

Methamphetamine and Its Impact on Dental Care

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ABSTRACT

Dental professionals should be aware that methamphetamine (MA) use is on the rise in North America. MA is a potent central nervous system stimulant with limited therapeutic effects. The allure of this drug is its availability in many different forms that are relatively easy to make and distribute and inexpensive to purchase and that produce prolonged euphoria for the user. This euphoria results from alteration of the normal physiologic processing of several centrally acting neurotransmitters, which also causes neurotoxicity and neurodegeneration with long-term use. Long-term use of MA has been associated with severe oral health effects, the most notable being a distinctive pattern of caries called methamphetamine-induced caries. Dental professionals need to recognize and understand patients who may be using MA and the risk factors associated with its deleterious oral effects. This knowledge will allow appropriate and effective preventive and treatment strategies for users of this drug.

MeSH Key Words: dental caries/etiology; methamphetamine/adverse effects; substance-related disorders/complication

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Methamphetamine (MA), which has a chemical structure similar to that of amphetamine (Fig. 1), is a potent central nervous system (CNS) stimulant. Both drugs are highly addictive and have a high potential for abuse; however, MA effects in the CNS are longer lasting and the systemic effects are more deleterious. MA (Desoxyn, Abbott Laboratories, North Chicago, Ill.) has limited therapeutic application; it is used primarily in the treatment of attention deficit disorder with hyperactivity (in children over 6 years of age and in adults), exogenous obesity (in children over 12 years of age and in adults) and narcolepsy (an off-label or investigational use).¹

MA is a white, odourless, bitter-tasting crystalline powder that readily dissolves in water or alcohol. It can be taken orally, intranasally (by "snorting" the powder), by smoking or by injection. MA hydrochloride, the smokable form, is produced in clear

chunky crystals resembling ice. It is smoked in a pipe (as for crack cocaine); the odourless smoke leaves a residue that can be resmoked. MA can also be made in the form of small, brightly coloured tablets. The pills are often called by their Thai name, yaba.²⁻⁴

This drug holds allure because it is cheap and easy to use, producing feelings of well-being, excitement, and prolonged euphoria, as well as heightening alertness, increasing activity and decreasing appetite.⁵ Immediately after smoking or injecting the drug, the user experiences an intense rush or "flash" that lasts for only a few minutes but is extremely pleasurable. This rush is followed by a prolonged euphoria or "high." Snorting or taking the drug orally produces the euphoria but not the rush. Snorting produces effects within 3 to 5 minutes, whereas oral use produces effects within 15 to 20 minutes. The duration of effect varies with the amount consumed. The effects

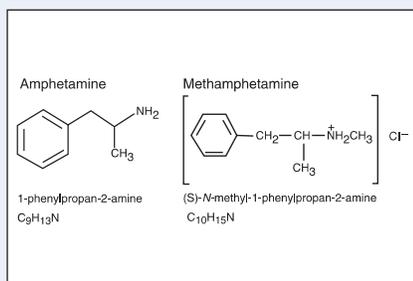


Figure 1: Chemical structures of amphetamine and methamphetamine (hydrochloride).



Figure 2: Typical pattern of methamphetamine-induced caries. Photo courtesy of Dr. Micheal I. Barr.

in several areas of the brain, including the nucleus accumbens, the prefrontal cortex and the striatum (a brain area involved in movement), which leads to neurodegeneration and neurotoxicity.¹⁰⁻¹² These actions result in high concentrations of these neurotransmitters in the synapses. The high concentrations of dopamine cause feelings of pleasure and euphoria, excess norepinephrine may be responsible for the alertness and anti-fatigue effects, and serotonin may cause cognitive impairment and eventual depression.^{10,13,14}

Box 1 Street terms for methamphetamine

Blue meth	Meth
Chicken feed	OZs
Cinnamon	Peanut butter
Crink	Sketch
Crystal meth	Spoosh
Desocsins	Stove top
Geep	Super ice
Granulated orange	Tick tick
Hot ice	Trash
Ice	Wash
Kaksonjae	Working man's cocaine
LA glass	Yellow barn
Lemon drop	Yellow powder

tend to last for 4 to 12 hours or more, much longer than the 1-hour high obtained with crack cocaine. Long-term use of MA may lead to tolerance and addiction, whereby the user, in an effort to intensify the desired effect, may increase the intake of the drug by escalating doses or altering the method of intake.^{3,4}

MA and MA hydrochloride are relatively easy and inexpensive to make, which results in high profitability. The drugs are produced mostly in clandestine laboratories from ephedrine, pseudoephedrine (found in over-the-counter cold medications), hydroiodic acid (created by combining red phosphorous and iodine) and other chemicals that are readily available in local drug and hardware stores, such as ammonia, paint thinner, ether, drain cleaner and lithium from batteries.^{4,6,7}

Street methamphetamine is referred to by many names (Box 1).

Mechanism of Action

MA acts by altering the levels of certain CNS neurotransmitters. It stimulates the release and blocks the reuptake of dopamine, norepinephrine and serotonin,^{8,9}

MA is associated with both acute and chronic cerebral and systemic adverse events. The short-term effects include intensified emotions, euphoria, increased alertness, insomnia, hyperactivity, decreased appetite, increased respiration and hyperthermia.^{3,15-17} The long-term effects can include psychological (but not physical) addiction and dependence, cardiovascular events and stroke, immunomodulation, hypertension, weight loss, violent behaviour, anxiety, confusion, paranoia, auditory and visual hallucination, mood disturbances and delusions (e.g., formication, the sensation of insects creeping on the skin), all of which may contribute to homicidal or suicidal thoughts and actions.^{3,15-17} In addition, long-term MA use may cause depletion of monoamines in the brain, which can have a negative effect on cognition and learning.¹⁸⁻²⁰ A further potential consequence of long-term MA use, due to damage to the dopaminergic system, may be an increase in the risk of Parkinson's disease (characterized by a progressive loss of dopamine neurons in the brain regions involved in movement) with advancing age.^{13,21}

Oral Effects

The oral effects of long-term MA use can be devastating. Howe²² discussed the effects of prescribed MA medication on 3 children undergoing treatment for attention disorders or narcolepsy. In these children, who would otherwise have been assumed to have a low risk of caries, the incidence of gross caries was greater than normal. Other authors have described a distinctive pattern of caries resembling that observed in early childhood caries; specifically, the caries are located on the buccal smooth surfaces of the teeth and the interproximal surfaces of the anterior teeth.^{23,24} The teeth of MA users have been described as “blackened, stained, rotting, crumbling, or falling apart.”²⁵ Often, the teeth are in such disrepair that they are unsalvageable and must be extracted.

One proposed mechanism of action for rampant caries is hyposalivation. MA is a sympathomimetic amine that acts on α - and β adrenergic receptors. The stimulation of α receptors in the vasculature of the salivary glands

produces vasoconstriction and reduces salivary flow.²⁶ This hyposalivation minimizes the normal protective capacities of the saliva and increases the risk of caries and demineralization risk. Because of the xerostomia resulting from action of the drug on saliva production, along with dehydration related to elevated metabolism and increased physical activity,²⁴ MA users report consuming large quantities of carbonated sugary soft drinks. Furthermore, long-term users are not concerned with general personal or oral hygiene,^{24,27,28} which is consistent with the many behavioural side effects associated with MA use. Additional risk factors include the acidic composition of MA and the drug's capacity for increasing motor activity, such as excessive chewing, tooth grinding and clenching, all of which contribute to the destruction of a compromised dentition.²⁷ These risk factors predispose MA users to extensive caries, a condition that has been termed "meth mouth."^{25,29} However, a more descriptive and grammatically appropriate description is methamphetamine-induced caries (MIC) (Fig. 2).

User Profile

Traditionally, MA use has been greatest among men between the ages of 19 and 40 years.³⁰ However, epidemiologists and health care providers report that MA use is increasing among college students and young professionals involved in the club scene or attending rave parties. According to the 2003 National Survey on Drug Use and Health,³¹ 12.3 million Americans 12 years of age or older (5.2% of the population) had tried methamphetamine at least once, the majority of prior-year users being between 18 and 34 years of age. Significant decreases in use among 12- to 17-year-olds have been reported recently.³¹ The 2004 Canadian Addiction Survey, which admittedly did not include hard-to-reach populations such as street youth and aboriginal communities in remote areas, showed that 6.4% of Canadians reported having used "speed" at least

once in their lifetime; less than 1% had used the drug in the preceding 12 months.³² Use of MA by gay and bisexual males is disproportionately high³³ purportedly because of the drug's physiological effects in increasing sexual activity, including risky sexual behaviours. Unsafe sex and multiple encounters related to these behaviours increase the risk of HIV transmission, which may exacerbate the HIV/AIDS epidemic within this community.^{34,35}

Instructions for Dental Professionals

It is the responsibility of dental professionals to recognize the association between rampant caries and MA use (Box 2). Appropriate measures taken by the dental team are essential for prevention of disease progression and for successful treatment. The following instructions to dental professionals who suspect patients may be using MA were recently developed by the American Dental Association.²⁵

- Complete a comprehensive oral examination, including a thorough dental and medical history.
- Attempt to educate the patient about the profound negative effects that MA can have on oral health.
- Refer the patient to such resources as physicians or drug-counselling services.
- Use preventive measures such as topical fluorides, remineralization products and chlorhexidine applications.
- Encourage the patient to drink water or artificially sweetened drinks instead of sugar-containing beverages.
- Be cautious when administering local anesthetics, sedatives, general anesthesia or nitrous oxide and when prescribing narcotics because of potential drug interaction.
- Take opportunities to educate patients about the risks associated with the use of MA and other illicit drugs.

Political Activity

On August 11, 2005, the government of Canada announced an increase in the penalties for possession, trafficking, importation, exportation and production of MA. The drug has been moved to schedule 1 of the *Controlled Drugs and Substances Act*, such that the maximum penalty for its production and distribution has been increased from 10 years' imprisonment to life in prison. Earlier this year, Health Canada proposed amendments to add 4 substances used in the production of MA (red phosphorus, white phosphorus, hypophosphorous acid and its derivatives, and hydroiodic acid) to the list of controlled chemicals under the *Precursor Control Regulations*. The illegal possession of these precursor chemicals would become an offence resulting in a fine of up to \$5,000, imprisonment of up to 3 years or both.³⁷

Conclusions

MA abuse is an extremely serious and escalating problem because of the drug's wide appeal and availability.

Box 2 Red flags for dental professionals

Dental professionals should watch for the following characteristics of MA use:

- accelerated tooth decay in teenagers and young adults that is not accounted for by other factors²
- distinctive pattern of decay on the buccal smooth surfaces of the teeth and the interproximal surfaces of the anterior teeth²
- malnourished appearance (MA acts as an appetite suppressant and increases activity levels)²
- poor compliance with and poor response to preventive treatments, combined with unreliability in keeping appointments²⁴
- excessive tooth wear because of excessive grinding and clenching.³⁶

The many sequelae of long-term use include rampant caries. Dental professionals will see a highly destructive caries process in MA users. It is important for dental professionals to understand the mechanisms of this process, so that they can develop a preventive and restorative treatment plan that will assist patients to preserve their remaining dentition; they should also support patients in seeking needed medical care and counselling. ♦

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