EDUCATIONAL ARTICLE

PROBLEMS WITH TEETHING IN CHILDREN

Mangla Sood, Sankalp Sood***

Abstract

Teething starts around 6 months of age and is complete by 30 months of age in most children. From medical professionals to grandmothers, everyone seems to have a list of symptoms they believe are linked to teething. It is important to remember that during this same time period of an infant's life, passive immunity due to maternal antibodies wanes and exposure to a wide variety of childhood illnesses occurs. Medical professionals need to be educated about teething to provide reasonable explanations to concerned caregivers. This article examines the signs and symptoms frequently attributed to teething and their possible alternative causes. The contemporary principles of the management of teething are discussed, including supportive measures.

Key words: Teething, childhood illnesses, management

Key Points

- Understand normal anatomy and physiology of tooth eruption as well as causes of delayed eruption.
- The inaccurate historical association between teething and significant morbidity and mortality.
- Be aware of the historic beliefs about the effects of teething and therapies that have been used in the past.
- Describe the effects of teething and the signs and symptoms that are unrelated to teething, which necessitate referral to a physician.
- The features that are currently accepted to be associated with teething.
- Advice which can be given to parents about current methods of teething pain relief, including conventional pharmacological and 'alternative' holistic methods.

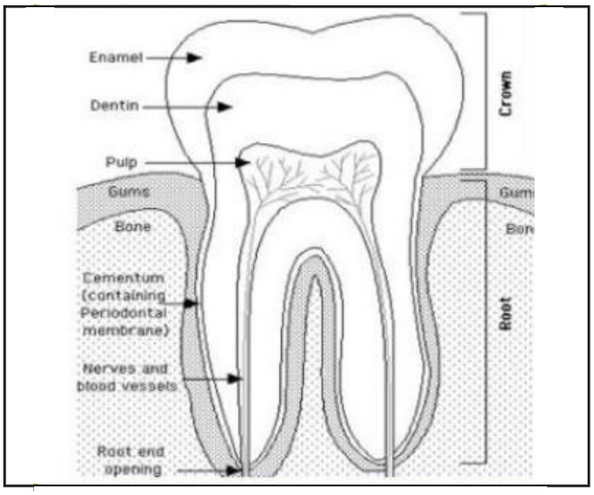
Introduction

'Teething' is an ill-defined non evidence-based entity proffered by both healthcare professionals and lay people as an inappropriate diagnosis for a wide variety of signs and symptoms such as fever, pain, irritability, sleep problems, mouthing/biting, drooling, red cheeks, decreased oral intake, gum inflammation, runny nose, and diarrhea. Often, the diagnosis of teething seems to help alleviate parental anxiety. Such parental beliefs are consistent worldwide, across all education levels, and for both first-time and experienced parents. The treatment modalities for teething have been diverse throughout the ages, frequently depending on the tenets of the medical profession and lay people, but principally involve pain relief.

Tooth Anatomy

Teeth form embryologically from neuroectoderm that develops into the central and peripheral nervous systems. Tooth development begins in the fetus around 28 days, but mineralization does not occur until 14 weeks in uterus. Tooth eruption occurs when the formation and mineralization of the crown are almost complete, but before the roots are fully formed. Teeth have two distinct parts, the crown and the root, and are composed of four different tissues (Fig. 1).The crown, which is made of enamel, lies above the gum line and covers the sensitive root, which lies below the gum line. The root makes up two thirds of the tooth's total length,

Fig 1 : Tooth Anatomy



goes through the periodontal ligament, and attaches into a socket in the alveolar bone of the jaw.

The four tissues that make up a tooth are:

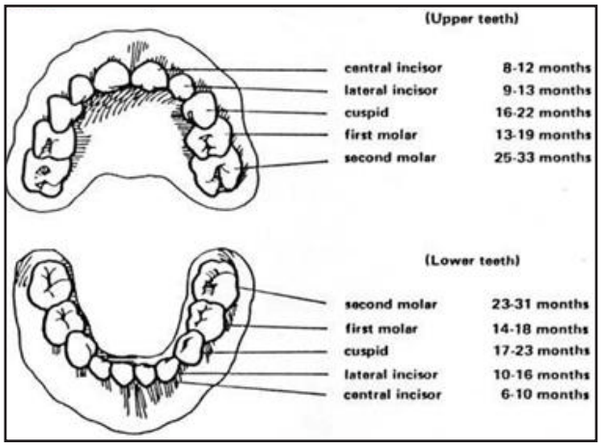
- Enamel: Outermost white covering of a tooth
- Dentin: Soft bonelike material that supports the enamel and carries some nerve fibers
- Pulp: The centre of the tooth that contains blood, lymph vessels, and nerves
- Cementum: Covers the root of the tooth and the periodontal ligament connects the cementum and the jaw bone.

Tooth Eruption

Most parents regard the appearance of an infant's first tooth as one of a series of significant developmental landmarks, and its precocious eruption as a sign of great intelligence. Tooth eruption or teething is the process by which a tooth moves from the pre-eruptive position in the alveolar bone through the mucosa into the oral cavity. It is believed that the dental follicle (sac containing the developing tooth and its odontogenic organ) rather than the tooth itself plays the essential role in this process. The dental follicle is a source of eicosanoids, cytokines, and growth factors and, thus, may contribute to some of the localized symptoms seen with teething. Prior to erupting, the crown of the tooth is covered by enamel epithelium. As the tooth moves upward in the jaw, this area of fused epithelium breaks down, and the tooth erupts. Prior to this, the gingiva may appear bluish and swollen as a result of a transient hematoma.

Primary teeth, also known as deciduous teeth or milk teeth, comprise 8 incisors, 4 canines, and 8 molars for a total of 20 teeth (Fig. 2). Beneath the primary teeth, 20 permanent (succedaneous) teeth are developing. The timing of tooth eruption varies widely, although most children get their first deciduous tooth around 6 months of age and their last between 24 and 30 months of age. The lower central incisors usually erupt first and the molars last. Teeth tend to emerge in pairs, and girls often get their teeth earlier than do boys. The average number of teeth a child should have is roughly his or her age in months minus 6 until 24 months of age. Preterm infants acquire their teeth at a later chronological age but the same post conceptual age as term infants.

Fig 2 : Primary teeth eruption chart



A number of pathologic conditions are associated with a delay in tooth eruption (Table 1)

Table 1:

- Impacted Teeth
- Down Syndrome
- Impedance of tooth eruption by adjacent or overlying tooth or bone.
- Cleidocranial Dysplasia
- Congenital Hypothyroidism
- Gaucher Disease
- Osteopetrosis
- Rickets

Historical Teething Remedies

Teething or "dentition difficilis,"derived from Latin for pathologic dentition or difficult dentition, was considered a deadly disease until the late 19th century. Hippocrates, Homer, Celsus and Aristotle are known to have associated teething with significant morbidity.(1) Hippocrates claimed that children experiencing teething suffered from itching gums, fever, convulsions, diarrhea, vomiting, cholera, tetanus and meningitis. Dr Thrasher, a well known dentist, wrote in Dental Cosmos, "So deadly has teething become that one third of the human family die before 20 deciduous teeth have fully appeared." (2) Infant mortality was extremely high in previous centuries, typically at 6 months to 4 years of age, a time period temporally corresponding to tooth eruption. Thus, it is not surprising that teething was also believed to be the cause of death.

Systemic medicaments have through the ages been used for managing teething, many containing opiates, lead acetate, mercurial and bromide. Ironically, most of these compounds were poisonous and contributed directly to the high morbidity and mortality of teething infants and children. (Table 2) In the 18th and 19th centuries, treatments for teething included purgatives and emetics even if the child presented with vomiting and diarrhea. Topical medicaments included animal milk, butter and a honey/salt mixture. Treatment also involved removal of teeth, hot nails pressed into the gums, and lancing of the gum tissue. Lancing consisted of two incisions given crossing at 900 overlying the 'difficult' tooth and it was supposed to relieve the pressure in ischemic mucous membrane overlying an incipiently erupting tooth in the absence of any anesthesia. (3)

Such remedies are no longer recommended. The complications are disfiguring and deadly. Traditional healers or village elders often use unsterilized equipment, leading to localized and systemic infections. Lancing or tooth removal can cause enamel defects, malformed teeth, and altered mandible size.

But many of these historical misconceptions about teething and the related dangerous remedies persist. In some rural areas the belief that teething causes diarrhea is common and the gum swelling that precedes tooth eruption is believed to be the cause. These remedies are believed to relieve the pathologic tension on the gums, thereby alleviating diarrhea and vomiting.

Table 2: Historical Teething Remedies no longer used now

Teething Treatment	Adverse Effects
Emetics, purgatives, and salts	Dehydration
Honey	Botulism
Opiates	Somnolence, respiratory depression
Lead	Paralysis, encephalopathy, seizures
Mercury	Vomiting, diarrhoea, renal failure
Bromide	Seizures, hallucinations

Teething Today

RS Illingsworth statement, "Teething produces nothing but teeth." is a straightforward summation of the actual process of teething. (4) Many conditions previously thought to be caused by teething like uncontrolled vomiting, weight loss, septicemia, tonsillitis, infantile paralysis, cholera, meningitis and tetanus are now accurately diagnosed after significant diagnostic and therapeutic medical advancement. But the enigma of teething continues to endure as a wastebasket diagnosis, when no cause can be found for a particular sign or symptom. Continued

worldwide education about teething and diarrhea is needed to ensure that infants and children are treated appropriately and safely. Among medical professionals, pediatricians attribute the fewest symptoms to teething and paramedic staff the most. Dentists also are more likely to attribute a greater variety of symptoms, including diarrhea, to teething, likely due to a lack of exposure to young children and because diarrhea is not part of dental training. Parents are bound to discuss teething with the dentist when their children are evaluated.

Symptoms

Many unexplained teething myths continue to pervade contemporary child health. The period associated with the eruption of the deciduous teeth in infants can be difficult and distressing for both the child and their respective parents. The eruption of the deciduous teeth is accompanied by a number of relatively minor symptoms (Table 3). General irritability, disturbed sleep, gum inflammation, drooling, loss of appetite, diarrhea, circumoral rash, intra-oral ulcers, an increase in body temperature, increased biting, gum-rubbing, sucking, wakefulness and ear-rubbing, have all been identified as being temporally related to teething. (5-9) Decreased appetite for solid foods and mild temperature elevation (<38.9^{0}C) also have been reported. (9)

Studies could not identify systemic manifestations such as decreased appetite for liquids, congestion, sleep disturbances, daytime restlessness, loose stools, vomiting, cough, body rash, fever greater than 38.9^{0}C, an increase in finger sucking, and gum rubbing to be associated with teething in children. (10,11). Macknin et al (1) and Wake et al (8) failed to associate above mentioned symptoms with tooth eruption. Carpenter found that in 120 subjects, during the eruption of the mandibular deciduous central incisor teeth, only 39% exhibited one of several symptoms (fever, vomiting, diarrhea, drooling, irritability, facial rashes or rhinorrhea), and the symptoms disappeared on either the day of, or the day after eruption of the tooth. (12)

Table 3: Signs and symptoms of teething

- Pain
- Inflammation of the mucous membrane overlying the tooth (possibly with small hemorrhages)
- General irritability/malaise
- Disturbed sleep/wakefulness
- Drooling/sialorrhea
- Gum rubbing/biting/sucking
- Bowel upset (ranging from constipation to loose stools and diarrhea)
- Loss of appetite/alteration in volume of fluid intake
- Ear rubbing on the same side as the erupting tooth

Parents hold a spectrum of opinions regarding the teething-associated symptoms. Wake et al. found that between 70-85% of parents reported teething was related to fever, pain, irritability, disturbed sleep, and biting, drooling and red cheeks. Furthermore, between one-third and one-half of parents felt that nappy rash, 'soaking', ear pulling, feeding difficulties, a runny nose, loose stools, and infections were related to teething, whereas a few parents related smelly urine, constipation, colic and convulsions to eruptive difficulties. (13)

In a survey among pediatricians, Honig found that only 5 of 64 pediatricians believed that irritability, eating problems, wakefulness and rashes were not consequent to teething, and 18 pediatricians thought that fevers of up to 390C could be caused by teething. (14) British Medical Journal editorial (1975) stated that fever, diarrhea, rashes, fits, and bronchitis should not be attributed to teething. Pediatricians that diagnose these symptoms and signs as teething were delaying the diagnosis and treatment of pyogenic meningitis, bronchopneumonia, gastroenteritis, urinary tract infections and other serious disorders. (15)

Despite this information, Swann examined the records of 50 children admitted to hospital with symptoms attributed to teething by either parents or doctors. (16) In 48 of these children, organic causes like upper respiratory tract infections, febrile convulsions, bronchitis, eczema and meningitis were identified.

Does teething cause Systemic upset?

The timing of eruption of the deciduous incisors (6-12 months) coincides with the diminution of the circulating maternal humoral immunity conferred via the placenta, and the establishment of the child's own humoral immunity. Most children of this age are susceptible to a myriad of relatively minor infections.

The study by King et al. found that 9 out of 20 infants reported to be 'teething' by one of their parents produced an oral swab positive for herpes simplex virus (HSV) and hence the possibility that certain teething symptoms (fever, irritability and eating disturbance) resulted from an undiagnosed primary herpetic infection. (11) An undiagnosed concurrent primary herpetic infection could be responsible for the symptoms of fever, irritability and appetite loss. The formation of a gingival crevice around a newly erupting tooth could act as a portal of entry for herpes viruses. (11)

The symptoms of elevated temperature and facial rash could also be due to infection with the Human Herpes Virus 6 (HHV-6), which is ubiquitous among infants of teething age. The fact is several of the features attributed to teething can be explained by alternative non-teething etiologies, but still many parents will testify that their children are teething.

Pain

Pain is reported as a common feature of teething by parents. It is not the tooth which contributes, but the dental follicle which is a rich source of eicosanoids, cytokines and growth factors resulting in a localized inflammatory response and pain. Lay people state that 'the tooth coming through the bone' is responsible.

There is no evidence to support this, and indeed, the etiology of the teething symptoms is caused by one of the many childhood illnesses.

Treatment

The current methods of the management of teething are presented in Table 4. Infants with severe systemic signs should be promptly referred to a physician for an accurate diagnosis and appropriate treatment.

Non-pharmacological management

The expression "born with a silver spoon in his mouth" has its origin as a teething remedy. This expression referred to wealthy 19th century parents who would give their teething children a silver spoon to bite on to relieve discomfort. Unlike many historical teething remedies, the "silver spoon" treatment was effective and still is used but has been replaced by more affordable textured or cold teething rings. The cold temperature of the object causes localized vasoconstriction, which decreases the inflammation, and biting on the object gives further relief by applying pressure to the gums.

A wide range of teething rings are commercially available for infants to 'gnaw'. Temporary pain relief is provided by the pressure produced by chewing the teething ring, maximal when chilled. Liquid-filled teething rings should be chilled in the refrigerator, not in the freezer, and should not be sterilized in boiling water or in the dishwasher (unless specified by the manufacturer). These should be attached to the infants clothing, and not tied around the neck, as strangulation could result. Many teething children are comforted by a pacifier, and will chew the teat to provide temporary pain relief.

Hard, non-sweetened rusks made from flour and wheat with no sugar or sweetener can also be attached onto the infant's clothing. A variety of fresh and frozen fruit and vegetables e.g., peeled cucumber, frozen bananas can be used by teething infants. Such remedies should not be used in children who are not yet taking solid foods, and foods that have high sucrose content are not recommended. Supervision is needed to ensure that small pieces of food do not break off and pose a choking hazard. Several of the methods described above involve the application of pressure to the painful area of mucous membrane, and mild pressure can also be applied with a clean finger (possibly with wet gauze) or a cold spoon. Excessive salivation commonly runs onto the infant's skin, and should be wiped away regularly otherwise, a rash (which may be considered pathognomic of teething) may develop. Reassurance can often be one of the most effective methods of calming a distressed teething child.

Table 4: Management of teething

- Teething rings (chilled)
- Hard sugar-free teething rusks/bread-sticks/ oven-hardened bread
- Cucumber (peeled)
- Frozen items (anything from ice cubes to frozen bagels, frozen banana, sliced fruit)
- Pacifier (even frozen)
- Rub gums with clean finger, cool spoon, wet gauze
- Reassurance
- Analgesic/antipyretics
- Topical anaesthetic agents
- Alternative holistic medicine

Pharmacological management

Most parents prefer to avoid using pharmacological preparations during teething, however, a wide range of effective topical and systemic preparations are available when local measures fail to provide relief.

Topical agents

- Lignocaine-based products
- Choline salicylate-based products

  This group of medicaments includes local anesthetics (lignocaine-based preparations) and minor analgesics (choline salicylate based preparations). Parents should be advised to wash their hands thoroughly before applying topical agents directly to the painful area of mucous membrane. Some of their reported relief may be due to the pressure of application. Lignocaine hydrochloride is a local anesthetic that is rapidly absorbed through mucous membrane giving prompt relief from pain. Gel should be placed on a clean finger or cotton bud, and rubbed onto the painful area. Salicylates are regarded as minor analgesics and penetrate mucous membrane readily to give prompt pain relief. They are also anti-inflammatory and antipyretic, thus reducing swelling which is an additional advantage. The link between aspirin and Reyes syndrome is not relevant for non-aspirin salicylates. Frequent applications of choline salicylate preparations to the oral mucosa may result in a chemical burn.

Systemic analgesics

The conservative use of acetaminophen and ibuprofen can reduces pain and pyrexia caused by teething. Parents must know the correct dosage for their children. A sugar-free paracetamol elixir is the drug of choice. It acts by inhibiting prostaglandin production. The recommended paracetamol dosage is:

3-12 months = 60-120 mg; 1-5 years = 120-250 mg

These doses are repeated at 4-6 hourly intervals, with a maximum of four doses in 24 hours. A graduated syringe should be used for doses under 5 ml, and a calibrated spoon for doses over 5 ml. Underdoses of paracetamol for teething children are ineffective, whilst overdosing may lead to severe hepatocellular necrosis and renal tubular necrosis. Ibuprofen suspension can be given to children over one year.

'Alternative' holistic medicine

Alternative non-pharmacological holistic therapies (acupressure, aromatherapy, massage and homeopathy) are also becoming popular to relieve teething discomfort. Aromatherapy include application of oils and herbs to the gums, like diluted clove oil, natural liquorice sticks, fennel, green onion, olive

oil, ginger root, and vanilla along with massage to neutralize the inflammatory mediators produced during teething. It is important for clinicians who care for children to be aware of the types of products that are available and used by parents.

Acupressure requires the parent to apply pressure to certain key skin points, providing immediate pain relief. Chamomile oil (recommended for teething) may be placed (out of reach) in an aromatherapy diffuser in the infant's bedroom. It is also helpful if the child is suffering from diarrhea, irritability, or red cheeks.

Teething children can be comforted and stimulated by a full body massage.

Practices that are not recommended

Parents should be advised that a number of outdated practices are potentially harmful. Adding sugar, honey or jam to feeding bottles, or dipping a pacifier in honey or jam has absolutely no pain relieving effect. Alcohols are not recommended for infants, and specifically the application directly to mucous membrane should be avoided as it may lead to hypoglycaemia.

General advice regarding medication

Only sugar-free objects and medication should be prescribed during teething. Parents should be told correct dosages to prevent overdose of the child when dispensing medicaments. Teething remedies should be kept well out of reach of all children, as even 'childproof' containers can be opened by small children, and because of added flavorings, children can unwittingly overdose themselves. Medicines, including teething remedies, should never be added to food or feeding bottles, as parents cannot accurately control the dosage ingested. In addition, the active ingredient of the medication may adversely interact with foodstuffs and the possibility exists for other children to share potentially harmful medication in this way.

Conclusions

- The diagnosis of teething has historically been applied to almost any potentially serious illness as well as normal childhood behavior during the period of teeth eruption.
- Young children are exposed to a wide variety of situations, environments, and illnesses and can have multiple episodes of fever, congestion, and diarrhea. Physicians and caregivers should be aware of the temporal relationship between teething, exposure to infection, and normal childhood illnesses.
- Parents need to be educated that local symptoms may occur, but systemic symptoms are not caused by teething.
- The infant should be promptly referred to a physician for an accurate diagnosis and appropriate treatment if severe systemic upsets occur.
- The currently accepted methods of pain relief for teething infants have progressed considerably since the historic days of gum-lancing and dangerous remedies which contributed to the high morbidity and mortality.
- Teething treatments range from topical and systemic pharmacological preparations, teething rings and cold washcloths to homeopathic oils and topical benzocaine.
- Most of these treatments are benign, but some have the potential to cause serious disease or pose a choking risk. Vigilance and caution should be used when physicians prescribe treatment and when parents choose to use non-traditional remedies.

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From: Department of Pediatrics*, Indira Gandhi Medical College & Department of Orthodontics**, H.P. Govt. Dental College, Shimla, India.

Address for Correspondence: Dr Mangla Sood, Pratasha, North Oak Area, Sanjauli, Shimla, Himachal Pradesh-171006. India. E mail: nishoosood@yahoo.com

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