

1982

# The doctrine of difficult dentition : evolution of a medical nonentity

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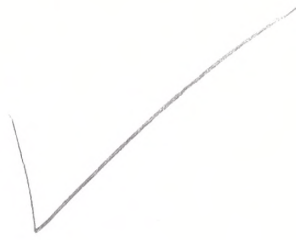



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# The Doctrine of Difficult Dentition: Evolution of a Medical Nonentity.

A thesis submitted to Yale University  
in partial fulfillment of the require-  
ments for the M.D. degree.

Jed Baron Gorlin  
Class of 1982  
Yale University Medical School  
New Haven, Connecticut



*This preparation, containing among other valuable ingredients, a small amount of Morphine, is in accordance with the Pharmacy Act hereby labelled POISON.*

How, Under the English Pharmacy Act, the English Authorities Compel the Manufacturers of "Mrs. Winslow's Soothing Syrup" on Each Bottle Offered for Sale to Acknowledge the Presence of Morphine in Their Preparation and Use the Label "Poison."

(The bottle from which this wrapper was taken was bought in London, in April, 1905.)

1884

1885

1886

1887

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ABSTRACTThe Doctrine of Difficult Dentition: Evolution of a Medical  
Nonentity

Teething is the process of the eruption of the primary dentition, which causes at most only minor symptoms. Throughout history, teething was blamed for a broad range of pediatric illnesses and even death. This misconception is traced in medical literature from classical times until the present. Infant mortality attributed to teething and the folklore of teething are explored. "Teething" symptoms, their proposed etiologies, and the therapy of teething are systematically analyzed. The role of "teething" as a diagnostic entity declined as more scientific alternative diagnoses were proposed. Despite controlled studies that link only minor symptoms with teething, many contemporary parents and practitioners continue to blame teething for a wide spectrum of maladies.



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I dedicate this text to Dr. Thomas R. Forbes who served both as an advisor and as a mentor. He introduced me to the study of the history of medicine. His enlightening discourses on the history of anatomy sparked my interest. As a supporter of the Nathan Smith Club, he helped maintain student enthusiasm for historical topics. As an advisor, his suggestions and criticisms helped immensely in the formulation of this text.





The Doctrine of Difficult Dentition:  
Evolution of a Medical Nonentity

I) Introduction

A. Background

Teething, the eruption of the primary dentition that typically occurs from six months to two and one-half years of age, is a physiologic process that causes at most minor symptoms such as irritability or drooling. Throughout recorded history, however, a seemingly endless spectrum of symptoms had been attributed to teething. The reasons for this dramatic change of opinion are worthy of review.

Until the nineteenth and twentieth centuries, major morbidity or mortality occurring by age five were more the rule than the exception. The diagnostic and therapeutic armamentaria at the disposal of the contemporary physician combined with public health measures make us forget what a treacherous journey the passage from infancy to childhood was throughout history. Mortality rates in excess of forty percent by age five are well documented for sixteenth and seventeenth century London, even as the norm between epidemics. It was a rare child who had not been exposed to one of the infectious scourges of his time such as smallpox, whooping cough, diphtheria, or poliomyelitis.

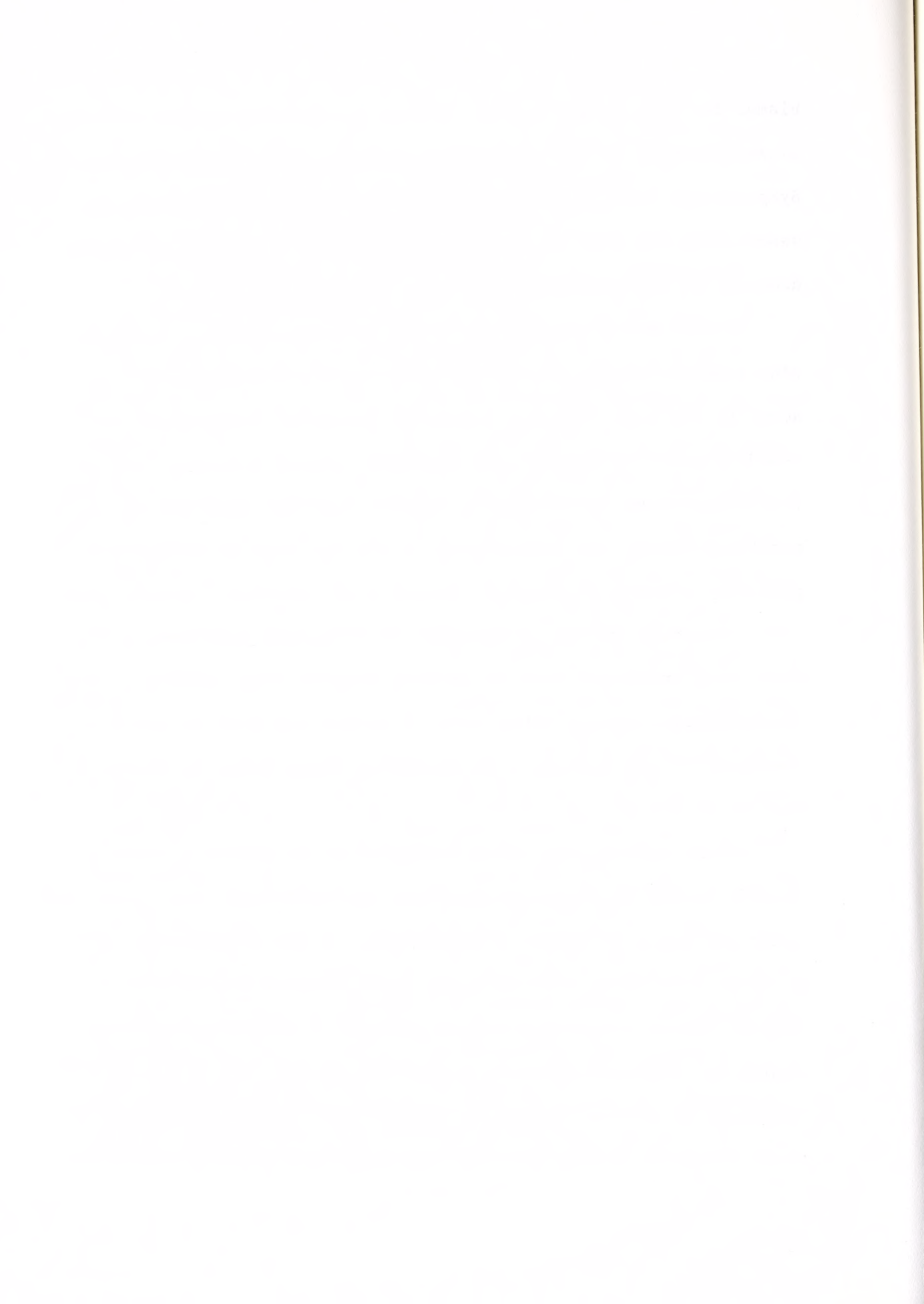
Teething, a striking physiologic change occurring during a highly susceptible age range, fell suspect. It and "worms" (the majority of infants faced the challenge of parasitic infections as well) were



blamed for many infant deaths. Writers of classical medical treatises blamed teething for the innumerable symptoms of childhood maladies. Symptoms and disease entities were often confused and mere temporal association was often mistaken for causality--if, in fact, the times demanded an explanation of etiology.

Practitioners since Hippocrates have listed symptoms associated with teething and naturally most common infant maladies rapidly were added to the list. Authors discussing "teething" symptoms and their remedies wrote voluminously in nineteenth century journals. As the list of symptoms evolved, which included diarrhea, constipation, fever, vomiting, rashes, and convulsions, so did the range of therapies and prophylactic measures designed to prevent these ailments. General therapies, including emetics, purgatives, diuretics and sedatives, were used with local treatments such as teething objects, oils, powders, rubbing the gums with teeth or other parts of animals and even the surgical treatment of gum lancing or scarification (superficial incisions productive of blood).

Infant medical care, often relegated to the mother or perhaps midwife during the classical, medieval and renaissance eras, later came under the aegis of medical practitioners. By the seventeenth century, at least five books on children and their diseases had appeared in England alone. Nineteenth century colleges of medicine created new chairs for children's disease specialists and the list of alternative diagnoses to explain "teething" symptoms grew. It was not until the early twentieth century that few deaths were attributed to teething.



The practice of gum lancing rapidly declined as did the incidence of mercury poisoning from calomel-containing teething powders. However, the practice of attributing systemic symptoms, such as fever, diarrhea, and even convulsions to teething, remained common. Current surveys show that both the public and many practitioners continue to profess these beliefs despite studies that discredit any connection between such symptoms and teething.

#### B. Objectives

The purpose of this thesis is to trace the evolution of teething as a concept in medical practice. One might ask, why did medical authorities blame a process that occurs in all children? Statistics reveal that infant mortality was great. Most children were exposed to serious illness and many died. Understandably, practitioners and parents alike sought a common explanation to rationalize the frequency of grave illnesses during early childhood. The initial portion of this thesis documents the high mortality and explores the influence it had on attributing illness to teething.

The shared misconceptions of the public and practitioners about dentition are reflected in the fact that medical folklore abounds with references to teething. That ancient remedies were incorporated into popular superstition, suggests that the public shared ideas about disease and its treatment with earlier medical authorities. The parallels between teething folklore, literary references to teething, and medical



practice are noted. This background of beliefs in teething symptoms explains why many practitioners were incapable of rejecting the concept of difficult dentition.

Symptoms attributed to teething have remained relatively constant throughout the last two thousand years, although the list grew as each authority made his contribution. This reflects both the finite number of disease manifestations possible in an infant, as well as the stability of common afflictions prior to the control of infectious diseases. Systematic analysis of teething symptoms reveals a multitude of explanations for any given symptom. The great lengths to which defenders of dentition symptoms would go in rationalizing the link between a symptom and teething suggested a lack of suitable alternative explanations. Tracing each symptom documents that the link to dentition weakens when a better diagnosis exists and "teething" is no longer required to fill a diagnostic void.

Teething remedies allowed both the practitioner and parent to take action against what they considered a serious threat to the child. The evolution of both local and general treatments is traced and the rationale used to justify them considered. Many remedies, including gum lancing, were quite invasive and contributed to the decline of the diagnosis. As mortality rates decreased, parents and practitioners were understandably less eager to sanction treatment with a gum lancet.

Finally, the paucity of empirical data concerning teething symptoms is considered. Since all "normal" children undergo teething, the difficulty of designing a study may have contributed to the fact that the first well-controlled investigation was published in 1968. Hence, the





expansion of diagnostic alternatives, and not empirical data, brought about the decline of the doctrine of difficult dentition.

The most complete historical reviews of teething are those of Rendle-Short (1955) and Radbill (1965a; 1965b). Both were written prior to Tasanen's (1968) definitive study and each author focused on classical and renaissance medical authorities. The intent of this thesis is to expand upon their brief summaries and to speculate on the reasons for the decline of the teething diagnosis.

### C. Infant Mortality Attributed to Teething

The high rate of infant mortality contributed to the impression that teething was a time of peril for infants. Mortality rates for children under five years of age were often in excess of forty percent in the sixteenth through eighteenth century London. Statistics of infant mortality for the beginning of the nineteenth century revealed equally dreary prospects for infants in Boston and New York City. Forbes (1976) cited Short, a reviewer of the London bills of mortality, who commented in 1750, "What a fatal time is infancy and childhood to young citizens."

Mortality rates often revealed seasonal variability, especially infant mortality rates. Schofield (1979) analyzed "childhood" mortality during the end of the sixteenth century in England. Rates during peak summer months were fifty percent greater than during winter months. This conforms with the observation of Forbes (1973) that although overall burials at the Parish of St. Martin (1686 + 1695-1702) were significantly more frequent during winter months, "teething" deaths were reported most frequently during May through August. Many authors considered summer



the most dangerous time "to breed teeth," and these statistics are in accord with their impressions. They often cited cholera infantum, or summer diarrhea as the chief seasonal "teething" threat and modern epidemiological studies confirm the increased incidence of diarrhea in the summer months among infants (Nelson, 1979).

The London bills of mortality were first compiled and analyzed by Graunt (1675). The bills were compilations of records kept within each parish. Each sexton or other parish officer was required to record the age and cause of death of each individual that died within the boundaries of the parish. This practice existed since the early sixteenth century following a Thomas Cromwell edict issued under the auspices of Henry VIII. Graunt's tabulations began with 1629; a sample bill dated 1657 included teeth and worms as distinct causes of death, although Graunt's table from 1629 until 1656 combined teeth and worms as a single statistical category. Teeth were blamed as a cause of death almost entirely for children under age five, and usually under age two, although isolated cases of older children whose death was attributed to teething exist. The statistics compiled by Graunt (1675) and Forbes (1971a, 1971b, 1972, 1973, 1974, 1976, 1981)<sup>1</sup> revealed that from one to ten percent of total deaths occurring during the sixteenth to the eighteenth century, "teething" deaths constituting two percent of all deaths were typical and similar figures were recorded for Boston and New York City.

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See Tables I and II that follow.



TABLE 1: Sixteenth Through Eighteenth Centuries

Year, Place and Source	Percent Dying by Age		Number and Percent of Deaths of All Ages Attributed to Teeth		Number and Percent of Deaths by Age Five Attributed to Teeth	
	1	2 5	Number	Percent	Number	Percent
<u>LONDON</u>						
1583-1599, St. Botolph Parish (Forbes 1976)		40% (by age 4)				
1583-1599 Aldgate Parish (Forbes 1971a)	30%	50%		1.1%		8% of deaths 2 mo.--1 yr. 18% of deaths 1-2 yrs.
1632 London Bills of Mortality (Graunt 1675)				5%		(teeth only)
1657 London Bills of Mortality (Graunt 1675)				7%		(teeth and worms)
1654-1693 St. Giles Parish (Forbes 1981)				8%		
1729-1743 St. Giles Parish (Forbes 1981)				8%		
1774-1793 St. Giles Parish (Forbes 1981)				0.6%		
1685-1687 & 1694-1703 St. Martin Parish (Forbes 1973)		55%		10%		
1728 London Bills of Mortality (Graunt, et al.)		44%		6%		14%
1758 London Bills of Mortality (Graunt et al.)		44%		3%		8%
1774-1793 Cripplegate Parish (Forbes 1871b)	18%	27%		0.6%		

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TABLE 2: Nineteenth Century

Year, Place and Source	Percent Dying by Age			Number and Percent of Deaths of All Ages Attributed to Teeth		Number and Percent of Deaths by Age Five Attributed to Teeth	
	1	2	5	Number	Percent	Number	Percent
1814-1828 St. Anne Parish (Forbes 1974)			50%		0.3%		
1820-1849 St. Bride Parish (Forbes 1972)	12.5%		30%		1%		
1841 - ENGLAND, Registrar General's Report (Hood, 1845)				5,016		5,016	3.5%
1842 ENGLAND, Registrar General's report (Forbes, 1976)					2%		12%
1897 England Registrar General's Report (Radbill 1965a)					5%		
<u>BOSTON</u>							
1810-1812 (NEJM&S 1:320)		34%	39%	15			1.6%
1811-1820 (Hartley 1842)		28%	34%				
1821-1830 (Hartley 1842)		30%	37%				
1831-1840 (Hartley 1842)		32%	43%				
<u>NEW YORK CITY</u>							
1806 (Mitchell 1807)		34%	43%	30		30	3.4%
1808 (Mitchell 1809)		32%	40%	37		37	4.5%
1822 (N.Y. Med. Phys. J., 1823, 2: 254)		32%	39%	37		37	2.9%





Many authorities when discussing the "calamitous" symptoms of teething, cited the large number of "teething" deaths among records of children dying. Arbuthnot (1732), who wrote Practical Rules of Diet, a popular text, claimed that ten percent of all childhood deaths were attributable to teething. Hurlock (1732) who cited Arbuthnot and the London bills of mortality, argued that recorded rates of teething deaths were too low; infants' deaths attributed to convulsions, he argued, were often caused by "the anguish of teething." Hayden (1809) and Hood (1845) both prefaced their remarks on teething symptoms with pages of statistics documenting high infant mortality and a large number of "teething" deaths.

By the end of the nineteenth century, far fewer deaths were attributed to teething. The attitude change was reflected in Herrman's (1913) assertion that although the overall rate of deaths attributed to teething (in Berlin) had fallen from one percent in 1877 to three-tenths of one percent in 1910, that this was "still pretty high." He added, "The number of certificates giving teething as a cause of death is an index of the intelligence of the physicians, their knowledge being inversely proportional to the number of such certificates submitted."

#### D. Nineteenth Century Folklore and Literature of Teething

The folklore and superstitions about teething reflect popular opinion during the time they were collected. In many cases home remedies for teething symptoms were exact duplications of those advocated by medical experts one hundred or two thousand years earlier. Many ancient remedies were modified to reflect the local culture and the availability of the prescribed items. As early infancy was associated with high



mortality in most cultures, it is not surprising that teething superstitions were ubiquitous. Space will permit the recording of only a few examples of teething folklore.

A piece of the wedding bread was saved by Hessians who rubbed the crumbs on the gums of the teething child. Lammert (1869) noted a variation of this custom among the Bavarian mothers who fashioned a pacifier out of a breadcrust before emerging from childbed. In Prussia, Kanner (1928) recorded that the father touched the baby's mouth and then a pail of water while chanting thrice, "Pain to the ground, in the name of the Father, the Son, and the Holy Ghost." During the baptismal ceremony the Franconians secretly rubbed the child's gums with holy water to prevent teething troubles. In Cornwall, sanctified water was so valued for its charms that it had to be locked up.

Gums were rubbed with almost every conceivable agent. Both Fossel (1886) and Lammert (1869) recorded the custom (in Stiermark and Swabia) of the father using his thumb to rub the infant's gums with spittle. Fossel added that the mother performed this task using her own breast milk and cooked the child's first table food in breast milk. The observation that weaning was associated with increased infant mortality was reflected in the superstitions associated with the time of weaning. In Bohemia, a child avoided tooth troubles if the last day of nursing was St. John's Day. In Silesia a full moon was an acceptable alternative (Kanner, 1928). Bohemian mothers were advised to sit on a stone during the last nursing, while in Silesia mothers were advised to sit on stones with bare buttocks while the church bells rang.



Honey has been used since ancient times to rub on the gums of teething infants and numerous plant and animal products were often mixed in. It was Swiss custom to dismember toads and water rats in order to rub the infant's gums with the paws. The blood from a cock's comb, an ancient remedy, was rubbed on the gums during the nineteenth century in Switzerland, Silesia, Bohemia and Russia. The animal most exploited for the purpose of devising teething remedies was, without a doubt, the hare. Ancient remedies recommended that hare's brain be rubbed on the teething child's gums. Lammert (1869) recorded Swabians soaking hare's brain in red wine and applying it to children's gums. Kanner (1928) noted that hare's brain "is still employed in modern Greece and in the other countries surrounding the Aegean Sea." In fact, in German states, almost any part not incorporated into Hasenpfeffer was used as a teething amulet. In Swabia, the head of a rabbit with particularly sharp teeth was placed under the infant's pillow, and the jawbones were nailed to the sides of the crib. Even the fur lost by copulating rabbits was tied in a small sack about the infant's neck! (Lambert, 1869).

Teething objects were popular and many derived from the ancients' recommendations of animals' teeth, or necklaces of coral, seeds or glass pearls. Other animals' teeth included those of horses, wolves and marine animals. Typically the animals either had very prominent teeth, e.g. rodents, or were considered ferocious because of them, e.g. wolves, crocodiles, or sharks. Even the teeth of rabid dogs were recommended by some, although Radbill (1964) noted that Ranchin (1565-1641) protested against this use, lest the "poison" be transmitted to the child.



Radbill added that dog's teeth amulets were used widely, by American Negroes, Argentinians, Thuringians, Peruvians and others. Kanner (1928) reported that the Maronites of Mount Lebanon, used a mole's tooth as an amulet, whereas a crocodile's tooth was used in the Philippines. Somehow, the feelers of snails acquired the label of "snail's teeth" in the vicinity of Southern Germany and "are pitilessly torn out and placed in a small bag" about the infant's neck (Kanner, 1928).

Fossel (1886) noted the use of numerous teething necklaces, including those made of coral, glass pearls or dried seeds of peonies. Lammert (1869) commented on a Bavarian custom that, when teething was over, the mother should throw the dried green peas that were tied about the infant's neck backward over her own shoulder into a flowing stream, while maintaining complete silence. Superstitions that established complex routines with numerous opportunities for omissions may have been more durable, because the disappointed parents would never know whether the charm or their rendition of it was to blame, in the event of their child becoming ill. For example, Lammert (1869) noted the custom in Ochsen of tying a sack with sewing objects around the child's neck. It must remain for exactly four weeks, even during baths, always resting against the child's back. If perchance it comes off, or is not removed exactly twenty-eight days later, then the process must be repeated to insure the charm's protective power. What must have proven a true test of the dedication of parents, however, was the Bavarian custom of biting off the head of a living mouse and placing it in a sack to be tied around the child's neck. Lammert (1869) noted that the parent must be sure not to get any knots into the cord, lest the charm be in vain.





Kanner (1928) added that the Styrians required that it be the mother who performed the decapitation and in Swabia the "biter" must not be spoken to during the ceremony. Both Kanner (1928) and Radbill (1964) noted that some superstitions required that a red thread be used to tie the sack. If none were available, a white thread could be stained by passing it through the eyes of the mouse, thereby soaking it with blood.

Many predictions were made about the course of teething and the time of teething was considered an omen. In Germany there was a proverb that early teething foretold an early grave. Radbill (1964) noted that Titus Livius (59 B.C.) and other ancient authors considered congenital teeth to be predictors of misfortune. Pliny observed that there were many great men who had been born with teeth and concluded that it was girls born with teeth that brought bad luck."

Popular conceptions about teething spilled over into the literary spheres. Kanner (1928) cited Sylvia Townsend Warner's novel, Lolly Willows or the Living Huntsman (1926) in which an infant will have to "cut the rest of his teeth on the poor old coral when Auntie Lolly goes." A descendent of Nathaniel Hawthorne noted that Mrs. Nathaniel Hawthorne's invalidism until her marriage at the age of thirty-one was attributed to "teething and the heroic system of medicine then in vogue." She had been treated with mercury, arsenic, opium and hyoscyamus for teething and by age nineteen remained on the hyoscyamus.

Charles Dickens, who was well acquainted with the difficulties of urban children, wrote in Dombey and Son (1848) about the problems of a particularly delicate child.



"All this vigilance and care could not make little Paul a thriving boy. Naturally delicate perhaps, he pined and wasted after the dismissal of his nurse, and for a long time seemed but to wait his opportunity of gliding through their hands, and seeking his lost mother. This dangerous ground in his steeplechase towards manhood passed, he still found it very rough riding, and was grievously beset by all the obstacles in his course. Every tooth was a break-neck fence and every pimple in measles a stone wall to him."

Samuel Clemens (1894), alias Mark Twain, added a wry comment to the notes from the calendar of Pudd'nhead Wilson that introduce each chapter of his book by that title. "Adam and Eve had many advantages, but the principal one was that they escaped teething." The Oxford English Dictionary, under "teething", lists the citation that Princess Alice commented on her sister in 1865, "Princess Victoria is teething, which makes her pale and poorly."



## II) Symptoms of Teething

### A. Ancient History

Teething has been invested with medical significance throughout recorded history. Ancient cultures entertained a belief in the connection of teething and illness and wrote prayers and devised remedies for "teething". The earliest writings of many disparate cultures including Sumerian, Hindu and classical Greek contain references to teething. Radbill (1965b), a contemporary pediatrician and medical historian, noted that the Sumerian literature, which began approximately 3000 B.C., blamed "worms" for dental pain. The association of teeth and worms and Graunt's (1675) records combined teeth and worms as a cause of infant mortality some 4000 years later. The importance of teeth to the Sumerians is documented by the fact that the goddess Ninsutu was assigned the role of a protector of their teeth.

The ancient Hindu literature is rich in references to teething children and their troubles. Radbill (1965b) cited the Atharva - Veda (about 1000 B.C.) as containing a prayer "for the safe cutting of a child's teeth. The erupting teeth were compared to two rampaging tigers." As a protection against teething troubles a "proper diet" was also emphasized. Radbill also attributed a teething remedy recorded in the Bower manuscript (about 500 A.D.) as originating from a "pediatrics" text by Kasyapa (about 600 B.C.). Vagbhata (about 600 A.D.) blamed difficult dentition for many pediatric diseases but considered these self-limited and advised against energetic treatment.



The Homeric hymns (about 1200 B.C.) contain a reference to teething and worms. In one hymn, Radbill (1965b) noted, Demeter assured an anxious mother "that she knew the proper charms that would protect the teething infant."

Hippocrates (d. 377 B.C.) was the most quoted classical Greek author on the subject of teething. He noted teething to begin at the seventh month and second dentition to begin at the seventh year. The twenty-fifth aphorism reads: "At the approach of dentition, itching of the gums, fevers, convulsions and diarrhea occur, especially when the canine teeth are cut, and in those who are particularly fat and constipated." The beginning of the aphorism could be interpreted to suggest only a temporal coincidence between teething and symptoms but the emphasis placed on the eruption of the canine teeth implies a causal relationship. The authenticity of the Hippocratic text entitled, On Dentition is questioned by some modern historians, although its contents were considered Hippocratic in origin by other ancient authors and therefore its historical impact was significant. Hippocrates' remarks included statements that teething children with fever and diarrhea were less liable to convulsions, whereas well fed, yet lethargic, infants were more prone to convulsions; that many convulsions were not fatal and many infants recovered; that winter was the most favorable season for teething; that teething was complicated by a cough and that it was aided by being "suitably attended to."

Most of the text dealt with oro-pharyngeal ulcerations, suckling and weaning whereas teething occupied a smaller section. Several concepts were established, however, that were maintained throughout the





following millenia. Hippocrates considered diarrhea a salutary sign. This concept became ingrained in European medicine. Dorning (1895), two thousand years later, noted that "The erroneous doctrine that a mild diarrhea is beneficial to teething children is responsible for a large annual sacrifice of infant life." The seasonal variation that Hippocrates noted suggests that summer gastroenteritis had significant morbidity. By establishing the concept of predisposition, Hippocrates laid the groundwork for explaining why some children were more affected by teething than others. The aphorism suggested that fat, constipated children were more prone to symptoms and the text, On Dentition, established several prognostic criteria.

Soranus (117 A.D.) focused on oral complications and mentioned pain and inflammation of the gums, jaws and tendons, possibly blaming the trismus associated with tetanus on teething. In addition, he contributed the concept of prophylactic measures to prevent "further inflammation." Such measures included gum rubbing and having the wet nurse express milk by hand lest "the infant be injured by the sucking."

Many of the classical medical authors simply restated Hippocrates' observations on teething without substantial modifications from the original text. Not surprisingly, the list of symptoms grew with each rendition. Crying and thrashing about (Galen, about 210 A.D.) and suppurative otitis media (Aetius, d. 575 A.D.) were added to the list.

Paulus (625-690 A.D.) of Aegineta was another encyclopaedist and he based his work primarily upon that of Oribasius. He was extensively cited by later Muslim medical authorities. He combined the lists of symptoms that Soranus and Hippocrates had attributed to teething.



Rhazes (865-920 A.D.), a Persian physician, cited Galen when discussing teething in his text, Practica Puerorum, which many consider to be the first treatise on pediatrics. Perhaps the most frequently cited medical authority of his time, after Avicenna, his text had enormous impact. Radbill, who translated the text, considered it the guide for all the early pediatric textbooks from the tenth to the seventeenth century. The section on teething contains many similarities to that of Paulus, especially with regard to remedies offered. He listed the same symptoms but added suppurative otitis media ("irritation in the ears, and a flow of blood and noxious matter") and abscesses of the jaws or gums.

He elaborated on the course of teething and noted that teeth that came forth quickly produced less pain but were weaker, whereas slower eruptions were more painful, yet yielded stronger and harder teeth. The association of teething symptoms and the seasons achieved a new level of complexity in Rhazes' text. Teeth arriving in the spring come forth at once without pain, the contrary in winter, though then the gums "will not be swelled." Summer eruptions had little pain, but they were the most prone to complicating symptoms.

Avicenna (980-1037) was extensively cited by later medical authorities. He attributed to teething local gum inflammation, oral ulcers, pain, trismus and swelling of the temporal region, as well as the more general symptoms of diarrhea, constipation and convulsions. He divided convulsions into those occurring in "moist" and robust infants and those occurring in "dry" or dehydrated infants, a condition he associated with "tetanic" convulsions.



## B. Renaissance Through the Eighteenth Century

From the renaissance through the eighteenth century few questioned the attribution of childhood maladies or death to teething. The major medical trends included proposing mechanisms, describing symptoms in detail, and devising remedies. Medical authorities paid increasing amounts of attention to children's diseases throughout this period, patterns of symptoms were noted and new disease entities were described. This provided more alternative diagnoses to teething, though few defended the idea that any given symptom was neither produced nor exacerbated by teething.

Paré (1536) was the surgeon to Henry II, Francis II, Charles IX, and Henry III, Kings of France. He was a prolific writer and his works were widely acclaimed. Paré earned part of his fame from discrediting the popular conception that gunshot wounds were, in themselves, poisonous. He designed an antiseptic solution (of turpentine and ethanol) that resulted in far better wound healing than occurred following cauterization with hot oil, then the current practice. His reputation as a surgeon and anatomist may have contributed to the widespread acceptance of his therapies for teething, especially gum lancing. He devoted an entire chapter to the "breeding" of teeth and noted both local and general symptoms beginning about the (Hippocratic) seventh month of age. Local signs and symptoms included: pain, itching (as evidenced by the child's propensity to place its hand to its mouth), inflammation with a "heat of the gummess", and increased salivation. General symptoms included: fever, irritability, diarrhea, convulsions, alopecia ("falling of the hair") and even death. He was the first to give case



histories to justify his assertions regarding teething and its treatment by gum lancing. He described an autopsy as well as the successful lancing of his own children's gums.

Phayre (1553), a lawyer, physician and translator, wrote the first pediatrics text in English. The Boke of Chyldren was written with the intention of bringing medicine up to date in the English language, yet it bears a great resemblance to Rhazes' text. Phayre noted local pain with swelling of the jaws and gums and considered the general symptoms of "unquiet crying, fevers, palsies, fluxes (diarrhea) and reums<sup>1</sup>" to result from teething. Like Rhazes, he mentioned neither convulsions nor the therapy of gum lancing and concurred that earlier eruption was less troublesome for the infant.

Mauriceau (1668), the most progressive obstetrician of his time, attributed pain and itching to teething, but rejected many traditional remedies.

Harris (1689), an English author, wrote his text, De morbis acutis infantum, in Latin but it was rapidly translated into several languages including English, and widely acclaimed. Harris considered teething to cause local inflammation and even thrush. He also attributed uneasiness, watchings (disturbed sleep), convulsions and numerous

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<sup>1</sup>Reum, a spelling variant of Rheum, is defined by the Oxford English Dictionary as "watery matter secreted by the mucous glands or membranes such as collects in or drops from the nose, eyes or mouth, etc., and which when abnormal was supposed to cause disease, hence an excessive or morbid 'defluxion' of any kind."





gastrointestinal symptoms including vomiting, constipation and diarrhea, especially vomitus or stool stained green with bile. He considered teething a very dangerous time and although "physiologic", he compared it with pregnancy, which he also felt to be attended with "innumerable calamities."

Hurlock (1742), who wrote the first treatise entirely devoted to dentition, included an extensive historical review and noted the opinions of Paré, Sennertus and Sylvius de la Boe on teething. Hurlock cited Boerhaave (d. 1738), an academic physician of international repute, when he listed the following teething symptoms: inflammation, local swelling, salivation, gangrene, convulsions, green loose stools, fever and death. He agreed with Sylvius that not all tooth eruptions caused symptoms and devised a complex explanation that included a primary cause and numerous "contingent" or exacerbating conditions.

Cadogan (1750) was a London physician widely known for his best work, "An Essay on the Nursing and Management of Children" which went through nine editions in twenty years. His writings had significant impact on infant care, especially when he protested the custom of swaddling babies, the practice of wrapping infants in many layers of cloth. His essay also protested the frequency with which symptoms were blamed on teething. "It is no disease," he wrote, "and many get through without symptoms." The tone of his work is more modern than the writing of his contemporaries although he did not reject the diagnosis in its entirety. All tooth eruptions were associated with some pain, he wrote, usually greater with molars than incisors, but this was usually slight and "without any bad consequence." Fever, fits, and



other dangerous symptoms were possible if pain agitated the humors.

Armstrong (1777), who wrote a text devoted to the diseases of children, directly quoted Cadogan when arguing that the teething diagnosis was overused. He listed only local pain, again greater with molars, as a teething symptom.

Theobald (1764) used numerous symptoms for prognostication. Breeding of teeth will be difficult if "the child is continually crying, [if he] bites the nurse's nipples, if the mouth and whole body are very hot, [and if the child] slavereth much and thrusts its fingers into its mouth." The dangerous disorders resulting from teething he described included: "restlessness, gripes, costiveness, green stools, thrush, fevers, suffocating coughs, convulsions and epilepsies, which often end in death."

Rosen Von Rosenstein (1776) was the chief physician to the King of Sweden and widely read. He frequently cited Harris when discussing symptoms or treatment, although he did not adopt Harris' conception that most disorders stemmed from a single cause. He listed symptoms similar to those described by Harris: local pain, swelling of the gums, tonsils, eyes and cheeks, as well as convulsions, lethargy and death. He agreed that some escaped without symptoms, such as those who were full term babies whose "mothers had no violent passions or sorrow" during pregnancy. Diarrhea, which resulted from swallowing the increased amount of saliva, was salutary, he argued. He limited the diagnosis of teething when he argued that it ought not to be considered after the child had all twenty (deciduous) teeth.



John Hunter (1778) called the "Father of English Surgery" by some, wrote a lengthy text on both the anatomy of the teeth and diseases of teething. Although the anatomical portion of the text was derived from extensive dissections he performed, the section on diseases of dentition was an amalgam of Harris' and similar works, as well as extensive anecdotes from his own clinical practice. He attributed such a broad range of symptoms to teething that he ironically noted "that it is difficult to conceive that they come from the same cause." Symptoms began "almost with life"; he listed those recorded by Harris but added flexion contractures of the hands and feet, urinary tract infections and even venereal disease:

A boy, about two years of age, was taken with a pain and difficulty in making water; and voided matter from the urethra. I suspected that by some means or other this child might possibly be affected by the venereal poison, and the suspicion naturally fell on the nurse.

He also recorded symptoms, possibly hysterical in origin, that occurred in twenty-five year old women. He justified the connection between symptoms and teething by the symptomatic relief observed with tooth eruption or gum lancing. He further considered teething to have a potentiating effect on other distinct disease entities such as scrofula.

Benjamin Rush (1745-1813) was a prominent physician as well as a signer of the Declaration of Independence. Radbill (1973) noted that



he accepted the theory of dentition symptoms but only mentioned it incidentally. He was more concerned with worms; round worms were so ubiquitous that he considered them salutary.

### C. Symptoms of Teething: Nineteenth and Twentieth Centuries

The preponderance of medical opinion at the outset of the nineteenth century supported the use of teething as a diagnosis of childhood illness. The typical author of a medical text or article that discussed teething enumerated distinct symptoms and proposed theories to link the symptoms with teething. Many reviewed the mechanisms proposed by predecessors or contemporaries and some noted contradictions between theories proposed and their own observations. Instead of questioning the link between the symptom and teething, new mechanisms were proposed, although the seeds of skepticism had been sown by Cadogan (1750) and Armstrong (1777). As the list of symptoms attributed to teething expanded, inevitable conflicts arose among authors regarding theories of origin, symptoms observed and therapies advocated.

By the latter half of the nineteenth century, several authors, including Jacobi (1860) and Finlayson (1874), challenged the frequency with which the diagnosis was made. The dissenters argued counter to public as well as professional opinion. Roughly equivalent numbers of articles supporting and criticizing the use of teething as a diagnosis for serious illness appeared in the popular English language medical journals during the latter half of the nineteenth century.

The tide of opinion shifted gradually with the onset of the twentieth century. Most symptoms were not entirely expunged from the





list of teething sequelae but rather teething was made a diagnosis of exclusion. Each subsequent edition of major pediatric textbooks, such as those of Holt or Rotch, discussed the symptoms due to teething more cautiously and skeptically, as well as offering more alternative diagnoses. Parallel with changes in medical opinion was a dramatic decline in the number of deaths attributed to teething. By the onset of the twentieth century it was uncommon to find that teething was listed on an American or English death certificate. The numerous opinions offered about teething and its symptoms during the last two centuries can best be considered by surveying the consensus about individual symptoms, both local and general, over that time span.

Local signs and symptoms of teething discussed in the medical literature included gum rubbing, drooling, local inflammation, oral infections and localized pain. All nineteenth century authors, even the most skeptical, felt that pain was associated with teething. Variations existed on which teeth the author blamed for giving the greatest discomfort and degree of pain. The Reverend John Wesley, noted evangelist and founder of Methodism, felt that teething was "often tormenting" (1830), whereas Jacobi (1860) considered teething merely uncomfortable. The observation that infants frequently place their hands or other objects in their mouths was often interpreted as evidence that teething produced pain or discomfort. Fox (1803) and Miller (1913) supported the "teething" diagnosis with this observation, though Jacobi (1860) and Clarke (1921) both observed this behavior "since the hour of birth" and, therefore, criticized the connection.



Increased salivation was observed by numerous authors, such as Hersey (1836), often under such diverse titles as slavering, drivelling, drooling and ptyalismus. It was usually considered a salutary sign, although some felt it to be evidence of "increased action of the system." Most critics of the teething diagnosis (Jacobi, 1860; Guthrie, 1905; Tasanen, 1962) supported the observation, yet Clarke (1921) denied not only the association but the observation of increased drooling.

The four classical signs of inflammation, dolor (pain), calor (warmth), rubor (erythema) and turgor (swelling) were described by many authors as resulting from tooth eruption. The graphic descriptions of "swollen, red and tender" gums of teething infants led Rendle-Short (1955) to argue that signs of scurvy, frequent among the poor, urban infants during the nineteenth century, were often confused with those of teething. Guthrie (1905), otherwise a critic of the teething diagnosis, considered teething symptoms possible only when the erupting tooth passed through an already inflamed gum, creating irritation that could spread by "reflex action."

Oral infections were blamed on teething during the nineteenth century despite concurrent discoveries about the microbial agents that inhabited the lesions observed. Stomatitis and thrush (Heller, 1860) were specifically cited as accompanying teething. Jacobi (1860) was a German clinician who, according to Cone, introduced pediatrics as a specialty to the United States. He organized the children's service at Mt. Sinai Hospital in New York and was known for his vigorous protestations against popular but unsound practices, such as the indiscriminate use of calomel. He argued that alternative explanations for many oral



infections could be found and cited muguet, the French name for Thrush, as an example. Newborn infants, he said, were more frequently affected than teething infants and he pointed out its association with the fungus Oidium albicans (now Candida albicans). Other mucocutaneous infections, he added, were "no more characteristic of dentition than scabies."

General symptoms blamed on teething during the last two centuries include almost every manifestation of acute pediatric illness. Irritations, fussiness, "startings," "watchings" and other picturesque descriptions of crankiness attributed to teething permeated the writing of both nineteenth and twentieth century authors. The inherent frustration of trying to determine the source of distress in a patient too young to respond to the practitioner's inquiries may have fueled these beliefs. Whatever the interpretation, almost all authors in both centuries noted some behavioral changes, associated with tooth eruption. Clarke (1921), the major exception, asserted that teething bore little relation to fussiness. "Being cross and perverse: In this matter babies differ little from their parents--they have their good days and their bad days ... It is a comforting though fallacious doctrine for parents to attribute natural sin to teething."

Fever was uniformly attributed to teething during the nineteenth century, with the exception of Cook (1887) and the skepticism, although not denial, expressed by Jacobi (1860). Many considered "dentition fever" as a part of the mechanism whereby other symptoms were produced. Fox (1803) tied "dental fever" to subsequent convulsions and skin rashes. The reviewer of Fox's book in the Edinburgh Medical and Surgical Journal (1807) considered "dentition fever" to "disturb the system" and predispose the infant to gastrointestinal complaints.



Others who emphasized the role of fever included Wesley (1830), Hersey (1836), and Holt (1894) while Ashburner (1833) even blamed chronic fever with night sweats on teething.

By 1900, the majority of authors recognized multiple alternative causes of fever. Many practitioners, including Burnet (1918), Moody (1919), and Holt (1933) continued to consider fever as an integral symptom of teething although their contemporaries, Guthrie (1908) and Clarke (1921), flatly denied any connection between teething and fever.

The gastrointestinal tract was a major focus of attention when teething symptoms were discussed. The reasons for the frequency of this association are a matter of speculation. Gastrointestinal disturbances are among the most frequent as well as most visible of pediatric disorders, however. Much of the medical pharmacopoeia prior to the nineteenth century was devoted to modifying the action of the gastrointestinal tract and pukes (emetics), purges (cathartics), and clysters (enemas) were frequently used. The physical contiguity of the gastrointestinal tract with the mouth as well as its "shared mucous membrane" were factors in rationalizing the connection between teething and symptoms.

Jackson (1812), who wrote a lengthy article on dentition in the first issue of the New England Journal of Medicine, explained the seasonal variation in incidence of diarrhea. He noted that in winter and spring, teething caused symptoms above the diaphragm, whereas in the summer and autumn, the heat and moisture contributed to the migration of symptoms below the diaphragm. Jacobi (1860) also noted seasonal





variation in diarrhea, but considered that observation as evidence that ambient temperature had a direct effect on the intestines.

The concept that diarrhea was beneficial gained many adherents during the nineteenth century (Fox, 1803; Hersey, 1836; Underwood, 1842). Many authors who based their therapy on humoral theory, as did Ives (1821) a Yale College of Medicine professor, believed that diarrhea "carried away the irritability." Becker (1848) felt so strongly about the salutary nature of diarrhea that he stressed the concept emphatically.

Diarrhea is to be regarded as a beneficial effort of nature... Everything calculated, at this time, to draw towards another point the excess vitality in the head, is at the same time capable of preventing the consequences... Beware then, of stopping this diarrhea by any imprudence!

Breastfeeding has been well documented to have a protective effect against gastroenteritis. Many authors, even as early as Hurlock (1742), observed that diarrhea was much more common among infants who were not breastfed, yet they tenaciously clung to the assertion that the diarrhea resulted from teething. Jackson (1812) observed that "we seldom find this disease (cholera infantum or summer teething diarrhea) in any of its severe forms among infants at the breast. A child while at the breast... will often digest even other food better than after he is weaned." Adams (1889) a critic of teething as a diagnosis, performed a retrospective study of teething infants. He noted the association of diarrhea with non-nursed infants and with the use of condensed cow's



milk as a substitute for breast milk. Despite the fact that Adams (1899) found "gastrointestinal complaints" as frequent among infants before they began to teeth as after, diarrhea was still considered a teething symptom by many twentieth century authors (Rotch, 1901; Burnet, 1918; Still, 1924). Clarke (1921) simply denied the association.

Vomiting and constipation were also considered effects of teething and bilious vomiting was regarded as an especially morbid sign of teething. Jacobi (1860) was one of the few who remarked on the apparent inconsistency of blaming both diarrhea and constipation on the same cause. The frequent use of opiate containing teething syrups may have contributed to the impression that constipation was associated with teething. Several authors during the nineteenth century, for example, commented on the "retention of stools" that followed the use of opiates.

"Teething" rashes challenged authors who sought to provide a comprehensive etiologic theory. Some limited the association to circumoral rashes, whereas others considered skin eruptions on any part of the infant as linked to teething. Diaper rashes are dependent upon a moist environment. The incessantly damp face of a drooling infant could conceivably contribute to a circumoral rash, especially if there were another source of irritation such as frequent rubbing of the area. Fox (1803) and Underwood (1842) attributed whole body rashes to teething, though Jacobi (1860) and Clarke (1921) disputed the connection.

After Hunter's (1777) case history of "teething gonorrhoea," already noted, many nineteenth century authors attributed urinary tract symptoms to teething. These ranged from alterations in volume excreted to far more unusual findings such as polyuria, oliguria, anuria and



peripheral edema. These symptoms were often noted in association with "morbid signs" of teething. Indeed, many of the accounts of "teething" infants are exquisite descriptions of dehydration, probably secondary to anorexia, vomiting or diarrhea that accompanied serious illness. Jackson (1812) described the teething infant with diarrhea in graphic terms.

The countenance grows pale ... the skin grows dry ... (and) the skin on the forehead grows tight, and appears bound to the bone, as the disease advances; the eyes are sunk but look large and bright; the cheeks fall in, and the nose is comparatively sharpened; while the lips assume the shrivelled appearance of old age.

Ives (1821) blamed teething for both "urinary retention" and what may have been a case of nephrotic syndrome: polyuria with swelling of the hands and feet. Symptoms descriptive of urinary tract infection or venereal disease were noted by Jackson (1812), Underwood (1842), and Hall (1844). Jacobi (1860) apparently considered the connection frequent enough that he rebuffed it, arguing that "I have not been compelled to resort to dentition as the mysterious source of this evil," and listed several other causes for urinary tract infections, gonorrhoea, and "catarrh of the vagina" including foreign objects. He also disputed the alleged association of dentition and masturbation, which, he claimed, "was either a bad habit contracted by the manipulations of injudicious nurses or in consequence of worms irritating the mucous



membranes of the intestinal canal."

Convulsions generated a large amount of controversy during the nineteenth and early twentieth centuries, both in regard to etiology and treatment. Teething was often blamed for convulsions which were alternatively labelled fits, spasms, or eclampsia. The Hippocratic observation that many survived convulsions with no sequelae was often repeated. Early nineteenth century authors (Fox, 1803; Ives, 1821) recognized only motor seizures and, as they did not subdivide them, considered convulsions a single disease entity. Shortly thereafter, Andral (1833) listed many causes for convulsions, including dentition as a "frequent" cause, and Hall (1844), an experimental neurophysiologist, devised elaborate schemata for classification of the type and etiology of a fit. Throughout the latter half of the century, many continued to associate teething with convulsions. Some authors specified particular neurologic signs as attributable to teething; Starr (1890) attributed choreoid movements and epilepsy developing during a child's second dentition to the tooth eruption. He substantiated his assertion with the fact that the child had "teething" convulsions during eruptions of her primary teeth. By the twentieth century, authors who linked convulsions and teething either considered them rare (Holt, 1894), limited to "spasmophilic" children (Miller, 1913), or specified particular varieties of seizures, such as spasmus nutans (head noddings with nystagmus) (Still, 1924).

Jacobi (1860), who criticized the alleged link between teething and seizures, noted that convulsions were signs, not a disease entity, although he did not rule out dentition as a possible precipitating





factor. Finlayson (1874) cited Armstrong (1777) when arguing against teething convulsions, and Guthrie (1905) and Clarke (1921) suggested other causes that "better" explained convulsions.

Many nineteenth and twentieth century authors attributed a veritable panoply of maladies to dentition. Respiratory symptoms, for example, were attributed to teething including those compatible with pneumonia. "Dental irritation" was blamed by Skinner (1844) for "breathing difficulties" and by Starr (1890) for cough. Ophthalmia (conjunctivitis) was connected with teething by both Starr (1890) and Trenor (1823); the latter cited Hurlock (1742) and Rosen Von Rosenstein (1776) as sources. Burnet (1918) considered strabismus a sequela of difficult dentition.

Otitis media was as frequent an occurrence in infants during the early nineteenth century as it is now, and many authors attributed it to teething. Some, including Trenor (1823) and Starr (1890), considered suppuration from the ears not only normal but salutary, illustrating the persistence of the concept of "laudable pus". Rotch (1901), who was the first full professor of pediatrics in the United States, and Still (1924) connected middle ear infections to teething although even some of their contemporaries, who believed in other teething symptoms, protested the link (Miller, 1913). Ashburner (1833) included stammering as a teething symptom that he "successfully remedied" by gum lancing.

Infantile paralysis was often tied to teething, possibly because the paralytic sequelae of poliomyelitis follow an infection often characterized by a prodrome of nonspecific symptoms. Many authorities, including well known neurologists, concurred with the connection between



paralysis and teething. Starr (1890) cited Romberg as holding this belief and Jacobi (1860) criticized Brown-Sequard for defending the link. Even agonal signs were blamed on teething. Buckingham (1875) considered fixed and dilated pupils "a morbid sign" of teething.

Whether or not to associate symptoms with second dentition was debated in the nineteenth and early twentieth centuries. Jacobi (1860) and Elterich (1908) observed that many symptoms ascribed to teething occurred with much greater frequency in infancy than during later childhood. They reasoned that, if one postulated that primary dentition caused symptoms, then so should secondary dentition. They considered the apparent absence of symptoms in later childhood as evidence that those symptoms occurring during infancy were not due to teething. Rationalization of this observation was given many forms by the proponents of the teething diagnosis, including suggesting "greater irritability" of the infant and decreased "tension" with increased jaw size. Perhaps the most interesting response was to deny the observation and, instead, to describe symptoms associated with second dentition. Ashburner (1833) gave innumerable case histories in his article, fully half the patients were over five years old and many of those were nineteen year old females. The amelioration of the symptom by gum lancing, he argued, was proof of the connection between the symptom and tooth eruption.

Entire books and articles were devoted to the symptoms of second dentition. Delabarre (1845) asserted that second dentition not only caused symptoms but complicated and increased the symptoms of concurrent disease. He added: "As the skilled pilot, sitting tranquilly at the helm, knows how to avoid the rocks, so may the medical philosopher, by



a wise maneuver, make childhood surmount the sometimes dangerous passage which separates it from vitality." Smith (1869) discussed gastrointestinal symptoms accompanying the second dentition and Starr (1890) ascribed the same symptoms to second dentition as he did primary dentition. These included "disorders of the mouth and throat including catarrhal stomatitis," loss of taste, anorexia, tonsillar hypertrophy, vomiting, diarrhea, constipation, cough, herpes simplex, eczema, urticaria, paralysis and "mucous disease" (cystic fibrosis). Twentieth century authors also blamed a long list of symptoms on the emergence of the permanent teeth. The list included "pale rings beneath the eyes" (Miller, 1913), enuresis, and bruxism (Still, 1924).

Contemporary texts list few, if any, symptoms associated with the eruption of primary teeth. Holt's textbook, Pediatrics (1952) mentioned neither convulsions nor any other serious disorder that earlier editions (Holt, 1897, 1933) had noted under teething. Rather, it listed only minor symptoms, such as "a little fretfulness or increased salivation." Nelson Textbook of Pediatrics (1979) made no mention of teething symptoms. Neaderland (1952) reviewed the literature about teething and its symptoms and found the conflict of opinion so great that he argued that only a new well controlled clinical study could resolve the debate.

Tasanen (1968), in the only large scale, well controlled, prospective clinical study to date, concluded that only daytime restlessness, salivation or drooling, and placing of the child's hand to his mouth were significantly correlated with tooth eruption. Infection rate, temperature, diarrhea, changes in complete blood count (CBC) or erythrocyte sedimentation rate (ESR) and sleeplessness all had no significant association with tooth eruption.



Honig (1975), in a survey of practicing pediatricians in the Philadelphia area, noted that many more symptoms were attributed to teething by pediatricians, regardless of age, than could be justified by Tasanen's findings. These included fever, loose stools and diarrhea, rashes, pulling on the ears, otitis media and others.

Swann (1979) reported fifty admissions to Royal Hospital for Sick Children in Edinburgh that were attributed either by the parent or general practitioner to teething during the course of the year. In all but two cases, alternative diagnoses were made including H. influenza meningitis, febrile convulsions, infected scabies and submandibular abscess. He concluded that the mislabelling of childhood illness as teething is still frequent and still hazardous.





### III. Etiologies Proposed to Explain Teething Symptoms

The origin of the diverse symptoms attributed to teething has been explained in varied ways and each explanation reflects, not surprisingly, the general understanding of medicine at the time. From the time of Hippocrates until the eighteenth century, humoral theory dominated medical thought. The majority of classical and many renaissance authors commented on teething symptoms and offered remedies without explanation or justification. Elsewhere in their texts, multiple references are found attributing the origin of diseases to an imbalance of humors, however, and it is reasonable to conclude that their conception of teething derangements rested on the same theory.

By the seventeenth century, there were anatomical explanations that presupposed a barrier between the erupting tooth and its eventual emergence from the gum. This paralleled an increased tendency to suggest gum lancing as a therapeutic modality. The eighteenth century witnessed significant advances in many areas of science. Medical authorities, perhaps cognizant of these advances, discussed diseases as perturbations in human "vitality" and "nervous energy", terms reminiscent of early investigations into electricity. Just as electrical currents were made to pass through wires, experimental investigators discovered that muscles could be stimulated through the body's "wires" or nervous system. The diverse symptoms of teething were proposed to share a linkage through the nervous system by the "law of reflex action."



By the late eighteenth and early nineteenth centuries, various medical authors had proposed many mutually exclusive explanations to link illness and teething. Authorities criticized the mechanisms proposed by competing authors more than they questioned the symptoms that their competitors attributed to teething. Several pointed out logical contradictions in others' theories, both internal and with observed fact, but then proposed even more intricate schemes to connect the bulk of pediatric illnesses with teething.

Classical medicine was founded on the concept that the body had four humours: blood, phlegm, black and yellow bile. Hippocrates had postulated that disease resulted from an imbalance of these bodily fluids, and therapies consequently attempted to restore this balance. The concept and its derivatives, including that of Galenic temperaments (that individuals could have a predominance of a given humor and hence, have a given temperament) dominated medical theory for the next two thousand years. Hippocrates (d. 377 B.C.), Soranus (117 A.D.), Celsus (about 0 A.D.), Rhazes (about 900 A.D.), and Phayre (1553) all gave no etiologic explanation when discussing teething, although they all relied on humoral pathology.

Authors in the fifteenth and sixteenth centuries blamed teething pain for causing a localized excess, deficit, or simply imbalance of humors. This could result in nerve paralysis (Metlinger, 1491, cited by Radbill, 1965b) or swelling (Leonellus Faventinus de Victoriis, 1544, cited by Radbill, 1965a).



Cadogan (1750) and Armstrong (1777), critics of the excessive use of the teething diagnosis, did not entirely rule out teething either as a cause of local pain or of systemic disturbance. Cadogan explained: "The corrupt humors of the body (are) put into agitation by the stimulating pain the tooth causes in breaking its way out." Rosen Von Rosenstein (1776) cited numerous authors and his text reflects a blend of proposed mechanisms. He combined both theories--mechanical and humoral--when he asserted that a soft tooth or a thick gum will produce many more symptoms because of a "greater flow of humors to the part affected."

During the nineteenth century, very few defended their assertions regarding teething by relying upon humoral theory, as did Ives (1821). Indeed, reviewers of derangements of dentition during the mid-nineteenth century dismissed humoral theory "without discussion" (Jacobi, 1860; Cook, 1887).

Harris (1689) crossed humoral theory with an awareness of acids and bases present in bodily fluids to create an "acid" theory. His theory drew relatively little attention despite the fact that Harris' text was extensively referred to regarding symptoms and treatment for the following century. Avicenna (d. 1037) had attributed gastrointestinal disturbances to the excessive "acid ferment of food" but unlike Harris, he did not claim all disease stemmed from this etiology. Harris asserted that all childhood maladies had in common an "excess of acid." Harris considered the efficacy of treatment with neutralizing agents as proof that all pediatric diseases could be cured by "first subduing the acid and then purging it out." Radbill (1974) commented that "Harris did not put much stock in specific diagnosis since he had a one cause



theory." Ironically, he advocated polypharmacy of teething disorders and suggested numerous medical therapies.

Hayden (1809) developed a truly unique formulation to explain symptoms of dentition. Although "excess acid" was an integral concept in his theory, Hayden also incorporated anatomical elements. He concurred with the idea that teething caused many symptoms and even death, but he elaborated on the shortcomings of other authors' theories of etiology. He postulated the existence of a cavity above each erupting tooth; fluid was secreted into each cavity at a steady state with its reabsorption. "By some derangement" he argued, "the fluid is retained and increases in quantity (and) acrid quality until it is capable of producing irritation, inflammation and ulceration together with most other symptoms and calamities associated with difficult dentition." He considered the "relief afforded" by local remedies, such as leeches and gum lancing as proof of his thesis.

Inflammation and irritability were often considered mediators of the connection between tooth eruption and general symptoms. Authors generalized from the observation of "swelling and discomfort" to the concept that localized irritation led to systemic irritation. Unlike reflex theory, discussed later, there was often no pathway posulated to explain the dissemination of the irritation.

Avicenna (1037) noted that convulsions resulted because teething heightened nervous irritability and that tooth eruption triggered inflammation in the "ligamentous structures around the mandible" causing trismus. During the eighteenth century, advances in other areas of science may have contributed to the conception that the human body had





internal forces capable of being excited. Early investigators into electrical phenomena, for example, discussed electromotive forces using terms like action and drive. Rubbing an amber rod against cloth, investigators discovered, concentrated forces that were released in the form of a spark. By analogy, the irritation created by an emerging tooth could result in a convulsion or other symptom.

Jackson (1812) described three effects of dentition: " (1) Perturbing bodily functions, (2) suspending some actions and (3) producing a morbid irritability." Authors tied the "hyperemia or increased arterial action" of dentition to convulsions; the increased "action" of the blood often led to "congestion of the cerebrum," "nervous center irritations" and, hence, an unstable excitability (Andral, 1833). Starr (1890) proposed a mechanism for the spread of the irritation. The lymphatics, according to his theory, carried the irritating matter to the "lymph gland", which in turn, "spread distress throughout the sympathetic distribution."

The anatomical conception that the tooth was embroiled in a struggle to free itself from the restricting confines of the gum was embraced by many authors. The erupting tooth began in the jaw bone and passed through the gums. Symptoms were proportional to the difficulty the tooth had in pushing its way through. Various barriers to progress were proposed, including capsules, investing membranes, such as the periosteum, or fibrous strands that played particular favor by increasing the tension created during the tooth eruption. The significance of postulating a barrier to the erupting tooth lay in its frequent use to justify surgical intervention.



Paré (1536) noted that the pain in breeding teeth occurred "when they begin to break, as it were, out of their shell or sheath." Several authors argued that symptoms occurred both when the tooth emerged from the jaw and when it pierced the gum. This variation of the theory allowed its proponents to invoke "teething" to account for the presence of symptoms regardless of whether or not a tooth was about to pierce the gums. The conception, first expressed by Harris (1689), that there were "two times of breeding" teeth, suggested that the emerging tooth could cause symptoms both when the tooth emerged from the bone, as well as when it later pierced the gum. This variation allowed the authors to blame teething for symptoms that occurred prior to the eruption of the first tooth, as well as between eruptions. Hunter (1778), Still (1924) and many others all explained the onset of symptoms "almost from birth" and the occurrence of symptoms between eruptions utilizing this concept. Note that according to this hypothesis all normal children between ages six months and thirty months would always be teething, and, therefore, it would be impossible to design a controlled study to determine teething symptoms.

Because the theory was anatomical in essence, it lent itself to many structural variations and interpretations. Boerhaave (d. 1738), who was cited by Hurlock (1742), felt that puncturing of the gum created the symptoms. The canines, the "sharpest and hardest", were, therefore, the worst. Hurlock (1742) refined that physiology and considered the source of symptoms the "solution of the continuity of the gums." He invoked an "exquisite sense" that lay in an "enclosing membrane."



Astruc (1746) contended that symptoms were proportional to tooth size and position, hence, "close teeth" led to "violent symptoms."

Anatomists often made careful dissections of both stillborn animals and humans. The developing teeth, it was claimed, were covered by an investing membrane, that had to be pierced by the tooth prior to eruption. Eustachius (1563), Hunter (1778) and Fox (1803) all began their texts with extensive discussions about the results of their dissections and interpret the origin of symptoms in mechanical terms. For example, Fox gave a clear and cogent explanation of how an aortic aneurysm, through prolonged pressure, could painlessly erode the bone of the sternum or a rib. He made the analogy of this pressure to that of the emerging tooth on the gum. He noted that normally the gum is simply absorbed and no symptoms are produced. He explained: "But when the growth of the teeth is too rapid for the absorption of the gums, dentition is often attended with much pain and derangement of the whole system."

Yale (1879), a former student of Ives, blamed pressure as the source of pain. He cited a Professor Velpeau (1846): "Besides the four vicious directions of the tooth, backward, forward, inward and outwards, there is a fifth one directed upwards, caused by the tooth merely pressing against the gum, and being thus impeded ... producing such severe pain in the face and mouth with swelling so as to close the jaws." Velpeau related the successful therapy of a case of trismus by opening the locked jaws with a wooden wedge and lancing the gums. Hayden (1809) and other authors criticized the concept that the gum was under significant tension. They observed that the edges of the gum did not draw



apart after they were lanced, and often reunited, necessitating the repeated lancing of the same gum over an erupting tooth.

The pyrexia theory suggested that all the symptoms of teething were sequelae of fever which, in turn, was caused by tooth eruption. The theory never gained great popularity in the medical literature, although authors who criticized attributing symptoms to teething often mentioned it. Its origin may have been related to the frequency of fever, a nonspecific sign, in pediatric diseases. Tolver (1752) felt that fever was indirectly responsible for gastrointestinal disturbances. He postulated that fever created increased thirst and excessive fluid intake; "they take more than their little stomachs are able to bear." Jacobi (1860) mentioned the pyrexia theory only to criticize it. He did attribute fever, albeit mild, to teething, however. Corson (1903) claimed that most dental fevers were really "duodenal fevers" and proposed a theory that condensed the etiology of most acute pediatric diseases into the space between the gastric antrum and the ligament of Treitz. Guthrie (1905) and Clarke (1921) dismissed the theory with the statement that "pyrexia" is absent, although neither offered data to support his contention.

The older medical literature is replete with allusions to foreign body reactions. Surgeons, in particular, dealt with the sequelae of those wounds in which a contaminated object remained. It is therefore fitting that the major proponent of this theory was Hunter (1778), the Scottish surgeon, who wrote that "teeth ... are completely enclosed within the sockets and gums [and] act in some degree as extraneous





bodies." He used this argument to support lancing as well; just as an abscess should be drained, gums should be lanced. Many nineteenth century authors made the analogy of a tooth to a foreign body, such as a splinter (James, 1868) or a thorn (Moss, 1794). Buckingham (1875), in an article defending gum lancing, argued, "Cutting the gum may be as great a relief to an obstruction as when an incision is made over a bullet, a piece of bone, a splinter of wood, or a fragment of needle beneath the skin, and the system is trying alone to help it to the surface."

The theory of reflex irritation was most popular among nineteenth century authorities. They believed that the erupting teeth created an irritation that was carried retrograde through the dental ramifications of the trigeminal nerve back to the brain. This theory was especially convenient for those who postulated peripheral causes of convulsions, but it was also invoked to explain the rest of the symptoms attributed to dentition. Variations existed as to which nerves were to be blamed, those of the gums or those of the teeth themselves, and as to which peripheral symptoms could be attributed to teething by this mechanism. Hood (1845) argued that the pressure of the tooth cap excited the dental nerves and cited Abernathy, who had mapped a connecting route from the dental nerves through the brain to the intestines, to explain gastrointestinal disturbances due to teething. Delabarre (1845) disagreed, and argued that the reflex irritation originated in forced dilatation of the canal through which the tooth passed and not pressure against the dental nerves. These, he contended, were protected because they are "surrounded by ossified alveolus."



Hall (1833) was the theory's most vocal, if not its most able, defender. As a well respected experimental neurobiologist, his primary concern was with the origin of nervous diseases and he was intrigued with the idea of reflex irritation. His interest in this concept originated in the 1820's when, while he was investigating the lung circulation of a recently decapitated newt, the headless creature lurched in response to cutaneous stimulation. Following this observation he designed experiments to investigate the reflex arc. He concluded that irritation and not pressure was the exciting cause of symptoms, as he observed that applying pressure to nerves caused only paralysis. He divided convulsions into those caused by central disorders (i.e. mass lesions, contrecoup injuries, meningeal irritation, etc.) and peripheral irritation. This latter group included three primary sources of irritation: (1) dental, through the dental branches of the fifth cranial nerve, (2) gastric, through the "pneumogastric" or tenth cranial nerve, and (3) intestinal, through the spinal nerves. Hall (1844) argued that tension could not cause sufficient irritation to explain teething symptoms; rather he reasoned that "there exists a subinflammatory action of the nerves of the teeth."

Jacobi (1860) one of Hall's most vocal critics, proposed explanations for convulsions that resembled Hall's hypotheses in many respects. Like Hall, he divided convulsions into those of central and those of peripheral origin. He constructed a table that mirrored Hall's in that it allowed for "irritation of the sensitive (peripheral) nerves, the grey substance being the joining link between the sensitive and motary nerve." In other words, Jacobi, like Hall, expanded the concept of the



reflex arc to allow a peripheral stimulation to be transmitted centrally to the brain, and from there, create a motor response anywhere in the body. He added that "the protrusion of a tooth under more or less unfavorable circumstances may be one [of] the very numerous and various irritations" that lead to convulsions. Hence, Jacobi's opposition to Hall was more on a quantitative than a qualitative basis.

The reflex theory remained popular among the early twentieth century authors. Rotch (1901) distinguished between dental nerve and gum nerve irritation; each, he described, had its own distinct set of symptoms. He included diagrams of the nerve pathways involved in reflex irritation. He believed that even ear infections could be caused by dentition and made special note of the connection between the fifth and seventh cranial nerves by the chorda tympani.

Guthrie (1905), although a critic of ascribing symptoms to teething, admitted, "No doubt irritation of dental branches of the fifth nerve may produce otalgia." He further accepted dental irritation as a "rare" cause of convulsions, but he staunchly argued that neither otitis media nor meningitis could result from teething. Miller (1913) and Still (1924) both utilized reflex theory to explain a multitude of ills. Clarke (1921) argued against reflex theory, suggesting that if the theory held true, then teething rings, objects or other sources of stimulation should cause more, not fewer, symptoms.



#### IV) Modalities of Treatment

Treatments advocated by medical authorities throughout history fall into one of two groups: local and general. The treatments varied widely and each author often had his own unique favorite remedy. Most classical authors offered treatments without justifying the technique. These were largely local gum rubbing with plant and animal extracts or general non-specific oral therapies. A typical author of the sixteenth century reviewed or listed the remedies suggested by his predecessors and perhaps added one or two of his own. Later authors tended to tie theory to treatment. Exceptions include proponents of a single etiology for almost all diseases, such as Harris (1689), who accompanied his one cause theory with a veritable pharmacopoeia of therapies. Gum lancing was popularized in the sixteenth century, although it had existed since classical times. It was used along side of emetics, purges and enemas in an attempt to balance the humors. Disagreements between authors in the nineteenth century often concerned the best mode of treatment and gum lancing was particularly at the nexus of debate. Many continued the effort to medicate teething symptoms away and opiates and calomel were popular ingredients in teething remedies. The propensity towards vigorous treatments faded after the beginning of the twentieth century as more authorities questioned the diagnosis of teething altogether.

##### A. Local treatments

Soranus (117 A.D.) advised that symptoms of dentition may be prevented by softening the gums by rubbing them with an anointed finger





after the child was five months of age. This treatment probably antedates that time. The infant's habit of placing his hands to his mouth probably contributed to the impression that rubbing the gums with a finger is soothing (Becker, 1848).

The bare or oiled finger is recommended by authors from the time of Soranus (117 A.D.) until the present. Rhazes (900 A.D.), Paré (1536) and Hurlock (1742) all mentioned its soothing effect. Rosen Von Rosenstein (1776) considered gum rubbing to be a duty of the nurse and claimed it to be of "great service to teething." Rubbing the gums with a finger was not universally accepted. Some authors believed, for example, that gum massage could spoil the baby, or, that it was useless, or, even worse, detrimental because the gums became hardened (Becker, 1848). At the present time, practitioners advise parents to rub the gums with their fingers, although Honig (1975) implies that it is the advisees who are being assuaged.

Innumerable plant and animal oils, as well as other animal parts, have been suggested as agents to be rubbed on the teething child's gums. The ability of oil to soften leather may have contributed to the frequency of this suggestion. Soranus suggested hare's brain or chicken fat. Butter, olive and camomile oils were added to the above list (Rhazes, 900). Camomile oil or tea was frequently advocated for teething symptoms by classical authors and Pliny prescribed its use for many disorders. The camomile plant is an aromatic creeping herb of the genus Anthemus. Named earth apple in Greek, because of its pungent aroma, it was made into a bitter tea that was considered to have "tonic" properties, perhaps by analogy to quinine.



Avicenna (1037), Paré (1536), Phayre (1553), and Rosen Von Rosenstein (1776) all offered combinations, especially those that included honey, oils and animal fats. Phayre augmented the list with oil of roses, night-shade and dill but repeatedly suggested hare's brain or, if that were unavailable, hare's stomach ("mawes of hares"). Paré (1536) suggested, perhaps a little skeptically, that "some think that the braines of hare, or a roasted pig ... through some secret property are effectual."

Mauriceau (1668), one of the first to protest the use of topical treatments, called rubbing the gums with bitch's milk, hare's or pig's brain or amulets of animals teeth "founded more on superstition than reason" and would not trouble himself "to enlarge upon what is so useless." Yet, Hoffman (1753) advocated hare's brain enthusiastically, one hundred years later.

Hurlock (1742) reviewed predecessors topical remedies and discarded most in favor of "judicious use of the lancet" (in 20 out of 20 case examples he cited). He criticized the application of fatty substances as they "nauseate the tender stomachs" of children, and noted the extensive use of plants such as the root of the marshmallow, valued by Sennertus (d. 1637) for its mucilagenous and hence, lubricating properties. The Reverend John Wesley (1830) nearly two hundred years later, advocated marshmallow root as an aid to teething. Hurlock also cited four authors who advocated topical use of blood of cock's comb for alleviating local dentition symptoms. Rosen Von Rosenstein (1776) concluded his chapter on teething with acknowledgment "That the braines of a hare or the blood from the comb of a black cock, has no preference to other softening remedies."



Authors in the nineteenth and twentieth centuries continued to recommend local massage with or without topical agents. The remedies suggested were either those repeatedly advised by predecessors or newer agents, reflecting the changing medical pharmacopoeia. Hence, Castle (1849) extolled the virtue of syrup of West Indian ginger, Garretson (1875) advocated cream and brandy and Starr (1890) prescribed a concoction of zinc chloride, opium, glycerine and rose water to be applied to the gums. Cook (1889) considered topical agents "from the old time remedies of blood from the recently wounded cock's comb and hare's brain, down to the most modern local anesthetic, cocaine hydrochloride ... (to be) useless." Yet, Honig (1975) noted that numerous contemporary practitioners recommended application of topical anaesthetics or even whisky to the teething child's gums.

In all cases the concept was to obtain local relief. If the irritation could be alleviated at its source, symptoms might not follow. Some felt that there were added benefits to topical treatments; The Maternal Physician (1818), an anonymous text, suggested that gum rubbing would promote eruption of the teeth "by drawing more nourishment to them and pressing the gum and nervous membrane against their parts."

#### B. Teething Objects

Lest the conscientious parent or nurse feel the above mentioned treatments left them too fully occupied (like the apocryphal Dutch boy with his finger in the dike), the hand could be freed with the substitution of a teething device. An analogy was made between the playful gnawing behavior noted in puppies and the child's propensity to put objects into his mouth (Underwood, 1842).



Authorities have often recommended teething devices, but their recommendations were conflicting. Some advocated hard objects in order to aid the tooth in pushing its way through the gum. Others dissented, worrying that the gum might become hardened, perhaps by analogy to the formation of callus on a cutaneous surface prone to friction.

Phayre (1553) was one of the first to advocate hard objects for teething. He suggested a red coral teething necklace. Mauriceau (1668) argued that soft objects such as liquorice root or a candle are just as suitable. Rosen Von Rosenstein (1776) disagreed and insisted that the teething object be hard. He noted a hazard associated with this quality, however, "the only inconvenience is that the child by playing with it may easily hurt itself in the face, especially the eyes."

Soranus (117 A.D.), however, had earlier expressed concern that mastication on hard objects could toughen the gums, creating later teething difficulties. He suggested the prophylactic measure of giving the child nothing that requires mastication prior to seven months of age lest the gums become bruised, irritated and calloused. Other ancients agreed. Paulus (640), for example, repeated this interdict as did Hurlock (1742) in the eighteenth century who considered the "too free use of hard bodies on the gums" as an exacerbating cause of symptoms. Hurlock also cautioned against putting trust in teething necklaces purveyed by "crafty imposters ... who take advantage of the great mortality within this period." Fox (1803) noted coral to be a "common appendage to a child's dress" but considered it a "very injurious and improper substance" owing to its hardness. Liquorice root, wax candles,





rubber and cork objects as well as bread crusts were all popular among those advocating teething objects that gave little resistance.

Avicenna (1037), Moss (1794), Wesley (1830), Underwood (1842), all suggested some of the above.

The teeth of other animals, in addition to being hard and smooth, were often invested with more mystical qualities. Perhaps they represented successfully erupted teeth or alternatively the attraction may have been their exotic source. The teeth could be individually rubbed or pressed against the infant's gums to help the emerging tooth pierce the attenuated gum overlying it. Alternatively, the infant's propensity to place things in its mouth could be put to advantage by giving the child a necklace of the recommended teeth. Pliny (23-79 A.D.) recommended dolphin's teeth, either reduced to ash or mixed with honey or even intact to rub the gums with. Other sources for the animal tooth amulets or teething necklaces included shark (Pliny) or later, teeth of a colt (Pharyre, 1553) or of a wolf (Pare', 1536; Mauriceau, 1668).

Fleishman (1877), cited by Neaderland (1952), criticized the use of teething objects as causes of irritation and inflammation. Modern thought regarding teething objects was aptly expressed by Jacobi (1862), when he claimed that he neither knew of evidence that they had any special virtue, nor could he conceive that they did much harm.

### C. Gum Lancing

The local treatment of teething symptoms by gum lancing generated more controversy than any other aspect of teething. Although practiced during the classical era, it was rarely mentioned in the ancient



literature. It reappeared in the medical literature in the fifteenth century, when Bagellardus (1472), cited by Radbill (1965a) suggested light scratching of the child's gums as a treatment of last resort. Paré (1536), who was internationally famous as a physician and surgeon, popularized lancing, suggesting that it would alleviate the mechanical tension of the tooth breaking from its "shell." He noted no contradiction between his etiology, "the cause of the pain is the solution of the continuity of the gummes," and his treatment. Radbill (1965a) also noted that Paré's contemporary, Francois Ranchin (1565-1641) strongly disagreed with lancing and with attributing symptoms to teething. Ranchin concluded that infant maladies were concurrent and not caused by dentition. Radbill further noted that Ranchin's book was almost unknown by other authorities and few paid attention to his conclusions.

Gum lancing during classical times, as judged by its reflection in the writings of medical experts, was probably not frequent although there are a few references to the technique. Adams (the translator of Paulus Aegineta in 1844) cited Marcellus Sideta and Pliny as the only classical authors who advocated scarification. Both Sideta and Pliny utilized the tail of the sting ray, Pastinaca marina.<sup>1</sup> Pliny (Natural History, Book 32:26), however, suggested that scraping the gums with the ray is advocated for tooth ache (dentium dolores), whereas the ray, when pounded and mixed with white hellebore, was used for teething.<sup>2</sup>

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1

Pliny used the term Pastinaca for the sting ray now classified as genus Dasyatis. The current genus Pastinaca includes the parsnip and the carrot.

2

"Pastinacae quoquo radio scariphari gingivas in dolore utilissimum contritus, is et com helleboro albo inlitis dentes sine vexatione extrahit." Translated, this reads: "Also, commonly it is very useful for painful gums to be scraped with the ray (tail of?) Pastinaca, and this mixed with white hellebore draws out the teeth without trouble."



Soranus and others believed gum lancing harmful, but neither he, nor Pliny, suggested a rationale for their assertions. The practice is conspicuously absent from the commentary of Paulus, Rhazes, Avicenna and Phayre.

The reasons given for gum lancing were myriad and paralleled the etiologies proposed for the origin of dentition symptoms. Paré (1536) bid the surgeon to incise the gums with a knife or lancet to "open a way for them." This he argued is "much better and more safe, than to doe as some nurses doe, who taught only by the instinct of nature, with their nails and scratching, breake and teare or rent the children's gummies." Paré witnessed the autopsy of the eight-month-old son of the Duke of Nevers which identified no other cause of death than a "contumacious hardness" of the gums. Had they been cut, he argued, "doubtless he might have been preserved." He also noted the success of the treatment in his own children witnessed by his peers including Guillemeau, also a surgeon to the King of France, and one of Pare's chief disciples. Guillemeau mentioned neither children's diseases or dentition nor gum lancing in his text, translated into English as "The French Chirurgery" (1597), even though both harelip and tongue-tie were discussed. (Tongue-tie referred to the belief that the frenulum hindered the free movement of the tongue and was, therefore, frequently surgically divided.)

Eustachius (1563) suggested that if the gums were like a calloused hide, "then cutting with a scalpel in all directions," would aid in the passage of the teeth.

Harris (1689) adopted Paré's logic that tension can be relieved by lancing the gums but he was very critical of surgeons who lance too



early. He believed that each tooth could cause symptoms both when the tooth breaks through the bone and later through the gums. Lancing during the former time was not only unnecessary and without benefit but "the destruction of many." An early incision with a narrow blade such as a lancet allows the gum to reunite and form an even tougher scar or cicatrix. Then "no opening remains ... it becomes of no sort of use and other remedies are in the meantime neglected." He therefore advocated the use of a wide blade, and, then, only when the tooth is close to penetration.

Hurlock (1742) agreed with Harris regarding the stages of eruption, the release of tension afforded by lancing, and that it is indicated only during the second stage of eruption. Although he did not advocate early lancing he countered that reuniting of the gum is not to be feared since lancing nonetheless "contributes to the more easy progress of the tooth." Consequently, the lancet is not to be criticized for lack of breadth, which he argued was sufficient, but rather because its double edge is dangerous in the mouths of infants prone to flail their tongues about.

The argument that lancing removed an obstacle from the path of the erupting tooth was cited by many later authors, especially those such as Moss (1794) who postulated an investing capsule about the tooth. Armstrong (1777), often cited as an early critic of attributing symptoms to teething, advocated the use of the fleem, a spring loaded blade, in order to aid the passage "of the grinders", which he felt was more difficult because of their bluntness. Rosen Von Rosenstein (1776) cautioned that the surgeon must be sure to cut down to the teeth and not





leave any fibers, lest the tension be concentrated on the remaining fibers and the pains be made even more violent.

The concern that reuniting of severed gums would result in a more tenacious scar was present continuously during the lancing era as numerous defenders of lancing devoted space to denying this assertion (Hunter, 1778; Jackson, 1812; Buckingham, 1875). Hunter noted that early lancing followed by reunion of the gums was often accompanied by recurrence of the troubling symptoms. He doggedly professed belief in the efficacy of the treatment and noted: "I have performed the operation above ten times upon the same teeth where the disease had recurred so often and every time with the absolute removal of the symptoms."

The idea that teeth acted as foreign bodies was first suggested by Hunter and later by James (1868) and Buckingham (1875). James made the analogy to a paronychia, which, like an abscess, ought to be drained.

Localized bloodletting was postulated to be a mechanism affording relief, either by releasing aggregated humors, decreasing congestion, "lessening evils" or "depriving the dental nerves," thereby decreasing their excitation or "morbid action." Phlebotomy as a therapeutic modality has a history too extensive to review here, let it suffice to note that it was widely accepted and that gum lancing justified by analogy drew similar acclaim. Hurlock (1742) suggested that any beneficial effects following early gum lancing were attributable to bloodletting and not release of tension. Clendon (1862) and Hood (1945) both felt that blood had a particular counterirritant property. Clendon, in a paper very critical of attributing symptoms to teething, paradoxically



admits a salubrious effect from gum lancing; "No doubt the bloodletting and the incision itself like any other counterirritant, may afford temporary relief."

Much of the nineteenth century debate was carried out by the publication of case histories, both for and against lancing. Each proponent listed one or more case histories where the symptoms either resolved with tooth eruption or lancing and concluded a greater than coincidental relationship (Jackson, 1812; Meigs, 1848; Ward, 1874; Cartwright, 1876; and Owen, 1884). Some critics of lancing believed in dentition symptoms but had poor or disastrous results from gum lancing and condemned its complications. Such debate naturally lent itself to emotional appeal and even legal sequelae. Richardson (1860) noted a case where a druggist in London was acquitted for failure to lance the gums of an infant sent to him for that purpose.

The depths of emotion can be felt in the criticisms of Castle (1849) who described "the narrow escape of two of my children from the disastrous effects of this scarification of the gums in the manner so highly extolled by [Marshall Hall]." Yet Buckingham (1875) a professor of obstetrics at Harvard, waxed eloquent about its virtues.

The relief afforded by a free incision through the gum in some instances ... has been more marked than that afforded by any other operation that I ever saw ... I have seen children who were crying with agony, before the operation, look up in my face and laugh through their tears; and I have known a child to come to me, and show by unmistakable signs her



remembrance of the benefit received on another occasion, by turning her head over upon my knees, and pointing to the swelling above a cuspid tooth ...

(He adds) There are many ... whose lives I believe to have been destroyed by the prejudice against the gum lancet.

The major and most quoted protagonists in the debate in the mid-nineteenth century were Marshall Hall in London, who promoted lancing, and Abraham Jacobi in New York, who criticized the practice. Although Hall vigorously defended gum lancing and called it localized blood-letting, he recognized hazards associated with the latter. Indeed, some of his acclaim as an investigator came from earlier papers published documenting the ill effects of excessive acute blood loss from phlebotomy. As the primary proponent of reflex theory, he postulated that the peripheral irritation in the dental nerves found its origin in the teeth themselves. Lancing, Hall believed, had counterirritant properties and he emphasized the vascular nature of the gums during teething and the generally "increased arterial action" which could lead to cerebral congestion if not prevented by lancing.

And it is not merely the prominent and tense gum over the edges of the teeth which should be divided; the gums or rather the blood vessels immediately over the very nerves of the teeth should be scarified and divided ... Now whilst there is fever or restlessness, or tendency to spasm or convulsions, this local blood-letting should be repeated daily, and in urgent cases,



twice a day. I would here repeat my maxim,  
'Better do this one hundred times unnecessarily than  
have one single fit from the neglect of so trifling  
an operation.'

Jacobi (1862), in a series of lectures on dentition, criticized Hall on many points. He noted Hall's propensity to use anecdotal evidence including those from nurses. Although Hall claimed never to have "lost a case from dentition" after he lanced, Jacobi asserted that he had an equally successful record without lancing. Jacobi also believed in retrograde transmission of exciting impulses and argued that incisions, especially multiple, would be a source of irritation, not relief, and in addition present the risk of damaging the partially developed tooth. His experience included only "one or two children whose convulsions ceased" with lancing. Despite offering multiple logical criticisms of lancing, Jacobi supplied few facts to support his own assertion. The impact of his opinions is difficult to judge, although the tide of opinion seemed to turn after Jacobi's articles. Owen (1884), a lancing advocate and surgeon, read a paper before the Medical Society of London and asked why the frequency of gum lancing had decreased. Owen was pleasantly surprised to find that the members of the audience were eager to affirm their support of the practice. Sixteen consecutive practitioners stood forward, concurred with the speaker's approval of gum lancing and many briefly noted symptoms that they considered especially remedied by the use of the gum lancet.





Forcheimer (1892), Holt (1897) and Rotch (1901) all attempted to evaluate the efficacy of lancing by reviewing the extant literature. Their results were frustrated owing to the paucity of data or to the fact that lancing was used concurrent with other remedies. In the early 1900's, pediatric texts (Holt's and Rotch's for example), began to abandon the practice and, in the 1933 edition of Holt, the procedure is omitted altogether. Occasional authors continued to refer to the practice in various medical journals (Miller, 1913; Moody, 1919), but lancing as a therapeutic procedure faded as swiftly as had teething as a diagnosis of morbid illness.

#### D. General Remedies

The spectrum of systemic remedies for disease of dentition is as broad as the range of symptoms ascribed to teething. Ancient therapies to aid tooth eruption relied upon medicaments for the gastrointestinal tract or upon plant oils or extracts applied externally. Later, sedatives especially opium and its derivatives, were employed. Although few of these therapies are in practice today, the desire to medicate away "teething troubles" is still in evidence today.

##### 1. Topical Treatments

Bathing or rubbing the ill child's body with plant oils or extracts was believed by many to have therapeutic value. Some felt that this aided in the easy exit of humors and a particular preparation often was invested with specific therapeutic properties. Paulus (640) recommended that the convulsing child be bathed in water in which turn-sol (Heliotropium, then possibly any flower such as the marigold or



sunflower that oriented towards the sun) had been boiled or that he be rubbed with warming (califacient) oils, such as oil of iris or privet (a bushy evergreen shrub).

Avicenna (d. 1037) used an array of topical treatments often directed at the general area of distress. Hence, for oral inflammation he recommended showering the head with tea of camomile and dill, severe diarrhea is remedied by rubbing seed (rose, caraway, anise and celery) on the abdomen and constipation is remedied by oils, turpentine and even ox bile. He repeated the use of an aqueous extract of Heliotropium for convulsions.

Phayre (1553), in addition to advising a twice or thrice weekly bath in warm water with decoction of camomile, dill and hollyhock, suggested a particular benefit in washing the head every morning "for it purgeth the superfluytie of the braynes, through the seames of the skull, and wythdrawth humours from the sore place, finally coforteth the braayne and all the virtues animal of the childe." These topical remedies continued through the nineteenth century. For example, Becker (1848) advocated oil rubs for the abdomen and camomile tea.

## 2. Leeches

Leeches were extremely popular throughout history and, like phlebotomy, generally applied. Some authors considered gum lancing more convenient but others combined the therapies. Harris (1689) considered one or two leeches placed below each ear as a useful adjunct in particularly morbid cases of dentition. He was widely cited for the next century by numerous authors including Hurlock (1742), who complained that leeches



were slow, although he still used them. Theobald (1864), Rosen Von Rosenstein (1776), and Underwood (1842) all retained the placement of leeches near the ear.

Moss (1794) favored their application on the feet for fever or drowsiness. Trenor (1823) concurred, noting the difficulty of applying leeches to the gums. The mechanism was presumably analogous to blood-letting, hence earlier authors used them to draw off humors. Later, Ives (1821) and Hall (1836) employed them to decrease irritation by depleting vessels about the head and to guard against convulsive attacks. Becker (1848) is one of the few that considered leeches far superior to gum lancing, arguing that where bloodletting is the desired treatment, leeches accomplish this with less trauma.

### 3. Therapy of the Gastrointestinal Tract

Although some claim that every conceivable agent has at some time or another bore the test of trial by passage through the intestines of children, remedies for the gastrointestinal tract usually fell under one of four categories: purgatives, constipatory agents, enemas, or emetics. The ubiquitous nature of diarrheal disease in infancy may have contributed to the notion that mild diarrhea was beneficial, as has been discussed. This concept was extended to therapy and few infant maladies escaped from purging remedies. Two of the most popular were rhubarb (of the genus Rheum, active ingredient presumably oxalate, an osmotic cathartic) and calomel (mercurous chloride, which has both cathartic and diuretic effects). Cadogan (1750) appeared particularly progressive in advocating the use of magnesia alba ( $Mg(OH)_2$ ) for most intestinal complaints. He believed these were due to acid corruption of the food and



found magnesia alba to have the added advantage of being a nonconstipating and neutralizing alkaline purge. He added that he had tried it on himself and found it to be efficacious for heartburn.

Armstrong (1777) described calomel as one of the best medicines for constipation and directed that it be followed by rhubarb, senna, or manna. He denied any ill effects from the use of calomel in his experience, having prescribed it "several thousands" of times. Numerous authors (Fox, 1803; Ashburner, 1833; Underwood, 1842; Starr, 1890; Corson, 1903) prescribed calomel and, in fact, it was easily available in many patent teething powders. MacDonald (1962) noted that the major cause of mercury poisoning, also known as Swift's disease or pink disease, was iatrogenic and that the main vehicle was teething powders. He observed that they were given repeatedly to squalling infants in a manner that was ironically self-perpetuating. Symptoms of mercury poisoning in infants include irritability, sleeplessness, and persistent crying and hence many parents continued to administer the powder for the symptoms it was causing!

Enemas or clysters were also advocated. Avicenna (d. 1037) mentioned suppositories made of honey, pennyroyal or orris root for constipation during dentition. Most of the later practitioners supported therapeutic enemas whether the child was "costive" or not. Harris (1689) and Armstrong (1777) both credited enemas with washing away a multitude of symptoms. The rationale behind the enemas varied. Enemas countered the side effects of opium (Rosen Von Rosenstein, 1776) and some felt that they prevented convulsions due to intestinal irritation (Hall, 1836). They were advised in cases of urinary retention by Underwood (1842), an unusual and probably unrecognized method of rehydration.





Emetics, such as the "antimonial puke" which contained antimony tartrate with or without rhubarb were popular remedies. Armstrong (1777), Moss (1794) and Underwood (1842) all recommended emetics and each offered his personal recipe. The appeal of emetics may have rested in their dramatic nature. "Spitting up", i.e., the gastroesophageal reflux normal to some degree in infants, may have provided support for its use. Furthermore, the protective mechanism of vomiting noxious substances was interpreted as a form of casting off bad humors.

#### 4. Sedatives

Sedatives had particular appeal for parents, doctors and nurses alike. The two most commonly used classes were opium and its derivatives (heroin, morphine, laudanum, etc.) and anticholinergics, typically atropine (belladonna). Although opium had been used long before by Europeans, Radbill (1965a) cited Paul de Sorbait (1625-1691) as one of the first to advocate its use for the pain of dentition. Opiates at one time or another have been advocated for almost every ailment including obstinate constipation, according to Lomax (1973). Opium found particular popularity in the therapies of eighteenth and nineteenth century practitioners and was as easily available and cheap as beer in England during the nineteenth century. It was an ingredient in at least ten patent medicines, including Dover's powder, the famous Godfrey's cordial, which dated from the previous century and Mrs. Winslow's soothing syrup, an American product. Unskilled day nurses often reduced their charges if the children were suitably sedated, although, all segments of society were known to use the syrups.



Both Rosen Von Rosenstein (1776) and Hunter (1778) noted the usefulness of opium, although Hunter suggested that it resulted only in symptomatic treatment. Its use occasionally corresponded to contemporary pharmacologic principles, even if few contemporary practitioners would condone such use. Moody (1919) treated a cough with heroin and Starr (1890) remedied "dental diarrhea" with opiates.

Lomax (1973) noted that this widespread use was not without its hazards. Of 543 poisoning deaths in England and Wales in 1837 and 1838, 186 were from opium and 72 of those who died were children. Hall, in 1816, was one of the first to caution practitioners to rule out chronic opiate poisoning when evaluating patients with malnutrition and inanition. Despite the medical community's awareness, little was done to control this abuse. An 1842 English commission heard testimony that "numerous children were receiving ever increasing doses of laudanum," until they were addicted. A majority of these children died, and over half the survivors were mentally impaired and "ruined for life." A Pharmacy Act of 1868 required that opiate-containing medications be so marked, but as patent medicines were excluded from any restrictions on sales, there was little change. A series of court cases in the 1890's curtailed the use of opium and by 1908 all opiates were placed on a restricted sales status and popular teething powders no longer contained opium.

Atropine was recommended by Becker (1848) for paroxysms and Rotch (1901) found it useful for aural congestion due to dentition. The practice of sedation still is common. MacDonald (1962) and Honig (1975) both noted that some current practitioners continue to advocate the use of sedatives.



## 5. Fresh Air

Fresh air was considered to aid teething children. It had been well documented by Edmonds (1835) that the childhood death rate in London was twice that of rural communities. The crowded conditions of urban slums, especially in industrial London, may have facilitated the dispersal of infectious diseases that contributed to infant mortality. Poor nutrition may also have been more frequent among infants of urban working mothers, who had less opportunity to breastfeed. Yet most nineteenth century authors concluded that it was the fresh air, per se, that had a therapeutic effect. Cool, country air was considered especially efficacious in treating fevers (Hood, 1845; Delabarre, 1845; Castle, 1849), or for New York City infants (Mott, 1844), a daily trip across the Hudson. Ward (1874) considered erupting teeth to be a veritable weathervane, especially if the wind was a northeast sea breeze.

Referring to the wind being in the north east I have observed that during the prevalence or even sudden accession of a northeast wind current the teeth appear to make a rapid advance, which advance, should the wind change may as suddenly subside.

He uses this explanation to counter Finlayson's critical observation (1874) that symptoms blamed on teething do not vary contemporaneously with eruption.

Treatment of teething convulsions was often controversial and Rosenheck (1918) brought new technology to bear on the problem. He advocated lumbar puncture for infants seized with convulsions. He noted



that the fluid removed was under great pressure and children ceased to have seizures after removal of some of the fluid. The modern reader must reflect on how many children with meningitis were brought to an even quicker demise from cerebellar tonsillar herniation!





#### V) Decline of the Doctrine of Difficult Dentition

The improper diagnosis of "teething" is not yet extinct from pediatrics as presently practiced, although the medical community rarely considers it the cause of serious disease. The change in attitude from the early nineteenth century, when almost every symptom was attributed to teething, was gradual and paralleled the evolution of medicine in general. Before the nineteenth century, there was a general consensus that teething caused symptoms, and the few objections voiced were often quantitative as opposed to qualitative. For example, Armstrong (1777) noted, "teething ... is said to carry off far more children than it actually does."

By the early nineteenth century numerous explanations for dentition symptoms were proposed and debate between most authors was not whether to connect symptoms to teething but how. Hence, arguments used by late-nineteenth century authors to reject teething as a diagnosis were first expressed by authors who believed in teething symptoms but who were disputing a proposed etiology. Debate in the latter part of the nineteenth century was largely theoretical. Dissenting authors compared the logic of their own alternative explanations with those offered by the proponents of more traditional teething doctrine. There were no empirical studies prior to Adams' (1889) and even that was probably not widely read as it was rarely cited.

Alternative explanations given in the mid-nineteenth century often focused on children's diet and reflected the rising interest in nutrition. Not until the beginning of the twentieth century did most authors offer



explanations that incorporated the concept of infectious disease. By then, the space in pediatric texts that was formerly devoted to diseases of dentition was being filled up by newly delineated disease entities or descriptions of the microscopic agents that caused many of the infectious scourges of the time. With specification of positive diagnostic criteria for alternative diagnoses, the need to suggest teething, a diagnosis of exclusion, declined. A relatively small number of studies have been performed to resolve the lingering debate, most since 1960.

The major changes in attitude can be described as a series of steps during the last two centuries. From an atmosphere of consensus, there arose conflicting ideas regarding etiology, with an increasing emphasis on suggesting pathophysiologic explanations. Treatments became more allied to proposed etiology and both were discussed in a rationalizing fashion. Only with the onset of the twentieth century did an empirical approach to the question appear.

Rosenberg (1977), in his essay, "The Therapeutic Revolution" argued that before 1800 physicians and laymen shared fundamental concepts about the origin of disease and its therapy. "The body was seen metaphorically as a system of dynamic interactions with its environment." The body's humors remained in a precarious balance and every part was interdependent; perturbation of one part would affect another. He traced this view to the rationalistic speculations of classical antiquity. "Specific disease entities played a relatively small role in such a system ... It is no accident that the term 'empiric' was a pejorative until the mid-nineteenth century." Because they had few diagnostic tools beyond the senses the



most important actions physicians could take involved manipulations of what they could observe. A physician's skill depended upon his ability to regulate the secretions. Drugs were used to elicit fundamental responses of the body to illness, such as sweats, vomiting, diarrhea, urination or cutaneous manifestations.

As the century continued there were criticisms and challenges to the traditional therapeutics. Economics dictated that less violent therapies be devised if the practitioner were to compete with alternatives such as homeopathic medicine. The emerging concept of specific disease entities still allowed practitioners to modify symptoms and many traditional remedies were directed at diseases with "new" etiologies. Rosenberg writes, "Older modes of therapeutics did not die, but, as we have suggested, were used less routinely and in generally smaller doses." By the twentieth century, the physician no longer shared a view of the body and the mechanisms of health and disease with his patients.

This conception of the evolution of medical therapeutics can be observed in the debate over 'teething' found in the medical literature of the nineteenth century. There were numerous grounds for the rejection of teething as a diagnosis. Although Ranchin has already been noted as a sixteenth century critic of the teething diagnosis he was largely unheard of or ignored. The better known Cadogan's (1750) assertion that "teething is no disease" was cited by many and may have provided seeds of skepticism, especially in regard to the frequency of the diagnosis. Although Cadogan's criticisms were progressive, his physiology was traditional and he explained teething symptoms as secondary to agitated humors caused by the pain of tooth eruption.



Elterich (1908) cited Wichman (1797) of Goettingen as vigorously protesting the doctrine of difficult dentition. His observations determined that the gum around most erupting teeth was neither inflamed nor especially sensitive to pressure. Most objections of authors during the following fifty years, however, were more theoretical.

Teleology was often invoked, with or without religious overtones. God/nature would not create a physiologic process that would be fatal to so many, some authors argued. Clendon (1862), a British dental surgeon, argued against the general consensus of his peers when he disputed the validity of the teething diagnosis and asserted, "God's plans are always wise and beneficent." Analogies were made to other animals. Animals did not seem particularly subject to illness during their tooth eruption which suggested that God was unlikely to "ordain that the highest of His creatures" alone was to suffer from teething. Hayden (1809) suggested that the gnawing behavior of young animals "is no proof of teething, but rather a disposition to playfulness." One must speculate whether the progress of animal husbandry was such that by 1800 farmers were better able to raise their livestock to maturity than parents were able to bring children through infancy.

Authors have continually observed that symptoms varied not only between children but within a given child between eruptions of successive teeth. Even the staunchest supporters of the dentition doctrine often admitted puzzlement. Hunter (1778) and Hayden (1809) both wondered how such different symptoms could stem from the same cause and why all children were not subjected to teething symptoms. Instead of questioning whether symptoms and teething ought to be connected, Hayden proposed an





alternative explanation that incorporated a reason for variability.

Yet Jacobi (1860), fifty years later, used this same evidence to support his claim that teething rarely caused symptoms, suggesting a milieu more tolerant of skepticism.

Elterich (1908), in a historical review, noted that "nearly all observers candidly admit that at least fifty percent of all children cut their teeth without visible symptoms, and also admit that all children cut some teeth without any disturbance of the general health." Elterich also denied the occurrence of any symptoms accompanying second dentition (except occasional local discomfort with wisdom teeth). Although several of the authors who wrote papers about symptoms attributable to second dentition were contemporaries of his, he dismissed them as "enthusiasts". He concluded that dentition produced nothing but teeth.

The defensive stances of authors who continued to believe in teething symptoms document the change in consensus during the early twentieth century. They countered the assertion that teething was "physiologic" and, therefore, harmless by pointing out that pregnancy, though physiologic, was attended by multiple dangers. More fundamental to their objections perhaps was the difficulty in turning against their own former practices and millenia of historical teachings. Still confessed:

At the risk of being considered old-fashioned and unscientific, I shall mention some of the disorders to which, in my opinion, teething may give rise. I admit the difficulty of proof; we all know that coincidences are apt to be mistaken for cause and effect



but I am not inclined to disregard the accumulated experience of generations of intelligent parents, and still less the observations of skilled observers, who affirm without hesitation that dentition may cause certain disturbances of health.

As did many before him, Still explained "teething" symptoms that occurred long before the first tooth appeared with the "two times of teething" theory, previously discussed. Yet Jacobi (1860), Guthrie (1905) and others considered the greater frequency of symptoms, such as infantile convulsions prior to initial eruption of teeth as evidence against dentition as an etiology. An important change exists in Still's admission that proof is difficult since correlation does not prove causation. Ashburner (1833) and most of his contemporaries listed case studies as their proof. The approach of Forcheimer (1892) was decidedly more empirical when he noted that the literature was replete with conflicting opinions but destitute of any data to support the assertions, and therapies were therefore unevaluable.

The inconsistency of symptoms occurring with each eruption was commented upon by numerous authors who challenged any etiology that failed to explain why one eruption would have concurrent symptoms and the next fail to do so. Jacobi (1860) extensively catalogued conflicting opinions regarding which teeth caused the most symptoms. Most early authors copied the Hippocratic assertion that the canines caused the most symptoms. Later authors, with more mechanical explanations of etiology considered the blunter molars to give greater trouble.



Dorning (1895) echoed Jacobi's complaints about inconsistencies and conflicting claims among those supporting teething symptoms. He noted conflicts regarding seasonal variation as well. Cook (1887) observed that infantile summer diarrhea was usually incorrectly blamed on teething. "How the mother dreads the child's second summer. But no complaint has yet been heard against a second winter. Do the teeth hibernate?", he wondered.

The conflicts arising about gum lancing have already been reviewed and dissenting opinions regarding its mechanism have been noted. Although lancing was first proposed to relieve tension, Jackson (1812) noted that the gum did not spread after incision and concluded that tension was absent. Even Hall, a vigorous advocate, proposed an alternative justification for lancing. The vigor with which gum lancing proponents defended the practice may have provided a stimulus for critics to question not only the technique but its indications. Part of Jacobi's confidence that teething was usually benign was grounded in his observation that his patients did well without lancing.

The more intricate the etiologies proposed, the more opportunities for criticism on a logical or experimental basis. Pressure of the tooth on the gum creating paroxysms of pain was unlikely if an aortic aneurysm wearing through a rib or the sternum was painless, Hayden (1809) and Jacobi (1860) argued. Pyrexia as a basis for all subsequent symptoms is an unlikely etiology, if most teething children have no fever, Dorning (1895) and Finlayson (1874) asserted, although neither offered temperature data to support this claim.



Reflex theory was criticized on multiple grounds. Castle (1849) could not reconcile a local origin and treatment for systemic symptoms, "As well might we scarify the skin over a fractured arm." Guthrie (1905) criticized reflex theory for failing to account for most symptoms. He equated it with the more physiologic and currently accepted concept of referred pain. (For example, a pain in the knee might be the result of a diseased hip.) No disease actually occurs in the painful part, he reasoned, only the pain and not the pathology is referred.

Turner, writing with Guthrie (1908), first described the microscopic pathology of the gums of teething infants. He concluded:

There is no definite evidence of teething causing trouble. The evidence points to the concurrent conditions; nothing is seen under the microscope to support tension, and clinically but little to support reflex. Vicious feeding, adenoids and the general ills to which humanity is exposed are sufficient to explain all the troubles attributed to teething.

Turner also observed that the suggestion of improper diet is often unpopular with the infant's mother and suggested that the desire to avoid blame makes the teething diagnosis popular among laymen. Jacobi (1860) also blamed most "teething" symptoms on poor feeding. He discussed symptoms by organ system and offered numerous alternative diagnoses. He did not rule out the possibility that teething caused symptoms, but considered the diagnosis as inherently one of exclusion. The only positive criterion was to have an emerging tooth. Although Jacobi questioned





the connection between entities we now know are infectious diseases and teething, the alternative diagnoses he gives illustrate that he retained many traditional conceptions. For example, when discussing the suppuration from otitis media he noted that "otorrhea occurs during periods of rapid cranial development, especially in children who from bad habits, hot pillows and bonnets or hereditary or acquired scrofulous disposition are liable to accumulations of an over amount of blood in the head."

Guthrie's writing less than fifty years later illustrates the impact that empirical investigations into microbiology had during the interim. "No doubt irritation of the dental branches of the fifth nerve may produce otalgia, but it cannot produce suppurative otitis media. In rare cases, it may give rise to convulsions, but it cannot cause meningitis." Because Koch had discovered the tubercle bacillus in 1882, the status of scrofula changed from Jacobi's "hereditary disposition" (the King's evil) to tuberculous cervical lymphadenitis.

To his credit, Jacobi connected thrush with an oral yeast infection, not teething. What he lacked was knowledge of the causative agents of most other disease entities that he diagnosed. Jacobi was aware that the diagnosis of improper feeding was less popular than that of teething with parents. Cook (1887) concurred and noted that agreeing with a concerned mother when she suggested teething as a cause of gastroenteritis was "... the easiest thing to do and entirely satisfactory to the mother. But putting aside all preconceived notions," he asked, "is it reasonable?"

Jacobi's and Guthrie's criticisms of the doctrine of difficult dentition do not differ that greatly. Guthrie had the added advantage



that many more alternative explanations had new foundations in recently discovered infectious agents whose diagnosis did not leave the parent at fault. The contemporary practitioner who states "There is something going around" to the nervous mother of a child with diarrhea, assuages her feelings by absolving her of culpability.

The more empirical approach of designing a study to test the efficacy of a teething remedy or assign symptoms was left until the latter part of the nineteenth century. Forcheimer (1892) noted the conflicting assertions in the literature regarding teething symptoms and called for "extended series of observations to determine the effect of teething on healthy and unhealthy children" and the effects, if any, of the popular teething remedies on the symptoms observed. He noted that he, as well as Kassowitz, had failed to observe symptoms consistently associated with teething. He explained conflicts of opinion with other observers by asserting that "some of the observers have not followed the same rules that my critic would follow if he was making a physiologic experiment." Kassowitz (1892) had planned to collect a large series of children suffering from "teething" symptoms but since "nothing happened", he abandoned the study and concluded that teething resulted in nothing but teeth.

Adams (1889) performed a retrospective study utilizing ten years (1879-1889) of hospital records of Washington, D.C. Children's Hospital trying to determine a correlation between the number of teeth an infant had showing and the presence of "a gastrointestinal symptom". He observed that symptoms occurred as frequently in children whose teeth had not yet erupted as those whose had, concluded that teething was not a



major determinant of disease, and suggested improper nutrition as the major cause. He bolstered this last conclusion with the observation that a disproportionate number of the children were not nursed and were fed condensed cow's milk.

Several authors during the first part of the twentieth century acknowledged the need for a controlled study to assess the relationship between teething and the symptoms attributed to it, yet few were performed. Neaderland (1952) cited a study by Helmerich in 1927 of infants with measles that reported that tooth eruption did not cause a fever. The study did report that fever increased the rate of eruption, despite Neaderland's calculations using Helmerich's data that showed no "statistically significant" increase in eruption rate.

No new studies appeared in the English medical literature until the extensive, prospective, controlled clinical observations of Tasanen (1968). Two hundred and thirty-three children (age 4-30 months) in Northern Finland were divided into a control group and an investigational group. The control group was selected by the criterion of having "no teeth at eruption", examined, given a battery of laboratory tests, and assigned behavior ratings. The investigational group was examined daily. During and following each eruption the following measures were taken: temperature, erythrocyte sedimentation rate and complete blood count (including differential). Additional assessments made in both groups included gingival sensitivity as tested by a pressure probe, "subjective" behavior ratings made by nurses, the condition of the mucosa and a limited number of histological investigations of gingiva over erupting teeth. The mothers of the children were simultaneously questioned about their impressions of illness and its relation to teething.



Tasanen's results statistically documented significant differences in only the "subjectively rated" measures of daytime restlessness, drooling and the child placing his hand to his mouth. There was no difference between the groups in incidence of infection, fever, diarrhea, white counts including changes in percent of neutrophils, their band forms, or lymphocyte count. Behavioral measures that also showed no difference included sleep and rubbing of the ear or cheek. No increase in the sensitivity of the marginal gum to pressure was observed among teething infants and histologic investigations showed only mild non-specific inflammatory changes compatible with gum resorption.

The results of the questionnaire showed strikingly different beliefs. Approximately half of all the mothers felt that teething caused fevers, disturbed sleep and caused cheek and ear rubbing and diarrhea and twenty percent of the "older" mothers blamed convulsions on teething. The results document the persistence of the doctrine of "difficult dentition" as well as illustrating the inaccuracy of data gathered through the questionnaire format.

Seward (1971, 1972) designed a longitudinal survey of 224 infants based upon two or three sequential interviews. Mothers were asked to describe the symptoms that occurred during the eruption of their infant's anterior and posterior teeth. The responses were subdivided into local and general disturbances. Naturally, Seward's questionnaire format precluded having a control group, a problem that she acknowledged. She failed to address the problem that a coincidental illness would be recorded on her questionnaire as due to teething, however. More than three quarters of the infants experienced general or local complications





reported during the eruption of the posterior teeth. The number of complaints versus the erupting tooth type were ranked and revealed that most complications were associated with second molars and the least with central incisors. Surprisingly, data regarding the duration between eruptions was omitted from her report. Consultation with a chart of eruption times reveals that only two months separate the eruption of central and lateral incisors. As the time between the eruption of the first and second molars is almost twice that, her observations may have been the result of a longer span of time during which coincident illnesses were incorrectly recorded as due to tooth eruption.

Concurrent with the above study, Seward performed a double-blind test of a proprietary teething solution, published separately (1969). She did not discuss the possibility that testing a remedy for teething symptoms would predispose mothers to believe in the existence of teething symptoms. The mothers were given unlabelled dropper bottles with a solution to be rubbed on the infant's gums with a finger. The "active" solution contained the local anaesthetic lignocaine hydrochloride, plus benzyl alcohol and tincture of myrrh, in addition to the contents of the control solution, a flavored aqueous base. Seward found a statistically significant difference between the mothers' subjective ratings of the active and control solutions. No difference was found when such variables as age of the infant, sex, time of application or whether or not a tooth was about to erupt were considered. Her results could also be interpreted as documenting a nonspecific behavioral response to the lignocaine concoction without regard to whether it had any effects specific to teething.



Carpenter (1978) omitted mention of Tasanen's article (despite referencing two articles that discussed it extensively) when he reviewed the literature on teething symptoms and concluded that there was "much debate and little agreement." He conducted a two part investigation, one retrospective and one prospective, to determine the relation between teething and systemic disturbance. The retrospective study involved reviewing medical records where the final diagnosis was a "well baby." He also noted whether the baby had a tooth erupting, or if one had erupted in the month prior to the visit. Forty-six babies (38 percent) had no symptoms recorded and seventy-four (62 percent) had one or more symptoms recorded. The second half of the study involved following six children for four office visits, a period of six months or longer. For each of the children, he gave an example of when a symptom "cleared" the day a tooth erupted, although he mentioned nothing about all the rest of the tooth eruptions during the six month period. He concluded that although he could not prove the relation between teething and the illnesses, he believed that he had demonstrated that a definite correlation existed between the teething process and the occurrence of systemic disease. The complete lack of controls and statistical significance make his conclusions, at best, idle speculation characteristic of the century before, and reaffirms Honig's assertion that many contemporary practitioners are as enchanted with the teething diagnosis as were their predecessors.



## VI) Conclusions

The distinction between symptoms and disease entities in classical times was blurred. Any symptoms that occurred during infancy and the process of tooth eruption were inexorably linked. Certainly the high morbidity and mortality of infants justified the correlation. The frequent occurrence of acute illnesses such as gastroenteritis and febrile convulsions contributed to their being considered specific teething symptoms.

One can speculate about why the age range of teething drew particular attention. By age six months, the passive protection gained from transplacental antibodies had ebbed and the weaning of the child had begun. The protective effect of breast milk against gastroenteritis is well documented, the table food to which the child was introduced was undoubtedly a bountiful source of pathogens. The assertion that weaning bore a relation to teething is substantiated by its place in teething folklore, as well as the frequent observations of medical authorities during the last two centuries of increased gastrointestinal symptoms in non-nursed infants, a phenomenon already discussed.

The evolution of theories regarding etiology also lends itself to speculation. The humoral theory, once it was accepted required no explanation of interconnection of symptoms. The humors, if agitated, could emerge where they would and it was the practitioner's responsibility to treat symptoms. Anatomical conceptions explained the localization of humors under tenacious gums and, as the theories became more complex, the concept of the gum creating resistance was used to justify therapeutic intervention.



Advances in physics and anatomy allowed refinements in discussions about the forces of tooth eruption. The concept of agitated humors was expanded into one that used terms like "morbid irritability." The body was considered a tinderbox, ready to be set off into convulsions at any time. Increasing awareness of the structure and function of the nervous system allowed medical authorities to elevate the vague concept of irritability into a "scientific theory of reflex action" in the mid-nineteenth century. The attractiveness of the theory lay in several factors. It allowed for a theoretical connection of almost any, otherwise difficult to explain, temporally related symptoms. Furthermore, as a scientific theory, it was relatively sophisticated. By the nineteenth century there was an onus to give theories of etiology and treatment more scientific foundations. In truth, just as flashing lights can precipitate seizures in certain types of epilepsy, the concept that peripheral stimuli were transmitted centrally and could cause systemic effects was not entirely mistaken.

Many theories were relied upon to provide grounds for intervention. All contemporary pediatricians understand the pressure of being expected to act when confronted with illness and many medications are currently dispensed more to allay the fears of the anxious parent than to alter the course of diseases that are often self-limited. Imagine, then, the anguish of practitioners a century or more ago when they were confronted with serious illness and a forty percent infant mortality rate. The threshold for action, even in a far more invasive manner, was understandably much lower.





The evolution of competing theories after the beginning of the nineteenth century resulted in essays like Hayden's (1809) Jackson's (1812) that quite insightfully revealed deficiencies in other practitioners' explanations of teething symptoms. Neither questioned the doctrine of difficult dentition; both devised even more convoluted explanations. One can speculate that it was too difficult to reverse all their teaching and eliminate the diagnosis of teething from their practice. The infant mortality was just too high. It is far easier to change an explanation of etiology than to change one's conception of pathophysiology. Hurlock (1742) expressed these concerns in his introduction.

We could hardly look upon the triumphs which death makes within the two first periods of our Bills of Mortality, which take in but the fifth year of life, without a very sensible emotion. To see the amount of these when added together, almost constantly to come near to an equality with the sum total of all the other ages of man, would alone be sufficient to excite us to a compassionate enquiry into the causes of it and the most probable means of obviating the same.

Local treatment was logical. A local irritation was postulated and attempts were made to sooth it. If Tasanen's findings are considered correct, then there is a behavioral change, labelled irritability by observers, associated with teething. A "pacifier" is a device given to infants, ostensibly to satisfy their desire to suck on something. Its



name implies that babies can be soothed with oral stimulation, long before the first tooth erupts. This may account for the persistence of practitioners' instructions to rub the baby's gum with a finger or other object. Many plant and animal substances were used to rub on children's gums. Of particular interest is the frequency with which the rabbit was exploited to devise teething remedies. Perhaps it offered a convenient blend of easy accessibility, with prominent teeth as a striking facial feature.

Gum lancing can also be rationalized. The erupting tooth "pierced" the gums and pain resulted when the tooth pierced the gums. What harm could come, the practitioner may have asked, in performing a process that the tooth was "trying to do anyway?" When gum lancing is considered in the context of the other heroic therapies practiced throughout history such as phlebotomy or surgery without anaesthesia, it becomes less gruesome to contemplate.

The desire to medicate symptoms away has been present as long as medications have existed. The pressure on a working mother in nineteenth century England, whether she did piece-work at home or held a job at a factory, must have been tremendous. The efficacy of opiates to "assuage" a child cannot be denied and the temptation to use them to quiet a squalling child must have been overwhelming, especially when sanctified by inclusion in a "teething syrup." With regard to gastrointestinal manipulations for teething symptoms, the frequency with which pukes, purges and clysters were used is not surprising, considering that vomiting and diarrhea are among signs most commonly attributed to teething.



Folklore of teething included many of the same treatments advocated by authorities hundreds of years before. The plethora of superstitions about teething supports the contention that the public has many misconceptions about teething. It also conforms with the natural parental desire to protect their child.

The decline of the concept that teething caused a multitude of symptoms has occurred gradually. The evidence existed since the beginning of the nineteenth century to dispel the concept but it was not until the beginning of the twentieth century that this critical stance was accepted by the majority of medical practitioners. The concept was not ruled out by empirical studies; rather, it was squeezed out by other diagnoses. Although no longer considered the source of serious disease, the public and many practitioners retain the conception that teething causes many symptoms.

Critics and proponents of teething symptoms in the mid-nineteenth century shared a patho-physiology which substituted scientific mechanisms for much vaguer humoral conceptions. By the beginning of the twentieth century the mechanisms proposed had "lives of their own" and diseases were classified into general categories of causation, e.g., infectious, traumatic and constitutional. Modern observations reveal that few symptoms can be attributed to teething. The studies of Seward and Carpenter, however, contain methodologic flaws that reveal the bias of their creators. Both relied upon temporal correlation of symptoms with broad spans of time during which a tooth erupted to prove causation. Lest one argue that persistence of a conception that blamed minor symptoms on teething is innocuous, Swann (1979) documented that serious illness is still mistaken for teething.



Inherent in any extensive review of medical history, especially a survey of a misconception, is the risk of a patronizing attitude. Hindsight is rarely myopic, yet the reviewer, like his subjects, is limited by conceptual constraints. The authors quoted in this paper were the authorities of their time. Their intentions were noble. Each wished to improve the care of children. One can fault them neither for mistaken ideas about etiology of disease nor for their misguided therapies. It was not long ago that the majority of children underwent tonsillectomies and adenoidectomies with the only clinical indications being their presence and we are still witnessing the sequelae of the practice of irradiating thymuses of infants. The lesson to be gained from this review, therefore, is one of humility. A knowledge of past errors may inspire the practitioner to re-evaluate his own therapeutic interventions. Accompanying this spirit of humility must be a willingness to change. An honest error is to be pardoned but an intransigence toward revision of one's practices in light of new findings is not. This review of teething has revealed both honest errors and recalcitrance, commendable compassion, and obstinate denial. It is unlikely that each succeeding generation of practitioners will be free from its own diagnostic and therapeutic misconceptions. Perhaps a spirit of critical self-evaluation, however, will help minimize unnecessary interventions and yield a more satisfying outcome to all.





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