

Pathophysiology of stress in children

Acute stress response is a process that changes over time, starting with typical behavior and then changes into specific behaviors towards specific stressors. These behaviors recruit the hypothalamic pituitary adrenal axis, which then stimulates the release of cortisol to peak levels between 15 and 20 minutes after the stress onset.[11-13] The response to chronic stress results in a change in the ratio of arginine vasopressin to the corticotropin-releasing hormone in the hypothalamic paraventricular nucleus. This change decreases the sensitivity to glucocorticoid negative feedback, resulting in an increase in the release of glucocorticoid.[11]

In long-term illnesses, the hypothalamic pituitary adrenal axis reduces cortisol metabolism and production due to the elevated levels of cortisol in the plasma.[11] Additionally, several studies were conducted to evaluate the association between depression, salivary cortisol levels, and chronic periodontitis. They found a strong association between the levels of salivary cortisol and chronic periodontitis. Hence, indicating that psychoneuroimmunological elements have a profound effect on periodontal diseases.[14-16] Lee et al conducted a study on two groups: a group with periodontitis and a healthy group.[17] They found that psychological stress stimulates the hypothalamic pituitary adrenal axis in both groups, which in turn increases the cortisol levels in saliva and promotes periodontitis in both groups.[17]

Cortisol was found in the saliva of both groups; however, it was minimal in the healthy group due to the healthy oral environment.[14] Other studies were conducted to explore the link between periodontitis and stress. They found that cortisol levels in the saliva of individuals suffering stress were high and contributed to periodontitis and tissue destruction. Additionally, they found a strong association between stress and the growth of bacteria species that promote periodontitis.[18-20]

Stress-induced oral diseases

There are several examples of oral diseases that result from acute or chronic stress. For instance, lichen planus and glossitis areata are attributable to emotional stress. They appear in the oral cavity during intense stress episodes and undergo remission after stress resolution.[21] Additionally, diseases such as aphthous stomatitis, mucous membrane pemphigoid, and erythema multiform have a significant correlation with the emotional status of the patient. The psychological factor, especially emotional stress, determines the severity of the disease, in addition to the remission and exacerbation episodes.[21] Chronic periodontal disease (Figure 1) is another disease that is significantly affected by individuals' emotional status. Emotional status, such as stress and anxiety, decreases the ability of the gingiva and the periodontal tissues to respond adequately to irritations such as bacterial plaque and calculus.[21]

Emotional stress prevents antibodies from acting at mucosal sites against viruses in recurrent herpes labialis, which leads to the appearance of lesions on the skin and labial mucosa. Additionally, necrotizing gingivitis is caused by fusospirochetal infection, which is caused by several factors such as nutritional deficiencies, debilitating diseases, neurological diseases, and emotional stress.[21] One of the habits that children have is biting their oral mucosa or tongue, which is classified as self-mutilation. children suffering from stress or any psychological effects tend to traumatize their mucosa or tongue using sharp objects or nails.[21] Bruxism is another neurotic habit of patients suffering from stress. It usually occurs during sleep.

This habit results in tooth wear, temporomandibular joint pain, and periodontal tissue trauma.[21,22] Burning mouth syndrome includes a burning sensation of the oral mucosa and tongue. The underlying cause of this syndrome is psychological. Burning mouth syndrome is treated by managing the underlying psychological problems.[23] In addition to burning mouth syndrome, patients experience taste alterations, which result from psychological factors, such as stress, anxiety, and depression.[21]

Stress among families affects their children, which in turn affects their dental health. Children suffering from early childhood caries experience stress in their early life.[25] A study conducted by Tang et al, confirmed that children who were subject to stress suffered from early childhood caries. However, the study also highlighted other causes that can exacerbate early childhood caries (Figure 2), such as nutrition, behavior, family income, and ethnicity.[25] Kabani et al conducted a study that confirmed the results of the previously mentioned study. In their study, they proved that children who experienced adverse life events had poor oral health compared with their peers. They had more toothaches, unfilled lesions, and dental caries.[26] Furthermore, a positive correlation was found between the parents' perception of a child's health status and the results of clinical examination.[26] The poor oral health of children that results from stress is attributed to the allostatic load. The allostatic load is the hyperactivation of the stress response system. The activation of the stress response system results in an inflammatory response, causing periodontitis and dental caries, which impair oral health.[27]

Bruxism, characterized by the habitual grinding or clenching of teeth, is a prevalent condition observed in children across various regions globally. Research indicates that its incidence varies significantly by location. For example, a study conducted in Hong Kong identified that approximately 9% of children exhibited signs of bruxism. Meanwhile, in Poland, the prevalence rose to 23%. Notably, findings from the United States revealed that 38% of parents reported instances of their

children experiencing bruxism during sleep. Furthermore, alarmingly high rates were documented in Argentina, with 74% of children affected, and Brazil reported that about 35% of children suffered from this disorder.[29] Results vary widely in different studies due to the difference in methods these results were obtained with.

However, it still highlights a problem that multiple children suffer from, which is bruxism resulting from emotional stress.[29] Ferreira-Bacci et al conducted a study on 29 children suffering from bruxism to evaluate the factors leading to bruxism. In this comprehensive analysis of the participant cohort, it was revealed that 24 individuals required psychological intervention, highlighting a significant need for mental health support. Of these, 17 participants were diagnosed with neurotic disorders, while 7 exhibited signs of antisocial disorders.[30] Furthermore, the study identified a concerning correlation between children who exhibited bruxism and a range of additional health complications. Specifically, these children demonstrated an increased prevalence of asthma, frequent temper tantrums, and recurrent stomachaches.

Additionally, they were found to engage more in negative habits, including sleep disturbances and eating issues, along with exhibiting maladaptive behaviors characterized by dependence on maternal figures, insecurity, and impatience.[30] Additionally, 18.75% of the participants suffered psychological and physical manifestations of stress, such as bruxism, sleep disorders, and leg pains. Children who suffer from bruxism restrain their feelings and express them in negative behaviors.[30] Bruxism is often associated with stress, psychological, and neurological disorders in children, specifically in children with attention deficit and emotional stress.[30] Serra-Negra et al conducted a study on 120 children with sleep bruxism and 240 children who did not experience bruxism.[29] They found a strong association between bruxism and consciousness. About 62% of children with sleep bruxism scored high rates on the consciousness scale in comparison with 49% of children without sleep bruxism.

Additionally, they found a significant association between stress and depression and sleep bruxism.[29] Several studies agree that children who experience adverse childhood events are more prone to tooth loss and tooth cavities. Moreover, these factors can result in long-term poor oral health that extends into adult life.[31-33] Individuals who experienced more than four adverse childhood events have more lost teeth and restored teeth than other individuals who didn't experience any adverse childhood events. Moreover, the percentage of individuals who lost more than eight teeth increased from 1% of individuals with no adverse childhood events to 3% of individuals who experienced four or more adverse childhood events. This percentage in older studies was 13% and 26%, respectively.[31,34]

Additionally, individuals who live in deprived areas are more prone to experience adverse childhood events four times or more. Individuals in these areas are susceptible to poverty and violence, which negatively impact their overall well-being and oral health.[31,35,36] Furthermore, there is a significant association between exposure to adverse childhood events and the development of harmful behaviors, such as smoking, exposure to violence, and poor dietary habits. These factors lead to the development of tooth decay.[31]

In England, it was found that individuals who experienced four or more adverse childhood events exhibit significantly detrimental life outcomes. Specifically, they are twice as likely to maintain poor dietary habits, eight times more likely to encounter situations involving violence, and three times more inclined to engage in smoking behaviors. Additionally, individuals who experience such conditions are prone to developing mental health illnesses, which directly affect their oral health. These findings underscore the profound long-term impact of childhood adversity on lifestyle choices and health outcomes.[31,37]

CONCLUSION

Early-life stress, particularly stemming from adverse childhood experiences, significantly influences oral health through intricate psychoneuroimmunological pathways. Dysregulation of the hypothalamic-pituitary-adrenal axis and elevated cortisol levels lead to immune suppression and increased inflammatory responses, subsequently heightening vulnerability to oral pathologies, including dental caries, periodontitis, and bruxism. These conditions are further compounded by behavioral modifications, such as poor oral hygiene and maladaptive dietary habits.

The cumulative effects of stress, referred to as allostatic load, contribute to progressive oral health decline. Research indicates that individuals with multiple adverse childhood experiences face a greater risk of extensive tooth loss and impaired oral function. Consequently, the integration of psychological evaluations and early intervention strategies into pediatric dental care is critical for addressing the oral health ramifications of childhood stress.

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