

Narrative Review: Passive Smoking in Children: Associated Factors and its Impact on Oral Health

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ABSTRACT:

Passive smoking is the inhalation of the smoke given out by the cigarette smoker, and while its environmental implications have been widely discussed, the health hazard it is to passive smokers is yet to be encroached upon in-depth. Children are more susceptible to passive smoking, with their body systems and immunity being less developed than adults. It set them in grave danger when exposed to environmental tobacco. Considering that almost all of the constituents of tobacco have been proven to be potential carcinogens, mutagens with toxic properties, the how and why tobacco smoke is a silent killer primarily in children is of much interest. Hence this paper aims at appraising the readers on the technicalities of passive smoking in children and its associated factors and impact on their oral health.

KEYWORDS: Environmental tobacco smoke, Children, Dental caries, Bruxism, Nicotine,

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INTRODUCTION

Passive smoking plays a significant role in polluting the air where it is smoked. It is also is an amalgamation of side-stream smoke and exhaled mainstream smoke.^{1,2,3} On the other hand, it is the inhalation of a smoker's cigarette smoke.¹ The smoke released from the lighted end of the tobacco product and the smoke exhaled by the smoker during smoking has proven to have fatal consequences to the exposed.² Although it was reported to be almost 4000 chemicals released during passive smoking, an appalling 250 of these chemicals have been known to have toxic and carcinogenic properties.³ Cadmium, used in batteries, chromium in steel manufacturing, lead, a constituent of paint, arsenic used in pesticides, toluene in paint thinners, ammonia, a commonly used house cleaner, butane in lighters, carbon monoxide released in car exhaust, and cyanide used in chemical weapons along with other seldomly explored carcinogens like polycyclic aromatic hydrocarbons, aldehydes, organic compounds and tobacco-specific N- nitrosamines have been implicated as having irritant, toxicant, carcinogenic, teratogenic and mutagenic properties in humans.^{4,5,6} This supports the theory that active smokers, though definitely at greater risk of health disorders, subject non-smoking spouses and children to environmental tobacco smoke, putting them in equal if not less jeopardy.^{5,6} One such vulnerable population group to be taken into serious consideration is children. The morbidity and mortality weekly report stated that passive smoking is responsible for 150,000 and 300,000 lower respiratory tract infections in infants and children under 18 months of age, subjecting to hospitalization around 7,500 and 15,000⁷ The California Environmental Protection Agency reported that passive smoking is responsible for 430 sudden infant death syndrome deaths in the annually.⁸ More than 23 million children in the united states have been exposed to passive smoking. Passive smoking exposure among children has fallen over the past 15 years, children are still more heavily exposed to passive smoking than adults. Four out of ten children in the United States of America aged 3–11 years (40.6%) are exposed to passive smoking.⁹ While there is some awareness

regarding how arduously passive smoking could affect children, very little has been studied about the consequences of passive smoking on exposed children's oral health. There was an acute paucity of published works on this matter thoroughly in published literature. Henceforth, the purpose of the present paper is to describe the impact of passive smoking on children's oral health and the possible factors associated with it, and its consequences.

Factors associated with passive smoking

Children are considerably assailable to passive smoking since they have lower body weight, more excellent breathing rates, underdeveloped lungs, and larger surface area of lungs compared to adults and could inhale higher dosages of contaminants.¹⁰ Unlike adults, they are not adept at managing their environment and thereby unable to escape exposure through passive smoking.^{6,11} A child may be exposed to the chemicals of tobacco through exposure via maternal smoking, exposure due to passive smoking during pregnancy, parental passive smoking at home, increased bacterial load exposure of a caretaker or parent with a smoking habit, and to third-hand smoking exposure through the dust on interior surfaces in households. Tanaka co-workers¹² conducted a study to assess the risk factors associated with consequences of passive smoking among a cohort of 76290 Japanese children influenced by behavioral, environmental, and social factors. In infants, restricted mobility, proximity to parents, and most of their time at home make them susceptible to passive smoking.¹³ In the case of middle-aged children, they spend more time playing and crawling on floors, so they come close to the dust adulterated with the constituents of environmental tobacco smoking.⁹ It is also known as dermal transfer and recognized as an essential route for exposure to pesticides and semi-volatile chemical compounds like polychlorinated biphenyls (PCB's) and polycyclic aromatic hydrocarbons (PCH's).^{5,6}

Mechanism of passive smoking

The implications of passive smoking on children's oral health have been well-documented, and so has the mechanism that causes increased risk of caries and periodontal conditions among them.⁴ The direct exposure of the chemicals in passive smoking like nicotine and heavy metals like cadmium may impair the development of primary teeth.¹⁴ It may be due to interference of these tobacco substances with the reciprocal induction of oral ectomesenchyme tissues and mineralization of the tooth, which can be related to hindered tooth formation.¹⁵ Enamel hypoplasia and carious teeth are substantially associated with children exposed to passive smoking.¹⁶ The chemicals released from passive smoking deteriorate the function of the salivary gland. The smoke from cigarettes essentially activates the pro-inflammatory agents and local vasoconstriction producing edema and inflammation.¹⁷ It has been reported to reduce the salivary flow rates, saliva buffering capacity, and P^H.¹⁸ These products then reduce the serum IgG levels and IgA levels in saliva suppress T-helper cells activity.¹⁹ This, coupled with increased oxidative stresses, leads to periodontal problems and reduced alveolar bone density, eventually leading to tooth loss.¹⁶ Passive smoking has also increased the bacterial load, specifically lactobacillus counts and streptococcus mutants.²⁰ There is a higher risk of mother-child transmission of cariogenic bacteria due to enhanced streptococcus mutants (SM) load with environmental tobacco smoking, mainly nicotine.^{12,20,21,22}

Cigarette smoke also produces cyanides and carbon monoxide, which intervene with cell proliferation, wound healing, and osteoblastic activity while stimulating alkaline phosphatase activity.²¹ It impairs the functions of the fibroblast, thereby affecting fibronectin and collagen synthesis.^{5, 12, 14} Alleviated prevalence of dental plaque and caries can also be attributed to nicotine positively influencing SM biofilm formation and metabolic activity.^{21,22} Menon co-workers²⁰ found an association between passive smoking and dental decay and the presence of salivary biomarkers in 5-10 years old children. The authors reported with the mean colony count of 348.9 ± 166.509 and 247.3 ± 15.8 for streptococcus and lactobacillus, respectively, and the mean cotinine level (1.08 ± 0.265) among the passive smoking group children was observed higher than the control group. Less encroached upon effects of environmental smoking are gingival pigmentation, which could be due to increased stimulation of melanocytes due to benzopyrene and polycyclic amines like nicotine.¹⁶ Sleep bruxism was also reported as a manifestation of passive smoking where the nicotine in tobacco is thought to induce acetylcholine and glutamate synaptic transmission and enhance dopamine release to increase oro-motor activity.²³

Markers of passive smoking

The usually applied biomarkers to analyze the exposure to passive smoking are measuring the concentrations of carbon monoxide, thiocyanate, which have poor specificity, and cotinine, which is a direct metabolite of nicotine with higher specificity and longer half-life.²⁴ It is critical to cross the placental barrier and accumulate in the fetal tissues. Its traces can be extracted from saliva, blood, and urine to test the presence of nicotine for up to 3 days.²⁵ It was also reported that nicotine and cotinine could accumulate in 2 to 3 folds

higher concentrations in breast milk than plasma.²⁶ Postnatal cotinine detection is made via liquid chromatography-tandem mass spectroscopy are being developed to estimate exposure to passive smoking quantitatively.²⁷ Avsar co-workers²⁸ reported associating passive smoking with caries and salivary biomarkers in children. There was a significantly positive correlation between the lactobacilli and SM count, stimulated salivary flow rate, the DMFT (decayed, missing, and filled teeth) score, salivary cotinine level, and buffering capacity in the passive smoking group. Goto co-workers²⁹ also reported similar findings as they found urinary cotinine levels directly proportional to the number of dental carious lesions in children with a positive dose-response relationship in children exposed to passive smoking.

Effect of passive smoking on the overall health of a child

The effects of passive smoking on children both prenatally and postnatally have been established because the chemical constituents of tobacco are adept at crossing the placental barrier.³⁰ In this manner, the children become recipients of these chemicals unknowingly, causing them to be significantly prone to the health hazards associated with passive smoking.³¹ Passive smoking directly affects the growth and development of the fetus, subjecting the mother to a greater incidence of miscarriages.³² The newborn child with low birth weight, with studies claiming a difference of almost 200 g less in infants with smoking mothers and premature birth and perinatal death also been reported.³³ Postnatally, there is a constant surge of detrimental effects on the child, including poor cognitive functioning and decreased vigilance in younger children.³⁴ Studies suggest that nearly one-fourth of the risk factors causing sudden infant death syndrome are attributed to passive smoking.^{35,36} Children with greater exposure to tobacco in their households are more susceptible to respiratory disorders like bronchitis and pneumonia.³⁷ It was primarily noted among children below the age of 11 years and is directly proportional to the number of cigarettes smoked within the household per day, the location, the size of the space, and pre-existing health conditions in the family.³⁸ Bronchitis with wheezing is substantially more common among children within smoking households.³⁹ The effects on their respiratory system could be traced back to the ill-development of lung prenatally, leading to hampered breathing concerns in childhood like the ventilatory capacity seems to be reduced and a reduction in lung volume between 1 to 5 %.⁴⁰ Considering other facets of growth and health, it has also been often noted that children exposed to passive smoking have a height of 1 cm to 2 cm less.⁴¹ Several studies^{42,43,44} have consecutively pointed out lower cognitive scores, limited ability of advanced reading, verbal and mathematical skills, and aggrandized behavioral issues. The visual acuity of children with passive smoking has been detected in studies with a greater risk of being with the combination of atopy and cataract.⁴⁵ The most incessant nature of deafness in children is otitis media, also famously known as the middle ear effusion or "glue ear" is primarily linked to passive smoking, which requires extensive surgical procedures and affects the language development and learning capacity of the child.⁴⁶ The ramification of passive smoking on children has been pertinent with a greater risk of rhinitis, coughs, sputum, and tonsil extraction.⁴⁷ The prevalence of four or more sore throats was significant in children living in households with more cigarettes being smoked per day. Preliminary studies also show a positive linkage between the cardiovascular health of the children, which could be due to changes in the lipoproteins and oxygen transport in the blood of passive smoking, including exacerbation of cystic fibrosis⁴⁸. While not much has been published about cancer among passive smoking, it is however established that household exposure to 25 or more "smoker years" tends to double the risk of lung cancer among children and adolescents.⁴⁹

Oral manifestations of passive smoking

To summarise, the oral health consequences of passive smoking, primarily in children, are an increased risk of dental caries. Developmental anomalies include orofacial cleft, enamel hypoplasia, and reduction in tooth crown sizes (first molar teeth), and also gingival pigmentation, reduced periodontal attachment, and bruxism.⁴ Tanaka co-workers performed a study with 12729 children and concluded that the risk of caries at age three years was 14.0% in families with no smokers, 20.0% in households with smoking but no exposure, and 27.6% with exposure to tobacco.¹² In a study conducted by Montaldo co-workers, thirty-one percent of the children suffered from sleep bruxism, among which 116 children (76%) were exposed to passive smoking.²³ Among the articles narrowed down, the prevalence of dental decay was significantly higher among children exposed to passive smoking than their non-exposed counterparts.⁵¹ Tanaka co-authors¹² concluded the prevalence of DFT to be 82% among children subjected to parental smoking; Leroy co-workers⁵² stated the visible caries experience to be 7% of 3-year olds and 31% of 5-year olds wherein both age groups, 30% of the parents reported smoking behavior. Goto co-workers conducted a study among 405 pre-school children aged 3-6 years. They observed that 31.1% of the children had dental caries, and 29.5% had decayed teeth and that more than three pack-years of exposure to maternal smoking and five pack-years of exposure to smoking by all the members of the family was majorly associated with the

presence of dental caries as compared to the unexposed children.⁵² Mosharraffian co-workers²² had similar findings in his study. An exciting finding was put forward by Montaldo co-workers stating that 31% of the children under investigation suffered from bruxism, among which 116 children (76%) were exposed to passive smoking.²³ The prospects of pediatric dentistry have constantly been evolving from caries management to caries prevention.⁵³ While an array of etiological factors has been known to implicate primary teeth with oral disorders, passive smoking is one such factor that is seldom considered, the hazards of which cannot be overlooked.^{54,55} The American Academy of Pediatric dentistry advocates screening for tobacco use, tobacco dependence treatment, tobacco use prevention in children and adolescents, and educating the public on mammoth health and societal costs of tobacco.⁵⁵ Global health organizations should convene on elaborating the smoking issue with strict anti-smoking policies and smoking guidelines, which would then resolve the public health dilemma.⁵⁶

CONCLUSION

Upon a thorough literature search, there felt a need to shine a light on this matter, thereby increasing awareness among parents and children. It becomes the joint responsibility of dental health professionals to conduct tobacco counselling sessions during the oral examination part of dental visits of habitual patients. Smoking in closed confines should be strictly prohibited, especially amongst families with children, since it would increase the residual concentration of passive smoking contents. It is advisable no one should be permitted to smoke in or near homes, in the car, and children's day-care centres and schools should be strictly made tobacco-free.

IMPLICATIONS FOR TOBACCO REGULATION

The review paper describes the impact of passive smoking on children's oral health and its associated factors. It is a comprehensive paper that discusses factors associated with passive smoking, mechanism, and markers, the effect of passive smoking on overall health, and the oral manifestation. This paper will serve as a valuable insight into passive smoking among children and oral health. The more significant the impact of parents' smoking evident on children's life. In particular, the children's long endurance to passive smoking is more likely to obligate deleterious issues like misconduct issues, emotional symptoms, inattention, and hyperactivity. Nonetheless, prenatal care and awareness programs should be developed to promote the impact of passive smoking and its effect on children's oral health and overall health. Furthermore, there is a need for longitudinal studies with a large sample size are recommended to evaluate the impact of passive smoking on the oral and general health of the children

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