IJPSR (2020), Volume 11, Issue 7 (Review Article)

INTERNATIONAL JOURNAL OF PHARMACEUTICAL SCIENCES AND RESEARCH

Received on 05 October 2019; received in revised form, 07 February 2020; accepted, 04 March 2020; published 01 July 2020

POLLUTION IN DENTISTRY - A CRITICAL REVIEW

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Keywords:

Oral health, Periodontal, Air Pollution, Fluorosis, Water pollution

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ABSTRACT: Health may be defined as the capability to adapt and manage physical, mental, and social concerns throughout life. Oral health is a key indicator of overall health, wellbeing, and quality of life. WHO defines oral health as "a state of being free from chronic mouth and facial pain, oral and throat cancer, oral infection and sores, periodontal (gum) disease, tooth decay, tooth loss and other diseases and disorders that limit an individual's capacity in biting, chewing, smiling, speaking and psychosocial wellbeing. Oral diseases are the most frequent non-communicable diseases (NCDs) and affecting humans lifelong, resulting in pain, malaise, malformation, and till death. Environmental pollution is now recognized as a global threat, and the actions of mankind are largely accountable for this. Various oral diseases like dental caries, fluorosis are influenced by the food and water quality in a particular topographic area. Chemicals in water can be both naturally occurring or introduced by human interference and can have a huge impact on teeth and oral mucosa. High concentrations of arsenic in water can have an adverse effect on health particularly skin and other tissues of the body, including tongue, gingiva, and buccal mucosa. Without access to clean water, people living in developing and underdeveloped countries may suffer oral health deterioration well into their adulthood. This results in tooth loss, periodontitis, and even mouth cancer. Air pollution influences the development of cleft palate in some kinds of animals. There is evidence from the epidemiologic data on the relation of prenatal air pollution exposure and the risk of oral clefts. Oral precancer and cancer are complex multi-factorial diseases arising from the interplay between the genetic components and the environmental determinants. Environmental exposures in farmers can be explained by solar exposure. This study mainly focuses that air and water pollution produces serious effects in oral health for living organisms, especially in humans.

INTRODUCTION: Health, as defined by the World Health Organization, is "a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity [1]. This definition has been subject to controversy, as it may have limited value for implementation [2]. Currently, three kinds of descriptions of health seem to be possible and are used.

QUICK RESPONSE CODE

DOI: 10.13040/IJPSR.0975-8232.11(7).3069-77

This article can be accessed online on www.ijpsr.com

DOI link: http://dx.doi.org/10.13040/IJPSR.0975-8232.11(7).3069-77

The first is that health is the absence of any disease or impairment. The second is that health is a state that allows the individual to cope with all demands of daily life adequately. The third shows that health is a state of balancing, an equilibrium that an individual has created within himself and between himself and his social and physical environment.

Oral health is integral to general health and is essential to the overall health and wellbeing of all individuals. Oral health means more than healthy teeth. The word "oral" refers to the mouth, which includes not only the teeth, gums, and supporting tissue but also the hard and soft palate, the mucosal lining of the mouth and throat, the tongue, the lips, the salivary glands, the chewing muscles and the

jaw. The salivary glands are a model of other exocrine glands, and an analysis of saliva can provide clues of overall health or disease. Oral health is multi-faceted and includes the ability to speak, smile, smell, taste, touch, chew, swallow and convey a range of emotions through facial expressions with confidence and without pain, discomfort, and disease of the craniofacial complex. Stress, physical and mental abuse, nutrition and diet, exposure to toxins, pathogens, radiation, and chemicals as environmental factors and determinants of growth and body composition can contribute to the risk of some human cancers such as oral cancer. Oral health is considered a determinant of quality of life.

Oral health is a fundamental component of general health as poor oral health affects growth, development, and learning knowledge for a child, communication, nourishment, self-esteem, and several systemic conditions because of its effects on day-to-day-life. The impact of environmental change on the lives of natives of a particular geographical region influences the overall health status of an individual. The contamination of water by harmful or undesirable substances making it unfit for use. Chemical substances in water can be both occurring naturally or introducing by individual interference produces significant health problems. Without access to clean water, people living in developing and underdeveloped countries may suffer oral health deterioration well into their adulthood.

This may lead to loss of tooth, periodontitis and oral cancer. Poor, inadequate and polluted air quality is linked to sudden or early death, carcinoma, and chronic damage to cardiovascular and respiratory systems. Exposure to solvents and possibly pesticides, fertilizers, engine exhaust, textile dust, and leather dust also increase the risk of oral cancer. Climate change-induced oxidative stress, dietary transition [4-8] contamination, impacts on food chain ecosystem and food security have increased the vulnerability to oral cancer. Exposure to solvents and possibly pesticides, fertilizers, engine exhaust, textile dust, and leather dust also increase the risk of oral cancer. Indoor air pollution contributes to oral cancer, with other significant inflammatory respiratory diseases and infections. Estimated exposure to wood smoke and biomass smoke released from cooking in households in developing countries has led to an increased risk of oral cancer, particularly in women and children. In India, environmental pollution-related disorders may further weaken the existing inadequate public health infrastructure. Research should be targeted to understand the complex interplay of environment interactions and oxidant mediated oral diseases. Epidemiological assessment and willingness to tackle health burden arising due to the impact of environmental factors need to be strengthened. This would facilitate a harmonious balance to enable the sustainable development of optimum oral and in turn, overall health.

Water Pollution in Oral Health: Many of the major problems that humanity is facing in the twenty-first century are related to water quantity and/or water quality issues [9, 10]. These problems are going to be more aggravated in the future by climate change, resulting in higher water temperatures, melting of glaciers and an intense-fication of the water cycle, with potentially more floods and droughts. With respect to the individual health, the most direct and most serious impact is the deficit of better sanitation and related to it is the inadequate and insufficiency of secure drinking water, which currently affects more than a third of the people in the world.

Additional threats include, for example, exposure to pathogens or to chemical toxicants *via* the food chain (*e.g.*, the result of irrigating plants with contaminated water and of bioaccumulation of toxic chemicals by aquatic organisms, including seafood and fish) or during recreation (*e.g.*, swimming in polluted surface water). Surface and groundwater quality concerns apply to both drinking water and recreational waters. Polluted by infective agents or chemicals substances can cause mild to serious complications. Quality of the water has been seen to directly influence oral health based on several studies. The case study proved that without access to clean and safe drinking water, almost all of the children aged 5-7 years who were involved in the study had some level of tooth decay [11]. The water in their area was found to have no fluoride, high levels of manganese, and high acidity level, which all contributed to the poor oral health of the residents. Long-term effects of poor water quality [12-14] are, without access to clean

water, people living in developing and underdeveloped countries may suffer oral health deterioration well into their adulthood. This leads to tooth loss, gum disease, oral cancer [15-17]. Several oral diseases like dental caries, fluorosis are influenced by the food and quality of the water in a specific topographic region. Chemicals in water can be both naturally occurring or introduced by human interference and can have a huge impact on teeth and oral mucosa. Arsenic occurs naturally or by phosphorus from fertilizers. High concentrations of arsenic in water can have an adverse effect on health particularly skin and other tissues of the body including tongue, gingiva and buccal mucosa.

Dental Caries: It affects the majority of populations in many developing countries. It is characterized by the dissolution of the dental enamel and dentine. This eventually destroys the affected tooth or tooth surface. The immediate cause is an organic acid produced by micro-organisms present on the tooth. Dental plaque [18] consists of bacteria and a matrix of extracellular poly-saccharine produced from sucrose [19-26] by the bacteria. Tooth plaque, specific bacteria, diet, fluoride, and saliva are all involved in the dental caries process. In recent decades, preventive measures have helped to dramatically lower levels of dental caries in industrialized populations. The most important of these measures is exposure to an appropriate level of fluoride, from various sources, including water, food, and toothpaste.

Dental Fluorosis: Dental fluorosis [27-31] is a specific disturbance of tooth formation caused by excessive fluoride [32] intakes during the development of teeth. It is characterized by opaque white patches in the dental enamel. These patches may become stained yellow to a darker color, and in more severe cases normal tooth structure may be destroyed. The degree of fluorosis, plasma, and bone fluoride levels [33-34], is directly related to the concentration of fluoride in drinking water. In drinking water, fluoride is tasteless, odorless, colorless and totally soluble and its detection requires laboratory equipment and specially trained personnel. Methods for removing excess fluoride are well established, although the prevention of fluorosis through the treatment of drinking water requires favorable socio-economic conditions. The provision of a safe low level of fluoride in water from alternative sources should be investigated as a first option. Defluoridation of water may be the only option to prevent fluorosis if alternative supplies are either not available or too expensive. The methods for defluoridation depend on the specific local circumstances in the community and the level of fluoride concentration in the drinking water. In developing countries [35], whose initiative [36] has emphasized the effective and less expensive methods that are suitable for individual households, or community defluoridation of water for drinking and cooking.

Heavy Metals: These may be waterborne, or maybe found in air, food, or other sources of exposure [37-38]. These can also cause damage to your teeth. Metal amalgam is a common source of heavy metal exposure [39]. Although the heavy metals in amalgams are not damaging to teeth, they can damage the body if they are mobilized through vigorous chewing, tooth grinding, or with time. People in areas with high levels of heavy metal pollution have significant damage to their teeth as a result [40, 41]. The metals result in roughening of the tooth surface, which makes them more susceptible to decay from bacteria. Arsenic occurs naturally or by phosphorus from fertilizers. High concentrations of arsenic in water can have an adverse effect on health, particularly skin. Pipes and hoses, fixtures, soldering, and the power supply lines of several household pipeline systems containing lead that pollutes the source of drinking water. Petroleum products pollute the ground-water from under-ground fuel storage reservoir.

These pollutants come from mines waste and tailings, landfill sites, or hazardous garbage dumps, chlorine-containing solvents, metals, and thermo-plastic effluents, fabric scrubbing, electrical, electronic and aircraft construction are often discharged and polluted groundwater.

Oral Manifestations:

- **Arsenic:** Intense inflammation of oral mucosa, severe periodontitis, and tissue become painful, local contact with arsenic trioxide produces ulceration and general poisoning will cause excessive spit.
- **Inorganic Copper, Iron, Nickel, Chromium Coal:** Staining of teeth, pigmentation of gum,

generalized abrasion, calculus, gum inflammation and hemorrhage [42, 43].

- **Lead:** Blue-black pigmentation of gum and cause gingivostomatitis.
- **Mercury:** Gingivostomatitis, osteitis, pyta-lism, gingivitis/gingival gums and ulcers of oral cavity [44, 45].
- **Phosphorus:** Gingivostomatitis, ulceration of oral tissues, and osteomyelitis.
- **Organic Sugar:** cavities.
- **Bismuth:** Oral mucosa, gingivostomatitis, bismuth line: a thin blue-black line within the marginal gingiva typically confined to gingival papillae, also seen in buccal mucosa and ventral surface of tongue, Pigmentation shows precipitated granules of bismuth sulfide produced by action of hydrogen sulfide on bismuth, hydrogen sulfide is produced by microorganism degradation of organic material or food debris, burning sensation and metallic taste.

Agrochemicals: In the developing nation, deaths by accidental poisoning may be closely associated with improper usage and poor environmental governance of toxic and harmful chemical products including pesticides. Chronic pesticide exposure is most often a problem in the occupational setting, particularly among poor rural populations where men, women, and children all work and live in close proximity to fields and orchards where chemicals are applied and stored.

Chronic exposure to pesticides enhances the risk of developmental disorders and sexual problems, immune-system and hormonal disturbances, impaired nervous system function, and development of certain carcinomas. Pesticides, as well as fertilizers, can infiltrate water sources contaminating drinking water and animal species, *e.g.*, fish, upon which humans rely on nutrition. Such contamination leads to a range of secondary public health issues.

A study of pesticides sales different parts of Brazil and cancer mortality rates a decade later finds pesticide sales show a statistically significant correlation with the mortality rates for several cancers, including cancer of the lip. A Swedish study based on a cancer registry of agricultural workers finds an increased risk of cancer of the lip by a factor of greater than 2.51.

Oral Hygiene and Safe Water Supplies: Good oral health requires a clean, safe and pure water supply [46-48], adequate for brushing and cleaning teeth frequently from an early age. Poor oral hygiene may also result in periodical problems since dental plaque may induce gingival inflammation and deep pockets. While fluoride intake from drinking water and a balanced, low sugar diet are almost the main factors for reducing tooth decay, deficiency of clean and pure water for basic oral health may tip the balance towards earlier and more severe patterns of caries. Where fluoride concentrations in water or the diet are known to be low, community water fluoridation [49] is safe and cost-effective. In the agriculture field, control the use of chemical contained fertilizers and pesticides. Agriculture peoples are switch over to natural-based fertilizers and pesticides to prevent the contamination of water.

Air Pollution in Oral Health: Air pollution is a worldwide issue, particularly in rural areas. In particular, particulate matter (PM) has been evaluated intensively as regards its impact on human health [50, 51]. PM [52] consists of breathable particles to which several compounds, such as heavy metals [53], polycyclic aromatic hydrocarbons (PAHs), and some volatile compounds, may adhere. Epidemiological studies have found a consistent association between exposure to airborne PM and incidence and mortality for cardiovascular disease[54] and lung cancer and natural-cause mortality. Recently, also diabetes and other chronic diseases have been associated with PM exposure, possibly through oxidative stress and inflammation. Poor quality of air is connected to premature death, carcinoma, and chronic damage to cardiovascular and respiratory systems [55].

Exposure to solvents and possibly pesticides, fertilizers, engine exhaust, textile dust, and leather dust [56] also increases the risk of oral cancer. Indoor air pollution contributes to oral cancer, with other significant inflammatory respiratory diseases and infections. Estimated exposure to wood smoke and biomass smoke [57] released from cooking in households in developing countries has led to an

increased risk of oral cancer, particularly in women and children. There is evidence from the epidemiologic data on the relation of prenatal air pollution exposure and the risk of oral clefts [58-62].

Ozone: Exposure to outdoor air ozone during the first and second months of pregnancy may increase the risk of CL/P [63-66]. Similar levels of O_3 encountered globally by a large number of pregnant women.

Control of Air Pollution: Air pollution can be better controlled by (a) reducing the emission of pollutants and (b) by using non-polluting materials. Some of the major steps for reducing air pollution are as follows: controlling particulate pollutants by using scrubbers, filters, cyclone separators, and electrostatic precipitators in the industries. Change from high-sulfur coal to low-sulfur coal, especially for the thermal power plants, to check the emission of sulfur dioxide. It is locating industries far from human settlements. Check automobile pollution by the use of unleaded petrol, better engines with low emissions, and proper maintenance of vehicles. Installation of catalytic converters in the vehicles. Conducting regular pollution control checks on the vehicles and adopting less polluting fuels like Compressed Natural Gas (CNG) and Liquefied Petroleum Gas (LPG) and adopting more non-conventional energy sources that are non-polluting, such as solar energy, wind energy, *etc*. Using mass transport systems and switching over to non-polluting modes of transport like bicycles. To check deforestation and encourage plantation especially around the polluting Industries.

Occupational Hazards: An occupational hazard is a risk faced in the place of work. Workplace hazards include several kinds of hazards, including chemical hazards. Chemical hazards are a subtype of occupational risks that contain dangerous chemicals. Chemical exposure in the workplace may occur in acute or chronic health illnesses.

A polychlorinated Biphenyls PCBs: [67, 68] is an organochlorine compound. PCBs were once commonly used as dielectric and cooling fluids in electric appliances, carbonless copy paper, and in heat transfer fluids. In general, people are exposed to PCBs overwhelmingly through food, much less so by breathing contaminated air and least by skin contact. Once exposed, some PCBs may change to other chemicals inside the body. These chemicals or unchanged PCBs can be excreted in feces or may remain in a person's body for years, with half-lives estimated at 10-15 years. PCBs [69] collect in body fat and milk fat. PCBs biomagnify up the food web and are present in fish and waterfowl of contaminated aquifers. Human infants are exposed to PCBs through breast milk or by intrauterine exposure through transplacental transfer of PCBs and are at the top of the food chain.

Polychlorinated dibenzofurans PCDFs: [70] is a group of organic substances with single or more of the hydrogens in the dibenzofuran [71] structure replaced by chlorines. It is also known as persistent organic pollutants (POP), classified among the dirty dozen in the Stockholm Convention on persistent organic pollutants [72-74].

Dibenzofuran exposure may occur through inhalation and contact with body skin, specifically at areas where coal tar, coal tar derived products and creosote are generated or used. Seafood like fish and milk and dairy products consumption also had been explored in relation to the body burden of dibenzofuran in women who are pregnant. Consumption of contaminated water and food is the primary source of exposure. PCDFs are eliminated 22% of the regular consumption of dioxins from meals is discharged from stools and 29% from sebaceous matter.

Food, Water and Air: Generally, levels of PCBs, PCDDs, and PCDFs in the air are very low, except in the vicinity of inefficient incinerators. Concentrations of these compounds in drinking water and surface water are also very low because they are poorly soluble in water. Air releases from insufficient incineration and releases from waste disposal sites pollute the land and aquatic sediments, leading to bioconcentration and bioaccumulation through the food web.

The higher chlorinated components and compounds with specific positions of chlorination persist longer in the environment and show greater bioaccumulation. The substances have high-fat solubility, which may lead to higher concentrations in fatty foods, such as dairy products, some fish,

meat, and shellfish. Most human exposure is through ingestion of contaminated food. These components remain in adipose tissue, with typical half-lives in individuals in excess of seven years. Severe developmental effects were ascertained in infants and kids born to mothers who had been exposed to polychlorinated dibenzofurans/ biphenyls (PCDFs/PCBs). A variety of dental and oral changes were additionally reportable in children exposed to PCB/PCDF are Birth-natal teeth oral pigmentation, childhood-missing permanent teeth delayed eruption of permanent teeth, disturbed root development, and Adulthood - the periodontal disease was common.

Waste Disposal: Any other source of organic substances in the presence of chlorine or other halogens will generate dioxins and furans during combustion. PCDDs and PCDFs are produced through the incineration of waste (domestic, industrial, and hospital) at lower to medium temperatures; guidance had been designed to determine and quantify releases from various incineration processes. The use of modern incineration technology destroys dioxins and furans, whereas inadequate incineration creates them [75-78]. Disposal of electrical equipment may release PCBs (and PCDF contaminants); guidance is available on equipment likely to contain PCBs[79-85]. Stockpiles of old industrial lubricants containing PCBs are also a potential source of emissions.

CONCLUSION: There is a huge burden of oral diseases that afflict humankind, which require population-wide prevention and access to appropriate care. The many links between general and oral health, particularly in terms of shared risk factors and other determinants like air and water pollution provide the basis for closer integration of oral and general health for the benefit of overall human health and wellbeing. Without access to clean water, people living in developing and underdeveloped countries may suffer oral health deterioration well into their adulthood. This leads to tooth loss, periodontitis, and even oral cancer. Contaminated air influences the progression of cleft palate in animals. Synthetic and natural trace contaminants that are present in natural water and air. Most of these micropollutants may exert toxicological effects even at such low levels, specifically when present as mixtures. The wide range and great structural variety of micropollutants make it, however, usually very difficult to assess such side effects, which often are not acute but are subtle, long term effects. This contrasts with the common, acute health effects of the rather small number of well-known pathogens that may be present in polluted water and air. Therefore, considering the problems of evaluating the effects of micropollutants on aquatic life and individuals health and that suitable, affordable water treatment methods for their effective elimination are not available in many parts of the world, major efforts (such as restricted use, substitution or oxidative treatment) have to be undertaken to prevent these chemicals from reaching natural water.

On the other hand, increasing the sensitivity of people to air pollution concerns and promote the local authorities' involvement in efforts to reduce urban air pollutants. In this review, we conclude that good oral health depends on safe water and clean air supply. Good management, use, and disposal of agrochemicals, particularly pesticides, is an important health and environmental issue in developing countries, where economies may be heavily reliant on agriculture. The use of modern incineration technology destroys dioxins and furans, whereas inadequate incineration creates them. In this review, we conclude that good oral health depends on safe environmental conditions.

ACKNOWLEDGEMENT: Nil

CONFLICTS OF INTEREST: No conflicts of interest.

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How to cite this article:
Kavitha J, Sivakrishnan S, Lakshmisree S and Srinivasan S: Pollution in dentistry - a critical review. Int J Pharm Sci & Res 2020; 11(7): 3069-77. doi: 10.13040/IJPSR.0975-8232.11(7).3069-77.