

Abstract

Objective: Early childhood caries (ECC) is the most common chronic disease among children. In fact, it is five times more common than asthma. From a physiologic standpoint, the main cariogenic bacteria, *Streptococcus mutans* (S. mutans), produces acids in the mouth that could lead to the early demineralization of dental enamel characteristic of ECC [1]. When left untreated, ECC can result in malnutrition, childhood speech problems, and low self-esteem. It is also often associated with increased risk of diabetes, cardiovascular disease, and premature births. The reality remains that conceptual models regarding the development of caries focus on only a limited number of contributing variables. Many studies have identified gender, ethnicity, and socioeconomic status (SES) as additional risk factors for ECC [2]. Therefore, a comprehensive model regarding the causes and consequences of ECC is important to developing treatment modalities and reducing the prevalence of these longer-term complications.

Methods:

Keywords: Early childhood caries; Allostatic load; Conceptual model; Stress; Sociobiological model

Introduction

Early childhood caries (ECC) is the most common chronic disease among children. In fact, it is five times more common than asthma. From a physiologic standpoint, the main cariogenic bacteria, *Streptococcus mutans* (S. mutans), produces acids in the mouth that could lead to the early demineralization of dental enamel characteristic of ECC [1]. When left untreated, ECC can result in malnutrition, childhood speech problems, and low self-esteem. It is also often associated with increased risk of diabetes, cardiovascular disease, and premature births. The reality remains that conceptual models regarding the development of caries focus on only a limited number of contributing variables. Many studies have identified gender, ethnicity, and socioeconomic status (SES) as additional risk factors for ECC [2]. Therefore, a comprehensive model regarding the causes and consequences of ECC is important to developing treatment modalities and reducing the prevalence of these longer-term complications.

Oral health is subject to both social and behavioral stressors that have the capacity to increase the biological risk of developing ECC. For example, prevalence is especially high among individuals who lack access to dental care, affecting up to 50% of low-income children [3]. For this reason, the etiologic model of ECC proposed in this manuscript includes an exploration of allostatic load as a potential source of higher risk.

Allostasis is described as the active process by which the body makes changes to homeostatic parameters in response to daily events and stressors [4]. Deviations from these parameters occur as an adaptation to stress. The cumulative physiologic toll of these repeated attempts

at stress adaptation is referred to as allostatic load, which can have pathogenic effects on the body's regulatory systems. The hypothalamic-pituitary-adrenal (HPA) axis is a major regulatory system that is subject to the effects of allostatic load. Exposure to stress activates the HPA axis, which in turn leads to elevated levels of glucocorticoids [4]. Chronically high levels of these hormones damage tissues and potentially give rise to adrenal axis adaptations. By modifying adrenal hormone response or function, these adaptations shield the body from excessive glucocorticoid exposure. While initially protective, these early-life alterations in adrenocorticoid production may compromise the ability of the organism to adequately modulate stress later in life. The resulting changes in the adrenocorticoid phenotype, often described as an increase in HPA axis activity, predisposes infants and young children to compromised functioning, homeostatic dysregulation, and/or disease throughout their lives [4,5].

The purpose of this paper is to review the scope, usefulness and applications of the proposed conceptual model in guiding future research of ECC risk as it relates to allostatic load. The proposed

***Corresponding author:**

leah@paediatricdentistry.com

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sociobiological model of ECC includes, as its primary component, an altered responsiveness to physical or socio-behavioral perturbation of homeostasis that results from the cumulative effects of chronic stress (allostatic load). This altered output may manifest in the form of inadequate behavioral response during acute or chronic stress resulting in poor oral health and early childhood caries.

Allostatic load, Allostasis, and ECC

Allostasis is the adaptive process by which the body changes the levels of one or more regulated parameters in order to adjust to new or changing environments. The energy required for successful adaptation is maintained by an extraordinary repertoire of physical reactions that attempt to counteract the effects of stressors [6]. As part of this homeostatic regulation process, purposeful responses work together to defend bodily parameters critical to an individual's well-being [7].

References

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cleaning visits. Clearly there is a role for population-based strategies to screen defined populations of children in the primary care setting, risk stratify all children within registries, and improve the reliability of delivery of evidence-based oral health care to both low and higher risk children.

Parental attitudes towards oral health related behaviors do influence whether these behaviors are reported to occur in children and that the strength of attitudes varies between diverse ethnic groups and sites around the world [32]. Children experience profound impacts from their environment and family circumstances. Thus, for disadvantaged children, outreach is necessary to ensure they receive services, including dental care. Oral health advocates should partner with others in child and family advocacy to work towards the larger vision of family and community wellness, while ensuring oral health is integrated into these efforts. To succeed in alleviating health disparities, we must deliberately embrace new paradigms that emphasize 1) oral health as part of overall health at the level of the individual child, family, community, and society; 2) health promotion and wellness, not just absence of disease; 3) family and community empowerment as critical to improving children’s health and future lives; and 4) health professional efforts that include access to care but also reach beyond access to care to embrace a multifactorial model of health determinants [26], including oral health and its determinants.

In this paper, we have proposed a conceptual model of the role of allostatic load in promoting ECC (Figure 1). The most effective response on the part of both dental and medical professionals caring for children is a population-based interprofessional collaboration strategy which will create capacity for the reliable delivery of preventive and restorative care to defined populations of children in order to reduce the burden of preventable ECC among children in the US. This model provides a conceptual framework to support the work of change leaders in dentistry and primary care who are now demonstrating that quality improvement methods may be leveraged to accomplish this goal. More research should now be focused on the translational strategies which will most effectively contribute to a reduction in ECC and the medical, developmental, and psychosocial sequelae suffered by children who are affected.

Citation:

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