

Incidence and Prevention of Childhood Dental Caries-a review

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Abstract

Dental health problems are more common among the children and adolescent. A number of causes are behind it. Early childhood caries also calls baby bottle caries. Early childhood caries (ECC) is the presence of one or more decayed (non-cavited or cavited lesions), missing (due to caries) or filled tooth surface in any primary tooth in a preschool -age child as defined by- American Dental Association(ADA) and the term "severe Early childhood Caries (SECC) "refers to "Atypical" or "progressive" or "acute" or "rampant" patterns of dental caries. The severe early childhood caries (s-ECC) is due to low frequency and improper tooth brushing. Children of breast feed longer than one year and bottle feed containing carbohydrates specially at night are more affected. In low-income families, who consume snacks in high amount, bottle with sweetened drinks other than milk or water are more suffer. Early childhood caries (ECC) evolve with the factors like age at start of brushing, lack of proper tooth brushing, Parental attitudes toward children's oral health, plaque on primary incisors at 1 year of age, over weight and obesity, Frequent consumption of cariogenic foods and bacterial infection, Feeding practices in the first year of life, not using of dental floss and presence of S. Mutans, Lacto-bacilli etc. Ethnic minority groups are also sufferer. Four predisposing risk factors are related to ECC- child's age, gender, age at weaning, and frequency of sweet drinks. Tooth brushing awareness among the children, Socio-economic upliftment, cultural and behavioural changes, Parental education, feeding practice, weaning at proper age, maintenance of oral hygiene, treatment of bacterial infection are essential for primary prevention of early childhood dental caries. Secondary prevention needs proper diagnosis and appropriate restorative treatment. Treatment modalities varies from severity of disease; temporary, permanent filling, crowning, root canal and treatment of complications.

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Introduction

Dental caries is an important bacterial infectious disease of childhood as well as adolescent in all over the world. It is a destructive process causing decalcification of tooth enamel and dentin; subsequently cavitations occur on tooth which is known as tooth decay. Early childhood caries (ECC) defined by American Dental Association (ADA) as the presence of one or more decayed (non-cavited or cavited lesions) , missing (due to caries) or filled tooth surface in any primary tooth in pre-school age children (birth to 71 months of age). Early childhood caries also known as baby bottle caries. The term "severe early childhood caries" (S-ECC) refers to "Atypical" or "Progressive" or "Acute" or "Rampant" patterns of dental caries. ECC is a significant public health problem in selected population as well as general population stated ADA. Dental caries is endemic and a high prevalence found in minority and rural population. 56% of ECC was evident in a study¹; ECC and S-ECC were 56.5% and 47%

respectively in Korean study². 42% children had caries in their primary teeth³. Prevalence of caries in school- age children was 60-90% - WHO report on 2003 in oral health. Center for Disease Control and Prevention (CDC) stated in 2005 that 27% caries found in pre-scholars, 42% in school aged and 91% in adult. Decayed Missing and Filled Teeth (DMFT) is an indicator which indicates severity of caries

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Dental caries is widely prevalent in Latin American countries, Middle East, South Asia and also in China¹². It is not only a public health problem in Bangladesh but world wide pandemic. Objective of this study to knowledge building among the parents and caregivers of children about dental caries causation and to prevent (primary prevention) it due to their own efforts by practicing good oral hygiene, dietary modification, improvement of socio-demographic condition, change of behaviour and enable them to decide to take treatment of caries and its complications.

Causes

Causes of dental caries are multi-factorial¹³. Low frequency and improper tooth brushing methods, age at start of tooth brushing, time of tooth brushing are associated with severe early childhood caries (s-ECC)¹⁴⁻¹⁶. A high percent of caries develop in children those who are breast fed for a longer period (more than 1 year), bottle containing carbohydrates over night or allowed to sip from a bottle either going to sleep or more like to be bottle feed to sleep or during day^{13,17}. Prevalence of S-ECC is high among children who have high consumption of snacks¹⁸, daily use of bottle with sweetened drinks, sugar containing drinks in between meals¹⁹⁻²². A predictive probability of sensitivity and specificity are significantly high among the children those who use sweetened milk in bottle, increase frequency of consumption of soft drinks, increase frequency of intake sweets²³. Frequent consumption of cariogenic foods, presence of bacterial infection, presence of specific type of bacteria such as streptococcus Mutans (s-Mutan) and lacto-bacilli (LB) produce lactic acid in presence of fermentable carbohydrates such as sucrose, fructose, and glucose. S-mutans and lacto-bacilli are correlated with plaque presence and proximal caries and smooth surface caries significantly associated with Occlusal caries^{22,24-27}. White spot lesion is a risk indicator of high caries level at base line (HCLB)²⁸. Early feeding practices, intake of fluoride from water, presence of fluorosis are the risk factors for caries²⁹⁻³¹. Low socio-economic status,

fatalistic oral health beliefs and religiosity are significant determinants of early childhood caries (ECC) and S-ECC^{20,32-35}. There is strong relationship between caries in early childhood and proximal caries prevalence in the posterior teeth at 15 years of age. Parent's attitudes to dental health, psychosocial factors during early childhood have an effect on approximal caries in 15-year-old. Plaque on primary incisors at 1 year of age and infrequent tooth brushing at 3 years of age associated with a high caries experience at 15 years. Adolescents with overweight and obesity had significantly associated with higher proximal caries prevalence than those of normal weight³⁶. Cultural³⁷ affect on the dental habits of the children, not use of dental floss, child's age, gender and age at weaning are related to a significant increase in the risk for caries^{22,38,39}. The poorest oral hygiene and highest level of gingivitis, large family size are associated with dental caries of school children^{40,41}. Medical conditions that reduce the amount of saliva such as Sjogren's syndrome, diabetes mellitus, diabetes insipidus and sarcoidosis⁴² and Medications such as antihistamines, antidepressants, methylamphetamine, Tetrahydrocannabinol can also impair salivary flow which enhance the development of caries. Radiation therapy of head, neck may also damage the cells in salivary glands causing less saliva flow, consequently increase the likelihood of caries formation⁴³. The use of tobacco, smokeless tobacco may also increase the risk for caries formation by causing gingiva to recede⁴⁴⁻⁴⁷. Pregnant and neonatal lead exposure and all atoms with electrical charge and ionic radius similar to bivalent calcium, cadmium promote tooth decay⁴⁸⁻⁵⁵.

Sign/symptoms: Earliest sign is the appearance of a chalky white spot on the surface of the tooth which is known as an incipient carious lesion or "micro cavity"⁵⁶. It turns brown but will eventually turn into a cavitation. Cavity appears more visible as enamel and dentin are destroyed. Once the decay passes through enamel, the dentinal tubules, which have passages to the nerve of the tooth, become exposed resulting in

toothache. Pain may worsen with exposure to heat, cold, or sweet foods and drinks (information from medline plus). It causes bad breath and foul tastes. Infection can spread to surrounding tissues and causes abscess, Ludwig's angina⁵⁷ and Cavernous sinus thrombosis (CST)^{46,47} are life threatening complication of dental caries^{46,57}.

Prevention of Dental Caries

All levels of prevention such as primary, secondary and tertiary preventions are possible to reduce the prevalence and its consequences.

Primary prevention: Causes of dental caries are multifactorial^{13,58}. For prevention, holistic approaches are needed in socio-economic, cultural, behavioral and educational aspects. In socio economic approach; economic⁵⁹ upliftment, family planning⁴⁵, high level of mother's education^{59,60,61} help in this regard. Cultural²⁸, ritual beliefs should be eliminated. In behavioral aspect; Proper breast feeding practice important. It should not be Less frequent and no longer period and it should be timely. Child should not bottle feed with sweet drinks other than milk or water. Children should not be rewarded with sweetened and chocolate. Bottle containing sugary or sweet beverage consumption at night, daily intake of sugar containing drinks with greater frequency, Snacks in between meal, cariogenic foods at greater frequency should be prohibited. Frequency of tooth brushing is important. It should not lesser frequent and at least two⁶⁰ or more times after meal with proper method, flossing (information from Int.net) daily help to remove and prevent plaque formation. Oral hygiene such as mouth wash, water picks also help in this regard. Children usually are not habituated with tooth brushing. For habit formation of tooth brushing, it should kept in mind the following factors; tooth brushing at ages one to three, "motive for starting tooth brushing", "frequency of tooth brushing per day on the average", "co-operative of the child towards its mother's help", "positive attitude towards tooth brushing", "experienced guidance in tooth brushing from mother", "experienced guidance

in tooth brushing from a dentist⁴². Maintenance of proper oral hygiene, avoidance of over night bottle feeding, stopping eating sweets, treatment of gingivitis and S.Mutans (which prevents lactic acid formation and subsequently prevents demineralization of enamel, dentin and cementum)⁶². Maintenance of normal body weight³⁷, use of dental floss, weaning at appropriate age, removal of plaque, rinsing, start of tooth brushing at the age of two, help the prevention of dental caries in great extend. Mother should not share utensils and cups and caregiver also should not kiss the children to prevent transferring bacteria from mouth of mother and caregivers⁶³. Use of dental sealants⁶⁴ prevent tooth decay. calcium containing foods like milk, vegetable also can prevent tooth decay. It is important to give proper feeding instruction and hygiene education to the parents. Children are examined once every two months. They should be received supervised professional topical fluoride treatment⁴⁰.

Secondary prevention: Diagnosis can be made on clinical inspection and sometimes dental x-ray or laser which helps in detecting cavities easily. Usually dental caries does not need emergency medical care unless become painful. Pain relievers and suitable antibiotics should be prescribed when there is toothache and infection. It needs removing the decayed material with a drill⁶⁵ and filling⁵⁸ the resulting hole with a stable dental material. Tooth filling may be temporary or permanent.

Temporary filling: Temporary tooth filling is done when patients feel pain with cold liquids, foods, tongue or even cold air touches in the affected area. A filling is basically a way to repair a decay or cavity of tooth with materials such as porcelain, gold, composite resin, amalgam⁵⁸ zinc oxide and eugenol. While performing it, decayed area is removed and adjacent area is cleaned and then fills in the voided area with a special material that will cater to the shape and form of the tooth. Filling⁵⁸ prevents further decay as it close the opening area through where pathogen do not enter into inside.

Permanent filling: Permanent filling is done when a crown is displaced or a Temporary tooth filling is lost. Permanent filling is used in Permanent class III (Mesial or distal Major restorative), class V (Mesial or distal involving incisive edge) restorations and small class fillings, Restoration of deciduous teeth especially class I (Occlusal which is preventive), Primary teeth fillings, Fissure sealing, Fillings of cervical erosions, Core-Buildups, Fillings prior to crown preparation (information from int-net, page accessed nov.30, 2013).

Root canal: Root canal treatment⁶⁶ procedure can be performed in vital (living) tooth or in non-vital (non living) tooth. When a patient complains of severe toothache due to decay or when a patient meets with an accident, root canal treatment is indicated to save or repairing the teeth before they get to stage of removing. The most important step, before starting the treatment is proper clinical diagnosis, which is based on the subjective as well as objective symptoms. The initial subjective information is supplied by the written medical history form, which is completed by the patient. Further information is gathered by the clinician (objective symptoms) like patients chief complaint, past medical history, past dental history, current medical and dental status. The best treatment is prevention; one should place a pulp protective base under all deep fillings (restorations). Application of zinc oxide eugenol as a temporary sedative filling⁵⁸ can be done, normally pain disappears, if the pain persists, the pulp should be removed. If the part of the tooth remain intact but pulp is decay inside the tooth; in this case root canal treatment is needed. In case of acute irreversible pulpitis, nerve or pulp tissue of a primary or permanent tooth infected, treatment is needed to prevent dental abscess and loss of tooth. Two methods are used in treating dental nerve tissue infection are pulpotomy and pulpectomy⁶⁷.

Crown⁶⁵: The reasons for making that suggestion can vary from case to case. Some of the indications for a crown are a previously

filled tooth where there now exists more filling. The existing tooth structure becomes weakened and can no longer support the filling. If the cavity is large, filling is not enough to support the tooth; in this case, artificial crown is done. Extensive damage by decay, Discoloration and compromised aesthetics, Fractures, Root canal - After root canal, teeth tend to become brittle and are more apt to fracture. They therefore need to be protected by a crown. Bridges - When missing teeth are replaced with a bridge, the adjacent teeth require crowns in order to support the replacement teeth. Crowns strengthen and protect the remaining tooth structure and can improve the appearance of teeth. Crowns can be made from different materials, which include the full porcelain crown, the porcelain fused-to-metal crown and the all-metal crown⁶⁵.

Treatment of abscess: A periodontal abscess if occurs should be drained. Infected tissue can be removed by surgical curettage, and then the root surfaces thoroughly debrided and patient is treated with suitable antibiotics⁵⁷.

Treatment of Ludwig's angina: it is also known as angina Ludovici; a potentially life threatening complication. In that case patient is advised to immediate admission into a hospital for procurement of a sample for culture and sensitivity to treat with suitable antibiotics. Patient needs tracheotomy for securing the airway and drainage of swelling to reduce pressure⁵⁷.

Cavernous sinus thrombosis (CST)⁴⁶: A rare, life threatening complication. If occurs; patient must be hospitalized. Diagnosis is made by CT scan and MRI. Patient to be treated with suitable antibiotics intravenously and surgical intervention for drainage of fluids from brain (information from webmed, page accessed on Nov.24.2013).

Tertiary prevention: artificial denture is to be done in cosmetic purpose according to the desire of patient.

Conclusion

Low-frequency and improper tooth brushing methods, Bottle containing sugary or sweet beverage consumption at night, improper weaning, presence of *S.mutans* are associated with S-ECC. The care giver's brushing frequency is a risk indicator associated with the children's poor oral hygiene. Several maternal cognitive, behavioral, and psychosocial factors are associated with young children's brushing practices. Preventive measures may successfully arrest ECC and thereby avoid invasive procedures. The poor oral hygiene practices, lack of parental guidance, inappropriate dental health knowledge with frequent exposure to cariogenic foods in addition to socio-demographics are the main risk factors for dental decay among the children.

Reference

1. Tsai AI, Chen CY, Li LA, Hsiang CL, Hsu KH. Risk indicators for early childhood caries in Taiwan. *Community Dent Oral Epidemiol.* 2006; 34(6):437-45.
2. Jin BH, Ma DS, Moon HS, Paik DI, Hahn SH, Horowitz AM. Early childhood caries: prevalence and risk factors in Seoul, Korea. *J Public Health Dent.* 2003; 63(3):183-8.
3. Dental caries (Tooth Decay) in Children (Age 2 to 11). National Institute of Dental and Craniofacial Research. page accessed Nov.30,2012
4. Ullah MS, Aleksejuniene J, Eriksen HM. Oral health of 12-year-old Bangladeshi children. *Acta Odontol Scand.* 2002; 60(2):117-22.
5. Peng B, Petersen PE, Fan MW, Tai BJ. Oral Health Status and oral health behaviour of 12 year-old urban school children in the people's of republic of china. *Dent community health.* 1997; 14(4):238-44.
6. Wang HY, Petersen PE, Bian JY, Zhang BX. The second national survey of oral Health Status of children and adults in China. *Int.dent.J.* 2002; 52(4):283-90.
7. Varenne B, Petersen PE, Ouattara S. Oral health status of children and adults in urban and rural areas of Burkina Faso, Africa. *Int Dent J.* 2004; 54(2):83-9.
8. Van Palenstein Helderman WH, Joarder MA, Begum A. Prevalence and severity of periodontal diseases and dental care in Bangladesh. *International Dental Journal.* 1996; 46(2):76-81.
9. Arvidson Bufano UB, Holm AK. Dental Health in Urban and Rural areas of Central and Western Bangladesh. *Odontostomatol trop.* Sep 1990; 13(3): 81-6.
10. Gray M, Morris AJ, Davies J. The Oral Health of South asian five year old children in deprived areas of Dudley compared with white children of equal deprivation and fluoridation status. *Community Dental Health.* 2000 Dec; 17(4): 243-5.
11. Jose B, King NM. Early childhood caries lesions in preschool children in Kerala, India. *Pediatr Dent.* 2003; 25(6):594-600.
12. The world oral Health Report 2003. Continuous improvement of oral health in the 21st century-the approach of the WHO Global Oral Health Programme, released by the World Health Organization. (file in pdf format). (accessed Nov.20,2013).
13. Slabsinskiene E, Milciuviene S, Narbutaite J et al. Severe early childhood caries and behavioral risk factors among 3-year-old children in Lithuania. Source: Department of Oral Health and Pediatric Dentistry, Kaunas University of Medicine, J. Luksos-Daumanto 6, Kaunas, Lithuania. egleslabsinskiene@yahoo.com
14. Hsieh HJ, Huang ST, Tsai CC, Hsiao SY. Tooth brushing Habits and Risk Indicators of Severe Early Childhood Caries among Aboriginal Taiwanese. *Asia Pac J Public Health.* 2012 Mar 16;
15. Luli-Duki O, Juri H, Duki W, Glavina D. Factors predisposing to early childhood caries (ECC) in children of pre-school age in the city of Zagreb, Croatia. *Coll Antropol* 2001; 25(1):297-302.
16. Albertsson KW, van Dijken JW. Awareness of tooth brushing and dentifrice habits in regularly dental care receiving adults. *Swed Dent J.* 2010; 34(2):71-8.
17. Spitz AS, Weber-Gasparoni K, Kanellis MJ, Qian F. Child temperament and risk factors for early childhood caries. *J Dent Child (Chic).* 2006 ; 73(2):98-104.
18. Hashim R, Williams S, Thomson WM. Severe early childhood caries and behavioural risk indicators among young children in Ajman, United Arab Emirates. Source: Growth and Development Department, Ajman University of Science and Technology, Ajman, UAE. ragd69@yahoo.co.nz .pageAccessed Mar 9, 2012.

19. Martens L, Vanobbergen J, Willems S, Aps J, De Maeseneer J. Determinants of early childhood caries in a group of inner-city children. *Quintessence Int.* 2006; 37(7):527-36.
20. Jin BH, Ma DS, Moon HS, Paik DI, Hahn SH, Horowitz AM. Early childhood caries prevalence and risk factors in Seoul, Korea. *J Public Health Dent.* 2003; 63(3):183-8.
21. Vanobbergen J, Martens L, Lesaffre E, Bogaerts K, Declerck D. Assessing risk indicators for dental caries in the primary dentition. *Community Dent Oral Epidemiol.* 2001; 29(6):424-34.
22. Olmez S, Uzami M, Erdem G. Association between early childhood caries and clinical, microbiological, oral hygiene and dietary variables in rural Turkish children. *Turk J Pediatr.* 2003; 45(3):231-6.
23. al Ghanim NA, Adenubi JO, Wyne AA, Khan NB. Caries prediction model in pre-school children in Riyadh, Saudi Arabia. *Int J Paediatr Dent.* 1998; 8(2):115-22.
24. Palmer CA, Kent R Jr, Loo CY et al. Diet and caries-associated bacteria in severe early childhood caries. *J Dent Res.* 2010; 89(11):1224-9. Epub 2010 Sep 21.
25. Chedid NR, Bourgeois D, Kaloustian H, Baba NZ, Pilipili C. Caries prevalence and caries risk in a sample of Lebanese preschool children. *Odontostomatol Trop.* 2011; 34(134):31-45.
26. Hardie JM (May 1982). "The microbiology of dental caries" *Dent Update* 9 (4):199-200, 202-4, 206-8.
27. Rogers AH (editor). (2008). *Molecular Oral Microbiology*. Caister Academic Press. ISBN 978-1-904455-24-0.
28. Tagliaferro EP, Ambrosano GM, Meneghim Mde C, Pereira AC. Risk indicators and risk predictors of dental caries in schoolchildren. *J Appl Oral Sci.* 2008; 16(6):408-13.
29. Feldens CA, Giugliani ER, Vigo A, Vtolo MR. Early feeding practices and severe early childhood caries in four-year-old children from southern Brazil: a birth cohort study. *Caries Res.* 2010; 44(5):445-52. Epub 2010 Sep 13.
30. Mariri BP, Levy SM, Warren JJ, Bergus GR, Marshall TA, Broffitt B. Medically administered antibiotics, dietary habits, fluoride intake and dental caries experience in the primary dentition. *Community Dent Oral Epidemiol.* 2003; 31(1):40-51.
31. Mascarenhas AK. Oral hygiene as a risk indicator of enamel and dentin caries. *Community Dent Oral Epidemiol.* 1998; 26(5):331-9.
32. Uribe S. Early childhood caries--risk factors. *Evid Based Dent.* 2009; 10(2):37-8. Source: School of Dentistry, Universidad Austral de Chile, Valdivia, Chile. (Access 7 Mar 2012).
33. Ismail AI, Lim S, Sohn W, Willem JM. Determinants of early childhood caries in low-income African American young children. *Pediatr Dent.* 2008; 30(4):289-96.
34. Vachirarojpisan T, Shinada K, Kawaguchi Y, Laungwechakan P, Somkote T, Detsomboonrat P. Early childhood caries in children aged 6-19 months. *Community Dent Oral Epidemiol.* 2004; 32(2):133-42.
35. Jose B, King NM. Early childhood caries lesions in preschool children in Kerala, India. *Pediatr Dent.* 2003; 25(6):594-600.
36. Alm A. On dental caries and caries-related factors in children and teenagers. *Swed Dent J Suppl.* 2008; (195):7-63.
37. King NM, Wu II, Tsai JS. Caries prevalence and distribution, and oral health habits of zero-to four year-old children in Macau, China. *J Dent Child (Chic).* 2003; 70(3):243-9.
38. Honkala S, Honkala E, Al-Sahli N. Do life- or school-satisfaction and self-esteem indicators explain the oral hygiene habits of schoolchildren? *Community Dent Oral Epidemiol.* 2007; 35(5):337-47.
39. Bray KK, Branson BG, Williams K. Early childhood caries in an urban health department: an exploratory study. *J Dent Hyg.* 2003 Fall; 77(4):225-32.
40. Barenie JT, Leske GS, Ripa LW. The effect of tooth brushing frequency on oral hygiene and gingival health in school children: reassessment after two and one-half years. *J Public Health Dent.* 1976; 36(1): 9-16.
41. Levine RS, Nugent ZJ, Rudolf MC, Sahota P. Dietary patterns, tooth brushing habits and caries experience of schoolchildren in West Yorkshire, England. *Community Dent Health.* 2007; 24(2):82-7.
42. Neville, B.W, Douglas Damm, Carl Allen, Jerry Bouquot. "Oral & Maxillofacial Pathology." 2nd edition, 2002, p. 398. ISBN 0-7216-9003-3.
43. Oral Complications of Chemotherapy and Head/Neck Radiation, hosted on the National Cancer Institute. (accessed January 8, 2007).
44. Neville, B.W., Douglas Damm, Carl Allen, Jerry Bouquot. "Oral & Maxillofacial Pathology." 2nd edition, 2002, p. 347. ISBN 0-7216-9003-3.
45. Tobacco Use Increases the Risk of Gum Disease, hosted on the American Academy of Periodontology. (accessed september7, 2012).

46. Banting, D.W. "The Diagnosis of Root Caries." Presentation to the National Institute of Health Consensus Development Conference on Diagnosis and Management of Dental Caries Throughout Life, in pdf format, hosted on the National Institute of Dental and Craniofacial Research, p. 19. Page (accessed september2, 2012).
47. Executive Summary of U.S. Surgeon General's report titled, "The Health Consequences of Smoking: A Report of the Surgeon General," hosted on the CDC website, p. 12. (accessed september7, 2012).
48. Brudevold F, Steadman LT (1956). "The distribution of lead in human enamel". *J Dent Res* 35 (3): 430-437.
49. Brudevold F, Aasenden R, Srinivasian BN, Bakhos Y (1977). "Lead in enamel and saliva, dental caries and the use of enamel biopsies for measuring past exposure to lead.". *J Dent Res* 56 (10): 1165-1171.
50. Goyer RA (1990). "Transplacental transport of lead". *Environ Health Perspect (Brogan & #38)* 89:101-105.
51. Moss ME, Lamphear BP, Auinger P (1999). "Association of dental caries and blood lead levels". *JAMA* 281 (24): 2294-2298.
52. Campbell JR, Moss ME, Raubertas RF (2000). "The association between caries and childhood lead exposure". *Environ Health Perspect (Brogan & #38)* 108 (11): 1099-1102.
53. Gemmel A, Tavares M, Alperin S, Soncini J, Daniel D, Dunn J, Crawford S, Braveman N, Clarkson TW, McKinlay S, Bellinger DC (2002). "Blood Lead Level and Dental Caries in School-Age Children". *Environ Health Perspect* 110 (10): A625-A630.
54. Billings RJ, Berkowitz RJ, Watson G (2004). "Teeth". *Pediatrics* 113 (4): 1120-1127. PMID 15060208.
55. Leroy N, Bres E. (2001). "Structure and substitutions in fluorapatite.". *Eur Cell Mater.* 2: 36-48. PMID 14562256. page accessed Nov.16,2013
56. Richie S king (Nov.28.2011); mA closer look at teeth may more filling. The new York Times. page (accessed Nov.18,2013).
57. Richard W, Hartmann JR, M.D. Halifax Medical center-Datona, Florida; Ludwig's Angina in children. *Am Fam Physician.* 1999 July; 60(1):109-112.
58. Douglas Bratthall, Poul Erik Petersen, Jayanthi Ramanathan Stjernswärd, and L. Jackson Brown. Aspects of treatment of cavities of caries disease from disease contron priorities in Developing Countries. 2nd edition. Chapter 38, Oral and Craniofacial Diseases and Disorders. (accessed Nov.28,2013).
59. Lisa boge christensen, Svante Twetman, Annette Sundby. Oral Health in children and adolescents with different Socio-cultural and socio-economic backgrounds. *Acta odontologica Scandinavica.* January 2010; 68: No.1, 34-42.
60. Elaine Pereira da Silva Tagliaferro, Glácia Maria Bovi Ambrosano, Marcelo de Castro Meneghim, Antonio Carlos Pereira. Risk indicators and risk predictors of dental caries in schoolchildren. *J. Appl. Oral Sci.* ISSN 1678-7757, 16: no.6 Bauru Nov./Dec. 2008.
61. Tagliaferro EPS, Pereira AC, Meneghim MC, Ambrosano GMB. Assessment of dental caries predictors in a seven-year longitudinal study. *J Public Health Dent.* 2006; 66: 169-73.
62. Holloway PJ, Moore WJ. (Sept.1983) "The role of Sugar in the etiology of dental caries". *J Dental II* (3);189-213.
63. Guideline on infant oral health care. American academy of paediatric Dentistry website. page (accessed Nov.20,2013).
64. Mejarl et al. caries-preventive effect of fissure sealants: A systematic review. *Acta Odontol scand.* 2003; 61(6):321- 30.
65. Abdul Arif Khan, Sudhir K. Jain, and Archana Shrivasta., Prevalence of Dental Caries among the Population of Gwalior (India) in Relation of Different Associated Factors. *Eur J Dent.* 2008 April; 2: 81- 85.
66. Dr. Komal Jain & Associates , DMD. Root Cannel Treatment; countryside Dental clinic. also available in www.drjaindentistry.com/services/root-cannel-treatment. page accessed Nov.30,2013
67. Pulpotomy and Pulpectomy in Children sept 19, 2005-Pediatric Dental Health - dentalresource.org/topic58pulpotomypulpectomy.html; page accessed Nov.302013