

REVIEW ARTICLE

Systemic symptoms associated with tooth eruption in children: A narrative review

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ABSTRACT

Teething has been attributed to various childhood ailments and physical disturbances since ancient times. Due to this some of the organic childhood diseases may go untreated thereby harming the child's general health. Taking this negative impact into account, this review article aims at informing the medical community of the systemic symptoms that are associated with teething.

Introduction

Tooth eruption is a physiological process entailing the movement of a tooth from its site of development within the jaws to its final functional position in the oral cavity.¹ It represents a series of precisely regulated cascades of paracrine signalling events between epithelial cells of the enamel organ and

ectomesenchymal cells of the dental follicle.² The process of tooth eruption is controlled genetically and usually begins four to ten months after birth with the eruption of a primary tooth.³

Since ancient times various childhood ailments and physical disturbances have been ascribed to teething.^{4,5} Some of the systemic symptoms attributed to primary tooth eruption include general irritability, diarrhoea, loss of appetite, and sleep disturbances.⁴ Others include crying, ear rubbing on the side of the erupting tooth, nasal symptoms, facial flushing, fever, drooling, and fussiness.⁶

Although teething may cause problems to children, there is an ongoing debate concerning the direct association between the eruption of the tooth and systemic symptoms.⁶ This controversy is due to the cross-sectional study results that report data collected from parents of children who are subjective to personal opinion and recall bias.⁷

Because of the prevailing controversy, this literature review aims to review the relationship of tooth

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eruption to various systemic symptoms. This review considers the physiology of tooth eruption in children and the systemic symptoms associated with teething. The studies used were clinical studies that involved teething children during the teething phase.

Physiology of tooth eruption

Tooth eruption theories

Several theories propose to explain the tooth-eruption process. Some of these include the hydrostatic pressure theory, the equilibrium theory, the theory explaining the role of fibroblast and collagen fibres, root formation theory, periodontal ligament traction theory, the neuromuscular theory, and the role of dental follicles.^{2,8,9}

Despite all these theories, neither is entirely correct nor incorrect. Each of the eruption theories correctly explains some part of the tooth-eruption process. The tooth eruption process is controlled by root follicles, periodontal membrane, crown follicles, and dental follicles while the periodontal ligaments play a mechanosensor role.^{9,10} The direction of tooth movement is determined by the orientation of periodontal ligaments fibroblasts. The formation of the root causes compressive stress coronally and tensile hydrostatic stress apically forcing a tooth to erupt.^{2,10}

Biological basis (cellular and molecular) of tooth eruption

The process of tooth eruption comprises a series of precisely regulated cascades of events that consist of selective alveolar bone resorption in the coronal aspects of the erupting tooth and bone formation in the apical aspects of the tooth alveolar bone.^{2,11}

Several cellular and molecular processes lead to the coronal resorption and apical formation of alveolar bone during tooth eruption. The activity of osteoclasts (the cells which regulate the coronal portion of an erupting tooth) is under the control of molecules such as the receptor activator of nuclear factor kappa B (RANKL), colony-stimulating

factor-1 (CSF-1), and the monocyte chemotactic protein-1. The nature of the coronal portion of alveolar bone is scalloped and thus undergoes resorption easily.^{11,12} The osteoblasts are the most dominant cells in the apical portion of erupting tooth. The differentiation of these cells is increased apically by bone morphogenic protein-2 (BMP-2). With the aid of a scanning electron microscope, the apical bone crypt's nature is trabecular.¹¹

Inflammation and tooth eruption

Teething induces the release of pro-inflammatory and immune-regulatory cytokines such as tumour necrosis factors (TNFs), interleukins (ILs), interferons (IFNs), polypeptide growth factors (GFs), and colony-stimulating factors (CSFs).⁵ These pro-inflammatory cytokines, in turn, may have a role to play in the occurrence of some systemic symptoms associated with teething.

Systemic symptoms associated with tooth eruption

Irritability

It has been reported in the literature that irritability/frustration is one of the main symptoms associated with teething. Studies have reported its prevalence is between 58% and 92%.^{6,7,13,14} Irritability is noted 2 to 3 days before and after the emergence of the tooth into the oral cavity.¹⁵ As the tooth rises closer to the surface, several local symptoms such as gingival swelling, pain, and drooling do occur.¹⁶ These sensory stimulations may be the subsequent cause of irritability.¹⁷

Fever

Fever is the most frequently reported symptom associated with the eruption of teeth in children by mothers and some health care professionals.^{3,6,18} Results from different studies on children during the phase of tooth eruption pointed out a rise in body temperature. Its incidence range between 24% to 78%.^{7,13,14,19} Macknin *et al.* found an increase in children's body temperature one day before tooth

eruption, however, there was no significant association between fever and teething.¹⁵ Results from a meta-analysis done by Nemezio *et al.* depict that the association between the rise in body temperature and primary tooth eruption is significant only when the rectal temperature was used.³ It may be hypothesized that an increase in body temperature during teething may be attributed to mediators of inflammation like Interleukin-1 β and tumour necrosis factor - α which are released secondary to local inflammation of the gums during tooth eruption.^{6,7} Though there may be a body temperature rise during tooth eruption, it may not be characterized as fever.²⁰ The issue of fever during tooth eruption is controversial, therefore, it is essential not to misjudge the presence of fever during teething, ensuring that it is not due to any infection.³

Sleep disturbance

Prevalence of sleep disturbance in children during teething has been reported to range from 30 to 80%.^{6,21,22} Sleep disturbances in children may encompass sleeping less, awakening during sleep, and crying during sleep.²³ Wakefulness is associated with teething on days close to the tooth eruption but not on days further away.¹⁵ Shapira *et al.* found that the release of inflammatory mediators like interleukins (n IL-1 β and IL-8) and tumour necrosis factor- α (TNF- α) are the causal factors in sleep disturbances. It is essential to remember that disruption of children's sleep patterns can be for many reasons, including behavioural disorders, respiratory and airway disorders, and neurological disorders.²⁴

Diarrhoea

Loose stool or diarrhoea is among the symptoms commonly associated with teething. Several studies have looked into the prevalence of diarrhoea in teething children, with varying results, ranging from 22% to 86%.^{7,13,14,19,23} Macknin *et al.* reported that loose stool was more frequent on days closer to tooth eruption than those further away, however, there is

no significant association between loose stool and teething.¹⁵ It is postulated that one of the causes of loose stool is swallowing excess saliva that is produced during teething.^{6,19} Moreover, the release of IL-1 β and IL-8 cytokines have also been suggested to contribute to loose stools during teething.^{6,23} Some authors believe that diarrhoea associated with tooth eruption is mainly due to the contamination of the baby's fingers or objects that are inserted into the mouth as the child attempts to relieve pressure from erupting tooth by counter pressure from biting.^{6,7,19} Taking this into account, teething may be a scapegoat for many other events occurring to the child during the phase of tooth eruption, including diarrhoeal infections.

Loss of appetite

Results of various longitudinal studies investigating the perception of parents and care givers regarding symptoms of teething have commonly reported loss of appetite.^{25,26} During literature search, only two studies reported symptoms associated with teething in children as loss of appetite. Memarpour *et al.* reported 76% of children presented with loss of appetite four days before tooth eruption compared to 53.1% on the day of tooth eruption and only 37.4% on the third-day post-eruption.⁶ They further noted that only eruption of canine was significantly associated with loss of appetite. In their study, Erdogan *et al.* also found that loss of appetite was associated with tooth eruption.²² The increased levels of interleukin during teething have been proposed to be the reason for loss of appetite.⁶ Loss of appetite during teething may be considered a controversy since its assessment is very subjective.

Cough

Shapira *et al.* observed coughing in 12% of children during tooth eruption compared to 2% of the infants during the control period.²³ Some authors have noted that there is no significant association between coughing and teething in children.^{15,23} Generally, coughing may be caused by excess saliva, thus should not cause alarm except in children with other signs of respiratory disease.⁶

CONCLUSION

From this review of literature, it can be noted that despite that teething can be associated with some symptoms these associated systemic symptoms are not severe and are of short duration. Though as with parents, some health professionals believe tooth eruption is responsible for the onset of some symptoms, it is the duty of the health professionals involved in the care of infants to seek the organic causes of different severe symptoms in children during teething before attributing them to the eruption of teeth to avoid subsequent serious health complications to a child.

Disclosure Statements

Conflict of Interest

The authors have no conflicts of interest to declare.

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Ethical Approval

No ethical approval was required.

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