

# Teething symptoms and management during infancy - A narrative review

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## ABSTRACT

Even though teething is a normal part of infant development, surprisingly, little is known about the causes and management of its signs and symptoms. Due to the paucity of knowledge in this area, the purpose of this review was to provide clarity on teething symptoms and management options.

A PRISMA flow chart revealed 13 studies that were reviewed which reported on teething symptoms and signs as well as treatment and management options. The databases searched were EMBASE, Medline, PubMed, Google Scholar and the Cochrane Library.

The review showed that although conventional and generic treatment options are constantly in use, there remains no concrete evidence to prove signs and symptoms of teething nor evidence to disprove it. However, in this review, symptoms such as irritability, increased salivation, runny nose, loss of appetite, diarrhoea, rash, sleep disturbance and gum rubbing were most apparent.

Further studies are needed to ascertain these findings objectively and conclusively. Future research is also required to understand and investigate the efficacy of treatment methods and approaches among children with teething symptoms.

## Keywords

Teething, infancy, symptoms, treatment, review.

## BACKGROUND

The effect of teething on infant health has been debated for at least 5000 years, and traditional beliefs on the issue have still not been entirely supported by scientific literature.<sup>1</sup>

It is widely believed that pain and other discomfort associated with tooth eruption among infants should and can be managed by pharmacological and non-pharmacological means, but this has yet to be proven.<sup>2</sup> The eruption of primary teeth usually begins around 4-8 months of age with the eruption of the lower incisors, and is complete at around 30-36 months of age when second primary molars erupt. However, the timing of tooth eruption varies by as much as six months.<sup>3,4</sup>

Teething disturbances are transient but may recur repeatedly during 4 to 36 months of age. Evidence regarding teething signs and symptoms are mostly subjective comments from parents, childcare workers and/or health professionals.<sup>2,5-12</sup>

Generally, studies on teething have been small, retrospective, descriptive and cross-sectional in nature. Studies of larger cohorts<sup>13</sup> show no causal association between teething and infection, fever, or diarrhoea.<sup>2</sup> In some children, teething may be associated with increased drooling, sucking of digits and rubbing of gingivae. Nevertheless, more recent prospective studies reveal that most systemic teething signs and symptoms (fever, vomiting, facial rashes, sleep disturbances, stool looseness, decreased appetite for liquids, and cough) are due to other causes.<sup>14-18</sup>

Examples of these alternate causes are well documented in the literature,<sup>19-24</sup> and include meningitis, bacterial infections, and herpes simplex virus infections. The latter are painful in their own right.<sup>20-23</sup>

Teething disturbances may also be caused by development changes, including the decline of maternal antibodies,<sup>25-27</sup> while wakefulness and night crying may be due to separation anxiety from a parent or attention seeking.

## AIM

Even though teething is a normal part of infant development, surprisingly, little is known about the causes and management of its signs and symptoms. Due to the paucity of knowledge in this area, the purpose of this review was to provide clarity on teething symptoms and management options.

## METHODS

A systematic review was conducted according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines.<sup>28</sup>

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1. Yunus I Karjiker: Primary author - 60%
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### Data Sources and searches

While this was not intended to be a formal systematic review, a search strategy was used to identify the relevant literature. The databases searched were EMBASE, Medline, PubMed, Google Scholar and the Cochrane Library with the keyword search of “teething”, “teething symptoms”, “teething signs”, “teething management”, “teething treatment”, and “teething children”.

A preliminary scoping exercise was undertaken. It indicated that the studies available were too heterogeneous to permit a systematic review or meta-analysis of the interventions developed to tackle the number of children who presented with teething symptoms, eruptions or extractions. Therefore, a narrative review of the literature over a 20-year period (1999-2019) was conducted.

Studies were selected that considered child patients only (as teething symptoms mainly occur between six months and three years of age), had a defined intervention and methodology of patients who presented with varied teething symptoms, a treatment measure, management option or a measured outcome.

The titles and/or abstracts were reviewed to exclude any clearly irrelevant studies. The full texts of the remaining studies were then retrieved and read in full independently to determine whether the studies met the inclusion criteria or not.

### Inclusion criteria

In the search, both primary sources and systematic reviews were prioritised as these synthesise the evidence and are at the top of the evidence-based literature as well as studies from the local context. As a second strategy, key scholars from the literature review and institutions were identified, and searched for their recent critical publications, as well as new authors citing them, and which references they had used.

### Data extraction and synthesis

Using a standardised data extraction sheet, the following information (if available) was extracted and recorded from studies: authors and year of publication; sample size of participants; age or age range; location; symptoms and management or treatment options.

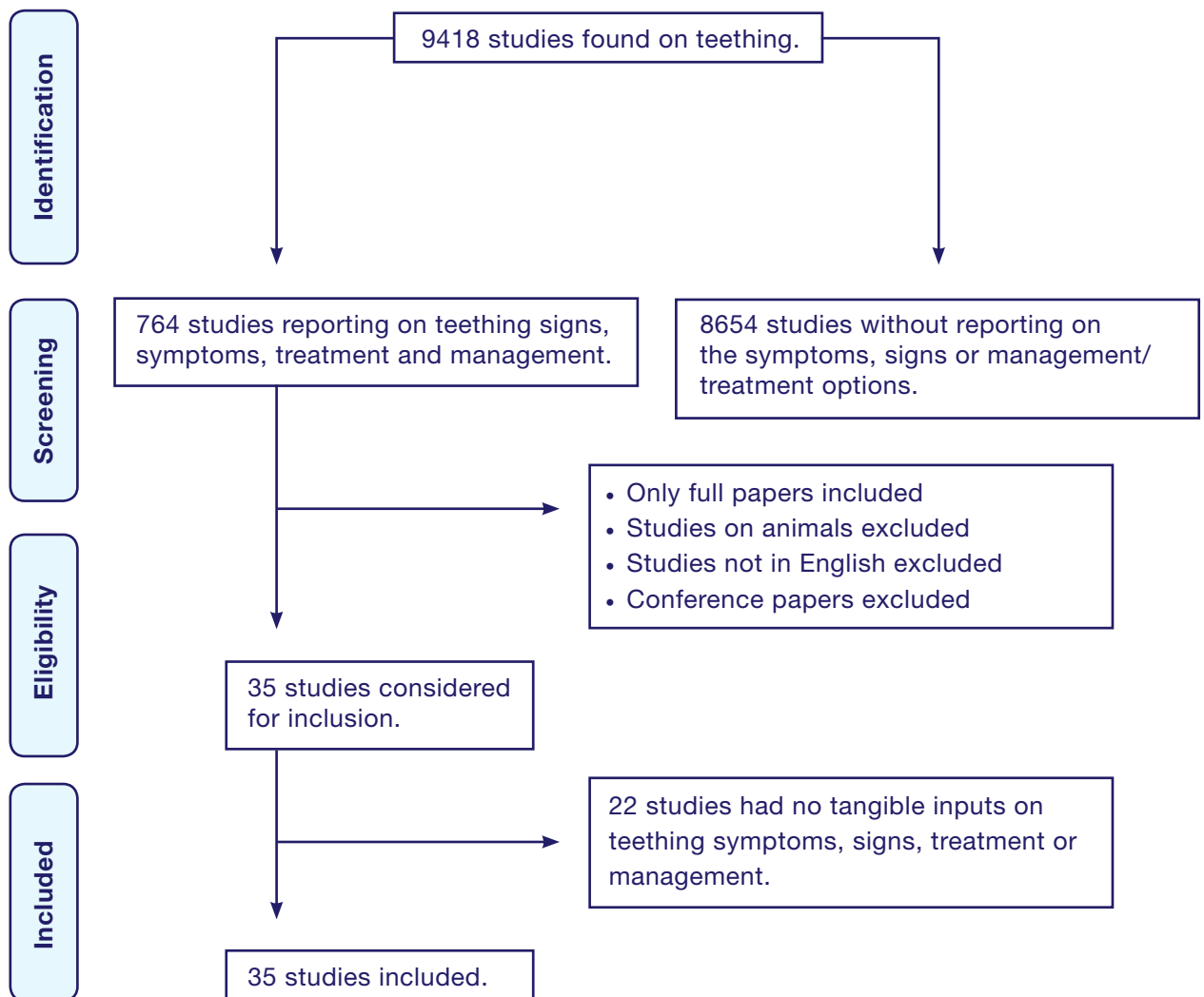


Figure 1. Flowchart of studies included in the narrative review using PRISMA guidelines.

## Quality assessment

The PRISMA guidelines were used to examine the quality of the studies. These include adequacy of study design; recruitment of sample; and findings. The quality of the studies was not summarised with a score, as this approach has been criticized for allocating equal weight to different aspects of methodology,<sup>29</sup> but a formal assessment of the risk of bias and strength of evidence according to the Agency for Healthcare Research and Quality (AHRQ) guidelines was conducted.<sup>30</sup> A study was considered to be of high quality if the study design was prospective in nature, consecutive or a random sampling method was used.

## RESULTS

### Study selection

The flowchart is shown in Figure 1 for the study selection of which the literature search resulted in 9418 studies. After a review of their titles and abstracts, 764 studies met the inclusion criteria and were retrieved for full text reading.

Of these, 751 studies were excluded from the narrative review as they no longer met the inclusion criteria. A total of 13 studies were included in the review, and the extracted data are summarized in Table 1.

## DISCUSSION

This narrative review investigated the available evidence about primary tooth eruption and local and systemic signs and symptoms, along with treatment and management options.

### Signs and symptoms

It is now generally accepted that the eruption of the deciduous teeth is accompanied by a number of relatively minor symptoms (Table 1).<sup>27</sup> General irritability, disturbed sleep, gum inflammation, drooling, loss of appetite, diarrhoea, circumoral rash, intra-oral ulcers, and increase in body temperature, increased biting, gum-rubbing, sucking, wakefulness and ear-rubbing, have all been identified as being temporally related to teething (Table 1).<sup>27</sup>

McDonald et al.,<sup>14</sup> described tooth eruption as a physiological process, which does not justify its association with fever and systemic disorders. Fever and respiratory tract infections in this period of life may happen at the same time as eruption but are not associated with it. In the submucosal phase, the number of mast cells is significantly higher than in the intraosseous phase of tooth eruption, and in the submucosa of the normal oral mucosa not associated with teeth. The consequent degranulation and the local release of mediators, such as histamine, leukotrienes, prostaglandins, proteases, cytokines and growth factors, contribute to the understanding of signs and symptoms assigned to tooth eruption, such as itching, inflammation, local redness and sialorrhoea.<sup>14</sup>

Macknin et al.,<sup>1</sup> conducted a prospective study that investigated the symptoms associated with infant teething. It was revealed that tooth eruption is associated with a slight temperature elevation, facial rash, sleep disturbance, and ear rubbing. In their study, symptoms of decreased appetite for solid foods, biting, drooling, ear-rubbing, gum rubbing, irritability, rash on face, sucking, abnormal temperature and wakefulness were found to have some association with the teething process.<sup>1</sup>

In 2009, Oziegbe et al.,<sup>9</sup> conducted a cross-sectional study consisting of 1,013 mothers of children between the ages four to 36 months who visited the immunization clinics at the Community Health Centres in Ife Central and Ife East Local Government areas in Nigeria.

A total of 765 mothers (75.5%) reported systemic signs and symptoms in their children. Fever (51.8%), diarrhoea (12.5%), and vomiting (2.9%) were the most prevalent symptoms and signs reported after eruption. However, there was no association between teething and symptoms such as fever or diarrhoea.<sup>9</sup>

In another study, most of the children had one or more signs and symptoms during tooth eruption.<sup>34</sup> The most frequent teething symptoms were drooling (92%), sleep disturbances (82.3%) and irritability (75.6%).

These symptoms were more pronounced in low birth weight children.<sup>34</sup> Low grade increases in body temperature were observed only on the day of eruption ( $36.70 \pm 0.39$  °C), when body temperature was significantly different compared to the day before and on the day.<sup>34</sup>

Interestingly, in Singapore, significant early-life factors affecting the child's susceptibility to teething-related pain and fever were commonly reported among infants.<sup>36</sup> These factors included infants of Chinese ethnicity, who were exposed to tobacco smoke during pregnancy, had childbirth *via* Caesarean section and infants that had elevated levels of prenatal plasma vitamin D.<sup>36</sup>

Much of the information gathered about teething is based on subjective parental information. According to Shapira et al.,<sup>31</sup> during the teething period, behavioural problems were observed in 50% of the infants, compared to 16% in the control period ( $p < 0.01$ ); fever was observed in 24% of the infants during tooth eruption and in 8% of the infants during the control period ( $p = .04$ ); and coughing was observed in 12% during tooth eruption compared to 2% ( $p = 0.06$ ) of the infants during the control period. Correlations were also found between high levels of IL-1 $\beta$  and fever, gastrointestinal disturbances, sleep disturbances, and appetite disturbances.<sup>31</sup>

During the same period, a correlation was observed between high levels of IL-8 and gastrointestinal disturbances. High levels of Tumour Necrosis Factor (TNF) were also correlated with fever and sleep disturbances. The Gingival Crevicular Fluid (GCF) cytokines were correlated to some of the clinical symptoms of teething. IL-1 $\beta$  and TNF are correlated with fever and sleep disturbances, IL-1 $\beta$  and IL-8 with gastrointestinal disturbances, and IL-1 $\beta$  with appetite disturbances.<sup>31</sup>

**Table 1.** Symptoms and treatment/management options for patients who experienced teething challenges between 1999 and 2019.

Author(s) (year)	n	Age	Location	Symptoms	Treatment / Management
Macknin et al. <sup>1</sup>	125	3 – 5.6 months old	United States	Decreased appetite for solid foods, biting, drooling, ear-rubbing, gum rubbing, irritability, rash on face, sucking, abnormal temperature and wakefulness.	N/A
McIntyre & McIntyre <sup>27</sup>	N/A	N/A	Glasgow	Pain inflammation of the mucous membrane overlying the tooth (possibly with small haemorrhages). General irritability/malaise. Disturbed sleep/wakefulness. Facial flushing circumoral rash. Drooling/sialorrhoea, gum rubbing/biting/sucking. Bowel upset (ranging from constipation to loose stools and diarrhoea). Loss of appetite/alteration in volume of fluid intake. Ear rubbing on the same side as the erupting tooth.	A number of supportive measures as well as topical and systemic pharmacological preparations, in addition to alternative holistic therapies can be used to relieve the pain of teething.
Shapira et al. <sup>31</sup>	16	5-14 months vmonths	Israel	Fever and sleep disturbances, gastrointestinal disturbances, appetite disturbances.	N/A
Oziegbe et al. <sup>9</sup>	1006	4-36 months	Nigeria	Fever (51.8 %), diarrhoea (12.5%), and vomiting (2.9%).	N/A
Owais et al. <sup>10</sup>	958	0-3 years	Jordan	The desire to bite, gum irritation, increased salivation and loss of appetite were correctly chosen by parents as an association with teething. Almost 75% of the participants attributed fever, diarrhoea and sleep disturbances to teething.	Giving the child a chilled object to bite on, systemic medications and the use of a topical anesthetic.
Ramos-Jorge et al. <sup>32</sup>	47	5 & 15 months Months	Brazil	Irritability, increased salivation, runny nose, loss of appetite, diarrhoea, rash, and sleep disturbance.	N/A
Noor-Mohammed & Basha <sup>33</sup>	1100	4-36 months	India	Fever (16%), drooling (12%), diarrhoea (8%), fever-drooling (15%), fever-diarrhoea (8%), drooling-diarrhoea (6%) and the combination of fever-drooling-diarrhoea was found in 3% of the children.	N/A
Memarpour et al. <sup>34</sup>	254	8-36 months	Iran	Drooling (92 %), sleep disturbances (82.3 %) and irritability (75.6 %).	Teething rings, cuddle therapy, rubbing gums.
Elbur et al. <sup>35</sup>	493	6 months to about 3 years	Saudi Arabia	Desire to bite 93.1%, fever 87%, gum irritation 84.2%, increased salivation 84% and diarrhoea 83% were the most reported.	About 88 % of parents agreed to the statement “allowing the child to bite on a chilled object will relieve pain associated with teething”, while 346 (70.2 %) preferred the use of systemic analgesics. Teething must be treated in the first instance with an appropriate device which applies local pressure to the gingivae. The use of pharmacological treatment can be limited to certain cases with careful monitoring.
Lam et al. <sup>36</sup>	1237	6-18 months	Singapore	Pain 35.5%, fever 49.9%	N/A
El-Gilany et al. <sup>38</sup>	457	N/A	Egypt	Correct knowledge related to bite fingers/objects (70.5%) and drooling (60.0%) Inaccurate knowledge was reported as gum rubbing (42.0%), gum swelling diarrhoea (51.0%), fever (83.2%) and weight loss (46.0%).	Mother's false beliefs may interfere with the prompt diagnosis and management of serious illnesses (Kakatkar et al., 2012).
Ip et al. <sup>39</sup>	200 pharmacists	N/A	San Francisco	N/A	Almost two-thirds (63.0%) of the pharmacists would incorrectly recommend a benzocaine-containing product, with benzocaine 7.5% gel being the most common product.

Owais et al.,<sup>10</sup> stated that there are side effects from teething, but any real cause-and-effect relationship is doubtful. In addition, it was also postulated that high body temperature (higher than 39°C) should not be attributed to teething and should be further investigated. Plutzer<sup>40</sup> conducted a randomized controlled trial on how first-time mothers perceive and deal with teething symptoms. It was revealed that teething symptoms, which are at the very root of the problem, are still poorly understood, despite many commendable efforts over the last 10 years to address them.

Their physiological or pathophysiological basis is not in doubt, but what they lead to in terms of discomfort is poorly understood. Partially, this is due to the confusion between the signs and symptoms. Symptoms are what a patient experience, but children getting their first few teeth can only communicate these through signs and signals that their caregivers can interpret.

Memarpour et al.,<sup>34</sup> conducted a clinical trial of non-pharmacological remedies with regards to the signs and symptoms associated with primary tooth eruption. It was found that most of the children in the study had one or more signs and symptoms during tooth eruption. The study found that tooth eruption was accompanied by local disturbances such as drooling and the urge to chew on objects.<sup>34</sup>

An association has also been shown between general objective signs (drooling, fever, and diarrhoea) and the eruption of primary teeth with fever being the most prevalent sign followed by drooling and a fever-drooling combination.<sup>33</sup> It was further stated that most signs appeared during the eruption of the primary incisors.<sup>33</sup> Furthermore, when an infant at teething age has some symptoms, they may be attributed to teething, but other possible causes must be ruled out first.<sup>33</sup>

Another study had results that demonstrated associations between teething and sleep disturbance, increased salivation, rash, runny nose, diarrhoea, loss of appetite, irritability, and a slight rise in temperature.<sup>32</sup> These associations were significant on the day of eruption and one day after eruption. Therefore, it is not possible to predict eruption through the observation of signs and symptoms because there were no associations on the day before eruption.

The findings of this study contribute towards supporting the concept that teething is not associated with severe signs and symptoms. Therefore, health professionals involved in the care of infants should seek other causes before attributing severe signs and symptoms to teething.<sup>32</sup>

Based on the current limited evidence by Massignan et al.,<sup>37</sup> there are signs and symptoms during primary tooth eruption. Gingival irritation, irritability, and drooling were the most common.

For body temperature analyses, it was possible to evaluate that eruption of primary teeth is associated with a rise in temperature, but it was not characterized as fever. There are also results which showed a wide gap in knowledge and misconceptions with regards

to the ascribed signs and symptoms and practices used to manage infant teething problems.<sup>35</sup>

### Treatment and management options

Aside from teething signs and symptoms, there has been a number of recommended options suggested for management and treatment.

El-Gilany et al.,<sup>38</sup> studied mothers' teething beliefs and treatment practices in Egypt. Their study showed that 13.6% of mothers did not give any treatment for teething problems. Analgesics/antipyretics, pacifiers and antibiotics were the most frequently given treatments (71.3%, 31.3% and 24.3%; respectively).

Relatives, friends and health care workers were the most frequent source of mothers' information about teething problems and their treatments. Deciduous tooth eruption has already been inaccurately associated with several health disorders, such as sleep disruption, ear and cheek itching, primary herpetic gingivostomatitis, cough, croup, bronchitis, diarrhoea, fever, convulsions and (in severe cases) even death.

Objectively, Memarpour et al.,<sup>34</sup> presented two main methods - pharmacological and nonpharmacological - which have been recommended as treatments during tooth eruption. Non-pharmacological remedies were used because of the parents' attitudes towards using remedies which do not threaten their child's health. According to their results, some methods such as teething rings, cuddle therapy and rubbing the gums were more effective than others. However, none of the methods was completely effective in dealing with all the teething problems that was reviewed.

Teething rings and rubbing the gums reduced gingival irritation and finger sucking. In the present study,<sup>3</sup> The pressure caused by biting teething rings or pacifiers and gingival massage may decrease pain by overwhelming the sensory receptors. Biting or sucking cold or frozen objects including fruits, vegetables or other foods causes localised vasoconstriction and decreases inflammation; in addition, the pressure on the gums reduces pain. However, it is suggested that these remedies should be used only for children who are able to eat solid foods. Also, foods that are very hard should not be used, to avoid pain caused by bruising the gum.<sup>4</sup> Moreover, parental supervision is needed to prevent choking on small pieces of food.<sup>34</sup>

In 2018, Ip et al.,<sup>39</sup> mentioned that the Food and Drug Administration (FDA) issued a warning to avoid the use of any benzocaine-containing products for infant teething treatment owing to a risk of methaemoglobinemia. Despite the release of this drug safety warning regarding the use of benzocaine-containing products in infant teething treatment, the majority of pharmacists in their study indicated that they would still incorrectly recommend a benzocaine containing product. Further education is warranted to ensure that all pharmacists, health care providers, and consumers are aware to avoid benzocaine, viscous lidocaine, and homeopathic products for infant teething treatment.

## Limitations

This study has several limitations. The included studies were not specifically designed to answer prospectively the question as to what tangible symptoms and signs as well as treatment options there are for teething and, therefore, a large diversity in studies, study designs, patient categories with different diagnoses, definitions, subjective insights from parents and severity of teething were combined.

Some studies with a low sample number were also included as it matched the inclusion criteria either for children who presented with signs and symptoms of teething, or where there were adequate options for treatment and management of teething. Due to the limited number of studies included in the review, the findings from this study are not generalizable to a number of population groups and patient settings.

## CONCLUSION

This review has shown that although conventional and generic treatment options are constantly in use, there still remains no concrete evidence to prove signs and symptoms of teething nor evidence to disprove it. However, in this review, symptoms such as irritability, increased salivation, runny nose, loss of appetite, diarrhoea, rash, sleep disturbance and gum rubbing were most apparent. Further studies are needed to ascertain these findings objectively and conclusively. Future research is also required to understand and investigate the efficacy of treatment methods and approaches among children with teething symptoms.

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Authors have no potential conflict of interest to declare.

## Compliance with ethical standards

This research is compliant with ethical research standards.

## Ethical approval

Ethical approval for this type of study and formal consent is not required. This article does not contain any studies with humans or animals performed by any of the authors.

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