

An insight into tobacco – A narrative review

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ABSTRACT

The epidemic of tobacco use is one of the greatest threats to global health. Tobacco use in smoked and smokeless forms has a potentially significant and negative impact on oral health. Effect of local and systemic outcome of tobacco use on oral health depends on method, frequency, and duration of use and is dose dependent. Tobacco-induced oral diseases contribute significantly to the global oral disease burden. Health professionals should be aware of oral problems associated with tobacco use and should also play an active role in prevention and control of tobacco-induced lesions due to their direct contact with patients who are at increased risk. Counseling on smoking cessation and smoking prevention programs should be an integral component of medical and dental teaching and practice. The present article provides a compilation about tobacco and its history, composition, metabolism, effects on general and oral health, and tobacco cessation.

KEY WORDS: Cessation, Oral health, Smokeless tobacco, Smoking, Tobacco

INTRODUCTION

Tobacco is obtained from a plant of genus “Nicotiana” from the potato family. Tobacco plants originated in the mainlands between North America and South America. Cultivation of tobacco dates back to at least 5000 years. Carl Linnaeus (1753) named the genus of tobacco plant “Nicotiana” in honor of Jean Nicot, a French ambassador to Portugal king. Jean Nicot grew and promoted tobacco in Europe since it was believed to have magic “cure-all” properties.^[1] The genus *Nicotiana* has three main subgenera, namely *Nicotiana rustica*, *Nicotiana tabacum*, and *Nicotiana petunioides*, of which *N. tabacum* is commonly used in smokeless tobacco forms. Tobacco was introduced to the world by Christopher Columbus who discovered it among the treasures of the new world in 1492. By the early 17th century, tobacco had become a major export of American colonies and its use in various forms had spread throughout Europe, Russia, Turkey, Arabia, China, and around the world.^[2] The use of tobacco is evident ever since human civilization.^[1]

Tobacco was introduced in India by the Portuguese and British promoted cigarettes to expand their industry. American Indians were probably the first to smoke, chew, and snuff tobacco as early as the 1400s. A hollow Y-shaped piece of pipe was used to inhale powdered tobacco by placing the forked ends into each nostril, and the instrument was called as “tobaca” or “tobago” and the word was later used as “tobacco” by the Spaniards.^[2]

FORMS OF TOBACCO USAGE

Tobacco use can be broadly categorized into smoke form and smokeless form. Smoking type includes bidis, cigarettes, cigars, pipes, hookah, water pipes, chuttas, chillum, kreteks, and many other locally used forms.^[2]

Smokeless tobacco products can be classified into two types based on the mode of use.

- a. Oral use – Betel quid, mawa, dry snuff, gutka, khaini, loose-leaf, mishri, plug, snus, zarda, creamy snuff, gul, and many more.
- b. Nasal use – Dry and liquid snuff types, commonly used by Nandi tribe in East Africa.^[2,3]

A “chaw” refers to a portion of tobacco and the size of a golf ball which is chewed, and “quid” refers to a much

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smaller portion, and it is held in the mouth rather than chewed.^[2] Betel quid has four main ingredients: Betel leaf (piper betel), areca nut (Areca catechu), slaked lime, and tobacco (raw/sun-dried/roasted form).^[3,4]

PREVALENCE

The WHO states that there are 1100 million regular smokers in the world today. Globally, one in ten adults dies due to tobacco-related causes and 15 million deaths occur each year. India is the world's third largest tobacco growing country and the second largest consumer of tobacco products.^[2] India ranks highest among tobacco-related mortality with about 7 lakh annual deaths due to smoking in the past 10 years.^[2] It is expected to increase to 1 million in the coming decade. More than one-third (35%) of adults in India use tobacco in some form. 21% of them use smokeless tobacco, 9% go with smoking form, and 5% of dual use (both smokeless and smoke form). Annual oral cancer incidence among Indian males is as high as 10 per 1,00,000. Globally, one-third of adults and 700 million children are exposed to second-hand smoke at home. Third-hand smoke refers to the toxic chemicals built on the surface of rooms and smokers' belongings.^[5]

If the current trend continues, 10 million smokers are anticipated to die by 2025. Tobacco is the second major cause of death in the world. Every 6.5 s one tobacco user dies from tobacco-related disease somewhere in the world.^[6] By 2030, tobacco is expected to be the single biggest cause of death worldwide.^[7]

PRODUCTION OF TOBACCO

India is one of the major producers of chewing tobacco in Asia and is peculiar in the variety in types of tobacco produced. Tobacco is grown in states such as Tamil Nadu, Uttar Pradesh, Bihar, and West Bengal. Manufacture of bidis is one of the largest cottage industries in India and employs more than 3 million people on average.^[2,9] A bidi roller makes 500–1000 bidis per day and handles 225–450 g of tobacco flakes, thus causing exposure through dermal contact. In addition, workers are also exposed to airborne tobacco dust and volatile compounds.^[2,9]

COMPOSITION OF TOBACCO

Chemical Composition of Smokeless Tobacco

Roberts in 1988 identified a total of 3044 compounds in tobacco. Later, Hoffman *et al.* (2001) included 23 N-Nitrosamine compounds and 28 pesticides and totaled it to 3095 components in tobacco. Around 28 carcinogens have been identified in smokeless tobacco so far.^[2]

Nicotine is the major component of smokeless tobacco which is addictive. The following are the chemical composition of smokeless tobacco products in India:

- Nicotine
- Ammonia
- Carbonate
- N-Nitrosornicotine
- (N-methyl-N-Nitrosamine)-1-(3-pyridyl)-1-butanone
- Benzo [a] pyrene
- Cadmium
- Arsenic
- Nitrate.^[2,10]

Chemical Composition of Tobacco Smoke

An estimation of 7357 chemical compounds is made to be present in the large amount of complex combustion products of tobacco smoke. Except for nicotine, tar, and carbon monoxide, Hoffman analytes categorize the smoke components into nine classes such as ammonia, aromatic amines, polycyclic aromatic hydrocarbons, phenols, carbonyls, hydrocyanic acids, nitrosamines, inorganic elements, and other volatile organics.^[11,12]

Chemical Properties of Nicotine

Nicotine was extracted from tobacco by German physicians Wilhelm Posselt and Karl Ludwig Reimann. Nicotine is a strong alkaloid and is a clear liquid in its pure form with a characteristic odor. It is an amine compound and is water soluble.^[5,13]

ABSORPTION AND METABOLISM OF TOBACCO

Absorption

Nicotine, once absorbed into systemic circulation, is metabolized and excreted similarly regardless of the route of administration. Absorption of nicotine depends on the pH of the solution. Absorption can occur through oral mucosa, lungs, skin, and gut. An increase in the pH can cause an increase in absorption. Thus, the addition of slaked lime and catechu to tobacco increases the absorption of nicotine from the oral mucosa.^[2,13]

Metabolism

In humans, 85–90% of a dose of nicotine is metabolized before its excretion and only 5–10% is excreted unchanged in the urine. Nearly, all nicotine metabolisms occur in the liver. Metabolism occurs in two phases. In phase I, microsomal oxidation of nicotine and Phase II is the glucuronidation of metabolites, and finally, excretion occurs largely through urine and also through feces, bile, and sweat. Acidic pH of urine favors the elimination of nicotine, whereas a rise in pH leads to reabsorption of nicotine.^[13]

EFFECTS OF TOBACCO ON BODY CELLS

The use of tobacco eventually leads to changes in cell morphology, cellular atypia, increased nuclear-cytoplasmic ratio, widening of intercellular spaces, and increased expression of keratin K12 and K14 in oral squamous cell carcinoma.^[13] Nicotine use causes increased oxidative stress, neuronal apoptosis, DNA damage, increase in lipid peroxidase, and a variety of long-term effects in organ systems.^[14]

EFFECTS OF TOBACCO ON GENERAL (SYSTEMIC) HEALTH

Immediate Toxic Effects of Nicotine

On direct application, it causes irritation and burning sensation in the mouth and throat. Increased salivation, nausea, abdominal pain, increase in pulse rate, and blood pressure with a decrease in coronary blood flow and increase in respiratory rate with hypothermia are the other immediate effects of nicotine. Severe poisoning induces tremors, cyanosis, convulsion, and collapse.

Nicotine and Cancer

Nicotine allows the survival of damaged epithelial cells. In normal cells, it stimulates factors leading to cell transformation and carcinogenesis such as increased cell proliferation, decreased cellular dependence on extracellular matrix for survival, reduced contact inhibition, and DNA mutations. Nicotine negatively impacts tumor biology by promoting angiogenesis, tumor invasion, and risk of metastasis.^[14]

Cardiovascular System

Increased incidence of hypertension and reduced coronary blood flow lead to CVS disorders.

Respiratory System

The effects are two folds in the respiratory system: First due to direct local exposure of lungs to nicotine through smoking or inhaled nicotine and second through CNS mechanism. Nicotine plays a significant role in the development of emphysema in smokers.^[13]

Gastrointestinal Tract

There exists a high risk of gastroesophageal reflux disorder and peptic ulcer in tobacco users. Furthermore, high incidence of treatment-resistant *Helicobacter pylori* infection has been recorded.

Immune System

Nicotine impairs antigen and receptor-mediated signal transducers and also a reduction in T-cell population due to arrest in cell cycle.^[14]

Renal System

Evidence of increased albumin excretion in urine, lowered glomerular filtration rate, and renal artery stenosis causes chronic kidney disease in tobacco users. Tobacco users in end-stage renal condition have a high mortality rate.

Ocular System

Tobacco smokers have a greater risk of age-related macular degeneration than non-smokers.

Peri-natal Effects

Tobacco using pregnant women may face the risk of intrauterine growth restrictions, stillbirth, miscarriages, and mental retardation in developing fetus. Another serious ill effect is the transgenic transmission of the addictive pattern.^[13,14]

EFFECTS OF TOBACCO ON ORAL HEALTH

The use of tobacco in either smoke or smokeless form negatively affects the oral health. Significant dental findings are associated with chronic use of tobacco that must be identified by dental professionals.^[15] Oral manifestations include halitosis, taste and smell alteration, discoloration, teeth abrasion, increased dental caries risk,^[16] periodontal deterioration, acute necrotizing ulcerative gingivitis,^[17] delayed wound healing, risk of dental implant failure, smoker's melanosis,^[18] smokeless tobacco keratosis, nicotinic stomatitis, leukoplakia, and oral cancer.^[19,20]

TOBACCO DEPENDENCE AND WITHDRAWAL SYMPTOMS

The International Classification of Diseases-10 has recognized "tobacco dependence" as a disease. Tobacco dependence is defined as "Cluster of behavioral, cognitive, and physiological phenomena that develop after repeated tobacco use and that typically include a strong desire to use tobacco, difficulties in controlling its use, persistence in tobacco use despite harmful consequences, a higher priority given to tobacco use than other activities and obligations, increased tolerance, and sometimes a physical withdrawal state." The terms such as dependence, addiction, and withdrawal refer to compulsive drug-seeking behavior and abstinence associated disruptions.^[1,2] Nicotine is the drug in tobacco that defines the use of tobacco as addiction. Withdrawal symptoms include impatience, irritability, cravings, increased eating, anxiety, sleep disruption, and psychoactive effects on brain such as mood changes.^[21]

LEGISLATION

The first international tobacco control treaty was "The Framework Convention on Tobacco Control" which

was adopted unanimously by the 192 member states of the WHO in May 2003.^[2] It covers all aspects of tobacco control, including tobacco product regulation, advertising, health warnings, price and tax issues, illicit trade, and tobacco cessation. Legislation in India began with the Cigarette Act, 1975 (Regulation of Production, Supply, and Distribution Act). Later came, the Cigarettes and Other Tobacco Products Act, 2003, prohibits smoking in public places and direct advertising in all media.^[22]

TOBACCO CESSATION – ROLE OF DENTISTS

Tobacco cessation is essential to reduce the mortality and morbidity related to tobacco use. At present, India has about 18 Tobacco Cessation Clinics across the country. This clearly is an inadequate effort taking the existing 250 million tobacco consuming population into consideration.^[2]

Tobacco cessation methods can be broadly classified into:

- Cognitive behavioral therapy includes methods such as self-help and brief interventions which can be provided by health professionals.
- Intensive therapy at smoking cessation centers.
- The pharmacological means including nicotine replacement therapy and antidepressants such as bupropion.^[1]

Oral health professionals are in a unique position to contribute to tobacco control.^[23] The five A's: Ask, Advise, Assess, Assist, and Arrange and five R's: Relevance, Risk, Rewards, Repetition, and Roadblocks are a 5–15 min approach that has proven global success. Dentists are, thus, in an ideal position to reinforce the anti-tobacco message, as well as being able to motivate and support smokers willing to quit.^[8,23]

CONCLUSION

The shift in the global pattern of tobacco use is reflected in the changing burden of disease and tobacco deaths. Unfortunately, the future appears worse. Due to the long time lapse between the onset of tobacco use and the inevitable wave of disease and deaths that follow, the full effect of today's globalization of tobacco marketing and increasing rates of usage in the developing world will be felt for decades to come. Tobacco use is a major preventable cause of premature death and also a common risk factor to several general chronic diseases and oral diseases. A routine intraoral examination by a dental health professional can reveal most of these lesions at an early stage, and early intervention may prevent serious sequelae. Health professionals should play an active role in prevention and control of tobacco-induced lesions due to their direct contact with patients who are at increased risk.

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