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ABSTRACT

Dental clinicians must now incorporate the advent of recreational and medical marijuana usage in their patients' medical histories and polypharmacy assessments. As marijuana and its science may not have been taught in school to the vast majority of dental clinicians, even simple questions such as "What is THC?" and "What is CBD?" are frequently encountered. Also, dental professionals are generally not aware of how their patients consume these substances. This course will outline the human endocannabinoid system and how THC and CBD affect the brain and body. It will also discuss the current legal landscape, patient comorbidities, and pharmacologic adverse reactions that are more dangerous in dental patients if they are using marijuana. Malpractice liability issues in patients who are using recreational and medical marijuana will be addressed from an informed consent perspective. Finally, the course will discuss oral medicine issues that can occur with cannabis (THC/CBD) use, such as increased caries, fungal infection, periodontal disease, and oral cancer.

EDUCATIONAL OBJECTIVES

At the conclusion of this course, participants will be able to:

1. Summarize the human endocannabinoid system
2. Outline comorbidities that will be more problematic in dental patients who are consuming cannabis products
3. Describe the elevated risks with polypharmacy patients who consume THC/CBD consumption undergoing dental therapy
4. Summarize oral medicine issues that can arise with patient consumption of THC/CBD



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Cannabinoids and dentistry:

Legality, addiction, adverse drug reactions, oral medicine, informed consent, and procedure concerns

A PEER-REVIEWED ARTICLE | by Eric S. Bornstein, DMD

A recent American survey revealed that 50% of the US population has tried marijuana. This figure is the highest it has ever been since marijuana use assessments began in 1969, and the number hovered at 4%.¹ Cannabinoid availability in the United States takes many forms today. There is traditional marijuana with its psychoactive component delta-9-tetrahydrocannabinol (Δ^9 -THC), nonpsychoactive cannabidiol (CBD),² and a wide variety of dangerous synthetic THCs and THC derivatives.³ Any psychoactive element of cannabis must

be considered addictive through dopaminergic interactions in the brain's limbic (pleasure) center.⁴

Cannabinoid substances are available for consumption in a variety of methods. Cannabinoids can be smoked,⁵ vaped,⁶ dabbed,⁷ or consumed orally as edibles.⁸ Both cannabis inhalation and ingestion have significant impacts on oral health. Cannabis inhalation (smoking or vaping) is associated with periodontal disease, xerostomia, leukoplakia, microbiome changes, increased risk of oral cancer, and smooth surface caries.^{9,10}

Nonpsychoactive CBD can also be purchased and used freely today as lotions, tinctures, sublingual sprays, liquids, vapes, pills, and edibles.¹¹

A vital aspect of dental patient care is informed consent. Patients have the right to understand their diagnosis and make rational decisions on a proposed treatment plan.¹² The granting of consent requires the patient to be mentally and psychologically sound and unimpaired before making a decision.¹³ Because many cannabinoids are psychoactive and can cause mental impairment and a psychomotor deficit, the concept of informed consent while under the influence of cannabinoids is now a critical question. Finally, cannabinoid interactions with the cardiovascular system, interprocedural local anesthetics, and postoperative analgesic prescriptions are more challenging to predict and understand in patients taking cannabinoids.¹⁴

Legal landscape of marijuana ($\Delta 9$ -THC)

The possession and use of marijuana have been illegal under federal law since 1970 when President Richard Nixon signed the Controlled Substances Act (CSA).¹⁵ Notwithstanding this federal law, the United States of America is currently awash in cannabis and cannabinoids, with over two-thirds of the states legalizing some form of recreational or medical marijuana use.¹⁶

With the CSA, marijuana (delta-9-tetrahydrocannabinol, or $\Delta 9$ -THC) is classified as a Schedule I substance. Schedule I substances possess no currently accepted medical use and have a high potential for abuse.¹⁷ The federal government has largely ignored this Schedule I designation for $\Delta 9$ -THC for the last three presidential administrations (Obama, Trump, and Biden). In 2013, during the Obama administration, the Justice Department

issued the “Cole Memo,” which officially adopted a detached approach to federal marijuana prosecutions in states with marijuana-friendly policies.¹⁸ This disconnected federal approach has continued to hold so long as other national priorities were not inhibited, such as policing drug gang and cartel activities or deterring the distribution of $\Delta 9$ -THC to children. In April of 2022, during testimony to the Senate Appropriations Subcommittee, Attorney General Merrick Garland stated that prosecuting the possession of marijuana is “not an efficient use” of federal resources.¹⁹ On October 6, 2022, President Biden pardoned federal convictions for marijuana possession.²⁰ Today, in 2024, even though most states have legalized either or both the medical and recreational use of marijuana/THC, it is still federally illegal. Therefore, anyone with federal arresting authority can apprehend and prosecute marijuana possession and use, even in states where $\Delta 9$ -THC has been legalized.^{21,22}

Legal landscape of CBD

In December 2018, President Trump signed the 2018 Farm Bill into law. This law removed hemp and its derivatives from the definition of marijuana in the CSA. Under the new law, all hemp products (such as nonpsychoactive CBD) are no longer a Class 1 substance if the product contains less than 0.3% $\Delta 9$ -THC by dry weight.²³ Widely misunderstood with the new law’s signing is the fact that the FDA still maintains complete authority over all CBD advertising and sales. The FDA mandates that all hemp CBD products meet applicable FDA requirements and standards for foods, dietary supplements, human and veterinary drugs, and cosmetics.²⁴ To date, the only FDA-approved CBD product on the market is the drug Epidiolex for the

treatment of seizures in rare and severe pediatric diseases.²⁵ Therefore, according to FDA regulations, it is unlawful under the Federal Food, Drug, and Cosmetic Act (FD&C Act) to introduce into interstate commerce a food or supplement to which has been added a substance that is an active ingredient in an approved drug product, i.e., CBD (Epidiolex). This means that all CBD food and supplements are still illegal in the United States, according to the FDA.²⁶⁻²⁸ This same regulation applies to $\Delta 9$ -THC as multiple THC products are FDA-approved for nausea from chemotherapy and anorexia from acquired immune deficiency syndrome (AIDS).²⁹⁻³⁰

Dentists would do well to understand the legal issues with all cannabinoids before suggesting any marijuana or hemp products to their patients for any purpose. The FDA regularly sends warning letters to companies making, selling, and advertising THC and CBD. All cannabinoid products advertised and placed in supplements and foods violate the FD&C Act.²⁸ These federal cannabinoid laws and regulations open dentists and office personnel to significant potential legal (civil and criminal) exposure. Legal exposure includes individuals or companies making, selling, and advertising unapproved cannabis ($\Delta 9$ -THC and CBD) products independent of individual state laws.³¹

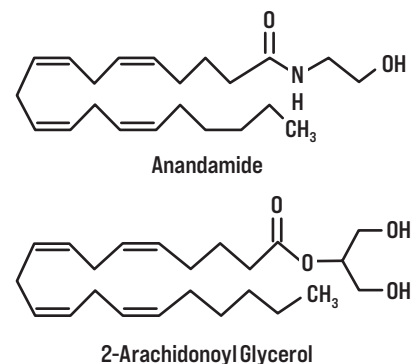


FIGURE 1: Endogenous endocannabinoids

The endocannabinoid system

All human beings possess an endogenous endocannabinoid system (**figure 1**). The endocannabinoid system produces and utilizes endogenous cannabinoid molecules as presynaptic neurotransmitter inhibitors.³²

Endocannabinoids slow presynaptic neuronal firing and thereby inhibit neurotransmission (**figure 2**). The endocannabinoid system acts as a “breaking mechanism” to soften fear-evoking stimuli and can assist in regulating behavioral responses to different stimuli and experiences. Dysregulation of the endogenous endocannabinoid system because of disease or drugs can lead to psychiatric disorders and addiction.³³ Endogenous endocannabinoid molecules modulate neurons in the brain and the peripheral nervous system.^{34,35} There is extensive regulation in human physiology that occurs with endocannabinoids. The molecules play at least partial roles in controlling human movement and motor coordination,³⁶ pain,³⁷ appetite manipulation,³⁸ the emesis reflex,³⁹ addiction,⁴⁰ the immune system,⁴¹ and fertility.⁴²

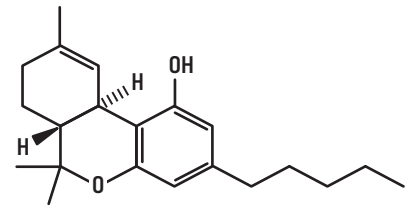
The endocannabinoid system is very susceptible to phyto-cannabinoids such as $\Delta 9$ -THC and synthetic

THCs (cannabinoids created in the lab). Plant and synthetic cannabinoids can have profound and adverse effects on human physiology and addiction through the dysregulation of the endocannabinoid and limbic systems (pleasure centers of the brain).^{43,44} Dysregulation with powerful plant and synthetic cannabinoids often leads to medical complications and adverse drug reactions.

The human endocannabinoid system regulates a wide array of human physiological and cognitive processes.⁴⁵⁻⁵⁰

- Fertility and pregnancy
- Pre- and postnatal development
- The immune system
- Appetite
- Sleep
- Cardiovascular system function
- Liver function
- Stress
- Pain sensation and tolerance
- Mood, learning, and memory
- Motor control and coordination
- Emotion
- Motivation
- Addictive behaviors

Adverse drug reactions can occur when a person consumes $\Delta 9$ -THC and CBD with blood pressure medications, anxiolytics, ADHD medications,



9- Δ -tetrahydrocannabinol (THC)

FIGURE 3: $\Delta 9$ -THC

opioids, cholesterol medications, alcohol, and many other substances.⁵¹

The ECS is constantly active in physiologic and neurologic regulation, even if a person is not using marijuana.

Addiction/drug dependence to $\Delta 9$ -THC and synthetic THC

Addiction to $\Delta 9$ -THC (**figure 3**) and other drugs is a disorder characterized by a compulsion to engage in rewarding stimuli notwithstanding the adverse consequences of the action causing the stimulus.⁵²⁻⁵⁶ Addiction is a multifactorial disease that also has genetic and social components.⁵⁷⁻⁶² A set of distinct features that characterize addiction in an individual include:

- a. Impaired control over substances or behavior
- b. Preoccupation with a substance or behavior
- c. Continued substance use or behavioral activity regardless of adverse effects⁶³

The *neuropsychiatric disorder of addiction* to a drug is defined as the loss of control over the use of, or the compulsive seeking and taking of, the drug despite adverse consequences. This definition is (at times) merged with *pharmacological drug dependence*, which is a state of psychological or physical dependence on a drug occurring because of continued administration. *Pharmacological drug dependence* will demonstrate tolerance and withdrawal symptoms because of the central nervous system’s reaction to the continuous administration

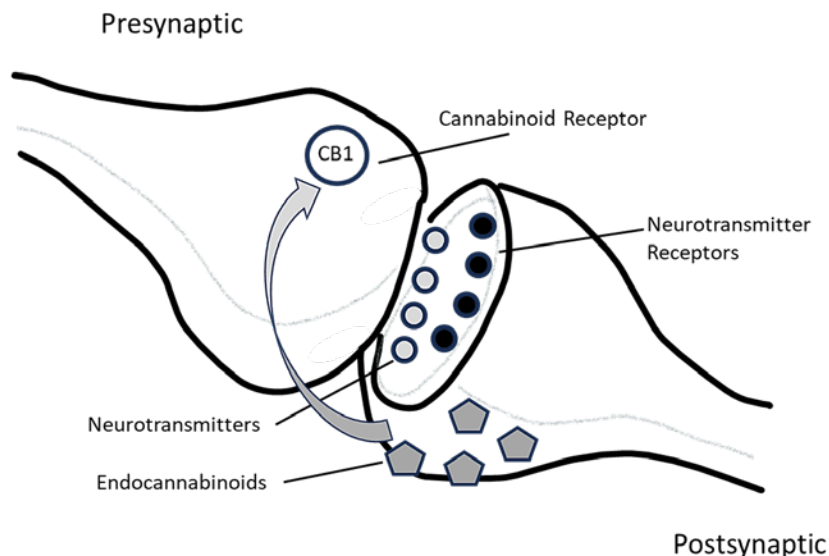


FIGURE 2: Endogenous action on the presynaptic neuron Courtesy Eric S. Bornstein

of the drug.⁶⁴ In many cases, pharmacological addiction and pharmacological dependence are two sides of the same coin.⁶⁵

The definitions of dependence and addiction have recently been updated to incorporate more nuances based on a patient's actions while consuming a drug.⁶⁶

- Addiction—or compulsive drug use despite harmful consequences—is characterized by an inability to stop using a drug; failure to meet work, social, or family obligations; and sometimes (depending on the drug), tolerance and withdrawal. The latter reflects physical dependence in which the body adapts to the drug, requiring more of it to achieve a certain effect (tolerance) and eliciting drug-specific physical or mental symptoms if drug use is abruptly ceased (withdrawal).
- Physical dependence can happen with the chronic use of many drugs—including many prescription drugs—even if taken as instructed. Thus, physical dependence in and of itself does not constitute addiction, but it often accompanies addiction. This distinction can be difficult to discern, particularly with prescribed pain medications, for which the need for increasing dosages can represent tolerance or a worsening underlying problem, as opposed to the beginning of substance use or addiction.

The dopamine reward system of the brain and Δ^9 -THC

To cause addiction and physical dependence, Δ^9 -THC works in a unique manner on the human brain. Δ^9 -THC will bind to the presynaptic CB1 receptors meant for endocannabinoids. These receptors are located in many brain areas, including the amygdala, hippocampus, cortex, basal ganglia, and cerebellum. They are also

interconnected with GABAergic and glutamergic cells. The activation of CB1 receptors with Δ^9 -THC inhibits GABA and glutamate release.⁶⁷ Because Δ^9 -THC acts as a neurotransmitter inhibitor, preventing the release of GABA (a postsynaptic neurotransmitter inhibitor), it permits postsynaptic dopamine neurons to fire more often. Therefore, under the influence of Δ^9 -THC, uninhibited dopaminergic neurons lead to an overabundance of dopamine. The surplus of dopamine in the pleasure center of the brain (the limbic system) leads to addiction and withdrawal symptoms.⁶⁸

- The prefrontal cortex coordinates the information and determines an individual's behavior.⁷²

Δ^9 -THC's effects on neurobehavior and human physiology: increased potency of Δ^9 -THC

The ingestion or inhalation of Δ^9 -THC will cause reflex tachycardia and increased blood pressure due to increased sympathetic nervous system activity. The phenomenon is believed to stem from presynaptic inhibition at the CB1 receptor of parasympathetic innervation (acetylcholine) to

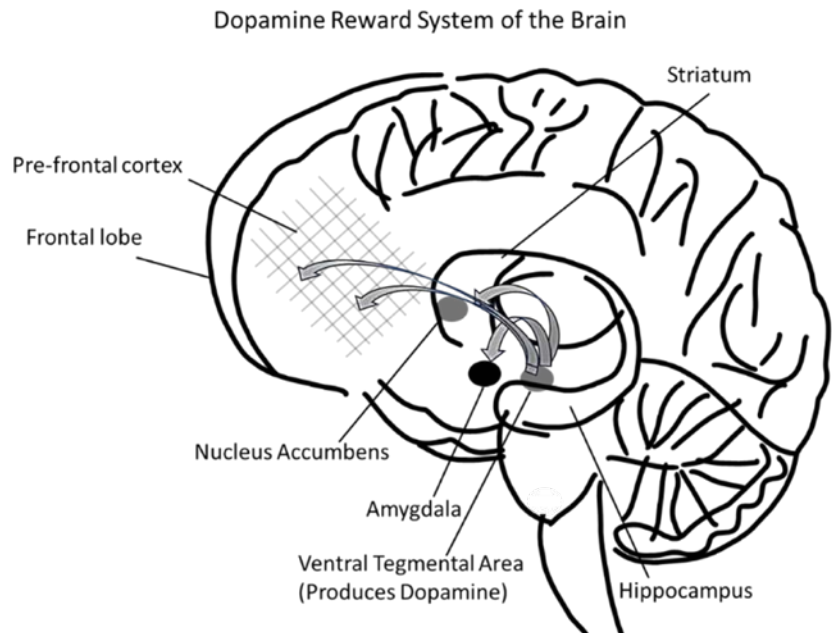


FIGURE 4: Dopamine reward system of the brain Courtesy Eric S. Bornstein

Dopamine pathways in the brain (figure 4):

- The ventral tegmental area releases dopamine.⁶⁹
- The nucleus accumbens contains dopamine-sensitive cells. Activation with dopamine will cause feelings of pleasure.⁷⁰
- The amygdala and hippocampus both play a role in memory and whether the (dopamine) experience is desirable.⁷¹

the heart and blood vessels, causing a reflex response (compensation) as tachycardia and vasoconstriction.^{73,74}

The amino acid glutamate is an excitatory neurotransmitter involved in memory generation and memory retrieval functions.⁷⁵ Δ^9 -THC inhibition of normal glutamate neurotransmission can result in working memory impairments,⁷⁶ loss of memory formation,⁷⁷ and perceptual changes.⁷⁸

There are short-term and long-term

negative effects on neurobehavior with the ingestion or inhalation of $\Delta 9$ -THC.⁷⁹ These include cognitive effects,⁸⁰⁻⁸² motor function deficits, attention deficits,^{83,84} and inhibited motor control.⁸⁵

Increased potency of $\Delta 9$ -THC

Average THC levels have climbed precipitously in the last 50 years in all cannabis products. In 1970, the $\Delta 9$ -THC potency of smoked marijuana hovered at just over 1%.⁸⁶⁻⁸⁸ In 2023, there are $\Delta 9$ -THC products widely available that advertise in excess of 90% THC.⁸⁹⁻⁹⁴ The increased THC potency has led to a rapid increase in adverse health outcomes, especially in mental health and addiction.⁹⁵ Medical and dental professional education has historically not been adequate to prepare dentists and dental personnel for the increase in cannabis use and potency. There is currently a distinct lack of knowledge about medical and recreational cannabis, and very few competency-based curricula are available.⁹⁶⁻⁹⁸ Finally, there is a significant variation in the amounts of legally available $\Delta 9$ -THC to the average consumer based on over 40 different state laws concerning the drug.⁹⁹

Informed consent

A vital aspect of dental patient care is informed consent for treatment. Patients have the right to understand their diagnosis and make rational decisions on a proposed dental treatment plan.¹² The granting of informed consent requires the patient to be mentally and psychologically sound and unimpaired before making a decision.¹³ Because many cannabinoids are psychoactive, causing mental impairment and a psychomotor deficit, the concept of informed consent while under the influence of cannabinoids is now a critical question.

A standard informed consent document includes a diagnosis,

treatment stages, benefits of the proposed therapy, risks, and limitations.¹² It has been long understood that alcohol intoxication makes a patient incapable of interpreting vital information a physician presents. Therefore, an intoxicated patient's consent of therapy lacks the necessary elements of "informing" and "conscious declaration of will," which lawyers believe to be required to make such will valid. There is a lack of clear and definite guidelines for how physicians should act in these cases.¹⁰⁰ The same logic would, therefore, hold for intoxication with THC.¹⁰¹ Speaking on a similar point, Anderson and McNair¹⁰² stated the following concerning opioid intoxication in 2018:

"The decision-making capacity (DMC) of individuals who abuse opioids has been called into question based on both the short-term effects of intoxication and withdrawal and the potential cognitive consequences of long-term drug use."¹⁰²

With acute THC intoxication, these issues are compounded by the drug users' altered states of consciousness.^{103,104}

Oral medicine

There are no known benefits to inhaled $\Delta 9$ -THC in the oral cavity, only harms. These include the following:¹⁰⁵

- Xerostomia
- Periodontal disease
- Thermal injury to the oral mucosa
- Leukoedema
- Candidal infection
- Oral cancer

It has recently been reported that presynaptic CB1 receptors are expressed in cholinergic neurons that innervate the submandibular gland. The proposed mechanism for xerostomia is the activation of the CB1 receptors to reduce salivation (i.e., an anticholinergic effect as THC is a neurotransmitter inhibitor), thus

offering a process for the dry-mouth phenomenon.¹⁰⁶ In a recent systematic review and meta-analysis examining over 13,000 patient records, it was determined that individuals who use cannabis presented a higher prevalence of periodontitis when compared with those who do not use cannabis. This could result from heat-induced damage of combustible cannabis, xerostomia from smoked or consumed cannabis, or immunosuppression from all types of THC and/or CBD.¹⁰⁷ $\Delta 9$ -THC also acts as an appetite stimulant, leading to the consumption of more significant amounts of cariogenic foods,¹⁰⁸ leading to higher caries profiles in these patients.¹⁰⁹

The advent of leukoedema is more frequent in cannabis users,⁹ and inhaled cannabis is connected to gingival enlargement,¹¹⁰ chronic inflammation of oral tissues, hyperkeratosis, and leukoplakia. These findings are collectively referred to as cannabis stomatitis.¹¹¹ Chronic inflammation is more likely to develop into malignant neoplasms with continued irritation from cannabis inhalation.¹¹² The use of cannabis also produces immunosuppressive effects that can lead to exacerbation of human papillomavirus and head and neck cancer.¹¹³⁻¹¹⁵ Finally, inhaled cannabis from electronic cigarettes has been found to promote microbiome changes consistent with the formation of multi-drug-resistant oral pathogens.¹¹⁶

Adverse drug reactions

There is a lack of accurate and centralized information available to most dental clinicians concerning their prescription of analgesics, anxiolytics, and antibiotics when the patient is a consumer of cannabis.¹¹⁷ As a general rule, there are systems and interactions that a dentist and dental personnel must be aware of when making pharmacology decisions

for their patients who are also consuming or inhaling cannabis. See Table 1.²⁹

The polypharmacy concerns stem from induced or inhibited liver enzymes and the physiologic effects of cannabinoids.¹²⁴ See Table 2.

The following are three examples of potential dental adverse drug interactions of concern with cannabinoids:

EXAMPLE 1: Cannabinoids and blood pressure meds

CBD is a potent liver cytochrome (CYP1A2 and CYP2D6) inhibitor.¹²⁵ If a 65-year-old patient consumes 300 mg of CBD daily, it will increase the serum concentrations of both beta blockers and calcium channel blockers that the patient is taking for blood pressure and cardiac conditions. This increased serum concentration can lead to amplified postural hypotension. Suppose the patient is then prescribed a benzodiazepine by a dentist for anxiety or temporomandibular joint muscle spasms. In that case, it will significantly increase the likelihood of slip-and-fall accidents, as the CBD also prolongs benzodiazepine metabolism, which would have an additive effect on the amplified postural hypotension.^{126,127} Patients should be instructed to discontinue Δ9-THC and CBD use during benzodiazepine or opioid therapy.

EXAMPLE 2: Cannabinoids and macrolide antibiotics

THC and CBD are both inhibitors of macrolide antibiotic metabolism, such as azithromycin.¹²⁸ The FDA has codified in a black box warning that a common adverse effect of azithromycin is QT interval prolongation on electrocardiogram (ECG), predisposing patients to life-threatening ventricular arrhythmias.^{129,130} Therefore, any medication that increases the plasma level of azithromycin by

TABLE 1: Systems and interactions of concern for cannabis

CNS effects	Polypharmacy concerns	Dental-specific pharmacology concerns
Dizziness, confusion, sedation, somnolence	Adverse reactions may occur when Δ9-THC is taken concomitantly with drugs that have similar effects on the central nervous system, such as CNS depressants.	Opioids and benzodiazepines ¹¹⁸ Antihistamines ¹¹⁹ Barbiturates ¹²⁰
Additive cardiac and blood pressure effects	Polypharmacy concerns	Dental-specific pharmacology concerns
Hypotension, hypertension, syncope, tachycardia	Adverse reactions may occur when Δ9-THC is taken concomitantly with drugs that have similar effects on the cardiovascular system.	Azole antifungals ¹¹⁸ Macrolide antibiotics ¹²¹ Epinephrine in local anesthesia ^{122,123}

TABLE 2: Liver enzymes induced or inhibited by cannabis and their dental drug cautions

Liver enzyme	Interaction and effect	Dental drug cautions
CYP 3A4 CYP 2C9	Inducers: May increase or decrease the drug effect through faster metabolism. This can occur with THC and/or CBD.	Azole antifungals Macrolide antibiotics
CYP 2C19 CYP 1A1 and 1A2	Inhibitors: May increase drug interactions through inhibited metabolism and longer pharmacokinetic interactions. This can occur with THC and/or CBD.	Benzodiazepines Opioids Barbiturates Sympathomimetics

inhibiting its metabolism could exacerbate this effect. Patients should be instructed to discontinue Δ9-THC and CBD use during azithromycin therapy.

EXAMPLE 3: Cannabinoids and sympathomimetic drugs

As discussed earlier, ingestion or inhalation of Δ9-THC will cause reflex tachycardia and increased blood pressure due to increased sympathetic nervous system activity. Therefore, it affects the normal cardiovascular and stress-response processes. There is a high potential for adverse responses with Δ9-THC and local anesthetic agents containing epinephrine or other sympathomimetic agents. Such a combination can lead to cardiac arrhythmias and dangerously high blood pressure responses.¹³¹ Patients should be instructed not to use Δ9-THC during dental procedures requiring local anesthesia with sympathomimetic agents.

Conclusion

Cannabinoids and their influence on dentistry and dental medicine is a complex and multileveled challenge. All dentists and dental personnel must familiarize themselves with the legality, pharmacology, and increasing usage of these substances. Increased knowledge will protect the patient and dental professionals from adverse reactions and lawsuits generated by the increasing use of cannabinoids in the general population.

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- The possession and use of marijuana has been illegal under federal law since:
 - 1970
 - 1980
 - 1990
 - Marijuana has never been illegal under federal law.
- With the Controlled Substances Act, Δ -9-THC is classified as:
 - Schedule V drug
 - Schedule IV drug
 - Schedule II drug
 - Schedule I drug
- Despite Δ -9-THC's legalization in over 40 states, possession and use can ____ be prosecuted under federal statute.
 - Sometimes
 - Never
 - Always
 - None of the above; Δ -9-THC is federally legal.
- To date, the only FDA-approved CBD product on the market is:
 - CBD candies
 - Epidiolex
 - CBD shatter
 - CBD tincture
- Federal cannabinoid laws and regulations open dentists and office personnel to:
 - Significant potential legal (civil and criminal) exposure
 - The ability to sell CBD in the office
 - The ability to sell THC in the office
 - The ability to prescribe THC for their patients
- All human beings possess endogenous:
 - THC
 - CBD
 - Cannabinoids
 - Marijuana
- The chemical in marijuana of hemp that causes the user to feel "high" is:
 - Dopamine
 - Norepinephrine
 - Delta-9-tetrahydrocannabinol
 - CBD
- Delta-9-tetrahydrocannabinol, the active ingredient in marijuana, acts on the brain by:
 - Coating the skull
 - Binding to specific receptors
 - Causing brain tissue to grow
 - Increasing glucose utilization
- In addition to causing psychomotor deficit in the brain, geriatric patients using marijuana may increase the risk of:
 - Amputation and obesity
 - Kidney stones and ruptured appendix
 - Heart attacks and respiratory illnesses
 - Toenail fungus
- CBD is metabolized in the:
 - Muscles
 - Brain
 - Liver
 - Lungs
- Delta-9-tetrahydrocannabinol is metabolized in the:
 - Muscles
 - Brain
 - Liver
 - Lungs
- CBD is FDA approved for sale in stores in America:
 - With therapeutic claims
 - In food
 - As a supplement
 - None of the above
- CBD is safe when mixed with:
 - Opioids
 - Benzodiazepines
 - Beta blockers
 - None of the above
- The human endocannabinoid system has receptors on:
 - Presynaptic neurons
 - Cells of the immune system
 - A and B
 - None of the above
- In 1969, the percentage of Americans using marijuana was about:
 - 4%
 - 10%
 - 60%
 - 90%
- Drivers on marijuana have an increased risk of getting into a car accident because of:
 - Slowed reaction time
 - Impaired judgment
 - Both A and B
 - Neither A nor B
- Is marijuana addictive?
 - No, addiction to marijuana is not possible.
 - Yes, physical and psychological marijuana dependency occurs in many users.
 - Yes, but only psychological addiction
 - Yes, but only physical addiction
- Is CBD addictive?
 - No, addiction to CBD is not possible unless it is tainted with THC.
 - Yes, physical and psychological marijuana dependency occurs in many users.
 - Yes, but only psychological addiction
 - Yes, but only physical addiction
- Any psychoactive element of cannabis must be considered addictive through dopaminergic interactions in the brain's:
 - Prefrontal cortex
 - Striatum
 - Hippocampus
 - Limbic (pleasure) center
- Smoking or vaping marijuana can cause:
 - Periodontal disease
 - Xerostomia
 - Oral cancer
 - All of the above
- A patient under the influence of marijuana will have:
 - Improved informed consent
 - Inhibited informed consent
 - No change in informed consent
 - None of the above

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22. THC of any kind will cause:
- A. No change in heart rate and blood pressure
 - B. Decreased heart rate and blood pressure
 - C. Increased heart rate and blood pressure
 - D. No adverse drug reaction concerns

23. Smoking or vaping marijuana:
- A. Improves the oral microbiome
 - B. Does not change the oral microbiome
 - C. Makes oral bacteria more susceptible to antibiotics
 - D. Makes oral bacteria more resistant to antibiotics

24. Dysregulation of the endogenous endocannabinoid system because of disease or drugs can lead to:
- A. Diabetes
 - B. Psychiatric disorders and addiction
 - C. Alopecia
 - D. Diplopia

25. The ingestion or inhalation of Δ^9 -THC will cause reflex tachycardia and increased blood pressure due to what mechanism?
- A. Increased sympathetic nervous system activity
 - B. Decreased sympathetic nervous system activity
 - C. Increased central nervous system activity
 - D. Decreased central nervous system activity

26. The average THC levels have ___ in the last 50 years in all cannabis products.
- A. Increased moderately
 - B. Increased by a large extent
 - C. Decreased moderately
 - D. Decreased by a large extent

27. It has recently been reported that presynaptic CB1 receptors are expressed in cholinergic neurons that innervate the ___ and cause xerostomia.

- A. Parotid gland
- B. Sublingual gland
- C. Adrenal gland
- D. Submandibular gland

28. The use of cannabis produces immunosuppressive effects that can lead to exacerbation of ___ and head and neck cancer.

- A. Epstein-Barr virus
- B. HIV virus
- C. Human papillomavirus
- D. Varicella zoster virus

29. The lack of accurate and centralized information on cannabis available to most dental clinicians should cause concern when prescribing:

- A. Analgesics
- B. Anxiolytics
- C. Antibiotics
- D. All of the above

30. THC and CBD should be discontinued when a dentist prescribes which class of antibiotics?

- A. Macrolide
- B. Tetracyclines
- C. Beta-lactam
- D. Fluoroquinolone

Cannabinoids and dentistry

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EDUCATIONAL OBJECTIVES

- Summarize the human endocannabinoid system
- Outline comorbidities that will be more problematic in dental patients who are consuming cannabis products
- Describe the elevated risks with polypharmacy patients and THC/CBD consumption undergoing dental therapy
- Summarize oral medicine issues that can arise with patient consumption of THC/CBD

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- Were the individual course objectives met?
Objective #1: Yes No Objective #3: Yes No
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EXAM INSTRUCTIONS. All questions have only one answer. If mailed or faxed, grading of this examination is done manually. Participants will receive confirmation of passing by receipt of a Verification of Participation form. The form will be mailed within two weeks after receipt of an examination.

COURSE EVALUATION AND FEEDBACK. We encourage participant feedback. Complete the evaluation above and e-mail additional feedback to Rachel McIntyre (rmcintyre@endeavorb2b.com) and Laura Winfield-Roy (lwinfield@endeavorb2b.com).

COURSE CREDITS AND COST. All participants scoring 70% or higher on the examination will receive a verification form for three (3) continuing education (CE) credits. Participants are urged to contact their state dental boards for CE requirements. The cost for courses ranges from \$20 to \$110.

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