

What is the truth about Electronic Cigarettes?

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SUMMARY. Cigarette smoking is the leading preventable cause of mortality. Every year many smokers try to stop smoking, but this is difficult as nicotine is a psychoactive agent that causes dependence and tolerance. The electronic cigarette or e-cigarette was recently introduced on the Greek market and it has become a hot topic that has generated global debate with the authorities. The aim of this review is to explain what the e-cigarette is and to examine its safety and efficacy in smoking cessation or reduction. *Pneumon 2012, 25(3):272-275.*

INTRODUCTION

Cigarette smoking is the leading preventable cause of mortality. The main causes of smoking-related mortality are cardiovascular disease (CVD), lung cancer, and chronic obstructive pulmonary disease (COPD)^{1,2}. Smokers who stop smoking reduce the risk of developing and dying from tobacco-related diseases^{3,4}. In various surveys almost 70% of smokers claim that they want to quit, and more than 40% report they had tried to quit in the last year and intentionally did not smoke for at least one day⁵. Nicotine, however, is a psychoactive agent that causes physical dependence and tolerance. Nicotine is absorbed into the bloodstream within 10-15 seconds of initiation of smoking and flows immediately to the brain, where it acts on nicotinic cholinergic receptors, producing a range of effects, including anxiety reduction, relaxation, pleasure, appetite suppression and cognitive enhancement. In the absence of nicotine, a smoker develops cravings for cigarettes and symptoms of the nicotine withdrawal syndrome⁶.

Clinicians should ask all their patients if they are smokers and if so, whether they are interested in quitting. Clinicians should also assess the pattern of tobacco use of the patients, their desire to stop smoking, and the history of their previous attempts at quitting, including the methods used and their effectiveness. It has been found that the combination of behavioural counselling and pharmacotherapy (with nicotine replacement, bupropion or varenicline) produces better results than either method alone for smoking cessation⁷.

Approximately 80% of smokers who attempt to quit on their own relapse within the first month of abstinence and only 3-5% remain abstinent after 6

months⁵. The use of smoking cessation products increases the chance of committed smokers to stop, but, because of the chronic relapsing nature of tobacco dependence, the need for novel and effective interventions for smoking cessation is unquestionable. Recently, the electronic cigarette or e-cigarette was introduced commercially on the Greek market. This has been advertised as an 'effective smoking cessation device'. The e-Cigarette is a hot topic that has generated global debate with the authorities wanting to ban or at least regulate it. This review article explains what the e-cigarette is and examines its safety and efficacy in smoking cessation or reduction.

WHAT IS THE E-CIGARETTE?

The e-cigarette is a battery-powered electronic nicotine delivery device (ENDD) visually resembling a cigarette⁸. It converts a nicotine containing liquid into a vapour that can be inhaled. It was developed with the goal of mimicking a conventional cigarette without the harmful effects of tobacco smoke. Advertisements often emphasize the lack of withdrawal symptoms in e-cigarette users, making it attractive to smokers who are planning to quit⁹.

The basic design of the various e-cigarettes is generally similar. They consist of a plastic tube, an electronic heating element, a cartridge containing nicotine, propylene glycol and water, a lithium battery and an atomization chamber with a membrane to suspend ingredients¹⁰. Some e-cigarettes contain a light on their tip which glows when the user puffs, to resemble the burning end of a cigarette. The solution in the cartridge is heated when the battery-powered heater is activated, and produces a vapour that can then be inhaled by the user, delivering the nicotine to the lungs and reaching the brain very quickly.

The nicotine content of the cartridges varies between different manufacturers and within the same brand, from no nicotine to 16 to 18 mg per cartridge. Usually chemical additives and flavours (such as various brands of tobacco, chocolate, coffee, mint or fruit) are also introduced into the cartridge¹¹. Propylene glycol is the chemical that is added to generate artificial "smoke" to simulate the appearance of using a "real" cigarette.

ARE E-CIGARETTES SAFE?

Information on the safety of e-cigarettes is limited. E-cigarettes are probably less harmful than tobacco smoking, but they are more dangerous than medicinal

nicotine inhalers⁸. E-cigarettes are not manufactured according to the high standards imposed on pharmaceutical companies and the inhaled vapour may contain impurities that may be dangerous. In a recent study, the use of an e-cigarette for 5 minutes was found to have an impact on pulmonary function tests and the fraction of exhaled nitric oxide (FeNO) of healthy adult smokers similar to that of tobacco smoking¹².

The US Food and Drug Administration (FDA) was concerned that in addition to nicotine delivery, the vapour may provide exposure to other potentially harmful volatile components. Various analyses conducted by the FDA showed that e-cigarettes may contain carcinogens, including nitrosamines, tobacco-specific components possibly harmful to humans, such as anabasine and beta-nicotyrine, and toxic chemicals, such as diethylene glycol, an ingredient used in antifreeze¹³. In addition, cartridges labelled as containing no nicotine were found to contain low levels of nicotine¹³. The origin of the nicotine in the cartridges was uncertain and pharmacological grade nicotine was not always used.

Apart from the FDA analyses, one other analysis in New Zealand showed that the mist from one brand of e-cigarette contained acetaldehyde and mercury¹⁴. Certain studies, however, report that the levels of nitrosamines in e-cigarettes are 500-fold to 1,400-fold lower than the levels measured in regular cigarettes, and conclude that although the current data are insufficient to confirm that e-cigarettes are safe, they appear to be much safer than regular tobacco cigarettes and their toxicity may be compared to that of the conventional nicotine replacement products. Further studies are needed to assess their safety¹⁵.

In September 2010, the FDA sent a number of warning letters to e-cigarette distributors regarding several violations of the Federal Food, Drug, and Cosmetic Act. These violations included use of the devices to deliver active pharmaceutical ingredients, disregard of good manufacturing practices and making unsubstantiated drug claims.

The e-cigarette may constitute a hazard for children. Solutions for the cartridges are often fruit-flavoured and are marketed in small bottles without a child safety cap, and consequently the risk of poisoning or overdose is evident. The solutions are very concentrated and one bottle may contain a very high dose of nicotine (from 500 to over 1,000 mg of nicotine/30 ml). When swallowed, the lethal dose of nicotine for adults is 30-60mg and for children only 10mg.

No side-stream tobacco smoke is released by e-cigarettes, but some vapour is released into the air as the smoker exhales. The impact of this vapour as second-hand or third-hand "passive smoking" has not been investigated. The most frequently reported direct adverse effects of the e-cigarette are dry mouth, throat irritation and dry cough¹⁶.

The European Respiratory Society (ERS) has also issued a statement opposing the use of all tobacco and unapproved nicotine delivery products, including e-cigarettes¹⁷, supported by the Hellenic Thoracic Society¹⁸.

DOES THE E-CIGARETTE HELP SMOKING CESSATION?

E-cigarettes were designed for the purpose of nicotine delivery without tobacco use. People buy e-cigarettes for a variety of reasons, such as trying to quit smoking, "smoking" in smoke-free zones and eliminating exposure to smoke. The use of the e-cigarette as an intervention for smoking cessation or as an aid to long-term abstinence from tobacco has not been formally investigated and for this reason the World Health Organization (WHO) has requested the companies producing e-cigarettes not to make any therapeutic claims¹⁹.

The use of e-cigarettes was found in one study to decrease the desire to smoke after overnight abstinence, when compared with a placebo or conventional cigarettes and to have an effect similar to that of the nicotine inhaler²⁰. Another study suggested that the e-cigarette suppressed cigarette use and helped smoking reduction and smoking abstinence with no apparent increase in withdrawal symptoms²¹. In addition many e-cigarette users have reported that this device helped them to quit or reduce smoking and compared it favourably with both the nicotine patch and bupropion¹⁶. One report noted, however, that e-cigarettes require stronger suction to smoke than conventional cigarettes, needing an increase in the puff strength to produce aerosol during smoking, which may result in adverse health effects²². The same report questioned whether e-cigarettes are useful as an ENDD, as the efficiency of aerosol production during e-cigarette smoking was found to be decreased, making the dosage non-uniform over time²².

Another important issue is that the promotion of e-cigarettes may convey to children and adolescents the message that smoking is harmless, increasing their risk of tobacco use and nicotine addiction. Some studies found that a very small number of the people that had ever used

e-cigarettes and who used the nicotine-containing variety, were never-smokers²³. Young people may be attracted to smokeless tobacco if they perceive it to be safer than cigarettes, but then subsequently graduate to higher-level nicotine brands or switch to cigarettes as their tolerance for nicotine increases²⁴.

Smoking is much more than satisfying the addicting effect of nicotine. It is a habit that includes rituals that smokers associate with their everyday life. A product that resembles conventional cigarettes may partially replace the rituals associated with the act of smoking, but will not divert the way of living and thinking of the smokers away from cigarettes.

CONCLUSION

Smokers who have decided to quit should not trade one carcinogenic product for another, but they should instead use methods for smoking cessation that are proven to be safe and effective⁸. Until more information about the e-cigarette becomes available, the use of e-cigarettes cannot be recommended for smoking cessation or reduction.

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