

**Effects of Cannabis Use on Oral Health and
Systemic Effects Relevant for Oral Health Professionals**

This evidence synthesis was prepared by the Office of the Chief Dental Officer, in consultation with Health Canada and the Prevention of Problematic Substance Use team at the Public Health Agency of Canada, based on a comprehensive review under contract by Dr. A. José Lança of the University of Toronto

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1. Objectives

Currently, there is no comprehensive review of the literature on the effects of cannabis¹ on oral health. This synthesis summarizes existing evidence on the effects of cannabis on oral health and presents the systemic effects of cannabis and the drug interactions (DIs) between cannabis and medications relevant for oral health professionals. Knowledge gaps are identified and evidence-based recommendations are provided to support patients' oral health care with regard to cannabis use.

The objectives of this review are to

- raise awareness about the effects of cannabis on oral health
- support continuing education of oral health professionals
- facilitate public access to evidence-based information on this issue and
- contribute to a preventive approach to improved oral health.

2. Background

Cannabis is a commonly used drug for medical and non-medical purposes, with some documented therapeutic uses but also health risks, adverse effects and potential for developing cannabis use disorder (CUD). The effects of cannabis are caused by active compounds, known as cannabinoids. In Canada:

- prescription cannabinoids² (Nabiximols and Nabilone) have been approved by Health Canada for over thirty years (1982)
- the use of cannabis for medical purposes³ has been allowed since 2001, and
- the use of cannabis for non-medical purposes⁴ was legalized in October 2018.

The indications of prescription cannabinoids reviewed and approved by Health Canada^{5 6} include:

- the management of severe nausea and vomiting associated with cancer chemotherapy (Nabilone, a synthetic tetrahydrocannabinol [THC] analog)

¹ For the purpose of this synthesis and for better fluidity and readability, the broader term “cannabis” is used to talk about the plant in its different forms and parts (oil, seeds, etc.) and the cannabinoids. The distinction is maintained only when/if necessary for clarity and better accuracy.

² marketed with health claims and subject to a premarket authorization by Health Canada

³ obtained via a health care practitioner's authorization for human use, with no health claims or premarket review for safety and efficacy

⁴ obtained from provincially and territorially licensed sellers, with no health claims or pre-market review for safety and efficacy

⁵ <https://www.canada.ca/en/health-canada/services/drugs-medication/cannabis/information-medical-practitioners/information-health-care-professionals-cannabis-cannabinoids.html>

⁶ <https://www.canada.ca/en/health-canada/services/drugs-health-products/drug-products/applications-submissions/guidance-documents/guidance-cannabis-act-food-and-drugs-act-related-regulations/document.html>

- adjunctive treatment for symptomatic relief of spasticity and neuropathic pain in adult patients with multiple sclerosis (Nabiximols, a botanical extract of THC and cannabidiol [CBD] from cannabis)

The prevalence of cannabis use in Canada is among the highest in western countries (1-2). According to the Canadian Tobacco, Alcohol and Drugs Survey (CTADS), in 2017, 15% of Canadians aged 15 years or older reported using cannabis in the past year (males: 19%; females: 11%) (3-4).

Poly-substance use of cannabis and alcohol, tobacco and other psychoactive substances is concerning and particularly relevant in clinical practice because of the increased risk, prevalence and severity of systemic and oral disorders (5-6).

3. General information and concerns related to cannabis use

Tetrahydrocannabinol (THC) is the main psychotropic compound in cannabis (7-12). It also has therapeutic properties such as analgesia and anti-nausea. Cannabidiol (CBD) does not have psychotropic properties but has some anti-inflammatory, analgesic, anti-nausea and muscle relaxant properties (9; 13-14). THC, CBD and other cannabinoids are rapidly absorbed through the lungs when cannabis is smoked. Approximately 50% of the THC from a burning cannabis cigarette is inhaled, while the remainder is lost in smoke or destroyed by heat. Half of that amount is exhaled so only 25% of the administered dose is actually absorbed, on average (15). Less THC is lost when vaping instead of smoking, resulting in greater absorption of THC and greater effects (16-22).

The psychological effects of cannabis include relaxation, euphoria and a sense of well-being. Cognition, attention, memory and motor coordination are also impaired (23-25). Onset and duration of effects depend on route of administration. When cannabis is smoked or vaped, the first effects are felt in seconds to minutes, can last for up to three to six hours and persist for up to 24 hours. When ingested, the onset of effects occurs 30 minutes to two hours after ingestion, the effects last for four to 12 hours and can persist for up to 24 hours (7-9; 26).

Chronic use of cannabis can lead to tolerance, physical and psychological dependence - now referred to as “cannabis use disorder” (CUD). A person who has developed a physical or psychological dependence can also have withdrawal symptoms when they abruptly stop using cannabis (23; 27-29). In the Diagnostic and Statistical Manual of Mental Disorders, 5th edition (DSM-5), CUD describes a range of problems with cannabis use that includes the possibility that people can be negatively impacted by their cannabis use, without necessarily being addicted, and the recognition that addiction to cannabis can happen. CUD can be mild to severe (30).

4. Effects of cannabis use on oral health

The effects of cannabis on oral health depend on drug potency (e.g., concentration of THC), other cannabis constituents, toxic byproducts from smoking cannabis (e.g., tar, carcinogens),

route of administration (e.g., inhalation or orally), mode of administration (e.g, smoked, vaped or ingested), and the frequency of use (e.g., occasional, regular or daily) (24; 31-32).

People using cannabis – especially when smoked and if used on a regular or daily basis – tend to have a poorer oral health than people who do not use cannabis, with higher prevalence of dental caries and periodontal disease (24; 33). Other oral pathologies include xerostomia, stomatitis, gingivitis, gingival hyperplasia, higher decayed, missing and filled teeth (DMFT), candidiasis and leukoedema (24; 34-44). Additional pathologies, such as uvulitis, alveolar bone loss and premalignant lesions of the oral mucosa, such as leukoplakia and oral papilloma, occur less frequently (39; 41; 45-46). The prevalence of oral diseases by exposure to cannabis smoke is further compounded by poly-substance use (47). Approximately 90% of individuals who smoke cannabis also smoke tobacco cigarettes, and have a higher risk of developing oral pathologies (48).

Although both alcohol and tobacco use are associated with an increase in head and neck cancer, including oral squamous cell carcinoma (OSCC), the relationship between cannabis use and OSCC is still unclear (49).

The direct exposure to the physical elements and chemical components of cannabis smoke, unlike ingestion of cannabis products, is associated with a higher prevalence and severity of the oral pathologies observed in clinical practice (39; 50). The frequent exposure of the oral mucosa to the higher combustion temperature of cannabis (compared to tobacco cigarettes) increases the risk of hyperkeratosis and leukoedema (24; 36; 38-41; 50). The concentrations of tar and carcinogens are higher in cannabis (51-52). The direct exposure of the oral mucosa and respiratory tract to cannabis smoke has been estimated to be at least five times higher than that of tobacco (53-55).

4.1 Effects of cannabis use - especially when smoked - on periodontal disease and periodontal tissues

Cannabis use - and more specifically cannabis smoking - has been associated with poor oral health, and higher prevalence of periodontal disease, caries and gingival hyperplasia. The concurrent use of cannabis and tobacco, however, is a confounding factor in determining the role of cannabis on periodontitis (24).

Cannabis smoking is associated with higher prevalence and incidence of periodontal attachment loss (46; 56). People smoking cannabis who also smoke tobacco are twice as likely to present with poorer periodontal status with greater probing depth and attachment loss than people using cannabis who never smoked tobacco (44; 46). Cannabis plays an independent role from tobacco on periodontitis and the use of both cannabis and tobacco has a synergistic effect that further increases the prevalence of periodontitis (44; 46).

Heavy cannabis⁷ smoking can cause gingivitis, gingival hyperplasia (GH) and alveolar bone loss similar to both phenytoin and nifedipine-induced pathology (24; 34-37; 39-44; 56-57). Associated clinical manifestations observed in daily cannabis smokers that rarely or do not smoke tobacco cigarettes include: “fiery-red” papillary and marginal gingival hyperplasia, most noticeable in the anterior region (56); papillary and gingival enlargement more pronounced in the maxillary and mandibular buccal gingiva and nodular or “pebbly” appearance of the palatal surface (41; 58); red lesions of the oral mucosa, as well as “stomatitis” of the palatal mucosa typically speckled white and red in appearance from the hyperkeratosis and minor salivary gland openings (36); xerostomia, gingivitis, and periodontitis (58). Although the association between cannabis smoke and GH has been consistently reported in the literature, larger clinical studies, systematic reviews or meta-analyses have not yet been conducted.

4.2. Effects of cannabis use - especially when smoked - on dental caries

Particularly when smoked, cannabis can cause xerostomia, lower salivary pH and promote plaque and calculus formation, thus increasing the occurrence of caries (35). People using cannabis – especially if used on a regular or daily basis – tend to also have poorer oral health, as they tend to brush their teeth less frequently, visit their dentists less often, have higher cariogenic diets, and have xerostomia and higher plaque scores than people not using cannabis, all of which increase the risk of caries in cannabis users (24; 36; 38; 50).

4.3. Effects of cannabis use - especially when smoked - on dry mouth (xerostomia) and other forms of oral irritation

Xerostomia is the most commonly observed adverse effect of smoking cannabis (24; 34-37; 40-44). Cannabis smokers can experience xerostomia for one to six hours after use (36; 38). Vaping of cannabis products has also been shown to cause xerostomia, although evidence is still limited (22).

Some studies also indicate that cannabis smoke alters the chemical composition of saliva. Cannabis smoking significantly decreases salivary pH and phosphate concentrations when compared to non-smoking individuals (59). These changes in the chemical composition of saliva reduce its buffering properties and together, the decrease in salivary secretion and change in chemical composition increase the risk of developing oral pathologies (60). In cannabis smokers, xerostomia is frequently associated with gingivitis, gingival hyperplasia, periodontitis, dental caries and poor oral hygiene (19; 24; 35; 38; 42; 44; 50; 60) and, less frequently, with uvulitis (41; 45; 61).

Xerostomia is also associated with prescription cannabinoids (such as Nabilone [Cesamet®] – a synthetic THC analog available in capsules), Nabiximols (Sativex®) – a mixture of THC and CBD in the form of oral spray, and with the use of Marinol (dronabinol, a synthetic THC) (62).

⁷ The definition of ‘heavy’ use varies between studies, but in general it refers to people using cannabis at least three times a week, often every day and usually for years.

5. Overview of systemic effects of cannabis use relevant for oral health professionals

Because of the absorption of cannabis through the oral mucosa and respiratory system, cannabis use also has systemic effects that oral health professionals should be aware of and familiar with, to adequately manage patients in dental practice.

Cardiovascular system: Case reports and clinical studies have linked heavy or regular cannabis and cannabinoids use with adverse cardiovascular events, including stroke, myocardial infarction, cardiomyopathy, arrhythmias, and cardiac arrest (63).

Cerebrovascular system: Cannabis affects cerebral auto-regulation and increases vascular tone leading to vasoconstriction, which increases platelet aggregation, thus increasing the risk of an acute ischemic stroke or transient ischemic attack (TIA) (63-64). Cannabis use is also associated with an increased likelihood of hospitalization for acute ischemic stroke in young adults (65-66). An increase in acute subarachnoid hemorrhage (SAH) has also been associated with cannabis use in a group of 15-54 year old patients (67). **Oral health professionals should be aware that the risks associated with cannabis use and SAH can be further increased by the effects of epinephrine on the cardiovascular system** (68-69).

Gastrointestinal system: Cannabis can cause xerostomia, inhibits gastric acid secretion and motility, and decreases visceral sensation and gastrointestinal inflammation (70-71). Patients with chronic cannabis use may present with an emergency condition known as cannabinoid hyperemesis syndrome (CHS). CHS typically presents as a triad of severe and cyclical nausea and vomiting, relief of symptoms with hot baths, and resolution of symptoms after cannabis cessation (72-75). All clinicians and public health officials should be familiar with CHS diagnosis and treatment guidelines (76).

Musculoskeletal system and analgesia: Prescription cannabinoids -Nabiximols (Sativex®) in oral spray have been approved for the symptomatic relief of spasticity and neuropathic pain in patients with multiple sclerosis; cannabis is also used by patients with this medical condition. Xerostomia, oral pain, irritation of the oral mucosa, and increased risk of patients experiencing orthostatic hypotension as they stand up after dental treatment are listed as adverse effects of Nabiximols (62).

6. Drug interactions relevant for oral health clinical practice

It is important for healthcare professionals in general, and oral healthcare practitioners in particular, to be aware of the pharmacodynamics and pharmacokinetics interactions between cannabis and medications used in dental offices.

Pharmacokinetic DIs between cannabis/THC and medications: The most important pharmacokinetic interactions between THC and medications might result either as an increase or decrease in blood concentration of THC and/or medications, depending if the liver metabolism is inhibited or increased. For example,azole antifungals inhibit the liver

metabolism thus increasing THC concentrations in the blood and the risk of adverse effects. Another clinically relevant example is the inhibition of warfarin metabolism by competition with THC, thus increasing warfarin concentrations in the blood and the risk of bleeding (77-78).

Dental treatment of a patient under the influence of cannabis can cause the patient to experience acute anxiety, dysphoria, and psychotic behaviour (24; 79- 80). Drug interactions between THC and central nervous system (CNS) depressants (e.g., alcohol, opioids, benzodiazepines, barbiturates, anticonvulsants, antipsychotics, general anesthetics) potentiate the physiological and behavioural impairment caused by the individual substances, and may lead to the inability of a patient to provide valid consent to treatment (24; 39; 81-83).

Pharmacokinetic DIs between cannabis/CBD and other drugs: DIs with CBD should also be considered. CBD can adversely affect liver function and can interact with commonly used medications such as anticoagulants and anti-epileptics. Other observed common adverse drug events from CBD include sedation, sleep disturbances, infection, and anemia (77-78; 84).

DIs between cannabis/THC and alcohol: It is well known that cannabis (THC), as well as alcohol, impair cognition and motor coordination in a dose dependent manner (85). It is also known that the pharmacological interactions between cannabis and sedatives potentiate the effects of each substance (82; 86).

DIs between cannabis/THC and CNS depressants: In addition to the cannabis-alcohol interactions, six classes of prescription CNS depressants have significant interactions with cannabis: opioids, benzodiazepines, barbiturates, anticonvulsants, antipsychotics and general anesthetics. Interactions between cannabis and all CNS depressants potentiate the sedative, psychomotor, and other effects on the central nervous system, including respiratory and cardiovascular depression (82; 87-89).

DIs between cannabis/THC and sympathomimetics: Interactions between cannabis and sympathomimetic drugs, nasal decongestants or beta-2 bronchodilators potentiate the coronary vasoconstriction and tachycardia caused by each of the drugs separately. These interactions increase the risk of myocardial infarction, primarily in individuals with a medical history of coronary artery disease (35; 79; 82; 90-93). **Potential risks for dental practice from the interaction between cannabis and epinephrine must be considered.**

7. Conclusions

Although evidence is limited regarding the direct effects of cannabis use on oral health, the studies upon which this evidence synthesis is based suggest that oral health professionals need to be aware of the adverse effects and risks related to cannabis consumption, and to be particularly vigilant regarding drug interactions.

Considering the recent legislative changes regarding the non-medical use of cannabis (*Cannabis Act*) (94), it is expected that its use and inherent adverse effects and risks, including effects on

oral health, will also increase in prevalence. This view is supported by data showing an increase⁸ in cannabis consumption after legalization in several jurisdictions in the United States, either for medical or non-medical use (95-96).

It is important for health agencies to recognize the effects of cannabis use on oral health and to develop appropriate communication products to increase awareness of the public and health professionals (33).

8. Knowledge Gaps

The scientific literature currently available on the systemic effects of cannabis, although extensive, has many limitations. Large clinical studies are limited in number or non-existent. These limitations are particularly noticeable regarding (a) the direct effects of cannabis on oral health, and (b) the implications of the systemic effects of cannabis on patient treatment in the oral health professions.

In Canada, legalization of cannabis provides a unique opportunity to conduct studies to investigate not only the patterns of cannabis use and/or CUD, but also on therapeutic efficacy and long term implications for both oral health and systemic health.

Xerostomia is the most common oral adverse effect of cannabis use – especially when smoked - and cannabis-induced periodontitis is the adverse effect supported by the most robust literature. More studies addressing the following research questions will help shed more light on the subject:

- a) To what extent does cannabis use- especially when smoked:
 - i. increase the incidence of dental caries?
 - ii. affect the structure of teeth and their supporting tissues?
 - iii. Is associated with gingival hyperplasia?
 - iv. Is associated with oral squamous cell carcinoma?
- b) What are the implications of the systemic effects of cannabis use on patient treatment by oral health practitioners?
- c) What are the short, medium and long-term effects of the vaping of cannabis products on oral health?

Additional insights may also be gained by exploring the above research questions as they relate to the frequency of cannabis use (e.g., occasional, regular or daily).

⁸ It should be noted, however, that part of this increase could be explained by the fact that people may now be more open to reporting because of less stigma, so the increase is not necessarily only because of a higher prevalence.

9. Recommendations

In the future, it will be necessary to conduct clinical and observational studies in order to address the present knowledge gaps. Increased emphasis on public health education, continuous education and oral public health to develop strategies and programs for education, prevention, and management of cannabis use/misuse will also contribute to health improvements in general, and oral health improvements in particular.

The following recommendations are based on the current level of evidence, with the aim of supporting patient oral health care with regard to cannabis use:

- a) It is strongly advised, for patients/clients who are under the influence of cannabis and not able to provide informed consent, that the appointment be postponed and that professional guidelines regarding ability of a patient/client to provide informed consent be closely followed.
- b) Oral health professionals are encouraged to:
 - i. learn more about cannabis and cannabinoids and to stay abreast of the scientific literature on its potential effects on oral health and overall health.
 - ii. provide evidence-based advice to their patients/clients.
 - iii. monitor and document any observed unusual modifications to their patients'/clients' oral cavity.
 - iv. document patients'/clients' cannabis use, including frequency, type of product⁹, route and mode of administration.
- c) Oral health professionals must be aware of complex and potentially fatal sequelae related to drug interactions with cannabis¹⁰ – it should be determined at each patient appointment if cannabis has been used, either alone or in conjunction with other psychoactive substances, or with medications or if it occurs in individuals with previously diagnosed systemic pathologies.
- d) Potential risks for dental practice from the interaction between cannabis and epinephrine must be considered.

⁹ Including, when possible, brand name of product, name of license holder, THC and CBD profile, dried, edible, vape, topical, extract etc.

¹⁰ Oral health professionals are also encouraged to ensure that the other health professional(s) who will deal with the situation in case of adverse reactions will have all the information about what happened at the dental setting, so they can report the event to the license holder and to Health Canada's Canada Vigilance database: <https://www.canada.ca/en/health-canada/services/drugs-medication/cannabis/recalls-adverse-reactions-reporting.html>

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