Policy on Electronic Nicotine Delivery Systems (ENDS)

Latest Revision

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Purpose

The American Academy of Pediatric Dentistry (**AAPD**) recognizes the increased use of electronic cigarettes (**e-cigarettes**) among children and adolescents. In order to reduce health risks caused by nicotine addiction and exposure, the AAPD supports initiatives that increase public awareness of the health and societal costs of the use of tobacco and electronic nicotine delivery systems (**ENDS**), preventing tobacco and ENDS use among children and adolescents, and promote the cessation of the use of these products.

Methods

This policy was developed by the Council of Clinical Affairs, adopted in 2015[1], and revised in 2020[2]. This revision is based on a review of dental and medical literature and sources of recognized professional expertise and stature, including both the academic and practicing health care communities, related to e-cigarettes/ENDS use in children and adolescents. In addition, a search of the PubMed®/MEDLINE database was performed using the terms: e-cigarette AND oral health (MeSH) and identified 32 articles. Five publications were identified in a search limited to reviews, systematic reviews, and ages birth to 18 years. Additional searches using terms ENDS AND oral health (MeSH) and then imposing the same limits identified 12 and three articles, respectively. Papers for review were chosen from these searches and from references within selected articles. When data did not appear sufficient or were inconclusive, policies were based upon expert and/or consensus opinion by experienced researchers and clinicians.

Background

ENDS (e.g., e-cigarettes, e-pipes, vape pens) are battery-powered electronic handheld devices that heat and aerosolize liquids containing propylene glycol, glycerol, nicotine, flavoring chemicals, and other additives to be inhaled by the user.[3-8] The concentrations of ingredients, including nicotine, vary considerably and may even include cancer-causing toxins like formaldehyde and acetaldehyde.[8,9] The act of using ENDS commonly is called vaping due to the vapors that are inhaled and exhaled. However, the emissions from ENDS is most accurately classified as an aerosol to which non-users also can be exposed.[3,6] Vaping products have evolved over the years, from first generation disposable e-cigarettes, second generation e-cigarettes with prefilled or refillable cartridge, third generation with tanks or mods that are refillable, to fourth generation pod mods that are prefilled or refillable.[10] E-cigarettes can also contain substances other than nicotine, including marijuana.[11]

ENDS are marketed[12] as a less harmful alternative for tobacco smokers to consume nicotine.[13,14] They also are used as an aid to stop smoking tobacco-containing products,[15,16] although studies relating to the effectiveness of e-cigarettes as a smoking cessation tool have had mixed results, and the use of e-cigarettes for tobacco cessation is not clearly supported by scientific evidence.[17-19] In fact, the use of e-cigarettes may be a gateway to cigarette smoking in adolescents.[20] There currently are no federally-approved e-cigarette products for adult smoking cessation.[21] E-cigarette solutions come in a variety of flavors and nicotine concentrations.[13,21] The 2020 United States (**U.S.**) Surgeon General's report *Smoking Cessation* reveals that, although e-cigarette aerosol generally contains fewer toxic chemicals than conventional cigarette smoke, all tobacco products including e-cigarettes carry risks.[14]

The U.S. Preventive Services Task Force found that two of the strongest factors associated with initiation of smoking by children are parental smoking and parental nicotine dependence.[22] Studies have shown that exposure to nicotine has a deleterious effect on the brain of children and adolescents.[23-25] Unfortunately, addiction to e-cigarettes is growing among youth since many brands contain high levels of nicotine.[23] E-cigarette use is rising among adolescents at an alarming rate, and studies show that e-cigarette use among teens has surpassed tobacco cigarette use.[5,7,26] In 2019, 27 percent of high school students and 10.5 percent of middle school students reported current e-cigarette usage.[27] Since 90 percent of all adult tobacco smokers reported starting smoking as a teenager,[28] and almost 38 percent of habitual e-cigarette users never smoked tobacco products,[29,30] the potential for increased use of ENDS is a public concern. E-cigarettes may serve as an entry point for use of nicotine, an addictive drug.[26] In fact, adolescents and young adults who used e-cigarettes were found to be 3.5 times more likely to report using traditional cigarettes[31] despite having lower behavioral and social risk factors than those who smoked conventional cigarettes[32].

ABBREVIATIONS

AAPD: American Academy of Pediatric Dentistry. **E-cigarettes:** Electronic cigarettes. **ENDS:** Electronic nicotine delivery systems. **EVALI:** E-cigarette or vaping product use lung illness. **FDA:** United States Food and Drug Administration. **mg:** Milligram. **THC:** Tetrahydrocannabinol. **U.S.:** United States.

Due to lack of regulation in ENDS marketing, the sleek designs of the new products, and the appealing flavors, children who are impressionable and model the behavior of adults are at risk from marketing that normally is banned for tobacco-containing products.[3,23] Some brands appeal to youth as they are designed like universal serial bus (USB) flash drives and offers high concentrations of nicotine in the cartridges, commonly referred to as pods.[14] ENDS solutions are available in a number of enticing flavors, including fruit, candy, and dessert flavors such as Belgian waffle and chocolate.[33] Although they have not been banned for ENDS, these flavors have been banned in tobacco cigarettes due to their appeal to children, adolescents, and first-time.[34,35] Recently, the American Academy of Pediatrics called for all flavor ingredients, including menthol, to be prohibited in all tobacco and nicotine products including e-cigarettes.[4] In 2016, 78.2 percent of middle and high school students were exposed to ENDS advertising from at least one source.[3]

In 2016, the Family Smoking Prevention and Tobacco Control Act[36] was expanded to include regulation of ENDS. Among the regulations set forth was a requirement that manufacturers submit an application for review to determine the safety of their products by 2020.[37,38] Previously, manufacturers were not required to disclose their ingredients.[39,40] The deeming rule of the U.S. Food and Drug Administration (**FDA**) also bans the sale of ENDS to anyone under 18 years old, requires producers to cease giving free samples, and requires warning labels stating that nicotine is addictive.[37,38] Unfortunately, the regulation does not address flavors or nicotine strength or sufficiently restrict the advertising of ENDS.

The base solution in ENDS contains propylene glycol which can cause eye, throat, and airway irritation while long term exposure can cause asthma in children.[41] A five-milliliter vial of e-cigarette refill solution can contain a nicotine concentration of 20 milligrams (**mg**) per milliliter or 100 mg per vial.[42] The known lethal dose of nicotine has been estimated to be about 10 mg in children and between 30 and 60 mg in adults.[42] In addition to nicotine, the liquid can contain tetrahydrocannabinol (**THC**) and cannabinoid (**CBD**) oils and other substances and additives.[43] A national outbreak of lung injuries and deaths associated with e-cigarette use and vaping has been reported.[44] The chemical exposure causing lung injuries was not immediately known; however, analyses of bronchoalveolar lavage fluid samples of those affected revealed vitamin E acetate to be associated with e-cigarette or vaping product use lung illness (**EVALI**).[44] THC was present in most of the samples tested by the FDA.[44] Many different product sources were being investigated as no one causative compound or ingredient had emerged.[44] That the components of ENDS are not entirely disclosed and can vary according to manufacturer poses pressing concerns.[44]

As ENDS remain a popular substitute for tobacco smoking due to indoor smoking restrictions,[43] the effect of the exhaled vapors is also a concern. A number of toxic and potentially carcinogenic compounds have been found in the vapors of e-cigarettes.[45,46] Unrestricted access to smoking of e-cigarettes not only poses health risks to the user but also may pose health risks to people nearby due to secondhand exposure of the vapors.[44] One study showed a similar effect on serum levels of cotinine (a biomarker for exposure to tobacco smoke) with an one-hour exposure to both secondhand cigarette smoke and e-cigarette vapors.[47]

Evidence of the effects of ENDS use on oral health continues to grow, including both clinical and self-reported outcomes.[5,8,9,11,48-52] Cross-sectional studies reveal that those who use e-cigarettes are likely to report diagnosis of a dental problem by a healthcare provider, gingival pain and/or bleeding, tongue or cheek pain, and cracked or broken teeth within the past 12 months[11,48,52] and that use in the past 30 days may contribute to a bad taste in the mouth.[11,53] In adult populations, use of ENDS is associated with poorer periodontal outcome measures, including clinical parameters, gingival inflammation, increased odds of self-reported gingival disease, and dry mouth.[8,9,49-51,54] Further, nicotinic stomatitis, hairy tongue, and angular chelitis have been reported to be more prevalent among e-cigarette users.[49,51] While less common, intraoral injuries as a result of e-cigarette explosions, including tooth and dentoalveolar fractures, avulsions, traumatic ulcerations, burns, palatal perforations into the nasal cavity, and soft tissue injuries, can occur.[51] Although some have suggested that use of e-cigarettes may increase the risk for dental caries, the association is more anecdotal.[8,9,50,55] The proposed mechanism for the association between e-cigarette use and caries onset is attributed to some liquids containing sucrose and ethylmaltol.[9,50,55] E-cigarette aerosols may increase the adhesion of *Streptococcus mutans* to enamel and also promote the formation of biofilm on tooth surfaces.[50] The potential negative oral health consequences of using ENDS warrants patient education about prevention and counseling for cessation of use.[5,50]

Policy statement

Recognizing the potential general and oral health hazards associated with the use of electronic nicotine delivery systems, the AAPD:

- encourages oral health professionals to determine and document e-cigarette use by patients and their parents, and caregivers.
- encourages oral health professionals to educate patients, parents, and caregivers on the health consequences of e-cigarettes and other forms of nicotine delivery systems.
- supports the inclusion of ENDS in laws that ban smoking in all places where children and adolescents live, learn, play, work, and visit.
- encourages the enactment of FDA regulations on ENDS distribution including, but not limited to, national, state, and local legislation prohibiting the advertising, promotion, and sales of e-cigarettes to those under 21, banning the child-friendly flavoring of e-cigarettes, and limiting the use for smoking cessation purposes.

- opposes the use of all forms of unregulated nicotine delivery systems, such as tobacco lozenges, nicotine water, nicotine lollipops, and heated tobacco cigarette substitutes.
- supports further research on the effects of the secondhand vapors and the compounds produced from e-cigarettes and on strategies to prevent use of and addiction to ENDS.

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