

REVIEW

Teething in infants: a structured review of symptomatology, parental misconceptions, and evidence-based management

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Abstract

Teething is a common developmental milestone in infants, typically occurring between six and thirty months of age. Although generally associated with localized discomfort, current literature indicates that teething is frequently misattributed as a cause of systemic symptoms such as fever and diarrhea. This review synthesizes findings from existing literature on teething symptomatology, clarifies commonly held misconceptions and highlights the risks associated with inappropriate management strategies. A structured literature review was conducted using predefined criteria to identify relevant publications, including systematic reviews, meta-analyses, cohort studies, observational studies and professional health guidelines published between 1990 and 2024. The review focused on teething-related symptoms, caregiver beliefs and intervention outcomes. Current evidence supports a consistent association between teething and mild, localized symptoms including irritability, drooling and gum inflammation. Inflammatory cytokines such as interleukin-1 beta (IL-1 β) and tumor necrosis factor-alpha (TNF- α), found in gingival crevicular fluid, suggest a localized immune response. There is no credible evidence linking teething to high fever or gastrointestinal disturbances. Misconceptions—rooted in both historical practice and persistent caregiver beliefs—have contributed to the use of potentially harmful remedies, such as topical anesthetics and teething necklaces. According to current literature, teething is a benign, self-limited process that warrants conservative management. Caregiver education remains critical to reducing the use of unsafe remedies and avoiding delays in the diagnosis of unrelated illnesses. Pediatric dental providers are uniquely positioned to correct misinformation and promote safe, evidence-based approaches to teething.

Keywords

Teething; Syndrome; Pediatric; Dentistry; Management; Symptoms; Misconceptions; Inflammation; Infant

1. Introduction

Teething is a well-recognized yet often misunderstood developmental milestone in pediatric dentistry. The eruption of primary teeth marks a critical phase in early childhood, facilitating the transition to solid foods, promoting proper speech articulation, and contributing to overall orofacial development. While the process of tooth eruption is a natural and necessary biological phenomenon, it is frequently associated with a range of local and systemic symptoms, many of which remain a subject of debate within both scientific and clinical communities [1–60].

Historically, teething has been implicated in a variety of ailments, from mild irritability and increased salivation to more severe conditions such as fever, diarrhea and sleep disturbances. Despite advancements in pediatric dental research, misconceptions surrounding teething persist among parents

and caregivers, often leading to inappropriate management strategies, unnecessary medical interventions, and, in some cases, the use of potentially harmful teething remedies [9, 13–16, 25, 27, 28, 30, 31, 33–35, 37–50, 56, 57]. These strategies include the administration of topical anesthetics containing benzocaine, which has been linked to methemoglobinemia; the use of amber teething necklaces that pose strangulation and choking hazards; and reliance on unproven homeopathic or herbal compounds. Some caregivers also report using alcohol-based gum rubs or over-the-counter sedatives. In clinical settings, professionals have occasionally recommended teething gels, unregulated supplements, or even antibiotics for symptoms presumed to be teething-related, despite a lack of supporting evidence [1, 9, 18, 30, 33, 34, 38, 40, 44–47, 56]. The proliferation of anecdotal beliefs and culturally ingrained practices further complicates efforts to establish an evidence-based approach to teething management [9, 13–15, 27, 30, 31,

33–35, 37, 39–41, 43–47, 49, 50, 54–57].

This review aims to clarify the concept of teething syndrome by examining its definitions, prevalence and clinical manifestations as reported in scientific literature.

By reviewing findings from systematic reviews, observational studies, and descriptive reports, this study synthesizes current literature to differentiate between normal teething-related discomfort and unrelated pathological conditions, with the goal of clarifying common misconceptions about the teething process. Additionally, we will explore evidence-based management strategies, including both pharmacologic and non-pharmacologic interventions, as well as global recommendations for teething treatment. Finally, this review will analyze parental misconceptions, their impact on pediatric care, and the role of healthcare professionals in guiding caregivers toward safe and effective teething practices.

By addressing these key issues, this study aims to bridge the gap between historical beliefs and modern scientific understanding, ensuring that teething is managed appropriately while minimizing unnecessary medicalization and parental anxiety.

2. Literature review

2.1 Historical perspectives on teething and its misconceptions

For centuries, teething was mistakenly believed to be a direct cause of infant mortality. This misconception was largely due to the overlap between the eruption of primary teeth and the high mortality rates of infants and young children. In 1842, teething was documented as the cause of death in 4.8% of infants under one year and 7.3% of children aged one to three years in London. The belief that teething could lead to fatal illness led to a range of harmful interventions aimed at alleviating its supposed dangers [30, 39, 43].

One of the most persistent practices was gum lancing, introduced by the French surgeon Ambroise Paré in the sixteenth century. He theorized that erupting teeth were obstructed and that failure to create a pathway could lead to death. As a result, for centuries, physicians and dentists routinely lanced infants' gums, often causing pain, excessive bleeding, and infections. While lancing fell out of favor by the late nineteenth century, some dental textbooks continued advocating for the procedure as late as 1938 [30, 39, 43].

Other historical remedies were equally harmful, including the application of leeches, cauterization and bloodletting—practices emblematic of a broader tradition of untested medical interventions. As Archie Cochrane famously argued, treatments must be grounded in high-quality evidence—particularly randomized controlled trials—before being adopted into routine practice, regardless of tradition or anecdotal appeal. His critique of ineffective and often harmful medical practices is especially relevant to teething, where interventions like gum lancing and mercury-based powders gained popularity without empirical support. Cochrane's legacy underscores the enduring need for evidence-based decision-making in pediatric care [61]. By the early twentieth

century, teething powders containing calomel—a mercury-based compound—had become widespread. Prolonged exposure to calomel was later linked to acrodynia or “pink disease,” a severe form of mercury poisoning that ultimately led to the discontinuation of these products in the 1950s [39, 43].

Despite these harmful interventions, teething toys have a long history. In seventeenth- to nineteenth-century England, infants were given coral, ivory or bone teethingers, often mounted in silver and incorporated into rattles. Some historians suggest these materials were chosen based on sympathetic magic, with the belief that animal-derived substances could transfer strength to the child and ease discomfort [39].

The historical approach to teething highlights a broader trend in medicine—how misattributed causation and unproven treatments persisted for centuries despite lacking scientific basis. Today, teething is recognized as a natural developmental process that, while sometimes uncomfortable, does not inherently cause serious illness or require aggressive intervention [9, 14, 15, 30, 31, 33–35, 37–41, 44–47, 49, 50, 56, 57].

2.2 Definitions and classifications

Various healthcare organizations define teething syndrome differently, reflecting their perspectives on its symptoms and impact. The American Academy of Pediatric Dentistry (AAPD) characterizes teething as a natural, developmental process that may cause localized discomfort but should not be linked to systemic illness [1–3, 6, 26, 30, 31, 33–37, 40, 44–47, 50, 56].

Additionally, the International Classification of Diseases (ICD-10 and ICD-9) provides specific diagnostic codes for teething syndrome, categorizing it under disorders of tooth development and eruption. This classification acknowledges that teething may be associated with minor complications, including localized inflammation and increased salivation, but does not support the notion that teething leads to severe systemic symptoms [1–3, 6, 24, 31, 33–35, 40, 50, 56].

The International Classification of Primary Care (ICPC-2) groups teething under broader dental and periodontal conditions, aiding healthcare providers in documenting and managing oral developmental concerns [23]. Despite differences in classification, the prevailing consensus among medical organizations is that teething is a localized process with mild symptoms, and any significant illness should not be attributed to it without further medical evaluation [2, 3, 6, 15, 23, 30, 31, 38–43, 47].

Despite variations in classification, healthcare organizations share common ground in defining teething as a natural developmental process associated with mild, localized symptoms such as irritability, gum swelling, and excessive drooling. The AAPD, MedlinePlus, Cleveland Clinic and ICD classifications all acknowledge these common symptoms while emphasizing that teething does not directly cause systemic illnesses like fever or diarrhea. However, subtle distinctions exist in their approaches. The AAPD highlights best practices for managing discomfort, discouraging topical anesthetics due to toxicity risks, while MedlinePlus and Cleveland Clinic provide more detailed guidance on symptom relief, including dietary modifications. The ICD-10 and ICD-9 classifications take a

diagnostic approach, categorizing teething under disorders of tooth development and eruption, acknowledging minor complications but not severe systemic effects [1–3, 6, 24, 30, 31, 33–35, 38, 40, 50, 56]. Meanwhile, the ICPC-2 system broadens the scope by grouping teething under dental and periodontal conditions, reflecting its relevance in primary care settings. While all sources converge on the view that teething is a localized issue, their perspectives differ in focus—whether clinical classification, cultural impact, patient management or parental guidance [1–3, 6, 15, 23, 30, 31, 33–35, 40, 44–47, 50, 56].

2.3 Search strategy and selection criteria

A structured literature search was conducted using PubMed, Scopus and Google Scholar, covering all available years through March 2025. Search terms included combinations of “teething”, “teething syndrome”, “primary tooth eruption”, “infant symptoms”, “management”, “parental beliefs” and “systemic illness”. Only full-text articles in English were included. Studies were selected based on relevance to symptomatology, parental or provider misconceptions, management strategies, or biological markers of teething. Eligible study designs included systematic reviews, meta-analyses, cohort studies, longitudinal studies, cross-sectional surveys, and clinical trials, and case reports were included due to global lack of high-validity studies. Non-peer-reviewed opinion pieces were excluded. The specific inclusion and exclusion criteria applied during article selection are detailed in Table 1. Table 2 (Ref. [2, 3, 5, 6, 8, 10–15, 17, 18]) summarizes key studies on teething symptoms, misconceptions, and management; non-peer-reviewed opinion pieces were excluded. A breakdown of the number of studies by type is presented in Table 3.

2.4 Literature, reviews and meta-analyses on teething symptoms

Several well-designed studies—including prospective cohort studies, case-control studies, cross-sectional surveys, and systematic reviews with or without meta-analysis—have examined the relationship between teething and systemic symptoms. Study designs are specified below to clarify the level of evidence:

(1) Jaber *et al.* [6] (1992)

This prospective observational cohort study with a paired design examined the relationship between teething and fever in

46 healthy infants by analyzing mothers’ reports over 20 days before the eruption of the first tooth. Daily rectal temperatures and symptoms were recorded [6].

Results showed mean daily temperature ranged between 36.9 °C and 37.1 °C until three days before eruption, when it increased to 37.1 °C (Standard Error 0.66), peaking at 37.6 °C (SE 0.85) on the eruption day (95% Confidence Interval: 37.33–37.86 °C). On this day, 20 infants had a fever >37.5 °C, compared to seven or fewer on any day from day 19 to day 4 pre-eruption. Fever ≥38 °C was rare [6].

Findings highlight a slight temperature increase during teething but emphasize the risk of misattributing fever to tooth eruption, reinforcing the need to consider other potential causes [6].

(2) King *et al.* [5] (1992)

This case-control study examined the prevalence of herpes simplex virus (HSV) infection in infants presenting with symptoms commonly attributed to teething. Forty infants aged 7–30 months were evaluated, with 20 symptomatic infants compared to 20 asymptomatic controls. Results revealed that 45% of the symptomatic group tested positive for HSV, all of whom presented with oral infection and elevated temperatures. None of the control group tested positive. These findings illustrate how primary herpetic gingivostomatitis—an infectious condition—can be mistaken for teething. While the study does not analyze teething directly, it underscores the clinical importance of differentiating between benign teething symptoms and pathologies requiring medical attention [5].

(3) Macknin *et al.* [8] (2000)

This prospective cohort study evaluated 125 healthy infants to identify symptoms associated with teething. Over 19,000 child-days and 475 tooth eruptions were tracked using parent-reported daily symptom logs and tympanic temperatures [8]. Symptoms such as increased biting, drooling, gum-rubbing, irritability and mild temperature elevation were significantly more common during an 8-day teething window. However, no symptom occurred in more than 35% of infants, and signs like fever over 102 °F, vomiting, and diarrhea showed no significant association. The study concluded that while teething may cause mild, localized discomfort, it does not reliably predict tooth eruption or cause serious illness, reinforcing the need to consider other diagnoses when systemic symptoms are present [8].

TABLE 1. Inclusion and exclusion criteria for article selection.

Criterion	Inclusion	Exclusion
Time frame	All available years through March 2025	None based on date alone
Language	English	Non-English without translation
Access	Full-text available	Abstract-only or inaccessible articles
Population	Infants and toddlers (0–36 months)	Populations older than 36 months
Study design	Systematic reviews, meta-analyses, cohort studies, longitudinal studies, cross-sectional surveys, clinical trials and case reports	Editorials, non-peer-reviewed opinion pieces
Focus	Teething-related symptoms, caregiver beliefs, management strategies, inflammatory markers	Studies not addressing teething or misattribution of symptoms

TABLE 2. Summary of key studies on teething symptoms, misconceptions and management.

Author(s)	Year	Study Type	Sample Size	Main Findings	Study Limitations	Conclusion
Jaber <i>et al.</i> [6]	1992	Prospective Observational Study with Paired Design	46 infants	Temperature peaked at 37.6 °C on the eruption day; fever ≥ 38 °C was rare.	Small sample size, parental reporting may be subjective	Slight temperature elevations were observed, but true fever was rare; attributing febrile illness to teething may delay identification of infections.
King <i>et al.</i> [5]	1992	Case-Control Study	40 infants	45% of symptomatic infants tested positive for HSV; symptoms misattributed to teething.	Does not assess teething directly, limited to HSV misdiagnosis	HSV-related illness may be mistaken for teething, delaying proper diagnosis.
Macknin <i>et al.</i> [8]	2000	Prospective Cohort Study	125 infants	Symptoms peaked in an 8-day window surrounding tooth eruption; no fever > 102 °F observed.	Relied on parental symptom logs, potential underreporting	Mild symptoms are associated with teething, but they do not predict tooth emergence.
Wake <i>et al.</i> [10]	2000	Prospective Cohort Study	90 teeth (varied infants)	No significant temperature differences on teething vs. non-teething days; loose stools only symptoms weakly associated.	Limited sample from day care population, potential generalizability issues	No strong association between teething and systemic symptoms; parental beliefs persist.
Wake & Hesketh	2002	Cross-Sectional Survey Study	Healthcare professionals	Nurses and pharmacists were more likely to attribute systemic symptoms to teething than pediatricians.	Cross-sectional design cannot establish causation	Surveyed professionals—especially nurses and pharmacists—frequently linked systemic symptoms to teething, suggesting a need for updated education.
Shapira <i>et al.</i> [17]	2003	Prospective Observational Study with Within-Subject Design	16 infants (50 teeth)	Increased IL-1 β and TNF- α levels in gingival fluid; linked to mild teething-related symptoms.	Small sample size, limited generalizability	Cytokine activity may contribute to mild symptoms but does not explain systemic illness.
Cunha <i>et al.</i> [13]	2004	Prospective Cohort Study	1165 infants	95% of infants exhibited mild teething symptoms; fever not directly linked to eruption.	Retrospective design, lack of standardized symptom assessment	Teething was linked to mild, short-lived symptoms but not to high fever or systemic illness, underscoring the need to rule out other causes.
Sood & Sood	2010	Narrative Literature Review	Variable based on studies included	Parental and professional beliefs about teething symptoms often contradict clinical evidence.	Narrative format, lacks systematic methodology	Better education is needed to dispel myths about teething and its symptoms.
Noor-Mohammed & Basha	2011	Cross-Sectional Hospital-Based Survey	1100 children	Fever (16%), drooling (12%), diarrhea (8%) were most frequent symptoms; peaked during incisor eruption.	Subjective parental reporting, no clinical confirmation	Fever, drooling, and diarrhea were reported but are not definitive signs of teething; clinicians should remain vigilant for unrelated illness.

TABLE 2. Continued.

Author(s)	Year	Study Type	Sample Size	Main Findings	Study Limitations	Conclusion
Ramos-Jorge <i>et al.</i> [12]	2011	Prospective Longitudinal Observational Study	47 infants	Irritability, increased salivation, and loss of appetite associated with teething.	Small sample size, daily measurement limits external validity	Teething is linked to minor discomfort, but systemic illness should be ruled out.
Memarpour <i>et al.</i> [11]	2015	Nonrandomized Controlled Clinical Trial	254 children	Teething rings, cuddle therapy, and gum rubbing were most effective remedies for teething discomfort.	Lack of randomization, reliance on parental reporting	Nonpharmacological treatments effectively reduce mild teething symptoms.
Lam <i>et al.</i> [14]	2016	Prospective Longitudinal Cohort Study	1033 infants	Second-hand smoke and cesarean birth increased risk of teething pain and fever.	Observational design, associations not causative	Prenatal tobacco exposure and birth method impact teething pain and fever likelihood.
Massignan <i>et al.</i> [2]	2016	Systematic Review with Meta-Analysis	3506 children	Gingival irritation (86.81%), irritability (68.19%), and drooling (55.72%) were the most common teething symptoms.	Heterogeneity in symptom definitions, moderate risk of bias	Teething symptoms are mild; fever and systemic illness are not associated.
Nemezio <i>et al.</i> [3]	2017	Systematic Review with Meta-Analysis	6 of 83 studies	No overall association between fever and teething, except when measured via rectal temperature.	Only 6 studies included, variability in fever measurement methods	Rectal temperature measurements can detect mild temperature fluctuations, but fever is not a symptom.
Abdulsatar <i>et al.</i> [18]	2022	Cross-Sectional Survey Study	123 caregivers	67% of caregivers used unsafe remedies (amber necklaces, topical anesthetics).	Self-reported data, no clinical verification	Unsafe remedies for teething remain prevalent despite professional warnings.
Pereira <i>et al.</i> [15]	2023	Systematic Review of Cross-Sectional Studies	10,524 parents	80% of parents believed teething caused symptoms, despite evidence to the contrary.	Moderate quality across studies, diverse cultural contexts may limit conclusions	Parental misconceptions about teething are widespread and contribute to unnecessary treatments.

HSV: herpes simplex virus; IL-1 β : Interleukin-1 beta; TNF- α : Tumor Necrosis Factor-Alpha.

TABLE 3. Study types represented in the structured review.

Study type	Count
Prospective cohort/Observational studies	7
Cross-sectional studies	4
Case-control study	1
Clinical trial (Nonrandomized)	1
Narrative literature review	1
Systematic review with meta-analysis	2
Systematic review (Without meta-analysis)	1

(4) Wake *et al.* [10] (2000)

This prospective cohort study assessed the association between tooth eruption and systemic symptoms in 6- to 24-month-old infants attending long-day care [10]. Over 236 toothdays and 895 non-toothdays, temperatures and symptoms were recorded by both staff and parents. Average temperatures did not differ between tooth and non-tooth days, and regression analysis showed no significant link between eruption and fever, mood changes, diarrhea or sleep disturbances. A weak association with parent-reported loose stools disappeared when the teething window was expanded. The findings emphasize that despite widespread parental belief, tooth eruption is not strongly associated with systemic illness [10].

(5) Wake & Hesketh (2002)

This cross-sectional survey study investigated healthcare professionals' beliefs regarding teething symptoms and management strategies. Responses were collected from 500 child health practitioners across five professional groups in Victoria, Australia. The survey revealed that nurses and pharmacists were significantly more likely than pediatricians to attribute systemic symptoms—including fever, rashes and loose stools—to teething. Some pharmacists even reported recommending sedatives or topical gels, despite limited evidence supporting such interventions. While not an evaluation of treatment outcomes, this study highlights the persistence of professional misconceptions and their potential to influence inappropriate management recommendations [4].

(6) Shapira *et al.* [17] (2003)

This prospective observational study with within-subject design examined inflammatory cytokine levels in gingival crevicular fluid (GCF) during primary tooth eruption to assess their correlation with teething symptoms. Sixteen healthy children (5–14 months) were monitored biweekly for five months, with GCF samples collected from erupting teeth and again one month later as controls. Cytokine levels (IL-1 β , IL-8, TNF- α) were measured via enzyme-linked immunosorbent assay (ELISA), and clinical symptoms were recorded [17].

Among 50 teeth studied, 21 had GCF samples. During teething, only 22% of children were symptom-free, compared to 72% in the control period. TNF- α levels were significantly higher during teething ($p < 0.05$). Correlations were observed between IL-1 β /TNF- α and fever, sleep disturbances, and between IL-1 β /IL-8 and gastrointestinal issues [17].

Findings suggest cytokine activity in GCF may contribute to teething symptoms, though systemic illness should not be

attributed solely to eruption [17]. Elevated levels of IL-1 β , IL-8 and TNF- α in gingival crevicular fluid suggest a localized inflammatory response during tooth eruption. These cytokines are known to mediate pain and inflammation through recruitment of immune cells and sensitization of peripheral nociceptors, which can lead to discomfort, gum swelling, and irritability. However, their presence in gingival tissue does not indicate systemic immune activation. This localized response contrasts with the cytokine profiles seen in infectious or febrile illnesses, supporting the consensus that teething does not cause fever or other systemic symptoms. The inflammatory process appears confined to the eruption site and resolves as the tooth emerges [17].

(7) Cunha *et al.* [13] (2004)

This prospective cohort study analyzed teething symptoms in 125 healthy infants from 4 months to 1 year old, with parents recording daily tympanic temperatures, 18 symptoms, and tooth eruptions over 19,422 child-days (475 eruptions) [13].

Teething symptoms were significantly more frequent in the 4 days before, the day of, and 3 days after eruption, defining an 8-day teething window. Associated symptoms included increased biting, drooling, gum-rubbing, sucking, irritability, wakefulness, ear-rubbing, facial rash, decreased appetite for solids and mild temperature elevation. Symptoms not significantly associated included congestion, stool looseness, increased stool number, decreased appetite for liquids, cough, non-facial rashes, fever $>102^{\circ}\text{F}$, and vomiting. No infant had a fever $>104^{\circ}\text{F}$ or a life-threatening illness [13].

Findings confirm teething is linked to mild, short-lived symptoms but cannot reliably predict tooth emergence. Caregivers should rule out other causes before attributing serious symptoms to teething [13].

(8) Sood & Sood (2010)

This narrative literature review explores common misconceptions about teething and their impact on diagnosing serious illnesses. Many symptoms attributed to teething coincide with the period when maternal antibodies wane and infants are exposed to infections. Strong parental beliefs, often shared by medical professionals, persist despite a lack of supporting evidence [9].

Misinformation can delay proper medical intervention, as symptoms such as fever, diarrhea, and rashes may have alternative causes unrelated to tooth eruption. Educating healthcare providers is essential to dispel myths and guide caregivers toward evidence-based management [9].

Supportive care, including safe symptom relief methods, remains the cornerstone of teething management [9].

(9) Noor-Mohammed & Basha (2011)

This cross-sectional hospital-based survey study examined teething manifestations in 1100 children (4–36 months) with at least one erupting tooth. Parents completed questionnaires on fever, drooling, and diarrhea and children underwent oral exams. Data were analyzed using chi-square tests ($p < 0.05$) [7].

Results showed 68% of children exhibited at least one symptom, most commonly fever (16%), drooling (12%), and diarrhea (8%), with fever-drooling (15%) and fever-diarrhea (8%) combinations also noted. Boys had a significantly higher

prevalence of diarrhea ($p < 0.05$). Symptoms peaked during primary incisor eruption and were more common in children 4–24 months, with a significant decline in older age groups ($p < 0.05$) [7].

Findings suggest fever, drooling, and diarrhea occur more frequently during teething but are not definitive indicators. Teething-related symptoms should not overshadow the need to rule out other potential illnesses [7].

(10) Ramos-Jorge *et al.* [12] (2011)

This 8-month prospective observational longitudinal study assessed the association between primary tooth eruption and teething symptoms in 47 noninstitutionalized infants (5–15 months) in Diamantina, Brazil. Daily tympanic and axillary temperature measurements, clinical oral exams, and parental interviews on 13 symptoms were conducted [12].

Teething was linked to a slight tympanic temperature increase on the eruption day ($p = 0.004$), with median maximum temperatures of 36.8 °C (tympanic) and 36.6 °C (axillary). The most common symptoms were irritability ($p < 0.001$), increased salivation ($p < 0.001$), runny nose ($p < 0.001$), and loss of appetite ($p < 0.001$). Other associated symptoms included diarrhea, rash and sleep disturbances [12].

Findings confirm teething is accompanied by mild symptoms but do not support attributing severe symptoms, such as high fever, to tooth eruption [12].

(11) Memarpour *et al.* [11] (2015)

This nonrandomized clinical trial evaluated teething symptoms and the effectiveness of five nonpharmacological remedies in 254 children (8–36 months) over an 8-day teething window. Data were collected through oral exams, tympanic temperature readings, and parental questionnaires [11].

The most frequent symptoms were drooling (92%), sleep disturbances (82.3%), and irritability (75.6%). Low birth weight children exhibited more symptoms ($p > 0.05$). Canine eruption was associated with greater appetite loss than incisors ($p = 0.033$) or molars ($p = 0.014$). A mild temperature increase (36.70 ± 0.39 °C) was observed only on eruption day ($p < 0.001$), but no correlation was found between fever reported by mothers and recorded temperatures [11].

Teething rings were the most effective remedy, followed by cuddle therapy and gum rubbing. Findings suggest teething does not cause fever or diarrhea, but nonpharmacological methods can alleviate mild symptoms [11].

(12) Lam *et al.* [14] (2016)

This prospective longitudinal cohort study teething pain and fever prevalence in 1033 infants from the Growing Up in Singapore Towards healthy Outcomes (GUSTO) birth cohort ($n = 1237$), with tri-monthly interviews from 6 to 18 months. Poisson-log regression models assessed early-life risk factors [14].

Teething pain and fever were reported in 35.5% and 49.9% of cases, respectively. Second-hand smoke (SHS) exposure increased risk for both pain (Mean Ratio (MR) = 1.35, $p = 0.006$) and fever (MR = 1.22, $p = 0.025$), with active smoking plus SHS further elevating teething pain risk (MR = 1.89, $p = 0.029$). Caesarean delivery increased pain risk (MR = 1.27, $p = 0.033$), while prenatal vitamin D insufficiency lowered it (MR = 0.62, $p = 0.012$). Indian infants had a significantly lower risk of teething pain and fever than Chinese infants ($p \leq 0.001$)

[14].

Findings highlight key prenatal and perinatal factors influencing teething symptoms, reinforcing the need for maternal tobacco cessation and nutritional interventions during pregnancy [14].

(13) Massignan *et al.* [2] (2016)

This systematic review that includes a meta-analysis initially identified a total of 1179 articles, and following a two-phase selection process, 16 studies were included in the analysis. Among children aged 0 to 36 months, the overall prevalence of signs and symptoms associated with primary tooth eruption was 70.5% (total sample = 3506). The most reported symptoms were gingival irritation (86.81%), irritability (68.19%), and drooling (55.72%) [2]. Risk of bias among the included studies was generally moderate, with limitations in blinding and heterogeneity of symptom reporting. A formal Grading of Recommendations Assessment, Development and Evaluation (GRADE) assessment was not provided in the meta-analysis.

(14) Nemezio *et al.* [3] (2017)

This systematic review that includes a meta-analysis initially identified 83 potential studies. After removing duplicates and excluding those that did not meet the inclusion criteria, six studies were included in the final analysis. The overall meta-analysis found no significant association between fever and primary tooth eruption (Odds Ratio = 1.32 (0.88–1.96)). However, in the subgroup analysis, when fever was measured using rectal temperature, an association was observed (OR = 2.82 (1.55–5.14)). While mild temperature fluctuations were occasionally noted, these changes were only detected through rectal temperature measurement. Fever exceeding 38 °C was not identified as a symptom of teething [3]. A GRADE assessment was not performed in this analysis; however, the authors noted variability in study quality and acknowledged potential risk of bias due to inconsistent temperature measurement methods and study heterogeneity.

(15) Abdulsatar *et al.* [18] (2022)

This cross-sectional survey study assessed the prevalence of teething remedy use among caregivers and examined associations with socioeconomic status (SES) and maternal education. Caregivers of 12–18-month-old children visiting primary care for routine checkups completed questionnaires on teething symptoms and remedies. Unsafe remedies, as defined by pediatric guidelines, included topical anesthetics, teething necklaces, and liquid-filled rings [18].

Of 130 distributed questionnaires, 123 were analyzed. Teething remedies were used by 98% of families, with 67% employing unsafe methods. Amber teething necklaces were used by 27%, and 28% reported multiple unsafe remedies. No significant correlation was found between overall unsafe remedy use and SES or maternal education, aside from topical anesthetic use [18].

Findings indicate widespread use of unsafe teething remedies despite professional recommendations, underscoring the need for enhanced caregiver education [18].

(16) Pereira *et al.* [15] (2023)

This systematic review of cross-sectional studies examined parents' beliefs, knowledge, and attitudes toward the signs and symptoms of primary tooth eruption in children aged 0 to 36 months. A comprehensive search of electronic databases and

gray literature identified cross-sectional studies meeting the inclusion criteria. Three independent reviewers selected studies, extracted data, and assessed methodological quality using the Agency for Research and Quality in Health questionnaire, with disagreements resolved by a fourth reviewer. Descriptive analysis was performed using median and interquartile ranges [15].

A total of 29 studies, including 10,524 participants from various geographic regions, were analyzed. The methodological quality of the studies was moderate. The majority of parents believed in at least one teething-related sign or symptom, with the most commonly reported being an increased desire to bite. Oral rehydration was the most frequently cited management strategy. Only a small proportion of parents reported taking no action in response to perceived teething symptoms [15].

Findings indicate a widespread parental belief in teething-related symptoms, with minimal variation across different countries. The results highlight the need for educational interventions to prevent unnecessary medication use and ensure evidence-based teething management [15].

2.5 Cumulative findings

The collective results of these studies reinforce that teething is primarily associated with mild, localized symptoms such as gingival irritation, increased salivation and irritability, but it does not cause high fever or serious systemic illnesses [2–4, 6–15, 17, 18]. Multiple systematic reviews and meta-analyses, including those by Massignan *et al.* [2] (2016), Nemezio *et al.* [3] (2017), and Pereira *et al.* [15] (2023), confirm that while minor temperature fluctuations can occur, they do not meet the clinical threshold for fever ($\geq 38^\circ\text{C}$) [2, 3, 15]. Wake *et al.* [10] (2000) and Jaber *et al.* [6] (1992) further demonstrated no significant temperature difference between teething and non-teething periods. Noor-Mohammed & Basha (2011), Pereira *et al.* [15] (2023) among others highlight the widespread parental misconception that teething causes fever or diarrhea, underscoring the need for education to prevent misattribution of symptoms, which may delay appropriate medical care [2, 3, 6, 7, 9, 10, 13–15, 30, 31, 42–47, 49, 50, 56, 57].

Findings also reveal a disconnect between evidence-based medicine and professional beliefs. Wake & Hesketh (2002) among others found that nurses and pharmacists were more likely than pediatricians and dentists to attribute systemic symptoms like high fever to teething, despite a lack of supporting evidence [4, 9, 14, 15, 30, 31, 33–35, 44–47, 50, 56]. This misalignment suggests a need for better professional education to prevent the overdiagnosis of teething-related symptoms and the underdiagnosis of underlying illnesses [4, 9, 14, 15, 30, 31, 33–35, 44–47, 50, 56, 57]. King *et al.* [5] (1992) demonstrated the danger of misdiagnosing primary herpetic gingivostomatitis as teething, while Abdulsatar *et al.* [18] (2022) showed that caregivers frequently resort to unsafe remedies, such as amber necklaces and topical anesthetics, which pose risks like strangulation and methemoglobinemia [1, 5, 9, 15, 18, 30, 31, 33–35, 38, 40–42, 44–47, 50, 56].

While localized inflammation is involved in teething, studies such as Shapira *et al.* [17] (2003) provide a biological basis

for mild systemic effects by identifying increased levels of inflammatory markers IL-1 β and TNF- α in gingival crevicular fluid [2, 3, 11–14, 17]. However, these findings do not support teething as a cause of severe illness [17]. Macknin *et al.* [8] (2000), Lam *et al.* [14] (2016), among others suggest that environmental, cultural and socioeconomic factors may influence the perception and reporting of teething symptoms, complicating the differentiation between teething-related discomfort and other illnesses [2, 3, 8, 11–15, 17, 18, 30, 31, 44–47, 50, 56, 57].

Given these findings, healthcare professionals should emphasize the importance of distinguishing normal teething symptoms from unrelated medical conditions. Proper parental education is crucial to ensuring that serious illnesses are not overlooked due to persistent teething myths. A consolidated overview of the primary studies reviewed, including their design, findings and implications for clinical care, is provided in Table 2.

Further research has examined a variety of additional teething-related symptoms. Increased irritability and fussiness, commonly observed in infants for up to five days before and after tooth eruption, have been reported in multiple studies and reviews [2, 3, 8, 12–14]. Sleep disturbances have also been noted, though the literature consistently indicates these disruptions are mild and short-lived [8, 11, 12, 31, 32]. Increased biting or gnawing behavior, likely a self-soothing response to gingival discomfort, is frequently observed during eruptive phases [2, 8, 13]. Slight changes in stool consistency have been described, but no significant correlation between teething and diarrhea has been confirmed in well-controlled clinical studies [3, 7, 12, 32]. Furthermore, examining inflammatory markers in gingival crevicular fluid suggests mild localized immune responses, but no strong systemic effects [2, 3, 12, 13, 17, 33].

While this review synthesizes a broad range of studies on teething symptomatology, several methodological limitations must be acknowledged. Many of the included investigations relied heavily on parental reporting, which introduces potential bias and subjective variability. Sample sizes varied considerably, with some studies underpowered to detect less common effects. Additionally, inconsistencies in outcome definitions, symptom measurement, and temperature thresholds complicate cross-study comparisons. Few studies utilized validated assessment tools, and blinding was often not feasible. These limitations underscore the need for future research employing standardized methodologies and objective symptom tracking to clarify the clinical impact of teething more definitively.

2.6 Global recommendations for teething management

Different healthcare organizations provide varying guidelines for teething management, often reflecting regional beliefs and access to medical care. Additionally, the International Classification of Diseases, 10th Revision (ICD-10), includes specific codes for teething-related concerns. The primary ICD-10 code for teething symptoms is K00.7 (Teething Syndrome), which can be used for documentation and billing purposes in medical and dental settings [1, 15, 19–24, 30, 31, 38, 40, 44–47, 50, 56].

United States (AAPD & AAP): The American Academy of Pediatric Dentistry and the American Academy of Pediatrics recommend using chilled teething rings, gum massage, and systemic analgesics like acetaminophen or ibuprofen when necessary. They strongly discourage the use of topical anesthetics and teething gels due to potential toxicity risks [1, 38, 40].

United Kingdom (NHS): The National Health Service advises parents to use a similar approach, focusing on cold objects for relief and discouraging homeopathic or herbal remedies that lack clinical validation [19, 38, 40].

Australia (RACGP & ADA): The Royal Australian College of General Practitioners and the Australian Dental Association support evidence-based approaches while warning against the use of teething necklaces, which pose strangulation risks [18, 20, 21, 38].

Canada (CPS & CDA): The Canadian Paediatric Society and the Canadian Dental Association recommend nonpharmacological remedies such as rubber teething toys and highlight the importance of parental education to reduce reliance on unverified treatments [1, 15, 22, 40, 44, 50, 56].

Global Health Guidance: The World Health Organization does not classify teething as a medical condition but promotes awareness of safe symptom relief methods, particularly in regions where traditional remedies may involve harmful substances [16, 23, 38–43].

2.7 Parental misconceptions and their impact on pediatric care

Despite strong scientific evidence, many parents and even some healthcare providers continue to attribute systemic symptoms to teething. This has several consequences:

Delays in Diagnosis: Misattributing fever or diarrhea to teething can result in delayed diagnoses of infections or gastrointestinal illnesses [3, 7, 9, 12, 15, 30, 31, 35, 40, 41, 44, 45, 47, 50, 56].

Overuse of Medications: Many caregivers administer unnecessary medications such as antipyretics or antibiotics, believing them to be essential for managing teething discomfort [1, 9, 15, 30, 31, 33, 35, 39–41, 44, 45, 47, 50, 56].

Unsafe Practices: As highlighted in the study by Abdulsatar *et al.* [18] (2022) among many others, a significant number of parents use unsafe remedies, such as topical anesthetics and amber necklaces, despite warnings from major health organizations [1, 15, 18, 30, 31, 34–36, 38–41, 44, 46, 48, 50, 58–60].

Cultural Influences: In some cultures, traditional remedies such as herbal tinctures or rubbing alcohol on the gums persist, despite the associated risks. Healthcare providers must be aware of these cultural beliefs and address them with evidence-based recommendations [1, 15, 16, 30, 31, 35, 39–48, 50, 56, 57]. Cultural traditions and socioeconomic factors significantly influence how caregivers interpret and respond to teething symptoms. Studies from regions including Nigeria [49], Saudi Arabia [45, 50], India [46] and Egypt [47] reveal widespread belief in systemic teething symptoms such as fever, diarrhea and convulsions. In many cases, traditional remedies—such as herbal applications, burning the

gums, or administering spiritual concoctions—are preferred over evidence-based interventions. These beliefs persist regardless of maternal education level or healthcare access and may be reinforced by generational knowledge or community norms. To address these disparities, public health initiatives must prioritize culturally sensitive educational efforts that respect local traditions while promoting safe, evidence-based practices.

3. Conclusions

Teething is a natural developmental process frequently misattributed to systemic symptoms such as fever, diarrhea, and significant illness, despite a lack of scientific evidence supporting these associations [2, 3, 6, 7, 9, 12, 15, 30, 31, 33–41, 44, 45, 47, 50, 56]. While mild irritability, increased drooling, and gum discomfort are common, persistent or severe symptoms should prompt further medical evaluation to rule out underlying conditions [6, 7, 12, 13, 15, 30, 31, 44, 46, 50, 56]. Systematic reviews and meta-analyses consistently confirm that teething does not cause high fever or gastrointestinal disturbances [2, 3, 12, 13, 15, 46]. Global health organizations, including the AAPD, NHS, RACGP, CPS, WHO, among others provide consistent recommendations for teething management, advocating for non-invasive relief methods while discouraging unverified and potentially harmful treatments such as topical anesthetics and teething necklaces despite varied cultural beliefs surrounding teething [1, 15, 16, 19–24, 30, 31, 33–45, 48–50, 56]. However, widespread parental and cultural misconceptions persist, often leading to inappropriate treatment approaches, unnecessary medication use, and delays in diagnosing actual illnesses [1, 9, 15, 18, 30, 31, 33–36, 38–41, 44–47, 49, 50, 56, 57, 59, 60]. A strong emphasis on parental education and professional guidance is essential to ensuring that teething discomfort is managed effectively and safely. By understanding the biological mechanisms, global perspectives, and evidence-based treatment strategies, pediatric dentists and caregivers can help bridge the gap between outdated beliefs and scientific reality—minimizing unnecessary interventions and reducing health risks.

ABBREVIATIONS

AAPD, American Academy of Pediatric Dentistry; AAP, American Academy of Pediatrics; ADA, Australian Dental Association; CDA, Canadian Dental Association; CPS, Canadian Paediatric Society; ICD, International Classification of Diseases; ICPC, International Classification of Primary Care; IL-1 β , Interleukin-1 beta; IL-8, Interleukin-8; NHS, National Health Service (United Kingdom); RACGP, Royal Australian College of General Practitioners; TNF- α , Tumor Necrosis Factor-Alpha; WHO, World Health Organization; SE, Standard Error; CI, Confidence Interval; HSV, Herpes Simplex Virus; GCF, Gingival Crevicular Fluid; ELISA, Enzyme-Linked Immunosorbent Assay; GUSTO, Growing Up in Singapore Towards healthy Outcomes; SHS, Second-Hand Smoke; MR, Mean Ratio; GRADE, Grading of Recommendations Assessment, Development and Evaluation; OR, Odds Ratio; SES, Socioeconomic Status.

AVAILABILITY OF DATA AND MATERIALS

This review is based on publicly available data from previously published studies. All data analyzed during this study are included in this published article and its cited references. No new datasets were generated or analyzed for this review. Further details on individual studies referenced can be found in their respective publications, as cited in the References section.

AUTHOR CONTRIBUTIONS

JK—conceived the initial idea. DKL—conducted the investigation, performed the analysis, and drafted the initial manuscript. JK and MG—provided guidance throughout the process and contributed to manuscript optimization; consulted on journal selection and provided review. All authors contributed to editorial changes in the manuscript. All authors read and approved the final manuscript.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

Not applicable.

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CONFLICT OF INTEREST

The authors declare no conflict of interest. Marcio Guelmann is serving as one of the Editorial Board members of this journal. We declare that Marcio Guelmann had no involvement in the peer review of this article and has no access to information regarding its peer review. Full responsibility for the editorial process for this article was delegated to APG.

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