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Clinical issues: Illicit drug use and oral health

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Abstract

People with drug use disorders (PWDUD) have elevated prevalence of oral diseases, in particular dental caries (tooth decay), periodontal (gum) disease and xerostomia (dry mouth). When left untreated, these oral health conditions may progress and lead to tooth ache, abscesses and tooth loss, and in turn to poor chewing functioning and digestion, dental aesthetic problems, and reduced wellbeing. Illicit drug use may *per se* cause xerostomia, which in turn increases vulnerability for dental caries; however, the other main drivers of oral diseases and their progression -- poor oral hygiene, frequent sugar intake, and infrequent dental visits -- can mainly be ascribed to the irregular lifestyle, poor economy and mental health problems that often accompany illicit drug use. Establishment of good oral health habits is essential in the dental care for PWDUD. Dental treatment is often comprehensive and challenging, as the patients may have extensive treatment needs but also difficulties adhering to preventive measures and dental appointments. An integrated care approach for PWDUD would likely benefit both their oral and general health.

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Introduction – background

Good oral health is an integral part of overall health, quality of life and well-being. However, among people with drug use disorder (PWDUD), oral health is often strikingly poor. In this paper, I present an update of the epidemiology of oral diseases among illicit drug users, a description of clinical presentation of typical acute and chronic conditions, and brief reviews of the underlying mechanisms and assessment and treatment of oral diseases among illicit drug users.

Oral health conditions include various diseases and injuries that affect the soft and hard tissues of the oral cavity. They pose a major health burden, as they may cause pain, discomfort and disfigurement, and they are largely preventable (1). In their literature review, Djou and Dewi (2) summarized the most frequent oral health problems among PWDUD. Dental caries (tooth decay) and periodontal (gum) disease (both 78 %) were the most prevalent, followed by xerostomia (dry mouth) (44 %), bruxism (tooth grinding) (17 %), and oral mucosal lesions (11 %). These most common – and in our context the most relevant – diseases are briefly described in the following along with their aetiology and risk factors.

Dental caries is the result of demineralization and cavitation of teeth, due to acids produced by sugar fermentation by bacteria in dental plaque. Poor oral hygiene and frequent intake of sugar are therefore important risk factors for dental caries (3, 4). Fluoride exposure, via toothpaste, mouth rinse or drinking water, to the dental enamel protects against demineralization and is therefore an effective measure to prevent dental caries (5). Saliva's capacity to neutralize acids in the oral cavity (6) implies that poor salivation (dry mouth) and reduced saliva buffer capacity also are important risk factors for dental caries.

Periodontal disease is a chronic inflammation of the supporting structures of the teeth (7). The inflammation is due to bacteria (plaque) in gingival pockets. With increasing loss of tooth attachment, the tooth will loosen and eventually fall out. Inadequate oral hygiene allowing for subgingival plaque is one important risk factor, others include tobacco smoking, drug induced decreased salivary flow, and stress (7).

Xerostomia is a feeling of oral dryness or perception of dry mouth which is due to reduced salivary production (8). Xerostomia is not only an important risk factor for dental caries, but it is a debilitating condition in itself causing discomfort and reduced quality of life (8, 9). The most common cause is the use of certain systemic drugs (10, 11).

Bruxism is a detrimental motor activity which includes unconscious clenching, grinding or bracing of the teeth (12). Bruxism may have multiple causes, but often there is no known apparent cause (primary bruxism). However, certain diseases and drugs are known to cause bruxism (secondary bruxism) (12). Severe bruxism may cause damage to the teeth, including tooth wear, and pain in the temporomandibular joint (TMJ) and masticatory muscles.

Other diseases and injuries of relevance include lesions of the oral mucosa (including cancer and precancerous lesions) (13, 14), and lesions of the palate (15), and possibly fractures of teeth, jaws or other head bone structures due to accidental injuries or violent assaults.

Epidemiology

Use of illicit substances vary by type of drug and world regions and countries. Cannabis (recently legalized in several jurisdictions) is the most widely used drug; past year prevalence rates in the population aged 15 - 64 were in the range 2 % to 12 % , whereas opioids, amphetamines and other stimulants are mainly reported by less than 1 % (16). Most people using illicit drugs do so infrequently, and only a minor fraction of users fill criteria for a drug use disorder (DUD) (17). Although PWDUD are often categorized by their main or preferred drug of choice, many or most are poly-drug users (18).

Dental caries and periodontal disease are the most common oral diseases and major causes of tooth loss, and untreated dentine carious lesions make up the single most common disease that affects humans worldwide (19). The prevalence of untreated cavitated dentine carious lesions in the permanent dentition varies by world region in the range between 20 % and 45 % (19). Prevalence of severe periodontitis varies also substantially; in the range between 4 % and 20 % (19).

In epidemiological studies, dental decay is usually measured as the number of decayed (D), missing (M) and filled (F) teeth (T); DMFT. Not counting the wisdom teeth, the maximum possible DMFT is 28. As the DMF measure captures both past and current disease, the D component (i.e. untreated cavitated dentine carious lesions) and M component (i.e. missing tooth due to extraction or complete destruction of tooth crown) may be considered preferable measures of dental caries (19). Periodontal disease is measured by assessing the pocket probing depth (PPD). A pocket depth of 4-5 mm is assigned as a 'shallow pocket', and a 'deep pocket' is 6 mm or deeper.

Studies examining oral health in PWDUD in comparison to general population samples, report elevated prevalence of decayed teeth, missing teeth and periodontitis. Increased risk of other oral health problems is also reported. Baghaie and colleagues (20) identified 28 primary studies examining oral health problems in illicit drug users and controls, and 10 additional primary studies (21-29) were identified from more recent reviews (2, 30-32) and further literature searches. These 38 studies were conducted in 16 different countries. Several studies were small pilot studies, and 16 studies included fewer than 100 participants with DUD. Most of these studies assessed dental decay (n=25) or/and periodontal disease (n= 14). Baghaie and colleagues (20) reported that opiate users had on average more decayed teeth (+5.6) and less filled teeth (-0.4) than controls, and amphetamine users had on average more decayed (+2.6) and more missing (+2.1) teeth than controls. A similar pattern was observed for polydrug users; more decayed (+3.5) and missing (+ 3.4) teeth and fewer (-2.1) filled teeth than controls. More recent studies among crack cocaine users (21), opioid users (24, 27) and cannabis users (25) reported similar findings. Notably, a deviant finding was reported from a sample of morphine dependent men in 1945; dental caries prevalence was quite similar to that in a control group (33), but this may reflect that caries experience in the general population at that time was very high.

Baghaie and colleagues (20) reported that presence of periodontitis, both in terms of shallow and deep pockets was on average around three times higher in illicit drug users than controls. Other oral health issues were examined in six studies; oral mucosal lesions were more prevalent among illicit drug users than controls (23, 34, 35), and occlusal tooth wear and other signs of bruxism were more often observed in drug users than controls (36-38).

Clinical presentation

Although people with substance use disorder often experience oral health problems, they are less likely to seek dental treatment, even when they experience pain or frequent need of dental care (31, 39-42). The clinical picture may therefore differ somewhat by clinical setting; it seems likely that in dental clinics, PWDUD more often present with acute problems including pain and more severe oral health problems as compared to clinical presentations in addiction treatment centres or in primary or specialized health care.

Acute conditions

Acute pain, particularly toothache, is often reported by PWDUD (43, 44), and it is the most important reason for visiting a dental clinic (45, 46). There are reports that drug users take illicit drugs (e.g. heroin or cocaine) as an analgesic for toothache (43-45). From clinical descriptions, including intraoral pictures, such toothache may be due to severe dental decay resulting in inflammation of the dental pulp tissue (pulpitis) and possibly inflammation of the tissue surrounding the tooth apex (periapical periodontitis) (47). Both conditions may be very painful. Other acute conditions include oral abscesses (45), tooth or jaw fractures (48) and possibly acute oral lesions from accidents or violence, as PWDUD often experience such injuries (49, 50).

Chronic conditions

The chronic oral health conditions span a broad range of diseases and conditions and their sequelae. For all or most types of illicit drug use, the users often present with dental decay and tooth loss, gingivitis and periodontitis (2, 20, 31, 32). When left untreated over time, as they often are, these diseases typically become more severe, often more painful and more difficult and expensive to treat, and they may affect chewing function, dental aesthetics and oral well-being even more severely. A dry mouth (xerostomia) is frequently reported among illicit drug users and methadone patients (31, 51), and beyond increasing the risk of dental decay and periodontitis, it causes discomfort and often a sense of 'burning mouth', unpleasant taste and bad breath, and difficulties with eating and speaking (8). Jaw clenching and tooth grinding (bruxism) are frequently reported by stimulant drug users (15, 31, 52-54), and this condition is often accompanied by temporomandibular joint pain and tooth wearing and occlusal attrition (54, 55). Lesions of the oral mucosa, including leukoplakia, squamous cell carcinoma and fungus infections (candida albicans) and enlarged gingiva are seen in users of cannabis or/and opioids (31, 56). Among cocaine users, painful retracted gingiva at site of drug application (15) and oronasal tissue destructions, including palate perforation, are reported (15, 55).

A comment on methamphetamine use and oral health

While there are numerous case reports on illicit drug users and their oral health problems, it is not obvious that these provide the *typical* clinical picture. In particular, there are many case reports of oral health in methamphetamine users (e.g. (57-59)) describing the so-called "Meth mouth" with teeth as "blackened, stained, rotting, crumbling or falling apart" (54). Accompanying intraoral photos often show patients with grave dental decay: most or all teeth appear severely affected by tooth decay or completely missing tooth crowns. However, epidemiological studies suggest that this is not the typical picture; average DT scores were in the magnitude of 2 to 5 and average MT scores in the range from 3 to 5 (60-63). In other words, the dentition of methamphetamine users is – in most

cases – much less severely affected than what is portrayed in the case reports. Furthermore, it is noteworthy that the examples of "Meth mouth" vary considerably with regard to clinical appearance, and many of them appear similar to examples of rampant caries in heroin users and even rampant caries in children.

A related issue is whether methamphetamine users are more severely affected than other drug users. Some studies reported higher caries prevalence or more dental health problems in methamphetamine users than other drug users (46, 64), whereas the meta-analysis by Baghaie and co-workers (20) demonstrated that the elevated caries prevalence in drug users did not differ between opiate users and (meth)amphetamine users. Other studies have reported no difference in oral health or need for oral health services between users of methamphetamine/other stimulants users of other drugs (41, 65). Thus, the literature offers inconsistent evidence that methamphetamine use poses a particularly high risk for dental decay. Notably, methamphetamine and amphetamine are closely related drugs in the ways they act, and many users who inject the drug, find it difficult to differentiate between the two (66).

All this considered, it is thought provoking that so much attention is paid to the "Meth mouth" phenomenon, also in the scholarly literature on oral health in PWDUD (see for instance (31, 67, 68)), and it seems, to this end, far from clear that the "Meth mouth" concept is valid and useful. In a similar vein, Murakawa (69) challenged the evidence for the "Meth mouth" diagnosis and offered an interpretation of its construction as part of a drug scare.

Causal mechanisms

The elevated incidence of *dental caries* among PWDUD is likely due to a combination of risk factors, partly as an indirect effect of the substance use per se, and partly as an effect of the life-style, poor economy and other health problems that often accompany DUDs or/and result from DUDs. This is illustrated in Figure 1.

A broad range of drugs impact on salivary flow and may cause xerostomia, and thereby increase vulnerability for dental caries. In particular, opioids (e.g. heroin, methadone) and cannabis are known to cause hyposalivation (10, 38), but also other drugs frequently used by illicit drugs users, such as benzodiazepines, may cause xerostomia (10). Users of opioids, cannabis or methamphetamine very often report dry mouth symptoms (38, 40, 70, 71) and are found to have lower saliva production (38), which may reflect drug effects on saliva production or/and dehydration. It is reported that methamphetamine use seems to reduce saliva's capacity for neutralizing acids (buffer capacity) and thereby increase vulnerability for dental caries (38), whereas for other stimulants such as crack cocaine, the impact on salivary flow rate, pH or buffer capacity seems negligible and not of any importance for caries risk (72).

Irregular meals with frequent intake of sugar containing drinks and sweet snacks is often reported by PWDUD (71, 73, 74). Sugary drinks and foods are easily available and affordable, and sweet drinks are often preferred to alleviate the discomfort of dry mouth (31, 40). In combination with remaining dental plaque on tooth surfaces, resulting from poor oral hygiene and/or xerostomia (31), frequent sugar intake poses a substantial risk of dental caries. Moreover, PWDUD attend dental care services infrequently, for various reasons, such as financial constraints, general anxiety and dental fear (31, 40, 64, 75). Correspondingly, such infrequent use of dental services is also reported by people with alcohol use disorder and other severe mental illness (76). Thus, in the absence of

dental care, carious lesions may develop over a long period and may thereby result in more severe decay and further complications, including acute pain (due to pulpitis or apical periodontitis), tooth fractures, tooth loss, poor chewing function and poor self-esteem and quality of life (32) (Figure 1).

Periodontal disease is frequently observed in PWDUD, which may be ascribed to several risk factors that are prevalent among illicit substance users. First, poor oral hygiene causes exposure of oral bacteria in dental plaque in the gingival pockets and thereby initiation and further development of the inflammation leading to periodontal pockets and loss of tooth attachment (7). As noted above, poor oral hygiene is frequently seen in people with DUDs and may reflect an irregular lifestyle. Tobacco smoking or other tobacco use is another important risk factor for periodontal disease (7), which is highly prevalent among illicit substance users (77) (Figure 1).

Loss of dental substance (wearing) due to tooth grinding is prevalent in PWDUD, and the aetiology of bruxism is still largely unknown (12). A stressful lifestyle is considered an important risk factor (12), and it seems that stimulant drug use in particular may be a risk factor for bruxism (38, 78). Tobacco use is an important risk factor for *lesions of the oral mucosa*, such as oral squamous cell carcinoma and the potentially malignant disorder leukoplakia (79, 80), however, it seems unclear whether illicit drugs *per se* may cause these lesions. The evidence is mixed and insufficient regarding possible effects on precancerous and cancerous lesions from regular cannabis use (81-83) or khat chewing (84). Needle sharing may cause HIV infection in PWDUD, and while HIV infection is associated with oral squamous cell carcinoma, causality is not established (85) (Figure 1).

Oral diseases, including dental caries, periodontal disease and xerostomia, impact in turn various aspects of overall health and wellbeing, as they may cause severe pain and discomfort, poor chewing functioning and digestion and dental aesthetic problems, poor self-esteem and less social interaction. Overall, the mechanisms underlying the various oral health problems often observed in PWDUD seem complex, and not fully understood.

Insert Figure 1 about here

Assessment

As people with drug use disorders often avoid seeing a dentist, providers of other health and social services, such as drug treatment services, primary and specialized health services and prisons, may consider making crude initial oral health assessments, without having any formal dental training (20). Such assessments may include brief interviews about current subjective oral health problems, including pain symptoms, damaged or loose teeth, problems with dentures (if any), sensation of dry mouth, and chewing and swallowing problems. A quick intra-oral inspection of teeth and soft tissue in the oral cavity for assessment of severe dental decay, tooth fractures, missing teeth and soft tissue lesions can also be performed. Such assessments may serve as a basis for referral to a more comprehensive examination by dental health staff.

In the dental clinic, a clinical interview conducted by dental health staff should obtain general health information including chronic diseases and drug use, and specific oral health information, including symptoms and oral health problems, oral hygiene and sugary diet, and previous use of dental services. The clinical examination by a dentist should include thorough inspection of the dentition supported by radiographs and possibly intra-oral photos, assessing dental

caries, gingivitis and periodontitis, plaque level, attrition damages, soft tissue lesions, and chewing functions (67).

Treatment

The goals of dental treatment for patients with substance use disorders are, as for other dental patients, to maintain oral health, comfort, and function and to prevent and control oral disease (68). For many illicit drug users, the complexity of the oral condition implies, however, that treatment needs are often considerable (86). Hence, a treatment plan with treatment priorities and timing is essential. The plan should be simple and feasible (67) and must include preventive measures (68). The plan should be tailored to individual needs and resources (45) and developed in close cooperation with the dental patient. Communication with the patient should be non-confrontational and 'judgement-free' (67).

Preventive measures are crucial to maintaining good oral health and preventing further damage to oral health (67). These measures include regular oral hygiene, which for dentate patients includes thorough toothbrushing and use of dental floss, and topical use of fluorides (e.g. in dentifrice or mouth rinse). Frequent sugar intake in foods and drinks should be avoided, and sugarless products can be recommended (67). For patients on methadone, a sugar-free preparation should be preferred (51). Symptomatic relief of the discomfort from xerostomia is important and can be obtained by regular consumption of tap water to maintain hydration and by use of oral lubricants or moisturisers. Moreover, salivation can be stimulated by chewing sugar-free gum (8, 67). Notably, PWDUD may have poor understanding and misconceptions of the main causes of dental decay and periodontitis, and they may thus lack the necessary prerequisites for self-care (45). Educating the patients in why these preventive measures are effective is therefore essential, and this can be done also by non-dental staff and in health and social services other than the dental clinic. Good dental hygiene habits, including regular toothbrushing and use of fluorides, a non-cariogenic diet and – if relevant – management of xerostomia should be established before extensive restorative treatment is initiated. It is also important that patients are followed up over time to ensure that these preventive measures are continued.

It is usually recommended that complex treatment is performed only when the patient is in a stable condition with regard to the drug use disorder (68), and that only palliative and emergency treatment should be performed on patients who are not in remission or recovery phase (67). In the event of early detection of illicit drug use, it is the dentist's responsibility to refer the patient to a specialised substance addiction treatment centre (63). However, many dentists do not agree that screening for substance use should be part of their professional role (87).

Dental treatment of PWDUD is often challenging, for a number of reasons. Restorative treatment of severe dental decay can for instance include endodontic treatment, comprehensive fillings or/and prosthodontic treatment with crowns or bridges, all of which are time consuming and expensive, and they usually require use of analgesics and several, sometimes lengthy, treatment appointments (e.g. (86)). Often PWDUD miss their dental appointments or come late (88). Dental fear is common among PWDUD (75), and there are examples that drug users have performed 'dental treatment' on themselves by extracting teeth or draining abscesses (45). Many PWDUD suffer from general anxiety (31, 40), and under the influence of intense pain their usual anxiety may be dramatically magnified (40). Some have a phobia for needles when in the hands of others (40), which further accentuates anxiety. Opioid users, including patients on methadone, may have reduced

effect of local anaesthetics (31, 40, 51), whereas for stimulant drug users local anaesthetics containing a vasoconstrictor (e.g. adrenaline) may increase risk for a hypertensive crisis and should be avoided within 6 - 24 hours after last drug administration (15, 31). Successful management of pain and anxiety may therefore be difficult to achieve in this group of patients (40). Intravenous drug users are at increased risk of infective endocarditis, and they may therefore need to be assessed for the need for an antibiotic prophylactic regime prior to dental procedures in which a significant bacteraemia may arise (e.g. oral surgery or deep periodontal scaling) (40).

The combination of these various treatment challenges, including extensive treatment needs, dental fear and likelihood of missing appointments, may necessitate provision of temporary treatment solutions and 'patchwork dentistry', nonetheless it requires that the patient understands and accepts this treatment approach (89). Surveys among dental health professionals suggest that many are reluctant to treat PWDUD (42, 88), and correspondingly, it is reported that drug users may feel that dentists are generally unsympathetic towards them (75). Similar challenges are perceived for people on social assistance (90). Viral infections (e.g. HIV, Hepatitis C) are common among injecting drug users, and there are examples of drug users reporting they were denied access to dental treatment because of such infections (75). However, prophylactic measures to prevent virus spread in the dental clinic should be in place for all dental patients, and possible viral infection is not an acceptable reason for refusing patients with DUD in dental care.

Future directions

Notably, dental disease may impact overall health and wellbeing. According to the US surgeon general, oral disease can " … undermine self-image and self-esteem, discourage normal social interaction and cause other health problems and lead to chronic stress and depression as well as incur great financial cost. They may also interfere with vital functions such as breathing, food selection eating, swallowing and speaking, and with activities of daily living such as work, school, and family interactions." (cited in (86)). Thus, the oral health problems among PWDUD clearly extend beyond the oral cavity and need to be considered also by primary and specialized health and care services.

Over the last decades, an integrated care approach has emerged in health care settings to increase the effectiveness of care for patients with special clinical needs and problems (91), and interprofessional collaboration is to an increasing extent considered a critical factor in delivering quality services to vulnerable patient groups (88). There are now many examples that oral health care is integrated into primary health care, particularly for vulnerable populations, although a scoping review found none for PWDUD (92). Thus, it still seems that for PWDUD, dental care services are rarely integrated into – or well co-ordinated with – substance use treatment and other health and care services. For instance, in Norway, the authorities have sought to strengthen interprofessional collaboration across health care institutions, however, most dental professionals working with PWDUD in public dental service do not have a satisfactory collaboration with DUD treatment institutions (88). On the other hand, examples of success should also be noted. For instance, in the UK, a local drug and alcohol team established a 'drop-in' dental service for their clients, offering oral health advice, emergency treatment and referral to further dental treatment (75). Almost half of those referred, had completed or remained in a course of treatment (75). Another example is from a program (FLOSS) in the USA, which offered comprehensive oral health care to a sample of patients who were in DUD treatment and had significant dental needs (86).

Compared to others in DUD treatment, those in the FLOSS program had improved treatment outcomes with regard to drug abstinence, completion of DUD treatment, and employment (86). The authors speculated that these beneficial outcomes could be explained by improved overall wellbeing and quality of life. Thus, it seems that better co-ordination or integration of dental health services and other health and social services can be important for providing adequate help and treatment services for this group of vulnerable people with comprehensive treatment needs and challenges.

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Figure 1. An illustration of underlying mechanisms for oral health problems and their sequelae among people with drug use disorders.