Passive Smoking and Dental Caries in Children: A Review

Majedah A. Al-Homaidhi

Department of Pediatric Dentistry & Orthodontic, College of Dentistry, King Saud University, Riyadh, Saudia Arabia
malhomaidhi@ksu.edu.sa

Abstract: Dental caries is an infectious, communicable and multi-factorial disease. Various factors may influence the disease process. Behavioral factors such as poor oral hygiene and the consumption of sugar-containing snacks are significant factors in caries lesion initiation. Several recent studies have suggested a connection between dental caries and parental smoking, especially with maternal smoking. Children are the most susceptible group for the effect of passive smoke because their bronchial tubes are smaller and their immune systems are less developed. They also breathe faster and thus take in more harmful chemicals per kilogram of body weight than adults. Also, it has been shown dose–response relationships between the extent of smoking by parents and the salivary or plasma Cotinine level in children, therefore, the purpose of this review is to summaries the results of various epidemiological studies, and to determine if the Environmental Tobacco Smoke (ETS) affects the development of dental caries in children.

To cite this article
[Al-Homaidhi, M., A. (2017). Passive Smoking and Dental Caries in Children: A Review. *The Journal of Middle East and North Africa Sciences*, 3(5), 20-23]. (P-ISSN 2412- 9763) - (e-ISSN 2412-8937). www.jomenas.org**. 5**

Keywords: passive, smoke, caries, children**.**

1. Introduction:

During pregnancy, maternal smoking is associated with increased risk of miscarriage, premature labor, lower birth weight, prenatal mortality, poor infant growth and reduced educational attainment (Royal College of Physicians 1992; Poswillo 1998). If parents continue to smoke after their child's birth, the child is at great risk of sudden infant death syndrome, respiratory infection, asthma, shorter stature, and later may have a predisposition to develop chronic obstructive pulmonary disease and cancer (DiFranza et al., 1996; DiFranza et al., 2004).

In dental literature, there is an increase in the awareness of the role of smoking on the prevalence of oral pre-cancerous and cancerous diseases (Bergestrom, 2004; Baljoon et al., 2005). Evidence also suggests that cigarette smoking adversely influences periodontal health (Haber, 1994). Various studies have reported an association between smoking and alveolar bone loss, as well as the prevalence and severity of periodontitis (Haber & Kent, 1992; Kumar et al., 2011).

The tobacco smoke released into the ambient atmosphere contains over than 4000 chemicals, which is reasonable to assume that passive smoking may also affect human health including oral health (Florek et al., 2003). Pre-school children, due to their developing body defense may be at greater risk. Some studies have examined the relationship between passive smoking and oral health in pre-school children-3 to 5 years old- and have hypothesized that there may be a relation between passive smoking and oral health regardless of other factors such as oral hygiene, diet and socioeconomic status (Aligne et al., 2003; Billings et al., 2004; Tanaka et al., 2006). In addition, Environmental Tobacco Smoke (ETS) has immunosuppressive properties which are a known risk factor for infections of the cranial organ. Thus, it is not surprising that it would be a risk factor for dental caries development which is an oral infectious disease (Edwards et al., 1999). Therefore, the purpose of this review is to summaries the results of various epidemiological studies, and to determine if the ETS affects the development of dental caries in children.

2. Caries and Smoking:

Dental caries is one of the most common chronic infectious childhood diseases (US Department of Health and Human Services, 2000). The prevalence of dental caries in preschool children in Riyadh is 69% (Al-Meedani & Al-Dlaigan, 2016). It has been documented that maternal smoking associated with dental caries in children 5-12 years old (Bolin et al., 1996). Exposure to ETS has also been associated with an increased risk of dental caries in pre-school children (Williams et al., 2000; Shenkin et al., 2004; Avsar et al., 2009; Tanaka et al., 2015). Tanaka et al. found that maternal smoking during pregnancy without subsequent postnatal ETS exposure at home was independently associated with an increased prevalence of dental caries. Formation and mineralization of deciduous teeth usually begin at the 13th week of gestation and are completed at the end of the first year of life. An animal study demonstrated that the offspring of nicotine-injected mice appeared to have retarded

formation and mineralization of dentin and enamel, and the resulting irregularities of tooth surface might play an important role in colonization of cariogenic bacteria (Tanaka et al., 2009).

The possible association of dental caries with parental smoking may be explained via three pathways. ETS has been reported to have effects on the infectious process of Streptococcus Mutans (SM) (Kum-Nji et al., 2006). Alternatively, smoker parents may exhibit poorer oral health behaviors themselves than non-smoker parents, and have more dental caries, resulting in greater chances of vertical transmission of SM to their children. Smoker parents may also exhibit poorer behavior in terms of dental care of their children (Kohler et al., 1988). Passive smoke also results in medical conditions where the condition or its treatment may result in high incidence of dental caries in children; for example, Rhinitis may cause mouth breathing, resulting in dry mouth and increased caries susceptibility (Aligne et al., 2003).

Cotinine, a primary metabolite of nicotine, has a much longer half-life (about 18-20 hours) than nicotine (about 2 hours), resulting in higher and more stable plasma concentrations. According to Lindemeyer et al. nicotine promotes the growth of cariogenic SM, thus smoker parents are more likely than non-smokers to transmit these bacteria to their children (Lindemeyer et al., 1981).

Nicotine also might interfere with normal cellular maturation and normal inductive powers of dental papillae, the enamel organ, and subsequent odontogenesis. Smoking during pregnancy exposes the fetus to numerous chemical toxins including nicotine resulting in hypoplasia or hypomineralization of deciduous teeth (Yanagita et al., 2008). The deciduous teeth with such defects are at higher risk for dental caries (Elfrink et al., 2010).

3. The Effects of Passive Smoke on Saliva

Although the association between passive smoking and caries has been accepted in the literature, its relationship with the composition of saliva is unclear. Saliva plays a major role in oral health and any changes in its quantity or quality may alter the oral health status. A study by Avsar et al. (2009) found that pre-school children exposed to passive smoke have lower secretory IgA and Vitamin C, higher amylase activity and sialic acid level than children not exposed to passive smoke. The reduced level of IgA due to immunosuppressive effects of passive smoke results in aggregation of bacteria and dental caries.

Salivary amylase may play an important role in the colonization and metabolism of streptococci, leading to the formation of dental plaque and caries. It is a constituent of the acquired pellicle and could, therefore, be available to act as a receptor for the adhesion of micro-organisms to tooth surfaces. According to Avsar et al., the salivary amylase activity in children exposed to passive tobacco smoke was found to be statistically higher compared to the control group. The change in levels of amylase protein may be caused by reduced amylase secretion (Avsar et al., 2009).

Sialic acid is an important structural component of glycoproteins, playing a part in enhancing bacterial agglutination (Levine et al., 1978).

Decreased level of vitamin C has been associated with higher growth of cariogenic SM. The observed increase in children's caries risk associated with smoking by a household member could also be related to the decrease in serum vitamin C level. A study by Vaananen et al. (1994), found that the numbers of decayed tooth surfaces were significantly higher in the low plasma ascorbic acid group.

Salivary pH, buffering capacity and flow rate are also significantly lower in pre-school children exposed to passive smoke than those who are not (Avsar et al., 2008).

4. Conclusion:

Stopping smoking in the presence of children is important to prevent multiple medical problems, and also promote their dental health. The epidemiological studies from different areas in the world revealed an association between dental caries in primary dentition and exposure to passive smoke in pre-school children. However, the true mechanism is not clear yet. Therefore, further biological studies should be conducted.

Acknowledgments

The author wishes to thank Dr. Yousef Al-Dlaigan and Prof. Amjad Wyne for their help and support.

Conflicts of Interest:

Authors declared no conflicts of interest.

Corresponding Author:

Majedah A. Al-Homaidhi, Ph.D.

Department of Pediatric Dentistry & Orthodontic, King Saud University, College of Dentistry, Riyadh, Saudia Arabia.

E-mail: malhomaidhi@ksu.edu.sa

References:

1. Al-Meedani, L. A., & Al-Dlaigan, Y. H. (2016). Prevalence of dental caries and associated social risk factors among preschool children in Riyadh, Saudi Arabia. *Pakistan journal of medical sciences*, *32*(2), 452.
2. Aligne, C. A., Moss, M. E., Auinger, P., & Weitzman, M. (2003). Association of pediatric dental caries with passive smoking. *Jama*, *289*(10), 1258-1264.
3. Avşar, A., Darka, Ö., Bodrumlu, E. H., & Bek, Y. (2009). Evaluation of the relationship between passive smoking and salivary electrolytes, protein,

secretory IgA, sialic acid and amylase in young children. *archives of oral biology*, *54*(5), 457-463.
4. Avşar, A., Darka, Ö., Topaloğlu, B., & Bek, Y. (2008). Association of passive smoking with caries and related salivary biomarkers in young children. *Archives of oral biology*, *53*(10), 969-974.
5. Baljoon, M., Natto, S., & Bergström, J. (2005). The long- term effect of smoking on the vertical periodontal bone loss. *Journal of clinical periodontology*, *32*(7), 789-797.
6. Bergström, J. (2004). Influence of tobacco smoking on periodontal bone height. Long- term observations and a hypothesis. *Journal of clinical periodontology*, *31*(4), 260-266.
7. Billings, R.J., Berkowitz, R.J., & Watson, G. (2004). Teeth. *Pediatrics* 113 (4), 1120–1127.
8. Bolin, A. K., Bolin, A., Jansson, L., & Calltorp, J. (1996). Children's dental health in Europe. *Swedish dental journal*, *21*(1-2), 25-40.
9. DiFranza, J. R., & Lew, R. A. (1996). Morbidity and mortality in children associated with the use of tobacco products by other people. *Pediatrics*, *97*(4), 560-568.
10. DiFranza, J. R., Aligne, C. A., & Weitzman, M. (2004). Prenatal and postnatal environmental tobacco smoke exposure and children's health. *Pediatrics*, *113*(Supplement 3), 1007-1015.
11. Edwards, K., Braun, K. M., Evans, G., Sureka, A. O., & Fan, S. (1999). Mainstream and sidestream cigarette smoke condensates suppress macrophage responsiveness to interferony. *Human & experimental toxicology*, *18*(4), 233-240.
12. Elfrink, M. E., Schuller, A. A., Veerkamp, J. S., Poorterman, J. H., Moll, H. A., Ten, C. A. T. E., & Bob, J. M. (2010). Factors increasing the caries risk of second primary molars in 5- year- old Dutch children. *International Journal of Paediatric Dentistry*, *20*(2), 151-157.
13. Florek, E., Piekoszewski, W., & Wrzosek, J. (2003). The relationship between the level and time of exposure to tobacco smoke and urine nicotine and cotinine concentration. *Polish journal of pharmacology*, *55*(1), 97-102.
14. Haber, J., & Kent, R. L. (1992). Cigarette smoking in a periodontal practice. *Journal of Periodontology*, *63*(2), 100-106.
15. Haber, J. (1993). Smoking is a major risk factor for periodontitis. *Current opinion in periodontology*, 12-18.
16. Khan, S. A., & Khan, L. A. (1999). Cigarette Smoking: A Dangerous Trend in Saudi Arabia [Editorial]. *The Practitioner East. Med. Edition*, *10*(399), b2.
17. Köhler, B., Andréen, I., & Jonsson, B. (1988). The earlier the colonization by mutans streptococci, the higher the caries prevalence at 4 years of age. *Molecular Oral Microbiology*, *3*(1), 14-17.
18. Kumar, P. S., Matthews, C. R., Joshi, V., de Jager, M., & Aspiras, M. (2011). Tobacco smoking affects bacterial acquisition and colonization in oral biofilms. *Infection and immunity*, *79*(11), 4730-4738.
19. Kum-Nji, P., Meloy, L., & Herrod, H. G. (2006). Environmental tobacco smoke exposure: prevalence and mechanisms of causation of infections in children. *Pediatrics*, *117*(5), 1745-1754.
20. Levine, M. J., Herzberg, M. C., Levine, M. S., Ellison, S. A., Stinson, M. W., Li, H. C., & van Dyke, T. L. H. C. (1978). Specificity of salivary bacterial interactions: the role of terminal sialic acid residues in the interaction of salivary glycoproteins with Streptococcus sanguis and Streptococcus mutans. *Infection and immunity*, *19*(1), 107-115.
21. Lindemeyer, R. G., Baum, R. H., Hsu, S. C., & Going, R. E. (1981). In vitro effect of tobacco on the growth of oral cariogenic streptococci. *The Journal of the American Dental Association*, *103*(5), 719-722.
22. Poswillo, D. A. V. I. D. (1998). Report of the scientific committee on tobacco and health. *London: The Stationery Office*.
23. Royal College of Physicians (1992). Smoking and the young: A Report of a Working Party of the Royal College of Physicians. London, Royal College of Physicians.
24. Shenkin, J. D., Broffitt, B., Levy, S. M., & Warren, J. J. (2004). The association between environmental tobacco smoke and primary tooth caries. *Journal of public health dentistry*, *64*(3), 184-186.
25. Tanaka, K., Hanioka, T., Miyake, Y., Ojima, M., & Aoyama, H. (2006). Association of smoking in the household and dental caries in Japan. *Journal of public health dentistry*, *66*(4), 279-281.
26. Tanaka, K., Miyake, Y., & Sasaki, S. (2009). The effect of maternal smoking during pregnancy and postnatal household smoking on dental caries in young children. *The Journal of pediatrics*, *155*(3), 410-415.
27. Tanaka, K., Miyake, Y., Nagata, C., Furukawa, S., & Arakawa, M. (2015). Association of prenatal exposure to maternal smoking and postnatal exposure to household smoking with dental caries in 3-year-old Japanese children. *Environmental research*, *143*, 148-153.
28. US Department of Health and Human Services. (2000) Oral health in America: à report of the Surgeon General. Rockville (MD): US Department of Health and Human Services. Retrieved March. 15, 2017 http://www.nidcr.nih.gov/DataStatistics/SurgeonGeneral/Documents/hck1ocv.@www.surgeon.fullrpt.pdf
29. Väänänen, M. K., Markkanen, H. A., Tuovinen, V. J., Kullaa, A. M., Karinpää, A. M., Luoma, H., & Kumpusalo, E. A. (1994). Dental caries and mutans

streptococci in relation to plasma ascorbic acid. *European Journal of Oral Sciences*, *102*(2), 103-108.
30. Williams, S. A., Kwan, S. Y. L., & Parsons, S. (2000). Parental Smoking Practices and Caries Experience in Pre–School Children. *Caries Research*, *34*(2), 117-122.
31. Yanagita, M., Kashiwagi, Y., Kobayashi, R., Tomoeda, M., Shimabukuro, Y., & Murakami, S. (2008). Nicotine inhibits mineralization of human dental pulp cells. *Journal of endodontics*, *34*(9), 1061-1065.

Received April 07, 2017; revised April 17, 2017; accepted April 19, 2017; published online May 01, 2017.