ECRONICON OPEN ACCESS

EC DENTAL SCIENCE
Review Article

# Early Childhood Caries and Paediatric Oral Health Concerns in a Developing Country

**Saumya Taneja* and Abhinav Singh**

*Department of Dentistry, All India Institute of Medical Sciences, Bhopal, India*

***Corresponding Author:** Saumya Taneja, Department of Dentistry, All India Institute of Medical Sciences, Bhopal, India.

**Received:** March 01, 2019; **Published:** March 29, 2019

## Abstract

Early childhood caries (ECC) is rampant dental caries initiated by inappropriate feeding in infants and toddlers which affects the primary maxillary anterior teeth followed by primary molars. The effect of caries is not only limited to the oral cavity of the child but also affects the growth and personality of the child and causes both psychological and economical stress to the parents. Although dental caries is decreasing worldwide, but the prevalence of ECC still remains high. Various strategies to prevent ECC include education of parents about diet and oral hygiene habits, water fluoridation and personal and community preventive programs, provision of examination and preventive care in dental clinics. Approximately, 40 - 90% of the population suffers from untreated caries in primary teeth. Huge population of children with dental caries having no provision for dental care will lead to a major public health fiasco, if no measures are taken urgently. Formulation and implementation of oral health policies with an objective of reducing pediatric oral health burden and improving the quality of life among children is an immediate essential necessity.

***Keywords:*** *Early Childhood Caries; Nursing Bottle Habits; Deciduous Dentition; Restoration; Prevention*

## Introduction

Early childhood caries (ECC) is a relatively new term that describes rampant dental caries in infants and toddlers. It is thought to be initiated and exacerbated by inappropriate feeding with a nursing bottle. It first affects the primary maxillary anterior teeth followed by primary molars. Most common complications of ECC are pain and infection in the oral cavity. ECC begins with white-spot lesions in the upper primary incisors along the margin of the gingiva. Children experiencing caries as infants or toddlers have a much greater probability of subsequent caries in both the primary and the permanent dentitions [1].

ECC also affects general health and overall quality of life of a child, including their ability to speak, eat and socialize [2,3]. Chronic dental pain causes irritability, disruption of sleep pattern, a negative self-esteem and thus deteriorating their performance in the school. ECC inhibits the intake of adequate nutrition thereby adversely affecting the growth of the child as well as their cognitive development [4]. Extension of infection from the teeth might also cause compromised airway, sepsis or brain abscess which is rare but life threatening [5]. The effect of caries is not only limited to the oral cavity of the child but also affects the growth and personality of the child and indirectly affects the family causing both psychological and economical stress to the parents [6-8]. Dental problems proved to be the main reason for hospitalization of children in Australia in 2015 [9]. The American Academy of Pediatric Dentistry (AAPD), in 2003 defined ECC as the presence of one or more decayed (non-cavitated or cavitated), missing (due to caries), or filled tooth surfaces in any primary tooth in a child up to 71 months of age or younger. The academy also specifies that, in children younger than 3 years of age, any sign of smooth

surface caries is indicative of severe early childhood caries (S-ECC). From ages 3 through 5, 1 or more cavitated, missing (due to caries) or filled smooth surfaces in primary maxillary anterior teeth or decayed, missing, or filled score of ≥ 4 (age3), or ≥ 5 (age 4), or ≥ 6 (age 5) surfaces constitutes S-ECC [10].

Long standing carious lesions lead to severe destruction of teeth, causing dental abscesses, facial cellulitis leading to pain, loss of tooth and development of malocclusion. Hollister rightly said that tooth decay in primary dentition is the single strongest predictor of cavities in permanent dentition [11].

## Historical perspective

Dr. Elias Fass in 1962 was the first person to publish a comprehensive description of caries in infants which he termed as 'nursing bottle mouth' [12]. Children who were put to bed with a bottle containing milk or any sugar containing beverage were at a greater risk of developing caries as the liquid pooled around the teeth while lying down. Lower anteriors were protected by the tongue and were not cariously involved. At will breastfeeding, different cariogenic food substrates and poor oral hygiene are other potential risk factors.

Over the years the term Nursing bottle mouth has been succeeded by the terminology 'nursing caries' given by Winter in 1966 and 'nursing bottle syndrome' by Shelton in 1977 [13]. Kroll in 1984 described the condition as 'baby bottle mouth'. Tsamtsorius, in 1986 coined the term 'Nursing bottle caries' as he considered the cause to be prolonged use of a bottle filled with any liquid except for water [14]. In 1994 the 'Centre for Disease Control and Prevention' suggested the use of a less specific term like 'Early Childhood Caries'. In 1996 Moss shifted the emphasis from the bottle to the need for cleaning and called it as 'Tooth cleaning neglect'. Horowitz on the other hand, based on the nature of the disease and the rapidity of its spread named it as 'Rampant infant and early childhood dental decay' [15].

## Etiology of ECC

ECC is a multi-factorial disease. Most important etiological factors involved in dental caries are cariogenic microflora in the mouth, fermentable carbohydrates and susceptible tooth surface, suggested by Keyes (1960). A fourth variable, 'time' was added by Newburn in 1969.

ECC is an infectious disease. Loesche in 1975 suggested the mutans streptococci (MS), including the species *Streptococcus mutans* and *Streptococcus sobrinus* as the principle microorganism causing dental caries [16]. Teng., *et al.* concluded through his study that *Veillonella* species and *Prevotella* species are the trigger for caries, not *S. mutans* [17]. Lactobacilli also play a pivotal role in the progression of caries, but not in initiating. Caufield and coworkers found that the initial colonization of *S. mutans* occurred at the age of 19 - 31 months, which was called the first window of infectivity, coinciding with the eruption of primary molars [18].

Caries causing microorganisms can be transmitted from one individual to another. Mothers with dense salivary reservoirs of MS (> $10^5$ CFU), poor oral hygiene and higher daily frequencies of snacking and sugar exposure increase the likelihood of transmission of the infection to their child [19]. According to a study conducted by Li., *et al.* in 2005, infants delivered by cesarean section acquire *S. mutans* earlier than vaginally delivered infants [20].

Host factors responsible for development of ECC are salivary factors, immunological factors and tooth. Saliva plays a key role in post eruptive maturation making the tooth more resistant to caries. The pH buffering capacity, lubricating, antimicrobial and flushing actions of saliva help prevent dental caries [21]. Seow in 1998 stated that development of caries largely depends on carcinogenicity of sugars, the frequency of ingestion and oral clearance [22]. Children with ECC experience frequent and prolonged consumption of milk or sugared beverages. Breast feeding for longer than 1 year and at night may be associated with an increased prevalence of dental decay [23]. More the total time the sugar is in the mouth, higher is the demineralization and there is inadequate time for saliva to remineralize. Oral clearance of carbohydrates depends on salivary flow and stickiness of food [24]. Therefore, sleep time consumption causes more caries

as salivary flow during sleep decreases and so does the clearance of food. Clearance is slowest on the labial surface of maxillary incisors and the buccal surface of mandibular molars. Children with sleep deficits are also more prone to ECC because sleeping problems lead to more night time feeding [25-27].

Two major demographic variables that are believed to play a role in ECC are race and ethnicity and socioeconomic status. Racial and ethnic factors determine the educational status of parents, awareness regarding deciduous dentition, feeding pattern and oral habits. Increased risk of ECC in ethnic minorities is often associated with cultural norms, child rearing practices and barriers to dental care.

Studies have shown that higher the income, the lower is the caries prevalence which is basically because low income affects the degree of education, health values, lifestyles and access to health care information [28,29]. Some authors also suggested that ECC is not only limited to children of low socio economic status but equally affects higher socioeconomic status children also [30]. Prakash., *et al.* through their study on children of less educated mothers deduced that 38% of them were affected by ECC [31]. Change in dietary patterns also predisposes the child to caries. Milk consumption has decreased whereas the consumption of soft drinks, juices, non-citric beverages, and carbohydrates has increased. In a study conducted in Bangalore in 2012, statistically significant correlation was found between caries prevalence and consumption of in-between meal snacks [31]. Pre-natal and peri-natal malnutrition is also often the cause of enamel hypoplasia, reduced salivary secretion and low buffering capacity [32,33]. In 2006, Eronat compared nutritional status of children with ECC and found out that 83.1% children with an unbalanced diet suffered from ECC [34,35]. Children with existing carious lesions have 5 - 6 times higher tendency of developing new carious lesions [36].

## Pattern of caries in ECC

Children in the age range of 12 - 30 months have a special caries pattern that differs from that in older children. Value of recognizing the specific pattern of caries in deciduous dentition is more important than knowing the total number of lesions for making clinical decisions about disease management, dental repair and prevention of future disease. Patterns of ECC are clinically associated with differing disease locations, severity and speed of progression, sequence of manifestation, signs and symptoms, impact on developing dentition and quality of life.

## Treatment

The type of treatment instituted for patients with ECC depends on patients and parent motivation towards dental treatment, the extent of decay and the age and cooperation of the child. The initial treatment includes provisional restorations, diet assessment and counseling, oral hygiene maintenance and home and professional fluoride treatment. In past it was suggested to extract the grossly carious teeth but with the newer materials and techniques available it is possible to salvage the tooth till the time of exfoliation [37]. Horowitz suggested gross excavation of the carious lesion in one sitting and a second appointment if there are a large number of extensive carious lesions [38]. Early caries with minimal loss of enamel can be treated by weekly professionally applied fluoride therapy. Teeth with extensive caries, but no pulpal involvement are treated using composite resin restorations, Glass ionomer cement restorations, strip crowns and stainless steel crowns. Those teeth with pulpal involvement require either pulpectomy, pulpotomy, extraction and space maintainers or partial/complete dentures.

## Prevention

To prevent ECC three general approaches may be followed. The first one is a community based strategy that relies on education of parents about their own and their child's diet and oral hygiene habits, water fluoridation and personal and community preventive programs in high risk communities. Various educational programs should be conducted targeting mothers because they are the primary promoters of oral hygiene and have a major influence on dietary choices of their children. Programs should be centered on modifying the use of a baby bottle or nursing habits, on use of the fluorides and promoting supervised brushing using fluoridated toothpaste. Breast feeding for longer than one year and at night should be discouraged. Mothers should start weaning the child off the breast milk by 6 months. Cleaning of gum pads with a wet cloth after feeding and brushing teeth as soon as the first tooth erupts in the oral cavity must be practiced. Parental assistance and guidance is essential for maintenance of oral hygiene of children as they lack the manual dexterity.31,35 Brushing teeth twice daily at least, under parental supervision, using fluoridated toothpaste definitely reduces the occurrence of caries in children [39].

A concentration of 1450 ppm fluoride in toothpastes was shown to reduce caries in children, but this increased the chances of fluorosis [40]. Use of fluoride is a double edged sword which has both advantages and disadvantages. Therefore, the parents should be aware of the quantity of fluoridated dentifrice to be used for their children. Fluoride free toothpastes when the child is less than 2 years, followed by a pea sized fluoridated paste till 6 years of age is advised [41,42]. Parents should make sure that their child rinses and expectorates thoroughly after brushing to avoid ingestion of excessive fluoride [43,44]. Along with fluorides, hydroxyapatite and amorphous calcium phosphate have shown promising results in preventing ECC [45,46].

A recent study by Vozza., *et al.* in central Italy in 2017, reported that 53.1% of parents didn't brush their child's teeth for the first 3 years of life [47]. It was found that a child's short term and long term oral health status were much better when parents received recurrent counseling sessions. Perinatal engagement of parents as well as of other health providers with the pedodontist is more effective in preventing ECC. Children visit the pediatrician about 6 times in the first year of their life, therefore educating them about ECC and its risk factors is critical. Community based water fluoridation decreases caries by 40 - 60% and requires no dental visit. Hence, water fluoridation is considered a highly effective technique in preventing caries in the primary dentition.

The second approach is based on the provision of examination and preventive care in dental clinics. The third one is to develop appropriate dietary and self-care habits. All infants should receive an early dental examination, which helps in identifying the children at high risk or low risk and implementation of appropriate preventive strategy. Earlier American Academy of Pediatric Dentistry (AAPD) specified the age of the first dental visit as 6 months to 1 year. Now it is recommended to visit the dental clinic as soon as the first tooth erupts into the oral cavity. Other preventive agents that can be used are pit and fissure sealants, xylitol pacifiers, topical antimicrobial agents, chlorhexidine varnish and mouthwash, povidine iodine etc.

For high risk children aggressive strategies like anticipatory guidance, behavior modifications and establishment of dental home by first birthday may also be included. Dental Home is a primary health care concept that addresses ECC and other aspects of oral health in a comprehensive, continuously accessible, coordinated, family centered way and includes referral to specialists whenever appropriate. Anticipatory guidance (AG) is a process of providing practical developmentally appropriate health information about children to parents. AG should be introduced into dentist's protocol for managing child's first and subsequent visits by interviewing and discussing with parents the treatment needs and follow up.

## Global trends

Incidence of ECC in paediatric population with deciduous teeth is 1.76 billion [48]. The prevalence of ECC is estimated to range from 1% to 12% in preschoolers of developed countries and from 50% to 80% in high-risk groups [49]. Prevalence of dental caries among the 2 - 5 years children in United States was 24.2% as per National Health and Nutrition Examination Survey (NHANES) III between 1988 and 1994 and 27.9% in NHANES 1999 - 2004 [40,43]. In the year 1999 - 2004, Mexican-American children aged between 2 - 11 years had higher caries levels (55.4%) than black (43.4%) or non-Hispanic white children (38.6%). Children from families with incomes > 200% of the federal poverty level (FPL) had a lower caries experience (32.3%) compared to those in lower income groups (48.8%) [50,51]. In Norway, the prevalence at 3 years of age was 19.9%, and strong associations were found with socioeconomic status and ethnicity [52]. Experience of ECC was 2.8% and 25.9% among 18-month-old and 3-year-old children in Japan in 2007 [51,53]. Although dmft has decreased in recent times, the prevalence of ECC hasn't [54].

In developing countries, the prevalence of ECC differs according to the group examined, and a prevalence of up to 85% has been reported for disadvantaged groups [55,56].

### Caries trends in India

In India, according to national oral health survey and fluoride mapping (2003), the prevalence of dental caries among 3 - 5 year age group was found to be 51.9% [57]. A study conducted in Haryana, on the prevalence of s-ECC among children below 5 years, which used the American Association of Paediatric Dentistry criteria for s-ECC showed a higher prevalence of s-ECC of 42.03% [58]. In Southern India, dental caries prevalence in children below 6 years of age was comparatively low as reported by Gupta., *et al.* in relation to other parts of the country. In 1991 the mean deft in 2 - 5 year old children, found in Karnataka (Bangalore), Andhra Pradesh and Kerala were 0.6, 1.63, and 2.1 respectively [59]. The prevalence of ECC in urban Bangalore within the Karnataka state in 2012, was 27.5%, which was much lower than the rural areas, this could be due to the increased use of fluoridated toothpastes, increased oral hygiene awareness due to increased oral health education programs [31].

### Oral health services and financing in India

Records show that the dental students graduating from Indian dental institutions have increased from 8000 in 1970 to 30570 in the year 2010 [60]. If the present situation continues, there will be more than 1 lakh dentists graduating per year, by the year 2020 [61]. Despite dentistry being on such a rise in the past few years, the World Statistics 2014 by the World Health Organization (WHO), says India has less than 1 dentist (0.8) per 10,000 population [62]. Public spending on medical, public health and family welfare in India is much lower than what is required. There is no specific allocation for oral health in the Indian budget. Since people are not spending on the treatment part readily, the prevention of dental diseases is all the more neglected. Oral health burden is highest amongst the pediatric age group which could be due to low number of practicing dentists and lack of dental public health infrastructure especially in rural areas, geographical factors, lack of awareness among parents about oral health of children, ignorance on the part of general dentists and absence of appropriate oral health policies and programs.

### Alleviating the pediatric oral health predicament

Although dental caries is decreasing worldwide, but the prevalence of ECC still remains high. Approximately, 40 - 90% of the population suffers from untreated caries in primary teeth as reported in various point prevalence studies. This huge population of the children with dental caries having no provision for dental care will lead to a major public health fiasco, if no measures taken urgently.

Oral health policy formation for the population with a focus on pediatric population should be the main objective of the government. However, National oral health policy drafted in 1985 which recommend dental surgeons to be posted at PHC and CHC has yet not been implemented. Articulating and implementing a national oral health policy needs to be a priority. Health care spending has to increase by the government and a separate allocation for oral health needs to be earmarked [63]. The ultimate responsibility of the health of its people lies with the government.

All sections of society should have equal access to oral health services at affordable cost. Educational oral health programs to spread awareness amongst parents as well as policy makers must be implemented. Knowledge about the preventive strategies among parent needs to be enhanced and barriers to oral health care among the disadvantaged populations need to be abolished to decrease the risk of ECC which is critical for oral health among children.

## Conclusion

ECC is a significant public health problem with a debilitating effect on the development, speech, general health and self-esteem of children. In relation to habits related to nursing bottle usage, several other risk factors for ECC, including race, ethnicity, socioeconomic status, diet and oral hygiene practices act as an environment that overshadows the interplay of cariogenic factors. There is a well-established and an aggressively escalating demand for oral health care among the pediatric population in India. We need to focus on specifics rather than on rhetoric or gestures. Formulation and implementation of oral health policies with an objective of reducing pediatric oral health burden and improving the quality of life among children is an immediate essential necessity.

## Acknowledgement

None.

## Funding

None.

## Conflict of Interests

Authors declare that there is no conflict of interests regarding the publication of paper.

## Bibliography

1. Abanto J., *et al*. "Impact of oral diseases and disorders on oral health-related quality of life of preschool children". *Community Dentistry and Oral Epidemiology* 39.2 (2011): 105-114.

2. Naidu R., *et al*. "Oral health-related quality of life and early childhood caries among preschool children in Trinidad". *BMC Oral Health* 16.1 (2016): 128.

3. Filstrup SL., *et al*. "Early childhood caries and quality of life: child and parent perspectives". *Pediatric Dentistry* 25.5 (2003): 431-440.

4. Ferreira MC., *et al*. "Dental caries and quality of life of preschool children: discriminant validity of the ECOHIS". *Brazilian Oral Research* 31 (2017): e24.

5. Folayan M and Olatubosun S. "Early Childhood Caries - A diagnostic enigma". *European Journal of Paediatric Dentistry* 19.2 (2018): 88.

6. Casamassimo PS., *et al*. "Beyond the dmft: the human and economic cost of early childhood caries". *Journal of the American Dental Association* 140.6 (2009): 650-657.

7. Righolt AJ., *et al*. "Global-, regional-, and country-level economic impacts of dental diseases in 2015". *Journal of Dental Research* 97.5 (2018): 501-507.

8. BaniHani A., *et al*. "The impact of dental caries and its treatment by conventional or biological approaches on the oral health-related quality of life of children and carers". *International Journal of Paediatric Dentistry* 28.2 (2017): 266-276.

9. Chrisopoulos S and Harford JE. "Oral Health and Dental Care in Australia: Key Facts and Figures 2015". Canberra, ACT, Australia: Australian Institute of Health and Welfare and the University of Adelaide (2016).

10. "American Academy of Pediatric Dentistry: Policy on Early Childhood Caries (ECC): Classifications, Consequences, and Preventive Strategies". *Pediatric Dentistry* 38.6 (2016): 52-54.

11. Hollister MC and Weintraub JA. "The association of oral status with systemic health, quality of life, and economic productivity". *Journal of Dental Education* 57.12 (1993): 901-912.

12. Fass. E.N. "Is bottle feeding of milk a factor in dental caries?" *Journal of Dentistry for Children* 29 (1962): 245-251.

13. Shelton PG., *et al*. "Nursing bottle caries". *Pediatrics* 59.5 (1977): 777-778.

14. Tsamtsouris A., *et al*. "Dental education of expectant parents". *Journal of Pedodontics* 10.4 (1986): 309-322.

15. Horowitz AM. "Response to Weinstein: public health issues in early childhood caries". *Community Dentistry and Oral Epidemiology* 26.1 (1998): 91-95.

16. Loesche WJ., *et al*. "Association of Streptococcus mutans with human dental decay". *Infection and Immunity* 11.6 (1975): 1252-1260.

17. Teng F., *et al*. "Prediction of early childhood caries via spatial-temporal variations of oral microbiota". *Cell Host and Microbe* 18.3 (2015): 296-306.

18. Caufield PW., *et al*. "Initial acquisition of mutans streptococci by infants: evidence for a discrete window of infectivity". *Journal of Dental Research* 72.1 (1993): 37-45.

19. Berkowitz RJ., *et al*. "Maternal salivary levels of Streptococcus mutans and primary oral infection of infants". *Archives of Oral Biology* 26.2 (1981): 147-149.

20. Li Y., *et al*. "Mode of delivery and other maternal factors influence the acquisition of Streptococcus mutans in infants". *Journal of Dental Research* 84.9 (2005): 806-811.

21. Lai PY., *et al*. "Enamel hypoplasia and dental caries in very-low birthweight children: a case-controlled, longitudinal study". *Pediatric Dentistry* 19.1 (1997): 42-49.

22. Seow WK. "Biological mechanisms of early childhood caries". *Community Dentistry and Oral Epidemiology* 26.1 (1998): 8-27.

23. Wong PD., *et al*. "Total Breast-Feeding Duration and Dental Caries in Healthy Urban Children". *Academic Pediatrics* 17.3 (2017): 310-315.

24. Sheiham A and James WP. "Diet and dental caries: the pivotal role of free sugars reemphasized". *Journal of Dental Research* 94.10 (2015): 1341-1347.

25. Shantinath SD., *et al*. "The relationship of sleep problems and sleep-associated feeding to nursing caries". *Pediatric Dentistry* 18.5 (1996): 375-378.

26. Chen H., *et al*. "Insufficient sleep and incidence of dental caries in deciduous teeth among children in Japan: a population-based cohort study". *Journal of Pediatrics* 198 (2018): 279-286.

27. Kraljevic I., *et al*. "Risk indicators of early childhood caries (ECC) in children with high treatment needs". *Swiss Dental Journal* 127.5 (2017): 398-410.

28. Chaffee BW., *et al*. "Oral health-related quality-of-life scores differ by socioeconomic status and caries experience". *Community Dentistry and Oral Epidemiology* 45.3 (2017): 216-224.

29. Begzati A., *et al*. "Mothers' behaviours and knowledge related to caries experience of their children". *Oral Health and Preventive Dentistry* 12.2 (2014): 133-140.

30. Meyer F., *et al*. "Sociodemographic determinants of spatial disparities in early childhood caries: an ecological analysis in Braunschweig, Germany". *Community Dentistry and Oral Epidemiology* 45.5 (2017): 442-448.

31. Prakash P., *et al*. "Prevalence of early childhood caries and associated risk factors in preschool children of urban Bangalore, India: A cross-sectional study". *European Journal of Dentistry* 6.2 (2012): 141-152.

32. Johansson I., *et al*. "Salivary flow and dental caries in Indian children suffering from chronic malnutrition". *Caries Research* 26.1 (1992): 38-43.

33. Narang R., *et al*. "Nutritional Status and Caries Experıence Among 12 to 15 Years Old School Going Children of Lucknow". *Journal of International Dental and Medical Research* 5.1 (2012): 30-35.

34. Ersin NK., *et al*. "Association of maternal-child characteristics as a factor in early childhood caries and salivary bacterial counts". *Journal of Dentistry for Children* 73.2 (2006): 105-111.

35. Ibrahim S., *et al*. "A longitudinal study of early childhood caries risk, dental caries, and life style". *Pediatric Dental Journal* 19.2 (2009): 174-180.

36. Jabbarifar SE., *et al*. "Association of parental stress and early childhood caries". *Dental Research Journal* 6.2 (2009): 65-70.

37. Mittal N., *et al*. "Methods of intracanal reinforcement in primary anterior teeth-assessing the outcomes through a systematic literature review". *International Journal of Clinical Pediatric Dentistry* 8.1 (2015): 48-54.

38. Clovis JB., *et al*. "Maryland dental hygienists' knowledge, opinions and practices regarding dental caries prevention and early detection". *American Dental Hygienists Association* 86.4 (2012): 292-305.

39. "Tooth eruption". *Journal of the American Dental Association* 137.1 (2006): 127.

40. Tavener JA., *et al*. "The prevalence and severity of fluorosis in children who received toothpaste containing either 440 or 1,450 ppm F from the age of 12 months in deprived and less deprived communities". *Caries Research* 40.1 (2006): 66-72.

41. Limeback H and Robinson C. "Comprehensive Preventive Dentistry". Hoboken, NY, USA: John Wiley and Sons, Ltd. Fluoride therapy (2012): 251-282.

42. Marinho VC., *et al*. "Fluoride gels for preventing dental caries in children and adolescents". *Cochrane Database of Systematic Reviews* 6 (2015): CD002280.

43. Milgrom PM., *et al*. "Fluoridated toothpaste for ECC: failure to meet the needs of our young". *Journal of the American Dental Association (1939)* 140.6 (2009): 628-631.

44. Weinstein P., *et al*. "Motivating mothers to prevent caries: confirming the beneficial effect of counseling". *The Journal of the American Dental Association* 137.6 (2006): 789-793.

45. Dorozhkin SV. "Calcium orthophosphates (CaPo4) and dentistry". *Bioceramics Development and Applications* 6.96 (2016): 1000096.

46. Schlagenhauf U., *et al*. "Microcrystalline hydroxyapatite is not inferior to fluorides in clinical caries prevention: a randomized, double-blind, non-inferiority trial". *bioRxiv* (2018).

47. Vozza I., *et al*. "Infant and child oral health risk status correlated to behavioral habits of parents or caregivers: A survey in central Italy". *Journal of International Society of Preventive and Community Dentistry* 7.2 (2017): 95-99.

48. Vos T., *et al*. "Global, regional, and national incidence, prevalence, and years lived with disability for 328 diseases and injuries for 195 countries, 1990-2016: a systematic analysis for the Global Burden of Disease Study". *The Lancet* 390.10100 (2016): 1211-1259.

49. Çolak H., *et al*. "Early childhood caries update: A review of causes, diagnoses, and treatments". *Journal of Natural Science, Biology, and Medicine* 4.1 (2013): 29-38.

50. Dye BA. "Trends in oral health status: United States 1988-1994 and 1999-2004. National Center for Health Statistics". *Vital and Health Statistics* 248 (2007): 1-92.

51. Yumiko Kawashita., *et al*. "Early childhood caries". *International Journal of Dentistry* (2011): 725320.

52. Skeie MS., *et al*. "Caries patterns in an urban preschool population in Norway". *European Journal of Paediatric Dentistry* 6.1 (2005): 16-22.

53. Database. "Database: dmft scores for 18-month-old and 3- year-old Japanese children" (2007).

54. Basner R., *et al*. "Epidemiologische Begleituntersuchungen zur Gruppenprophylaxe 2016". Bonn, Germany: DAJ-Deutsche Arbeitsgemeinschaft für Jugendzahnpflege e. V (2018).

55. Cariño KM., *et al*. "Early childhood caries in northern Philippines". *Community Dentistry and Oral Epidemiology* 31.2 (2003): 81-89.

56. Thitasomakul S., *et al*. "A longitudinal study of early childhood caries in 9-to 18-month-old Thai infants". *Community Dentistry and Oral Epidemiology* 34.6 (2006): 429-436.

57. Delhi N. Dental Council of India 2004. National Oral Health Survey and Fluoride Mapping. An epidemiological study of oral health problems and estimation of fluoride levels in drinking water (2002).

58. Virdi M. "Prevalence of severe early Childhood caries in pre-school children in Bahadurgarh, Haryana, India". *The Internet Journal of Epidemiology* 8.2 (2010).

59. Johnson NW. "Dental Caries: Markers of high and low risk groups and individuals". Cambridge University Press (1991).

60. Jain H and Agarwal A. "Current scenario and crisis facing dental college graduates in India". *Journal of Clinical and Diagnostic Research* 6.1 (2012): 1-4.

61. Vundavalli S. "Dental manpower planning in India: current scenario and future projections for the year 2020". *International Dental Journal* 64.2 (2014): 62-67.

62. Dagli N and Dagli R. "Increasing unemployment among Indian dental graduates-High time to control dental manpower". *Journal of International Oral Health: JIOH* 7.3 (2015): i.

63. Singh A and Purohit BM. "Addressing oral health disparities, inequity in access and workforce issues in a developing country". *International Dental Journal* 63.5 (2013): 225-229.

**Volume 18 Issue 4 April 2019**