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Vaping and Dermatologic Manifestations: A Scoping Review

Julianna Gregory, Abigail Watson, Dr. Jessica Houpe, Dr. Monica Constantinescu, Dr. Armand B. Cognetta*

Florida State University College of Medicine, 1115 West Call Street, Tallahassee, FL 32306, United States

Abstract

Background: The use of electronic cigarettes (ECs), or vaping, has been increasing at an alarming rate, constituting a significant public health concern. A lack of data regarding the impact of EC use on dermatologic disease requires a scoping review of the current literature.

Methods: Our scoping review protocol was registered on Open Science Framework. Two independent reviewers completed a systematic review of the literature in Web of Science, Embase, PubMed, CINAHL databases. The search was performed according to PRISMA guidelines. The Covidence platform was used by the reviewers to assist with autonomous article screening and data extraction.

Limitations: Limitations include elements of study design, analytic methods, study populations, and limited articles.

Results: EC use was identified as both a provoking and exacerbating factor in several dermatologic diseases. Articles examining vaping-related dermatologic burden frequently reported clinical manifestations of impaired wound healing, thermal injuries, and allergic contact dermatitis. Of note, at least one study reported these effects in the absence of nicotine within the EC product.

Conclusion: ECs appear to contribute to the development of various skin diseases. Theories to the development of dermatologic diseases include exposure to various chemicals within the vaping fumes and the device itself, creation of reactive oxygen species, and direct thermal injury. Current experimental evidence on the dermatologic effects of vaping remain limited, underscoring the need for further investigation.

Keywords: Electronic Cigarettes; E-Cigarettes; Vaping; Contact Dermatitis; Dermatology; Skin Condition

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Correspondence:
Julianna Gregory, Florida State University College of Medicine, 1115 West Call Street, Tallahassee, FL 32306, United States,
E-mail: jg23bx@med.fsu.edu

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Abbreviations

Electronic cigarettes (ECs), Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA), electronic nicotine delivery system (ENDS)

Introduction

Electronic cigarettes (ECs) produce an inhalable aerosol by heating an e-liquid composed of propylene glycol, vegetable glycerol, water, flavors and at times nicotine [19]. These aerosols induce oxidative stress and irritation, cause DNA damage and create an environment conducive to carcinogenic effects [7]. The use of ECs, colloquially referred to as "vaping," has exploded in popularity among middle school, high school and college students [17]. EC use increases the risk of inhaling nanoparticles, heavy metals, and volatile organic compounds, which have been linked to obstructive lung disease and lung cancer [11].

The effects of EC use on the skin remain under-investigated, with limited standardized research available on the potential dermatologic harm associated with vaping. Prior studies on traditional cigarette use have demonstrated associations with various dermatological conditions such as psoriasis, hidradenitis suppurativa, chronic dermatoses, lupus erythematosus and skin cancer.[11] However, the mechanisms of vaping and traditional smoking differ substantially, which may influence the spectrum of skin conditions linked to EC use. Given the number of published case reports highlighting dermatologic burden of vaping and lack of comprehensive published reviews, a scoping review is warranted. Due to the relatively recent introduction of vaping products to the

Table 1: Characteristics and review of included articles.

Condition	Sex	Patient Age	Clinical Presentation	E-Cigarette Use Details	Year	Geographic Location
Erosive plaques of oral mucosa	Male	15	Persistent, painful ulceration of oral mucosa	2-3 months of marijuana concentrate	2020	United States
Contact Dermatitis	Female	38	Erythematous, scaly dermatitis with lichenification bilaterally on hands	6 month history of Cigavapore-cigarette use	2019	Portugal
Contact Dermatitis	Female	37	4-5 episodes of facial, lip, and eyelid swelling -Erythema pruritus of eyelids and cheeks bilaterally	6 month history of metal e-cigarette	2011	United Kingdom
Contact Dermatitis	Male Female	50 38	2 year intermittent facial and hand dermatitis; erythematous scaly patches under nose, chin, and hands 3 year history ill defined, erythematous, pruritic patches to right palmar hand	6 year e-cigarette use Undisclosed timeframe e-cigarette use	2018	United States
Contact Dermatitis	Female	54	2 month history of Erythematous, pruritic lesions of perioral region	Undisclosed history of e-cigarette use	2022	Italy
Morphea	Female	63	Pruritus, tenderness, with tight, shiny skin of left breast and abdomen	2-3 months of nicotine free vaping liquid with silica wick e-cigarette	2023	Ireland
Urticaria	Female	48	Transient, migrated, ill defined, erythematous, smooth lesion on trunk, chest, and neck	8 year history of e-cigarette use	2023	United States
Discoid Lupus Erythematosus	Female	34	Hyperpigmented plaque on upper lip with central pink atrophy with telangiectasia and hyperkeratosis Hyperpigmented pruritic patches on lower extremities	Undisclosed length but daily e-cigarette use	2019	United States
Free Flap Compromise; Delayed wound healing	Male	21	Left anterolateral leg free flap; pale	Use within 24 hours of surgery	2018	United States

generalized population and the absence of randomized clinical trials, a meta-analysis is not currently feasible.

Methods

Protocol adherence

This review followed the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) checklist [15]. The protocol was registered with Open Science Framework. An initial limited search of MEDLINE (PubMed) and Embase was conducted to identify relevant articles on the topic. The text words contained in the titles and abstracts of these articles, along with the index terms used to describe them, were used to develop a comprehensive search strategy for Web of Science, Embase, PubMed and CINAHL *(see Appendix #1)*. The search strategy, including all identified keywords and index terms, was subsequently adapted for each included database.

Eligibility criteria

This review included published case studies focused on dermatologic diseases associated with vaping from the start of each database through Jan 1, 2025. Sources were excluded if they met the following criteria: (1) were not written in English, (2) addressed dermatologic conditions unrelated to vaping, (3) focused on wound care, (4) were opinion pieces, conference abstracts, or reviews. Wound care articles related to vaping were excluded due to the large volume of existing systematic review on this topic.

Information sources and search strategy

PubMed, Embase, Scopus, and Web of Science were utilized to identify sources adhering to the eligibility criteria in February 2025. Keywords used included “vaping,” “dermatology,” “case report,” “electronic cigarette,” and “electronic nicotine delivery system”.

Data selection and collection

Eligible articles were uploaded into Covidence, a systematic review management platform, which automatically identified and removed duplicates. Two authors (A.W. and J.G.) independently reviewed titles and abstracts of the studies, excluding studies that were not relevant. Following the initial screening, A.W. and J.G. independently assessed the full-text articles to ensure they met the eligibility criteria. Critical appraisal of each source of evidence considered sample size, population, onset of dermatologic condition, and electronic nicotine delivery system (ENDS) modality.

Data synthesis

Data extraction was completed independently by both authors (A.W. or J.G.). Consensus on article inclusion was reached collaboratively between both authors, with mutual verification to ensure accuracy and completeness. Disagreements were settled by a third-party reviewer (M.C.), if necessary. For each source the following information was extracted: the last name of the first author, publication year, country, study population characteristics, and details regarding the association between vaping and diagnosed dermatologic disease.

Results

Summary of Study Characteristics

A total of 218 articles were identified across 4 databases: Pubmed (n=43), Embase (n=52), CINAHL (n=14), and Web of Science (n=109). 10 eligible sources were included in this study, in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines, as detailed in Figure 1. The 10 case studies included in this review, pertaining to vaping and dermatologic disease, were published between 2011 and 2023 (Table 1). Of the

studies included, most reported an association between vaping and contact dermatitis [3, 5, 14, 18]. The majority of cases originated in the United State [1, 2, 4, 16, 18], followed by reports from several European countries. As all studies are case reports, there is a high level of bias.

Summary of Patient Characteristics

The majority of patients were female (70%), aged 34 to 63 years, while male patients' ages ranged from 15 to 50 years. The time to onset of clinical presentation varied widely, ranging from 2-3 months of vaping to more than 4 years of use prior to symptom development. Reported diseases included contact dermatitis (n=4), perioral and oral lesions (n=2), and several other unique dermatologic disorders. A broad range of vaping liquids was identified, including marijuana concentrate, Cigavapor, and nicotine free formulations.

Discussion

Contact Dermatitis

The majority of studies identified contact dermatitis as a frequent complication associated with vaping. A broad range of irritants were identified in the literature, indicating several pathways through which vaping may contribute to contact dermatitis.

Per Ali et al., 2020, a 15 year old male presented with painful oral ulcerations following 2-3 months of marijuana concentrate ingested via an ENDS [2]. This case is of particular interest as it was one of the few that discussed the use of marijuana concentrate, indicating that various ENDS components may contribute to contact dermatitis. Another case reported dermatitis with lichenification on the hands after 6 months of Cigavapor use [3]. The patient tested positive for nickel sensitivity upon examination. Nickel allergy was noted in several reports and linked to liquid solutions used to create vapor in ENDSs [3, 14]. Additionally, a 37 year old female presented with a 4 month history of dermatitis to cheeks and eyelids, following a 6 month of metal EC use [14]. This patient also tested positive for dimethylglyoxime (DMG) nickel spot test [14]. These similarities in symptom presentation and positive nickel spot testing strengthen association between EC use and contact dermatitis.

Morphea

A particularly interesting case reported chemically induced morphea in a 63 year old female. This patient had a 2-3 month history of using a nicotine-free vaping liquid in an EC with a silica wick [10].

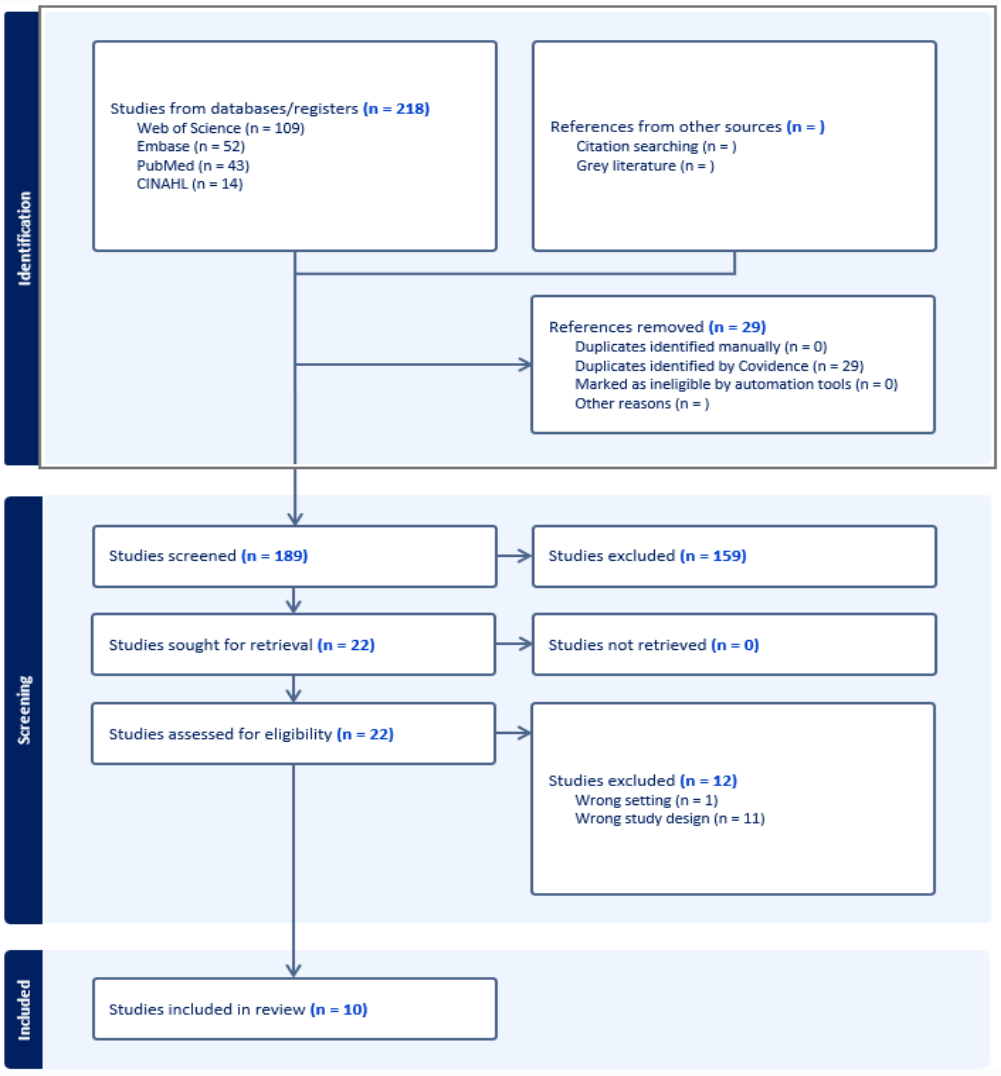

Figure 1: PRISMA 2020 flow diagram of study selection. Numbers indicate records identified, screened, excluded, and included in the review. Diagram generated using Covidence systematic review software.

Figure 2: Global distribution of dermatologic vaping cases reported within scoping review.

Her symptoms resolved upon transition to an EC device without a silica wick and application of topical emollients for 12 weeks [10].

Similar to several of the contact dermatitis cases, we note that the device delivering the vaping liquid may pose as much risk for dermatologic harm as the liquid itself.

Discoid Lupus

A 34-year-old woman with a history of systemic lupus erythematosus and Sjögren's syndrome experienced a disease flare following EC use for an undisclosed duration. An upper cutaneous lip skin biopsy demonstrated changes consistent with discoid lupus erythematosus [16]. The lesion's development may have been secondary to heat exposure from EC use, potentially related to the Koebner phenomenon [16].

Unlike conventional cigarettes, ECs are prone to overheating due to factors such as overcharging or physical damage to the battery. During normal use, the heating coil can reach high temperatures to aerosolize the e-liquid, generating localized heat within the atomizer chamber [13]. This heat may be conducted through the metal housing and mouthpiece, resulting in transfer of low-grade thermal energy to the perioral skin and mucosa [13]. Prolonged or repeated exposure to this localized heat, along with direct contact of the aerosolized vapor on the oral and perioral tissues, may contribute to dermatologic or mucosal injury.

Free flap

A patient experienced free flap compromise within 24 hours of surgical intervention due to the use of an EC [1]. Tissue oximetry readings of the free flap declined markedly, attributed to nicotine induced vasoconstriction. The patient reported vaping in the hospital bathroom shortly before the drop in oximetry values [1]. Following a period of observation to allow reversal of vasoconstriction, the patient achieved full recovery. Because ECs provide a discreet method of nicotine consumption, clinicians encountering unexplained postoperative vasoconstriction should consider recent EC use as a potential contributing factor.

Global distribution

The majority of case studies included in this review originated from the United States with additional reports from Italy, Ireland, the United Kingdom, and Portugal. The TackSHS survey highlighted heterogeneity in e-cigarette use across European markets, with current use reported by 7.2% of respondents in the United Kingdom, 2.7% in Ireland, 1.1% in Italy, and 0.9% in Portugal [8]. This distribution is somewhat consistent with the geographic pattern of published case studies identified in this review. Furthermore, the survey reported a median of 50 puffs per day among current EC users, with 58.8% using nicotine-containing liquids, which aligns with the products described in patients presenting with dermatologic conditions [8].

This review has several limitations. Restricting inclusion to case studies published in English may have excluded reports of dermatologic manifestations from other countries. Because EC use remains relatively novel, healthcare providers may not yet be consistently recognizing or screening for vaping associated dermatologic conditions. Furthermore, vaping regulations vary widely across countries, and it is possible that regions with stricter controls on vaping products may have fewer reported dermatologic manifestations compared to those with more permissive regulations.

Conclusion

Vaping via the use of ECs or ENDs not only increases risk of cancer, cardiovascular disease, and pulmonary disorders, but it also creates a free radical environment that is conducive to dermatologic disease [13].

ENDS typically consist of a cartridge that is filled with an e-liquid, a heating element or atomiser to aerosolize the liquid, a mouthpiece for inhalation, and a rechargeable battery [13]. Device materials often include wires, atomizers, fiberglass wicks, and solder joints. E-liquids commonly include propylene glycol, glycerol, nicotine, flavorings or other additives such as cannabinoids and vitamin E derivatives [13, 19]. However, the resulting aerosol also frequently contains acetaldehyde, formaldehyde, propylene oxide, and metal or silicate parts [13, 19]. The presence of metal and silicate particles may be linked to the device structure which widely varies, as do global regulatory standards. As highlighted in this review of case studies, the absence of nicotine from an e-liquid does not necessarily equate to reduced risk, as aerosols may still contain allergens and carcinogens.

Numerous systemic effects leading to inflammation and endothelial dysfunction are associated with EC use. The e-liquid components can act as haptens, inducing a type IV hypersensitivity reaction in predisposed individuals [17]. Flavoring additives have

been identified to increase inflammatory cytokine secretion and may contribute to skin sensitization and dermatitis due to impaired barrier function [17, 19]. Increased recruitment and activation of macrophages and dendritic cell, along with upregulation of proinflammatory cytokines such as IL-6, IL-8, TNF-a and IFN-γ have also been linked to increased oxidative stress induced by e-cigarette aerosols [17]. These pathways are particularly relevant to development of lupus and other autoimmune diseases.

Given the rapidly increasing prevalence of EC use among young adults and the broad systemic effects of these devices, healthcare practitioners should consider obtaining a detailed history of e-cigarette usage. Such histories should include information on e-liquid composition, type of EC device, and average number of puffs per day. Patient education should also emphasize that vaping affects not only cardiopulmonary health but also has systemic consequences.

Dermatologists, in particular, can play an important role in assessing EC use in younger populations that frequently come in for treatment of acne, psoriasis or other dermatologic conditions. Additionally, EC use is associated with perioral and oral eruptions, underscoring the importance of examining the oral mucosa and perioral region during comprehensive dermatologic evaluations, highlighting opportunity for interdisciplinary screening, particularly in collaboration with dental providers.

Vaping has a systemic impact on overall health. EC use can compromise epidermal barrier integrity and function, contributing to a wide spectrum of dermatologic conditions. Importantly, these effects occur regardless of nicotine content in the e-liquid. Physicians should routinely screen for EC use and provide patient education on the diverse associated health risks. Further experimental and translational research is needed to fully elucidate the dermatologic disease burden attributable to EC use.

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[1]Florida State University College of Medicine, Tallahassee, Florida.

[2]Florida State University Division of Micrographic Surgery and Dermatologic Oncology, Tallahassee, Florida.

[3]Department of Dermatology, University of Central Florida/HCA Healthcare Dermatology Residency Program, Tallahassee, Florida.

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Appendix 1: Search Querry.

Embase: ('electronic cigarette'/exp OR 'electronic cigarette') AND ('skin'/exp OR 'skin') AND ('vaping'/exp OR 'vaping') AND ('article'/it OR 'review'/it).

PubMed:((("vaping"[All Fields]) OR (electronic cigarettes)) OR ("electronic nicotine delivery"[All Fields]))) AND (skin condition).

Web of Science: (ALL=(electronic delivery system)) AND ALL=(skin disease).