Substance Use Disorder in Adolescence: A Review for the Pediatric Dentist

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ABSTRACT

Substance use during puberty has become a serious public health issue with significant morbidity and mortality in many countries. Approximately half of American youth have tried an illicit substance by the time they graduate from high school. Drug addiction is defined as a chronic, relapsing brain disease that is characterized by compulsive drug seeking and use. Substance use disorders are maladaptive patterns of use accompanied by clinically significant impairment or distress, causing reduced functioning in major areas of life, risk-taking behavior, exposure to hazardous situations, and an increase in the likelihood of legal problems due to possession. In 2008, there was an annual prevalence of drug use of approximately 7% for eighth graders, 11% for 10th graders, and 18% for 12th graders. The pediatric dentist is in a good position to help prevent and detect suspicious cases of substance use because of the age of patients seen in the pediatric dental practice as well as the many behavioral and oral aspects present in adolescents who use illicit substances. (I Dent Child 2009;76:209-16)

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Substance use during puberty has become a serious public health issue with significant morbidity and mortality in many countries. Neurobiological developmental factors can predispose adolescents for experimentation with substances: half of American youths (51%) have tried an illicit substance by the time they graduate from high school.^{1,2} The 3 major causes of death for US youth (motor vehicle accidents, homicide, and suicide) are all associated with substance abuse.³ Furthermore, it is often connected with incidents leading to severe consequences. These include: traumatic brain injury; major organ damage; contagious diseases (transmission of human immunodeficiency virus [HIV], hepatitis, sexual diseases, etc); teen pregnancy (failure to

Dr. da Fonseca is clinical professor, Division of Pediatric Dentistry, The Ohio State University College of Dentsitry, Nationwide Children's Hospital, Columbus, Ohio. Correspond with Dr. da Fonseca at <u>marcio.dafonseca@</u> nationwidechildrens.org use contraception happens often when individuals are drunk or high); involvement in criminal activities; and school failure.³ In our hospital, a major pediatric health care facility in the US, 1 adolescent on average is admitted each week for detoxification.

Drug addiction is defined as a chronic, relapsing brain disease that is characterized by compulsive drug seeking and use.⁴ Substance use disorders (SUD) are maladaptive patterns of use accompanied by clinically significant impairment or distress, causing reduced functioning in major areas of life, risk-taking behavior, exposure to hazardous situations, and an increase in the likelihood of legal problems due to possession.^{5,6} Adolescents are more vulnerable to the effects of illicit drugs because substance-induced neurobiological alterations likely strengthen drug use behaviors, which appear to have a more rapid progression than in adults.² Moreover, because their brains are still developing, they are at great risk of neuropathology as a result of substance abuse. Table 1 lists the most common substances used by adolescents and their street names.

PREVALENCE OF SUBSTANCE USE AMONG TEENAGERS

The 2008 Monitoring the Future survey, which has been tracking adolescent substance use in the United States since 1975, showed an annual prevalence of drug use (ie, the percentage reporting any use in the prior 12 months) of approximately 7% for eighth graders, 11% for 10th graders, and 18% for 12th graders.^{47,8} Students continued to show a gradual decline in their use of alcohol, nicotine, amphetamines, methamphetamine, crystal methamphetamine, cocaine, crack, anabolic steroids, and over-the-counter cough and cold medications containing dextromethorphan. Cigarette smoking has fallen to the lowest level since the survey was started.⁴

Many other drugs did not show evidence of decline in 2008, however, including: lysergic acid diethylamide (LSD) and other hallucinogens (3,4-diethylmethamphetamine or MDMA, phencyclidine); heroin; narcotics (specifically oxycodone and hydrocodone); tranquilizers; sedatives (including barbiturates); and the "club drugs," such as MDMA, ketamine, flumitrazepan, and GHB (gammahydroxybutyrate)—the latter 2 commonly known as "date rape drugs". The most common sources used to obtain prescription drugs were friends or relatives (obtained either for free or purchased) and, to a lesser extent, bought from a dealer or a stranger.⁷ Patient re-

ports suggest that street costs of prescription opioids are higher than the equivalent doses of heroin, a factor that could shift choice to the latter.⁹⁻¹¹ An important attitudinal issue is that teenagers misperceive prescription medications to be safer than heroin, considering the latter a "junkie" drug.⁹ Consumption of marijuana, the most commonly used illicit drug, declined in 10th grade but rose in grades 8 and 12. Tables 2 and 3 reflect prevalence figures for substance use in US adolescents.

ETIOLOGY AND RISK FACTORS

Adolescents are at heightened risk for experimentation with substances. Individual, peer, family, and community etiology and risk factors associated with SUD in puberty include: genetic factors which account for between 40 percent to 60 percent of a person's vulnerability to addiction; developmental issues and neurobiological processes of adolescence (adolescent feeling of being invulnerable, issues of autonomy, peer pressure); traumatic life events (childhood maltreatment, parental divorce, peer rejection, etc); cultural and ethnic factors (media portrayal of medication and substance use, religiosity, neighborhood disorganization, etc); psychiatric disorders; family history of substance abuse; nonsupportive or highly conflicted family life (poor parent-child relationships, low perceived

Table 1. Common substances used by adolescents and their street names⁴

Amphetamines	Speed, chalk, meth, bennies, crosses, hearts, uppers
Methamphetamine	Ice, crystal, fire, crank, glass, meth, chalk, go fast
Ecstasy	Dex, essence, roll, clarity, diamonds, Adam, Eve
Ketamine	Special K, cat valiums, K, vitamin K
Oxycodone	OXY, OC, killer, oxycotton
Hydrocodone	Vike, Watson 387
Codeine	Captain Cody, Cody, schoolboy, doors and fours, loads
Heroin	Junk, China White, smack, brown sugar, dope, H, Horse
Opium	Big O, black stuff, block, gum, hop
Lysergic acid diethylamide	Sugar, dots, L, cubes, acid, blotter, big D, boomers
Phencyclidine	Angel dust, hog, peace pill, sheets, sternly, boat, love boat
Flunitrazepam	Roofies, the dare-rape drug, roches, rope, forget-me pills
Gammahydroxybutirate	Liquid ecstasy, Georgia home boy, G, grievous bodily harm
Mephylphenidate	Poor man's cocaine, vitamin R, the smart drug, JIF, MPH
Hashish	Boom, chronic, gangster, hash, hemp
Marijuana	Blunt, dope, grass, herb, joints, pot, skunk, weed
Barbiturates	Barbs, reds, red birds, phennies, tooies, yellows
Benzodiazepines	Candy, downers, sleeping pills, tranks
Cocaine	Blow, bump, C, candy, Charlie, coke, crack, flake, toot
Smokeless tobacco	Snuff, spit tobacco, bidis, chew

Other commonly abused substances include alcohol, nicotine (cigarettes, cigars, etc), anabolic steroids, and inhalants

parental support, inconsistent family management practices, etc); affiliation with peers involved with drugs; and academic failure. $^{1.6}$

Puberty is a time of maturational changes in the central nervous system (CNS). CNS structural and functional evidence shows that adolescents have greater neurobiologically based tendencies for risk-taking with attenuated suppressive and regulatory controls (eg, avoidance of drug use environment) on behavior and enhanced stimulatory (eg, drug seeking) systems vs adults.² Decreases in parental monitoring during puberty allows for experimentation with substances and affiliative relationships between disinhibited peers, which appear to create an amplifying feedback cycle that increases both SUD risk and disinhibition levels.²

Thus, neurobiological changes during puberty contribute to 3 behavioral factors that relate to SUD development: (1) increases in peer affiliation; (2) decreased parental monitoring; and (3) risk-taking behaviors.² It appears that the combination of deviant peer associations and externalizing behavior problems (conduct disorder, aggressive behavior) poses the greatest risk for development of drug addiction.² Other adolescents who have an increased vulnerability to drug use and are more likely to engage in high-risk behaviors are those with limited coping strategies and social skills, those with life choices and options perceived to be limited, and those who experiment before 15 years of age, including smoking and drinking. 3,4,11

Unfortunately, the age at which experimentation begins has been gradually declining, especially for inhalants. Furthermore, there are a few neurobiological risk

Table 2.	Prevalence of drugs declining in use by eighth,
10 th and	12 th graders (2008) ^{4,7}

	Eighth grade (%)	10 th grade (%)	12 th grade (%)
Amphetamines	5	6	7
Methylphenidate	2-3 for all grades		
Methamphetamine	1	2	1
Crystal methamphetamine*	N/A	N/A	1.1
Cocaine	2	3	4
Crack	1	1	2
Cough and cold meds	4	5	6
Anabolic steroids	1	1	2
Alcohol [†]	16	29	43
Cigarette smoking [†]	7	12	20
Smokeless tobacco [†]	4	5	7
Boys only	6	8	12

* Measured for 12th graders only.

† Thirty-day prevalence use (ie, reporting use at least once in the 30 days prior to the survey).

Table 3. Prevalence of drugs holding steady in use by eighth, 10th, and 12th graders (2008)^{4,7}

	Eighth grade (%)	10 th grade (%)	12 th grade (%)
LSD	1	2	3
Hallucinogens other than LSD	2	4	6
Ecstasy	2	3	4
Heroin	1	1	1
Sedatives*	N/A	N/A	6
Tranquilizers	2	5	6
Narcotics (other than heroin)*	N/A	N/A	9
Oxycodone	2	4	5
Hydrocodone	3	7	10
Inhalants†	9	6	4
$Marijuana/hashish^{\dagger}$	11	24	32

* Measured for 12th graders only.

† Both showed an increase in eighth and 12t^h grade use, with a slight decline in 10th grade.

markers associated with the development of addiction, one of them being hypoactivity or hyperactivity of the hypothylamic-pituitary-adrenal axis, which plays a major role in stress response.²

Perceived risk and disapproval of a drug are also major deterrents to their use. The perception that casual use of recreational drugs is not a significant concern is held by many adults and health care professionals.¹ Even infrequent casual use poses increased risk of serious problems, including abuse, rape, and injuries.¹ The "gateway" drugs (alcohol, tobacco, and marijuana) can lead to polydrug use by mid- to late adolescence.^{10,11} In 2008, decreased perceived risk of harmfulness and disapproval was seen for LSD among 12th graders, marijuana and inhalants among eighth graders, and ecstasy among all students.^{4,7} This attitude change may be possibly due to the so-called "generational forgetting" of the dangers of a drug as new cohorts of students enter adolescence replacing those who knew more about the consequences of its use.

CLINICAL PRESENTATION

The clinical presentation of SUD varies with the type of substances used, the amount used during a given period of time, the setting and context of use, and individual characteristics of an adolescent.³ Trauma, chronic cough, chest pain, worsening asthma that is unresponsive to therapy, abdominal complaints, unexplained weight loss, hypertension, red eyes, nasal irritation, frequent colds or allergies, hemoptysis, frequent unexplained injuries, needle tracks, excessive acne, malaise, headache, hoarseness, and sore throat are some unspecific indicators of an underlying drug use problem.^{1,11} Behavioral changes include disinhibition, lethargy, hyperactivity or agitation, somnolence, hypervigilance, impaired concentration, changes in attention span, and disturbances in thinking (delusions).^{3,6}

Patterns of behavior that should raise suspicion of substance use include: (1) recent or sudden drop in academic achievement, attendance, and/or motivation; (2) recent, sustained mood changes (depression, irritability); (3) recent school disciplinary actions; (4) recent onset antisocial behaviors; (5) drinking before 15 years of age; (6) associating with peers known to be involved with substance abuse; and (7) substance-related legal or medical problems.⁵

PREVENTION, EVALUATION, AND TREATMENT

Prevention or early treatment holds great promise for limiting the costs, morbidity, and mortality associated with addiction.² Given that SUD has a multifactorial cause, approaches require a host of responses, including preventing the widespread availability and demand for drugs. A pervasive difficulty is the societal acceptance of drugs and its demand for medications to solve real or perceived health problems.¹¹ All health care professionals must screen patients by asking about substance use.⁵ A good first step is to use the following CRAFFT questions¹²:

- C-Have you ever ridden in a <u>c</u>ar driven by someone, including yourself, who was high or had been using alcohol or drugs?
- R–Do you drink or take drugs to <u>r</u>elax, feel better about yourself, or fit in?
- A–Do you ever drink or take drugs while you are <u>a</u>lone?
- F-Do you ever <u>f</u>orget things you did while using alcohol or drugs?
- F–Do(es) your <u>f</u>amily or <u>f</u>riends ever tell you that you should cut down on your drinking or drug use?
- T-Have you gotten into <u>t</u>rouble from drinking or taking drugs?

If the adolescent answers "yes" to 2 or more of the questions, further evaluation is warranted. The definitive diagnosis must be confirmed by a health care professional familiar with substance use issues.³ The adolescent should also be screened for co-occurring mental illness.⁶ SUD is a chronic condition, however, that requires specific intervention; consequently, it should not be assumed that by treating the underlying condition (psychopathology, post-traumatic stress disorder, etc), the substance abuse problem will go away on its own.³ Toxicological tests of bodily fluids (urine and/ or blood) and hair samples to detect the presence of specific substances are more useful for monitoring treatment than for diagnosing SUD.^{3,5}

The primary intervention for those at the curiosity or experimentation stage is psychoeducational, beginning early, actively involving the patient, and providing accurate information about drugs and their effects.³ The adolescent who uses substances regularly needs evaluation and treatment in an intensive, specialized outpatient program with individual and group therapy for the patient, family therapy, and behavioral therapy as well as referral to self-help support groups (Alcoholics Anonymous, Narcotics Anonymous, etc).^{3,5,6,10} Those who refuse or do not respond to intensive outpatient treatment require higher intensity approaches. Detoxification programs provide medical supervision for patients who are in acute withdrawal (eg, from intravenous heroin dependency) but usually do not include substance abuse treatment, as these therapies are best implemented once the adolescent is medically stable.¹⁰ Further treatment includes free-standing, short-term rehabilitation facilities (2-6 weeks in length for initial stabilization), long-term residential programs (3-12 months), partial hospitalization programs (patients return home to sleep and on weekends, appropriate for those who have a stable home environment), and community residencies (halfway houses).1,3,10

Medications may be helpful for the management of craving and withdrawal, and for aversion therapy. Commonly used medications include nicotine replacement and bupropion for nicotine addiction, acamprosate and naltrexone for alcohol addiction, and buprenorphine, methadone, and naltrexone for opioid addiction.^{5,10,11} Nitrous oxide also has been used successfully in the treatment of withdrawal symptoms from many drugs. Monitoring and follow-up of patients in intensive outpatient treatment should be done every 1 to 3 months to maintain patient and family motivation to complete treatment.³

Pretreatment factors associated with poorer outcomes (eg, relapse to use) include nonwhite race, increased seriousness of substance use, criminality, and lower educational level. Variables reported to be most consistent with successful outcome are treatment completion, low treatment use, peer and parent social support, and non-use of substances.⁵ Unfortunately, a large group of adults, especially SUD adolescents, are not being appropriately identified and referred for care. Compounding the problem, there are very few programs available in the US to treat them and many significant financial and organizational barriers for patients attempting to enter existing ones.¹³

THE PEDIATRIC DENTIST'S ROLE

The dental professional is in a good position to help prevent and detect suspicious cases of substance use. It is important to discuss the issue with patients because the longer they defer experimentation, the less likely they are to develop an addiction.⁶ The pediatric dentist cannot assume that this subject will be or should only be discussed by the primary care physician, which unfortunately does not happen as often as it should. A survey of American teenagers showed that only 35% of them had a physicianinitiated discussion on substance abuse, although approximately 65% wanted it to be brought up during a medical appointment.¹⁴ Education of all patients and parents should begin as early as elementary school, and all patients should be encouraged to ask questions about illicit substances.^{3,10} Educational materials on illicit substances (pamphlets, booklets, videos, etc) should be available in the dental office.

Pediatric dentists should acquire the skills necessary to identify patients at risk through lectures in dental school and continuing education courses. The physical exam of the patient as well as the accompanying adult may reveal chemical substances on breath, hair, face, mouth and clothes, ataxia, subcutaneous infections, and/ or track marks on the arms and legs, constricted pupils, perioral rash ("huffer's rash"), oral and nasal ulceration, nasal bleeding, and bloodshot eyes.^{3,15} Erratic behavior, mood swings, violent outbursts, paranoid behaviors, and poor coping skills also are observed.¹⁵ A review of the medical history should investigate the patient's and family's history of SUD and psychiatric disorders. Asking a few simple questions can be revealing, such as how the patient and the family feel toward alcohol and drugs, if the adolescent has friends who use substances, if they feel peer pressure to do the same, etc.⁶ Questions about

academic progress, nonacademic activities, and peer relationships also are important. $^{1}\,$

All patients should be asked at every recall visit whether they have ever smoked cigarettes, drunk alcohol, or used other drugs.¹⁰ The questioning should be done in a matter-of-fact and nonjudgmental manner, using openended questions.^{1,3,5} If suspicions arise, it may be better to interview the patient and the legal guardian separately. While outright lying occurs in severe cases, denial and minimization by the adolescent and the parents should be expected.⁵ Furthermore, many patients do not appreciate the connection between their own substance use and problems.¹⁶ For example, they may perceive their parents or teachers to be the problem, not their use of a substance.

If an adolescent who has an SUD is open to talk about it, it is always important to emphasize that the responsibility for change lies with him/her. This is a particularly important strategy, since teenagers usually seek autonomy and control over their lives.¹⁶ On the other hand, it is important that pediatric dentists and staff are compassionate in their approach because many SUD patients hide their habit lest they be treated differently if they disclose it.

The pediatric dentist should be vigilant for parents or other adults around the adolescent who may facilitate use of substances because the problem grows when important adults minimize, ignore, or actively promote drinking and/or drug use.³ The dentist should suspect patients who: have many "allergies" or intolerance to pain medications; keep returning with a complaint of pain in excess of the dental problem in order to get a stronger prescription; and demand pain medications for a dental problem they refuse to have fixed.¹⁵ One also should doubt the sincerity of a caretaker who keeps insisting on stronger pain medications for the child when the dental problem does not match the level of pain reported. If there are any questions about substance use, sincere concern should be expressed and a recommendation made that the patient see the primary care physician before the situation becomes harmful. The pediatric dentist also should speak directly with the patient's physician about his/her suspicions.

The dental professional can be very helpful by listening, discussing, encouraging, and helping monitor the situation. Always showing empathy and giving clear advice, without any hint of stigma or prejudice, gives the patient and the family a sense that the professional is genuinely interested in their well-being. Encouraging the adolescent to make choices toward harm reduction (eg, not getting in a car with a driver who is high or drunk) and avoid friends who are inclined to use substances is of great importance because interaction with deviant peers is a risk factor for SUD development.^{2,6} It is essential to try to understand the adolescent's feelings and perspectives without judging, criticizing, or blaming so that an atmosphere of mutual trust and comfort can be fostered. Providing support to parents who may feel ashamed of the child's problem and unworthy of continued support also is crucial.³

ORAL AND DENTAL ASPECTS OF SUBSTANCE USE DISORDERS

Drug addiction appears to have fast, severe, and deleterious effects in the oral cavity. There are no published studies on the impact of SUD in the oral health of pediatric patients. SUD adults have more absent, traumatized, carious, and extracted teeth as well as more calculus and periodontal disease than nonaddicted controls.¹⁷⁻¹⁹

Factors that may contribute to increased risk of dental disease in this population include: lack of an adequate diet, dry mouth induced by drugs, tobacco, alcohol, and medications, poor oral hygiene, increased acidity in the oral cavity from drug intake, gastrointestinal regurgitation, and vomiting, drug-associated impaired smell and taste sensation leading to use of heavily sweetened foods, and high sugar content of medications they may be on, including oral methadone solutions which may contain a high amount of sucrose.^{15,20-23}

Many patients being treated with methadone for opiate withdrawal symptoms will hold it in the mouth for long periods to extend the absorption time.²¹ Due to the constipation effects of certain drugs (eg, heroin), addicts may have no desire for solid foods, turning to sweets as a quick source of energy that can be consumed on the move as they feverishly seek to satisfy their drug habit throughout the day.20 It also is apparent that opiates induce a heightened craving for sweet carbohydrates through modulation of central opioid receptors. This can be reversed, however, with administration of the antagonist naltrexone.²¹ Ecstasy addicts are known to consume large quantities of carbonated drinks to quench their thirst, leading to extensive cervical caries and erosion.^{24,25} Given that the ecstasy-induced "trip" may last up to 36 hours, xerostomia can be prolonged.

Caries found in heroin addicts is usually confined to the labial and buccal surfaces of the teeth, much darker in color, with a broader and shallower base and covering a far greater area than a typical cervical lesion; some consider it pathognomonic of heroin use.²⁶ Crown fractures are not unusual in such cases. Caries associated with chronic methamphetamine use, while frequently occurring in the cervical areas, shows a pattern of progression more closely related to that seen in Sjogren's syndrome in which the progress is slower, going through periods of arrest rather than rampantly progressing.¹⁵ Patients who abuse methamphetamine usually present with poor oral hygiene, xerostomia, rampant caries, and excessive tooth wear ("meth mouth").15 Most drugs can lead to daytime clenching, nocturnal bruxism, and temporomandibular disorder with consequent tooth sensitivity, difficulty opening the jaw or chewing because of pain, and damage to the tongue, cheeks, and lips.^{20,27}

Many other effects of illicit substances on the oral cavity have been reported. Cocaine has a stimulative effect on the facial and masticatory muscles as well as a vasoconstrictor effect that causes ulceration and atrophy of the oral tissues, which has also been reported on the topical use of ecstasy.^{20,24,28} Cocaine may be tested on the gingiva or other oral mucosa for its ability to cause numbness, which is a sign of its quality and strength.²⁰ When patients are "high," cervical abrasions and gingival lacerations can occur as the result of excessive and hard toothbrushing.^{24,28} Chronic snorting of cocaine can produce irritation or atrophy of the nasal mucosa, decreased sense of smell, mucosal ulcerations, nosebleeds, maxillary sinusitis, and perforation of the nasal septum.²⁸

Prolonged use of anabolic steroids is closely associated with gingival enlargement, a clinical presentation that may aid the practitioner in identifying teenage users.²⁹ It is unclear, however, whether the enlargement would regress after withdrawal of the drug. Smokeless tobacco can cause periodontal disease, staining of teeth and composite restorations, halitosis, and leukoplakia, which is a premalignant lesion.²² Cannabis smoke also is a carcinogen and thus associated with dysplastic changes. Oral, laryngeal and pharyngeal carcinomas can develop in patients who concurrently abuse tobacco products and alcohol. Therefore, a biopsy of mucosal lesions in SUD patients is warranted to rule out dysplasia or carcinoma.^{22,30} Use of multiple substances and certain agents to dilute or cut opiates may result in fixed drug eruptions with associated pigmentary incontinence, such as tongue pigmentation in heroin addicts.^{23,31} Other oral manifestations described in SUD patients include ecstasy-induced lip paresthesia, salivary gland enlargement associated with alcoholism, gastroesophageal reflux caused by a relaxant effect of alcohol on the lower esophageal sphincter, and oral manifestations of drug-induced anorexia such as angular cheilitis, candidiasis, and glossodynia.^{25,28,30}

MANAGEMENT OF SUD PATIENTS IN THE DENTAL PRACTICE

Illicit drugs have systemic effects that may impact the safe delivery of dental care. Smokeless tobacco has high levels of sodium which contribute to an elevated blood pressure and cardiovascular disease.²² Opiates, cannabinoids, stimulants, and alcohol are immunosuppressive and associated with impaired stem cell regenerative activity; therefore, frank bone loss and gross dental erosion are common sequelae in the advanced dental disease that is frequently seen in SUD patients.^{17,23} When there is hepatic involvement, an icteric sclera and coagulation issues may be present. Thus, excessive bleeding intra- and postoperatively may occur. Elective surgical procedures should be avoided in these patients, whereas those scheduled for surgery must have a complete blood count, coagulation profile, liver function tests, and a consultation with the physician.^{23,30} Poor wound healing, infection, and osteomyelitis may develop following routine dental extractions.

There is evidence of a close relationship between substance abuse and postsurgical complications in patients with mandibular fractures because of physiologic alterations and patient behavior.^{20,32} Gonadal dysfunction, glucose abnormalities, impaired adrenal function, dyslipidemia, and reduced bone mineral density all have been described in injection drug users.³³ There is a risk that an adrenal crisis may occur during or after a stressful dental appointment. A consultation with the physician is warranted to determine the best approach to this problem.

In cases of suspicion or overt intravenous use of drugs, it is important to verify the patient's exposure to HIV, sexually transmitted diseases, and hepatitis.³⁴ A study of 94 addicted youth showed that about 40 percent engaged in recent sexual HIV-risk behavior such as having multiple partners and always having unprotected sex.9 Head and neck examination may show localized cervical lymphadenopathy due to infected skin injection sites or other problems.³⁴ Injected drugs also can lead to collapsed veins and infective endocarditis (IE), therefore a consultation with the patient's physician is necessary to determine the need for antibiotic prophylaxis.^{4,28,34} New heart murmurs or unexplained fever should raise suspicious of IE until proven otherwise. Cardiovascular effects of drug use range from abnormal heart rate to heart attacks.

Another major issue is the patient's behavior in the dental office. Psychiatric comorbidities are frequently associated with SUD. Anxiety disorder, fear of dentists, low pain tolerance, and needle phobia are not uncommon in this population.²⁰ Missed or canceled appointments are frequent due to the low priority given to oral health relative to the need to obtain drugs, lack of money (spent mostly on drugs), and a chaotic lifestyle in general.^{20,23} Illicit substances are sought by most users to self-medicate for pain, sometimes even injecting directly into the teeth or gingiva.²⁰ Toothaches may be masked by the pharmacological effects of certain drugs (eg, heroin), delaying appropriate intervention.^{20,21}

SUD patients, especially those who just started treatment for addiction, may show a reduced responsiveness to local anesthesia due to the pharmacological properties of certain drugs (eg, opioids). A long-acting anesthetic should be used to help control postoperative pain.²¹ Because of their anxiety toward dental procedures, SUD patients may use drugs prior to the appointment to help them cope with the stress.²³ Local anesthestics containing epinephrine or levonordefrin must be administered cautiously in patients who have recently used drugs that produce vasoconstriction (eg, cocaine, cannabis, ecstasy, methamphetamine) due to the possibility of a dangerous interaction between the drug and epinephrine that could lead to a severe hypertensive crisis, myocardial infarction, and cerebrovascular accident.^{15,25,28} Ideally, the procedure should be postponed for at least 6 hours after drug use; if that is not possible, use of a local anesthetic without

epinephrine is indicated.^{15,28} Patients who report a history of pruritic rash after using intravenous cocaine may have had an allergic reaction to the drug. Because cocaine is a benzoic acid ester, there is a potential risk in this group of patients for an allergic reaction to the ester class of anesthetics. Hence, an anesthetic from the amide class should be used instead.¹⁵ Nitrous oxide can be administered safely to these patients.

If the patient is not responding to local anesthesia, a safe alternative to deliver dental care, such as sedation or general anesthesia (GA), must be discussed with the physician. Administering GA or sedation to a person diagnosed with SUD as an outpatient poses several challenges. Use of illicit narcotics prior to the appointment will have an additive effect with any depressant drug administered, possibly leading to respiratory and/or cardiovascular failure. Any suspicions concerning sobriety of an SUD patient warrants a toxicology test and cancellation of the GA appointment.³⁴ Furthermore, increased tolerance to narcotics may lead to over- or underdosage of anesthetic drugs.

Many times, patients complain of inadequate anesthesia to obtain stronger postoperative sedative or analgesic agents. It is important to remember that patients going through detoxification or rehabilitation may be on medications that may interact with drugs used for pain management or sedation. Thus, consulting the physician is essential to prevent problems. For example, patients using naltrexone who need elective dental procedures requiring opioids or sedation should discontinue the medication 48 hours before the procedure, with the supervision of a physician.³⁰

Prescription of opioids, benzodiazepines and shortacting stimulants could trigger a relapse to the original drug of choice or could initiate a new bout of addiction to the prescribed drug.^{3,30,35} Patients with a history of alcohol addiction should not use oral products that contain the substance. All controlled drugs should be prescribed by one physician, filled in one pharmacy, and not be allowed to be phoned in.³⁵ If opioids are prescribed, it is best to administer them on a timed schedule rather than "as needed" with an adult holding and dispensing the medication, with no refills available.³⁵ Patients and parents must be made aware that lost, stolen, or damaged prescriptions are not going to be replaced.³⁵

The dental professional must bear in mind that the addict can use the prescription medications to give or sell them to someone else. It is an especially complex situation when there is another SUD patient in the household (eg, a parent). Emergency room visits should not be allowed unless approved by the physician with coverage arrangements clearly spelled out.³⁵ As soon as possible, the prescription should be converted to a nonsteroidal anti-inflammatory drug regimen combined with heat, ice, or any other complementary intervention.³⁵ Acetaminophen should be used with caution in patients who have chronically abused alcohol because of the potential for severe liver abnormalities to develop.³⁰ Unfortunately, an increasingly significant problem is the purchase of controlled substances on the Internet.

Xerostomia patients should be followed closely to prevent dental problems. Although saliva substitutes, oral moisturizers, and artificial salivas are available, most of these products do not have the correct viscosity to be retained in the oral cavity for very long, often providing little more relief than water.¹⁵ Another possibility is pharmacological stimulation of the salivary glands, but these products have many significant side effects and are not approved for use in patients younger than 18 years. Optimal oral hygiene and a healthy diet must be reinforced, and prescription of fluoridated products should be done judiciously, based on individual needs.

Unfortunately, in many cases of rampant caries, dental restoration may be hopeless given the patient's social and psychological situation. All attempts to rehabilitate the SUD patient's oral health must be done realistically, based on the willingness of the patient and the family to follow through with the dental professional's counseling.

CONCLUSIONS

Any substance use by young patients carries extraordinary risk because of the likelihood of progression to more dangerous drugs and their effects on physical, physiologic, neurologic, and emotional development. The key to recognition of substance abuse is the professional's willingness to ask parents and adolescents about it. The American Academy of Pediatric Dentistry has published policies only on nicotine addiction; it is time to expand them to all illicit substances.³⁶ Many of the American Academy of Pediatrics' recommendations are well fit for dental professionals¹:

- 1. become knowledgeable about the prevalence, patterns, cultural differences, and health consequences of substance abuse;
- 2. incorporate substance abuse prevention into anticipatory guidance;
- 3. be aware of the manifesting signs and symptoms of SUD, its association with risk behaviors, and the possibility of dual diagnosis with mental health disorders;
- 4. be aware of community services for evaluation, referral and treatment of substance abuse;
- 5. serve as a community resource for smoking prevention and cessation.

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