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**Oral Health Effects of Electronic Cigarettes: A
Scoping Review of Impacts on Saliva, Dental Caries,
and the Periodontium**

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ADMINISTRATIVE INFORMATION

Support - None.

Review Stage at time of this submission - Formal screening of search results against eligibility criteria.

Conflicts of interest - None declared.

INPLASY registration number: INPLASY2025120013

Amendments - This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 4 December 2025 and was last updated on 4 December 2025.

INTRODUCTION

Review question / Objective Population (P) Humans of any age who use electronic cigarettes, including comparisons with non-smokers, traditional cigarette smokers, and dual users. (In vitro studies using human oral cells/tissues are included to support mechanistic understanding.)
Concept (C) Oral health effects of electronic cigarette exposure, specifically:
• Saliva parameters (flow rate, pH, cytokines, metabolites, oxidative stress)
• Dental caries and precaries changes (DMFT/DMFS, enamel hardness, white-spot lesions, biomarkers)
• Periodontal health (CAL, PD, BoP, gingival inflammation, microbiome shifts, cellular responses)
Context (C)

All global settings, with no restriction on geography, healthcare system, or demographic context.
All study designs are eligible (clinical, epidemiological, in vitro, and review evidence).

PCC-Derived Research Question
"Among human electronic cigarette users (Population), what is known about the effects of vaping on saliva composition, dental caries risk, and periodontal health (Concept) across all clinical, laboratory, and epidemiological research settings (Context)?"

Background Electronic cigarette use has expanded globally, and the oral cavity is the primary site of exposure to inhaled aerosols. Evidence suggests measurable associations between EC use and alterations in saliva, increased caries risk, and periodontal inflammation. However, findings are scattered across diverse study designs. A scoping review is

needed to map existing evidence and identify gaps.

Rationale With the growing global use of ENDS, particularly among adolescents and young adults, concerns about their health effects have emerged as a significant public health issue discourse (Walker MW et al., 2022).

The detrimental effects of traditional tobacco smoking on oral health are well-established. Conventional cigarettes have been linked to a wide range of oral health conditions such as periodontitis, tooth discolouration, oral cancer, and delayed wound healing [Gupta et al., 2017]. However, the specific oral health outcomes associated with ENDS use remain under investigation. As ENDS is a relatively new phenomenon, the current evidence is limited and often inconsistent, requiring further exploration [Li & Hecht, 2022].

A comprehensive understanding of ENDS-related oral health outcomes is critical for dental practitioners, researchers, and policymakers (Hung et al., 2022). Despite the growing body of research on e-cigarettes and health, findings are scattered across various disciplines, with considerable variation in study designs, populations, and outcome measures (Lindson et al., 2024). This lack of consolidated evidence poses a challenge for clinicians seeking to advise patients, for regulators who aim to advise patients, and for regulators who aim to establish informed guidelines (Morphett et al., 2024).

METHODS

Strategy of data synthesis

Search

Strategy Databases: MEDLINE, Embase, Scopus, Web of Science, Cochrane Library. Grey literature: WHO, CDC, FDA reports, theses.

Keywords: 'electronic cigarette', 'vaping', 'ENDS', 'oral', 'saliva', 'caries', 'periodontal disease'.

Data Extraction

Data extraction will include study characteristics, EC exposure, oral outcomes, biomarkers, microbiological results, and limitations.

Data Synthesis

Evidence will be summarised narratively under saliva, caries, and periodontium domains. No meta-analysis is planned.

Eligibility criteria Eligibility Criteria

Population: Humans of any age; in vitro studies using human oral cells/tissues.

Exposure: Electronic cigarettes, ENDS, vaping products, heated tobacco.

Comparators: Non-smokers, smokers, dual users, HTP users.

Outcomes: Saliva parameters, caries indices, enamel changes, periodontal measures, biomarkers, microbiome shifts.

Study Types: Cross-sectional, cohort, case-control, in vitro, systematic reviews.

Exclusion Criteria

Animal studies; studies without EC-specific exposure; papers without oral outcomes; commentaries and editorials.

Source of evidence screening and selection

Study Selection: Two reviewers will independently screen titles, abstracts, and full texts. Discrepancies resolved by a third reviewer. PRISMA-ScR flow diagram will guide reporting.

Selection of Sources of Evidence

The study selection process involves a two-stage screening procedure. Two independent reviewers examine the titles and abstracts based on predefined inclusion and exclusion criteria. Inclusion required human studies that compared ENDS users with conventional smokers or non-smokers, focusing on oral health outcomes. Exclusion criteria encompassed non-peer-reviewed articles, in vitro or animal studies, papers solely on cancer treatment, non-English publications, unavailable full texts, and duplicates. Full-text screening will follow for eligible articles, with disagreements resolved by a third reviewer. Only studies aligned with the research objectives and methodological quality standards were included.

Data Items

Data extracted include: author(s), publication year, study design, sample size, and demographic characteristics (age, gender, socioeconomic status). Information on ENDS device type and usage patterns was also collected. Oral health indicators, including gingivitis, periodontitis, and caries, were recorded, along with self-reported and clinically assessed outcomes.

Statistical data and significance levels will be extracted where available. This review assumed peer-reviewed status for all included articles and focused primarily on clinical outcomes, excluding psychosocial dimensions. Findings are expected to reflect current ENDS usage practices and be generalisable across populations with similar demographic variability.

Data management All records identified through database searches will be imported into a reference management system (Zotero or EndNote) where duplicates will be identified and removed.

The de-duplicated library will then be exported into a systematic review management platform (Covidence or Rayyan) for title and abstract screening.

Two reviewers will independently screen all records. Screening decisions (include, exclude, or unsure) will be stored within the platform to maintain a full audit trail. Full-text PDFs of potentially eligible studies will be uploaded and stored in the same system, with reasons for exclusion recorded at the full-text stage.

A structured data-extraction form will be developed using Excel or a secure online platform (Google Sheets or REDCap). The form will include fields for study characteristics, population details, exposure information, oral health outcomes, biomarkers, laboratory findings, and study limitations. Extracted data will be entered independently by two reviewers, with discrepancies resolved through discussion or by a third reviewer. All extracted data will be version-controlled to ensure transparency and traceability.

Data will be stored in an encrypted, access-restricted institutional drive to ensure confidentiality and integrity. Backups will be made automatically. Only members of the review team will have access to the data repository. No identifiable participant data will be collected.

All decisions, extraction files, and synthesis documents will be archived at the completion of the review to enable reproducibility.

Language restriction Only English language articles will be included.

Country(ies) involved Malaysia.

Keywords Electronic Nicotine Delivery System, ENDS, Electronic Cigarette, E-Cigarette, Vaping, Vape, Oral Health.

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