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Title:
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Date:
2019-09-01

Citation:
Teoh, L., Moses, G. & McCullough, M. J. (2019). Oral manifestations of illicit drug use. Australian Dental Journal, 64 (3), pp.213-222. https://doi.org/10.1111/adj.12709.

Persistent Link:
https://hdl.handle.net/11343/286222

Oral manifestations of illicit drug use

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Acknowledgments

This work was supported by the Australian Government Research Training Program Scholarship. The authors have no conflict of interest.

Keywords: Illicit drug use, oral effects, meth mouth, cocaine, heroin

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This is the author manuscript accepted for publication and has undergone full peer review but has not been through the copyediting, typesetting, pagination and proofreading process, which may lead to differences between this version and the Version of Record. Please cite this article as doi: 10.1111/ADJ.12709

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Article type : Review Article (non-solicited)

Oral manifestations of illicit drug use

Abstract

The use of illicit and misuse of licit drugs is a global public health problem, with illicit drug use being responsible for 1.8% of the total disease burden in Australia in 2011. Oral adverse effects associated with illicit drug use are well established, with aggressive caries, periodontitis, bruxism, poor oral hygiene and general neglect documented. Other factors such as a high cariogenic diet and lifestyle, social and psychological factors compound the poorer oral health in illicit drug users. Literature has shown that the oral health-related quality of life among injecting drug users is poorer compared with the Australian general population and the overall quality of life of addicted people correlates with caries experience. Thus, the role of the dentist is imperative in managing the oral health of these individuals. Given their widespread recreational use, it is likely that dental practitioners will encounter patients who are regular or past users of illicit drugs. The aim of this article is to describe the prevalence and mechanism of action of commonly used illicit drugs in Australia, including cannabis, methamphetamine, cocaine and heroin and to inform dentists about the common orofacial presentations of their side effects to help with patient management.

Keywords: Illicit drug use, dental, meth mouth, cocaine, heroin

Introduction

Illicit drugs are defined as "drugs for which non-medical use has been prohibited by international drug treaties…because they are believed to present unacceptable risks of addiction to users."[1] The Australian Institute of Health and Welfare explains that it includes the use of illegal drugs, non-medical use of pharmaceutical drugs and inappropriate use of other substances (such as inhalants).[2] It is well established that both the use of illicit drugs and misuse of licit drugs are global public health problems. Illicit drug use, which includes injecting drug use, cocaine, opioid, amphetamine and cannabis dependence, contributed to 1.8% of the total disease burden in Australia in 2011[3] Illicit drug use is also associated with other physical and psychological harms such as such as overdose, self-harm, mental disorders and blood-borne bacterial and viral infections as well as other social and economic costs including violence, crime and family disruptions.[1, 3] The National Drug Household Strategy Household Survey reported that about 8.5 million people in Australia aged 14 or older had used an illicit drug or misused a licit drug at least once in 2016, with certain cohorts of the population including those who live in remote and very remote areas, unemployed people and Indigenous Australians reporting to be more likely to smoke and use illicit drugs.[2] Poly-drug use is also documented,[4] and is responsible for a significant amount of the disease burden caused by illicit drug use.[1]

Substance use disorder is a behavioural syndrome in which individuals depend and abuse drugs for the purpose of their effect on the central nervous system (CNS) or to prevent or reduce withdrawal symptoms, often despite medical or social consequences.[5, 6] This should be differentiated from tolerance, where a decreased physical effect of the same dose of the drug is observed after repeated administration, and physiological dependence, which develops when an individual continues to administer the drug to avoid a withdrawal syndrome.[6]

The oral health-related quality of life among injecting drug users is poorer compared to the Australian general population, with a greater extent among those who were female, unemployed and having a longer injecting history of 10-20 years.[7] A cross-sectional survey in Melbourne assessing dental problems of street-recruited injecting drug users found that oral health issues are common, with 68% of the sample reporting severe problems with associated pain.[8] A further study evaluating the impact of oral health conditions, socioeconomic status and use of specific substances including alcohol and illicit drugs, showed that the quality of life of drug addicted people was significantly associated with caries experience, contributing to lower self-esteem and diminished potential for psychosocial rehabilitation, and concluded that the role of the dentist is imperative in managing oral health of these individuals.[9]

Given the prevalence of illicit drug use globally and in Australia, it is probable that dentists will encounter patients who are regular or past users of illicit drugs. The aim of the present article is to document the prevalence and mechanism of action of the four commonly used illicit drugs in Australia: cannabis, methamphetamine, cocaine and heroin; and to summarise the orofacial adverse effects to help with patient management.

Cannabis

Cannabis, the most commonly used recreational drug both worldwide and in Australia,[2] is extracted from the plant Cannabis sativa.[10-12] The plant contains over 60 cannabinoids, of which delta-9 tetrahydrocannabinol (THC) is the most abundant and primarily responsible for the psychoactive effects.[11] Thirty-five percent of the Australia population aged 14 and over reported using cannabis in their lifetime at least once, and 10.4% had used cannabis in 2015.[4] Cannabis use is evaluated to be responsible for 0.2% of disease burden in Australia.[13]

Marijuana, hashish and hash oil are the three main forms of recreational cannabis.[10] Marijuana is composed of the dried flowering tops and leaves, usually contains between 0.5-5% THC and is prepared as a "joint" for smoking.[10, 13] Hashish contains normally around 2-20% THC and is formed of the flower heads compressed with resin, and hash oil is extracted from hashish, is the most concentrated consisting between 15-50% THC.[10, 11, 13] While there are various forms of administration, marijuana is most commonly administered by smoking, often in a hand-rolled, filterless cigarette, or through a water pipe, referred to colloquially as a "bong". Hashish can be incorporated in foods such as cookies as it is soluble in fat and alcohol.[10]

Following inhalation of cannabinoids from recreational use,, between 20-70% of THC and 5-24% of THC reaches the lungs and brain respectively,[13] with peak concentrations being reached in 10 minutes.[10] Oral ingestion of THC produces a slowed peak effect of 0.5-2 hours but a longer duration of action due to gut absorption.[14] Cannabis is highly lipophilic and has a propensity to diffuse slowly from fatty tissues for days after its initial administration, thereby making the tissue elimination half-life of THC around 7 days, but total elimination of THC up to 30 days.[10, 14] The mechanism of action of THC is by modulation of endogenous cannabinoid receptors, CB1 and CB2 in both the central nervous system (CNS) and peripheral nervous system (PNS).[11] The CB1 receptors are located predominately in various regions of the brain, including the cerebral cortex, limbic areas, basal ganglia and others[10]

and is primarily responsible for the psychoactive effects of cannabis, including the effects on cognition, memory, reward and motor coordination.[11] The CB2 receptors are predominately located in the spleen and macrophages.[11] In addition, THC has been shown to increase dopaminergic activity in the CNS, which is in common with other recreational drugs.[14]

Use of recreational cannabis has negative effects on most body systems, where is it estimated that approximately 12-15% of recreational users will become chronic users.[14, 15] It has anxiolytic, sedative, analgesic properties, stimulates appetite, and produces a euphoria that is primarily responsible for its recreational use and encompasses a feeling of decreased anxiety, alertness and reduced tension.[14] However, it can also generate negative responses, such as anxiety, panic and paranoia.[14] Other psychological effects include impaired psychomotor performance and slowing of reaction time, increased accident risk, difficulty in concentrating and an increased risk of psychiatric disorders.[13, 14] THC also affects the cardiovascular system by being associated with tachycardia, mild hypertension, systemic vasodilatation and subsequent cardiac ischemia in susceptible patients.[10, 16] Chronic smoking of marijuana is associated with respiratory effects, including increased symptoms of chronic bronchitis, including cough, wheeze and sputum production, as well as increased risk of respiratory infections.[13] Many other adverse effects are also documented by Reece,[16] Kumar et al[11] and others. It is well established that tolerance develops to the psychotropic effects of cannabis, thereby leading to a withdrawal syndrome and possible drug dependence.[14]

Medicinal cannabis is the term used to describe use of cannabis to manage medical conditions.[12] Various studies have been undertaken to assess the effectiveness of medicinal cannabis to treat medical conditions, such as chemotherapy-induced nausea and vomiting, chronic pain and epilepsy.[12] A recent systematic review and meta-analysis assessing the effectiveness of medicinal cannabinoids found that there was moderate-quality evidence to support the use of cannabinoids for chronic cancer-related pain and muscle spasticity of multiple sclerosis.[17] The one medicinal cannabis product listed on the Australian Register of Therapeutic Goods as a Schedule 8 controlled drug, nabiximols, is available under the Special Access Scheme is approved indication for "treatment for symptom improvement in patients with moderate to severe spasticity due to multiple sclerosis who have not responded adequately to other anti-spasticity medication and who demonstrate clinically significant improvement in spasticity related symptoms during an initial trial of therapy".[12] There is also increasing research into the use of the purified phytocannabinoid (CBD) for treatment of

resistant forms of childhood epilepsy,[15] such as Lennox-Gastaut syndrome or Dravet syndrome[18]

Oral implications and dental management considerations of recreational cannabis

It is established that smoking cannabis is associated with xerostomia and therefore an increased risk of caries,[10, 19] with users having a higher decayed, missing and filled teeth scores (DMFT) scores compared to non-users.[10] A study that aimed to determine the effects of cannabis smoking on oral soft tissues showed that 69.6% of users experienced xerostomia almost immediately following administration of cannabis.[20] A further study assessing the oral health of cannabis users in Switzerland demonstrated that cannabis users had significantly higher amounts of decay, more smooth surface caries, lower frequencies of daily oral hygiene, higher consumption of cariogenic beverages and less frequent regular dental attendance compared with the control group.[21] Interestingly, clinical trials of the purified CBD product "Epidolex" demonstrated that drooling and salivary hypersecretion were common oral adverse effects.[18]

Oral soft tissue changes have been documented, with an increased incidence of leukoedema in cannabis and tobacco smokers.[20] The same study reported an increased prevalence of candidosis in users compared with non-users, and postulated that it is likely a combination of poor denture hygiene, unsatisfactory nutritional factors and cannabis use that contributed to the observed manifestation of candidosis.[20] A review of the oral effects in cannabis users concluded that an increase in the prevalence of recreational cannabis use is associated with xerostomia, leukoedema and an increase in the prevalence and density of Candida albicans.[22]

Cannabis smoking is also associated with an increased risk of oral cancer, as cannabis and marijuana smoke contain a variety of carcinogens including phenols, vinyl chloride and aromatic hydrocarbons and others.[10, 19] Marijuana smoke contains 50% more of the carcinogenic hydrocarbons compared to tobacco smoke,[10] and Zhang et al described that one marijuana cigarette deposits approximately 4 times as much tar in the respiratory tract as that deposited from a single filtered tobacco cigarette of approximately the same weight.[23] In addition, dysplastic lesions, including both leukoplakia and erythroplakia have been associated with smoking cannabis,[10] and a case-control study demonstrated that marijuana use was associated with an increased risk of squamous cell carcinoma of the head and neck.[23]

Cannabis users can experience acute anxiety and paranoia that can worsen in association with a stressful event such as a dental visit.[10, 24] Other considerations for the dental treatment of

intoxicated patients is that the use of adrenaline-containing local anaesthetic that can exacerbate tachycardia caused by cannabis.[10, 24] Anecdotally, dentists find difficulty achieving effective local anaesthesia in cannabis users, especially when anxious, however the explanation for this has not been documented in the literature. The recommendation that alcohol-containing mouthwashes should also be avoided to prevent worsening xerostomia in these individuals.[24]

Table 1. Dental considerations when treating cannabis users (reproduced from Cho et al)[10]

- Cannabis abusers generally have poor oral and periodontal health
- Cannabis intoxicated patients may experience acute anxiety and dysphoria during treatment
- Local anaesthetic containing adrenaline may prolong tachycardia following an acute dose of cannabis
- Chronic smokers of cannabis have increased risk of developing oral leukoplakia and oral cancer, oral candidosis and other oral infections

Methamphetamine

Uses and pharmacology

Amphetamines are classed as psychostimulant drugs, with their mode of action thought to involve increased dopaminergic and noradrenergic neurotransmission in the central nervous system (CNS).[25] Amphetamines registered for therapeutic use in Australia include methylphenidate, dexamphetamine and lisdexamphetamine, used to treat narcolepsy and attention deficit hyperactivity disorder.[25] Methamphetamine (MA, "crystal", "speed" or "ice") is an illegally produced amphetamine and the most abused and widely illegally distributed form of amphetamine,[26] since it is relatively inexpensive to produce and acquire[27] and has a comparatively long duration of action compared with other illicit drugs such as cocaine.[28] In Australia in 2016, MA was the second most commonly used illegal drug used weekly or more often after cannabis.[2] Other recreationally used amphetamines include dextroamphetamine ("dexies" or "beans") and methyldioxymethamphetamine (MDMA, "ecstasy", "bathtub speed", "cat" or "goob").[26] Methods for the production of MA are widely available on the internet using readily accessible materials.[29] One popular method is the extraction of ephedrine from over-the-counter cold and flu preparations containing pseudoephedrine.[29] This activity prompted the up-scheduling of pseudoephedrine containing

products to being only available on consultation with a pharmacist (S3) or on prescription (S4) in April 2006 in Australia.[30]

Methamphetamine is a highly addictive, potent CNS stimulant and acts by increasing levels of the neurotransmitters dopamine, noradrenaline and serotonin.[31] The intense euphoria is thought to be produced by the high levels of dopamine released.[26] Being a stimulant, effects of methamphetamine use include hyperactivity, increased alertness, insomnia and appetite suppression.[31] As MA increases sympathomimetic activity by modifying noradrenergic transmission, cardiovascular manifestations from both acute and chronic use include hypertension, myocardial ischaemia, tachycardia, myocardial hypertrophy and atrial and ventricular arrhythmias.[31, 32] Paranoia, agitation, mood disturbances, violent behaviour and anxiety are some of the cognitive and mental health changes seen with MA use.[26] A systematic review has shown a consistent relationship between MA use and an increased risk of mortality due to suicide and overdose, as well as other psychological outcomes, including depression and psychosis.[33]

There are various forms of administration, as methamphetamine can be smoked, injected, 'snorted', taken orally or injected intravenously.[26] "Ice" or "crystal", the free-base form of methamphetamine that is usually smoked,[26] is the most popular form by users in Australia.[2] the time to peak effect varies depending on the route of administration, with users experiencing a peak in euphoria around 30 minutes after respiratory administration.[34] MA has a relatively long half-life, with the effects lasting around 12-15 hours,[34, 35] 10 times longer than the duration of action of cocaine.[34]

Oral implications and dental management considerations

The characteristics and significantly increased incidence of overt dental disease associated with MA use are well documented in the literature, given the appellation "meth mouth".[27] Users have articulated the appearance of their teeth as "blackened, stained, rotting, crumbling or falling apart",[35] with Hamamoto et al[26] describing the distinctive location of caries in chronic users generally involving the buccal and cervical smooth surfaces of the teeth and interproximal surfaces of the anterior teeth. The caries development tends to undergo periods of arrest and progression.[26] A recent cross sectional study with a large sample size confirmed that MA users were twice as likely to have untreated tooth decay, two more decayed, missing or filled teeth, and four times as likely to have caries compared to non-MA users.[36] There are several reasons for the increase in decay. Primarily methamphetamine causes xerostomia as a

direct action of the drug due to the sympathetic stimulation of adrenergic receptors causing a reduction in salivary flow[28, 37-39] and a reduced buffering ability.[28] Other contributing factors to the rampant caries development include the long duration of action of MA equating to the negative effects of the drug lasting longer, insufficient oral hygiene and dehydration due to hyperactivity.[26] Further, two prospective studies have demonstrated that MA users have a significantly increased intake of carbonated beverages containing sugar and poorer oral hygiene compared to the general population.[40, 41] MA itself is acidic,[35] and therefore smoked or inhaled MA has direct corrosive effects on the oral tissues.[27] However, users who inject MA have been shown to have increased dental disease, including missing teeth (OR of 2.47) compared to those who smoke MA, likely due to their addiction being more severe given that the time of peak activity of MA by the intravenous route is only 15 to 30 seconds with 100% bioavailability of the drug.[27]

Bruxism and jaw-clenching are well-documented findings in chronic methamphetamine users, thought to be due the increase in neuromuscular jaw activity from the increase in noradrenergic neurotransmission the CNS.[26] The resultant non-carious wear exacerbated by both the intake of acidic carbonated beverages and xerostomia resulting in decreased lubrication of the teeth.[42] Temporomandibular jaw joint pain and tenderness have also been shown to be a common finding among users.[43]

Other considerations for the general dentist is that the psychosis and paranoia associated with chronic MA use can persist for years after the cessation of the habit,[26] which can impact on patient management. It is also recommended that dental treatment should not be undertaken on patients who have ingested MA for a minimum of 6 hours after the last dose.[26, 44] Dentists should be mindful that the duration of action of MA can last up to 24 hours in cases of intoxication, and local anaesthetic with a vasoconstrictor is contraindicated when the patient is intoxicated.[26] The vasoconstrictor, together with the action of MA, synergistically increases sympathetic activity, which puts the patient at increased risk for a hypertensive crisis, that can result in cardiac dysrhythmias, myocardial infarction and cerebrovascular accidents.[26] A local anaesthetic without a vasoconstrictor should be used if dental treatment cannot be deferred during this time.[26, 44]

Table 2. Dental considerations for treating methamphetamine users

- MA users generally have poor oral hygiene with rampant caries
- Bruxism, clenching and non-carious tooth wear is often evident

- Xerostomia is common
- Treatment should be deferred for a minimum of 6 hours after the last administration of MA, and local anaesthetic containing a vasoconstrictor should not be used when the patient is intoxicated to avoid a hypertensive crisis

Cocaine

Cocaine is a naturally occurring alkaloid with local anaesthetic and psychoactive properties derived from the leaves of the Erythroxylon coca bush, a native plant to some countries in South America.[45-47] In the 1880s, cocaine was used as a local anaesthetic for opthalmic and otolaryngological surgeries,[47, 48] and cocaine drops are still used today for topical anaesthesia in some eye, ear, nose and throat procedures.[25] In Australia, the National Drug Strategy Household Survey found that illicit cocaine use has been increasing in recent years, making cocaine now the second most commonly used recreational drug after cannabis, although it was used less frequently than MA.[2] Cocaine is known by various street names including "snow", "nose candy", "coke", "blow and "toot".[47] Usually administered intranasally by "snorting", pure cocaine is usually diluted by drug dealers with other substances such as mannitol, lactose, talc, caffeine, quinidine to increase their profits, and the chemical irritants making the product more harmful for the user.[47] Cocaine can also be smoked, by converting cocaine to "crack", where it is transformed to the free-base by mixing it with readily available ingredients such as sodium bicarbonate.[45] The highly addictive free-base form is then heated and smoked, where "crack" derived its name from the popping sound made on heating.[45] When cocaine is snorted, the time to peak effect is a few minutes after inhalation, lasts between 20-90 minutes,[46] and has a relatively short half-life compared to MA of 1.5 hours.[45]

Cocaine is readily absorbed across mucous membranes and has both local anaesthetic properties by binding to sodium channels, as well as sympathomimetic properties by increasing the dopaminergic and noradrenergic neurotransmission in the CNS.[46] The euphoric effects are due to cocaine blocking the re-uptake and therefore subsequently increasing dopamine levels.[49] The other effects of the increase in neurotransmitter levels include light-headedness, blurred vision, delirium, aggressive behaviour and an increased respiration rate.[46] Neurological degeneration has also been noted with chronic cocaine abuse, including deficits in cognition, attention deficits, emotional instability and depression.[50] Due to the increased stimulation of the sympathetic nervous system, other complications therefore include

hypertension and cardiac arrhythmias but also constriction of coronary arteries, thereby putting the patient at risk of angina, acute hypertension and myocardial infarction.[46] Increasing doses of cocaine produce the euphoria and stimulation of the CNS, with periods of CNS depression as plasma levels decrease.[46] It is postulated that the depletion of dopamine levels that can be seen after chronic abuse is culpable for the dysphoria observed on cocaine withdrawal.[45]

Oral implications and dental management considerations

Bruxism and temporomandibular joint discomfort and pain in the surrounding musculature is a well-documented orofacial manifestation of cocaine use, likely due to the changes in dopaminergic neurotransmission.[46, 49, 51] Attrition and erosion of tooth enamel and dentine are also common findings, attributable to both the increased grinding as well as the decrease in salivary pH induced by cocaine.[46] Pure cocaine (cocaine hydrochloride) has a pH of 4.5 which is capable of disintegrating the enamel and dentine when ingested either by direct placement in the oral cavity or by nasal administration.[52] Cocaine is often placed directly onto the gingiva by users to test the quality and purity of the cocaine.[51]

Several case reports are documented of ulcerated, erythematous gingival lesions as well as marked gingival retraction at the local site of application.[51, 53-56] It is thought that the vasoconstrictive properties as well as the direct caustic effects of cocaine are the cause of the gingival erosion.[51] A recent cross sectional study also demonstrated crack cocaine addiction was associated with an increased caries experience (OR 3.65) but a lower filled- and missing teeth index in men.[57] The authors suggest further studies are needed with a larger and more varied sample size to confirm the results.[57] Cocaine use has also been associated with changes in the oral mucosal tissues, including an increase in the rate of cellular proliferation in normal buccal mucosal cells,[58] as well as inducing chromosomal breakage and cellular death in the cells of the oral mucosa.[59]

Other orofacial manifestations of cocaine use include epistaxis, rhinitis, nasal crusting and chronic sinusitis, where these nasal complications have an incidence of more than 50% in users who snort cocaine.[46] Another adverse effect is nasal septum perforation that is documented in around 5% of users following intranasal administration, and palatal perforation has also been reported.[49] Known as the saddle-nose deformity, the perforation of the nasal septum produces a broad flat nose, and perforation of the palate can lead to complications with speech, eating and drinking.[46, 49] Oronasal perforations are again

attributable to the vasoconstrictive actions of cocaine, resulting in reduced blood flow and subsequent ischaemia and necrosis of the orofacial tissues.[46]

Other considerations for the dentist is that users often have anxiety symptoms, due to both the psychoactive as well as the sympathomimetic properties of cocaine.[48] As cocaine has local anaesthetic and vasoconstrictive properties, administration of lignocaine in combination with cocaine has been shown to increase the patient's risk of developing convulsions.[49] There is also a synergistic effect of the vasoconstrictive actions of cocaine and adrenaline-containing local anaesthetics that increases the patient's risk of developing acute hypertension, angina, cerebrovascular accident and myocardial infarction.[49] Dental treatment should be deferred for a minimum of 6 to 24 hours after the last administration of cocaine.[49] Users often administer hypnotics such as diazepam and zolpidem to transition off the euphoric effect of cocaine. It is well established that these medicines also cause xerostomia, further compounding the risk of caries, oral infections and non-carious wear.

Table 3. Dental considerations for treating cocaine users

- Bruxism, clenching and non-carious tooth wear are a common presentation
- Gingival erosions, retraction and ulcerative lesions may be present
- Chronic sinusitis, epistaxis and nasal crusting is a frequent adverse effect
- Defer dental treatment for 6 to 24 hours after the last administration of cocaine

Opioids – Heroin and Methadone

Heroin, also known as diethylmorphine, is a semi-synthetic opioid derived from morphine and together with abuse of pharmaceutical opioids, contributes to the largest proportion of the global burden of disease of all illicit drugs.[60, 61] This is due to the high mortality and morbidity correlated with injected heroin use including infective endocarditis and hepatitis, but also the other associated harms including overdose, blood borne virus transmission and associated crime makes heroin use a serious public health problem.[62] heroin is the most commonly used opioid amongst those who inject drugs,[63] with heroin dependence affecting nearly 7 in 1000 Australian adults.[62] Pure heroin is often diluted with contaminants, including quinine, powdered milk, lactose and other substances, and administered either orally, nasally, or injected intravenously or subcutaneously.[64]

Opioids act as agonists on mu, delta and kappa receptors in the periphery and the CNS, to cause effects including analgesia, euphoria, constipation, sedation, respiratory depression, nausea and miosis.[65, 66] While factors such as availability of opioids, past history of trauma and learned coping strategies have all been documented as influencing the propensity for opioid addiction, pharmacodynamically, activation of the mu opioid receptor modulates pain and reward in the CNS as well as increases dopaminergic activity.[67] This further reinforces the reward experience and also influences increased opioid use and drug cravings.[67] The pharmacokinetic properties of heroin also influence it's propensity for addiction, with its short half-life and time to achieve peak plasma levels being correlated with its ability to induce reward.[67] With repeated use, tolerance develops to the effects with alteration of the dopaminergic and other neurological pathways, and increases the risk for physical and psychological symptoms of withdrawal to develop upon cessation.[67] Users then subsequently continue to administer opioids, often with increasing doses to avoid the abstinence syndrome,[67] which include restlessness, anxiety, sweating, insomnia, and drug cravings.[68]

Long term treatment is required for abstinence. Methadone has been used as an effective treatment for opioid addiction since 1985, with National Methadone Guidelines being established in Australia in 1987.[69] Methadone is a lipophilic, synthetic opioid with a long half-life of 13 to 50 hours with an average plasma half-life of 24 hours,[70] allowing once a day dosing, in contrast to heroin that is usually administered 3-4 times a day.[69] Its pharmacokinetic profile prevents the abstinence syndrome while not producing the euphoric effect of heroin.[65] The principal of replacing heroin with methadone aims to reduce the health, economic and social harms associated with illicit opioid use,[69] as patients can be on the methadone program for months to years.[71]

Oral implications and dental management considerations

It is well established that heroin and methadone use is associated with rampant caries and periodontal disease.[65, 68] The pathogenesis of these oral diseases is complex and multifactorial, with other concomitant factors documented such as personal neglect, poor oral hygiene, psychological factors such as depression, anxiety and lack of motivation, leading to delaying dental treatment.[68] Heroin addiction is associated with xerostomia accompanied by hypoglycaemia,[65] and chronic opioid use causing altered taste preferences from modulation of the kappa and mu receptors are possible reasons why users preference a high cariogenic foods and beverages.[68, 72] The location of caries lesions has been described to be prevalent on

the buccal, cervical and smooth surfaces, and are often present prior to the start of methadone use.[72, 73] Methadone syrup is administered daily under supervision of a pharmacist, is sweetened often with cordial for palatability, the latter which may potentially contribute to the development of caries.[68] A study of the oral health in patients on the methadone program found users having poorer oral health compared with non-users, increased presence of residual roots, less frequent dental attendance, xerostomia and increased prevalence of psychological problems accompanied by anxiety and fear.[74] Other reports have documented rapid tooth destruction with aggressive, widespread caries activity in patients on methadone maintenance therapy.[73]

Bruxism and abfraction lesions are also a predominate finding in opioid dependent patients, thought to be due to the increased incidence of psychological problems in this cohort of individuals.[65, 68]

Management of opioid abusers is complex. Users may have underlying psychological problems, compounded by the adverse effects of opioids, and can subsequently experience heightened anxiety when undergoing dental treatment.[68] In addition, these patients can experience a decreased effectiveness to local anaesthetics, and opioid use can obscure dental pain, all of which may be contributing elements to the user seeking dental treatment only when in extreme pain and dental disease is subsequently more advanced.[65, 68] Lastly, injecting drug users are at increased risk of blood borne viruses including hepatitis B and C, as well as an increased incidence of infective endocarditis, and so a thorough medical history should be undertaken prior to dental treatment and antibiotic prophylaxis considered as appropriate.[68]

Table 4. Dental considerations for treating opioid abusers

- Rampant tooth decay and periodontitis is a common presentation - Anxiety and opioid use can reduce the effectiveness of local anaesthetic - Injecting drug users are at greater risk of blood borne viruses and infective endocarditis

Other developments

Improved controls over heroin trafficking has led to the resurgence of novel psychoactive substances,[75] of which desomorphine has re-entered the illicit drug scene, originating in Siberia, and spreading throughout Russia, Ukraine, Georgia and other former countries of the

Soviet Republic.[75] Desomorphine is a semi-synthetic derivative of morphine and so has similar analgesic, sedative and euphoric activity by binding to mu-opioid receptors.[75] Its pharmacokinetic characteristics, including increased lipophilicity, faster onset of action and shorter half-life compared to morphine, are thought to be responsible for its addictive and reinforcement properties.[75] The homemade production of desomorphine by combining codeine-containing products (analgesic or antitussive preparations) and other readily available ingredients such as iodine, soda, red phosphorus, gasoline and hydrochloric acid[76] produces an injectable liquid. The route of administration is usually by either intra-muscular or intra-venous injection, making the user susceptible to the harmful effects of the other components.[77] Desomorphine gained its moniker, "krokodil", "crocodile", "croc" or "krok" due to the adverse effect the injection produces, which is a black and green discoloured, flaking skin, similar to that of a crocodile.[75]

Recent literature has showed that the active ingredient and diluents has an anti-resorptive effect and results in a high incidence of osteonecrosis of the jaw (ONJ), with maxilla involvement only in 27.5%, the mandible only in 52.5% and both jaws affected in 20% of patients.[78] In the vast majority of cases (92.3%), tooth removal was the trigger for the development of ONJ, where bone exposure can occur up to 12 months after the extraction.[76] In addition to exposed bone, other reported clinical signs included swelling of the adjacent oral mucosa, intra- and extra-oral fistulas in the surrounding area, together with associated pain.[77] Other reported risk factors for ONJ in users include poor-quality dentures, failed endodontic treatment, periodontitis, acute and chronic trauma of the oral cavity and poor oral hygiene.[76] Surgery is currently the predominant method of treatment.[76-78]

While desomorphine has not been reported for use in Australia as yet, an awareness of the high association with ONJ is imperative for dentists should they encounter a user of this drug mixture.

Misuse of pharmaceutical drugs

Misuse of pharmaceutical drugs involves a misuse of a drug that is available from a pharmacy, over-the-counter or by prescription.[2] The term misuse refers to both medicines that are used for non-medical reasons, as well as medicines that are used inappropriately administration in non-prescribed doses or frequencies.[2] The National Drug Strategy Household Survey found in 2017 that almost 1 in 20 Australians had misused a

pharmaceutical drug in the preceding 12 months, with the four most commonly misused drugs included over-the-counter codeine products, prescription codeine products, oxycodone and tramadol.[2] Furthermore, codeine products at the time such as Nurofen Plus® (containing ibuprofen with codeine) and Panadeine Forte® (containing paracetamol with codeine) were misused in approximately 3 in 4 recent users of pain-killer/opiates, and 4 in 10 respectively.[2] The pharmaceutical misuse of drugs and associated harms are significant public health burdens, with hospitalisation for pharmaceutical opioid poisoning now surpassing those for heroin use,[79] and a longitudinal study assessing the trends in opioid overdose deaths in Australia found that pharmaceutical opioid overdose deaths increased from 2001 to 2012, and at a greater incident rate compared to overdose deaths due to heroin.[61] In addition, prescription opioid and/or benzodiazepine use is the most common reason why addicted individuals commence drug and alcohol treatment programs.[79] A systematic review and meta-analysis of the source of pharmaceutical drugs for non-medical use showed that drugs are predominately sourced through social networks, including family and friends.[80]

Recent longitudinal studies in Australia show that dental dispensed opioids has been increasing in recent years,[81, 82] including Panadeine Forte,® tramadol and oxycodone, and that it is established that drug-seeking and drug dependent patients are common in general dental practice. Therefore dentists should be aware of the increasing issues relating to prescribing drugs of dependence such as opioids and benzodiazepines and the importance of establishing a true therapeutic need.[6] A cross sectional study of dentists in the US assessing dental opioid prescribing practices found a gap in existing dental training in the identification of prescription opioid diversion and screening for prescription drug abuse.[83] Furthermore, a prospective, observational study of patients who presented at emergency departments in Boston found that approximately 12% of patients reporting backache, dental pain or headache were "drug seeking" for a medicine of dependence.[84] A recent study showed that a pre-filled opioid prescription, given prior to the extraction of wisdom teeth, is an independent risk factor for persistent opioid use, mostly in young, opioid-naïve patients, with older age of 19-24 years (OR=2.13) and 25-30 years (OR=2.85) being associated with persistent opioid use compared with patients aged 13-15 years.[85]

Conclusion

Illicit drug use in Australia and overseas is a significant public health problem, with dentists likely to encounter current and past users of various illicit drugs, underscoring the need for dentists to be aware of the oral implications associated with substance use disorder. Concomitant factors such as poly-drug use, including the use of alcohol and tobacco, as well as psychological, behavioural and social issues, compound the oral health of addicted persons and complicate dental management. The dentist is an indispensable member of the multidisciplinary team, since oral adverse effects are commonly associated with illicit drug use and are associated with a poorer quality of life for these individuals. Dentists should be aware of the rising misuse and diversion of pharmaceutical drugs, and prescribe judiciously for a true therapeutic need with minimal quantities.

Conflict of interest

The authors have no conflict of interest.

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