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Oral and dental complications caused by methamphetamine use: A review

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ABSTRACT

Background and Objectives: Methamphetamine is a stimulant drug with stimulatory effects on the central nervous system. It also negatively affects the oral and dental health. This narrative review aims to review the oral and dental complications caused by methamphetamine use.

Materials and Methods: In this narrative review, an electronic search of the literature was carried out in Google Scholar, PubMed and SID databases for original articles published from 2000 to 2017 using the keywords "meth", "mouth", "methamphetamine", "dental caries", "oral health" and "dental problem".

Results: The most prevalent complications caused by methamphetamine use were xerostomia (94%), bad taste in the mouth (91%), extensive caries (89%), facial muscle stiffness (73%), dental esthetic problems (68%) and increased acidity of the saliva (68%). Temporomandibular joint problem had the lowest prevalence (13%).

Conclusion: Long-term methamphetamine use causes adverse oral and dental changes. By having adequate knowledge about the prevalence and physiopathology of these complications, clinicians can promote oral and dental health and decrease treatment costs.

Keywords: Methamphetamine, Dental caries, Bruxism, Meth mouth, Gingival inflammation.

Introduction

Methamphetamine is a highly addictive, synthetic substance. It is a stimulant drug for the central nervous system with significant adverse effects. It is also known as crystal, glass and ecstasy in the market. Its methods of consumption are variable and include oral intake, smoking, injection and nasal inhalation. It is an odor-less white powder in the form of water-soluble or alcohol-soluble crystals. It is easily accessible and can be easily synthesized as well. It is relatively cheap and highly profitable for drug cartels [1]. Scientific evidence and media reports confirm increased use of methamphetamine worldwide. The increase in crimes related to drug abuse also adversely affects the police force, teachers and medical personnel [2]. It imposes a high burden on the health and treatment organizations of different countries as well. Methamphetamine causes persistent changes in neurological processes leading to an increase in prevalence of crimes and violence as well as affliction with infectious diseases such as human immunodeficiency virus. It also adversely affects the oral and dental health and causes significant dental complications. Adverse effects of methamphetamine on teeth are mainly related to xerostomia and high acidity of methamphetamine as well as some other factors such as negligence and poor oral hygiene [3]. Oral and dental complications related to the use of methamphetamine have gained increasing attention in the recent

decades since they cause irreversible tooth destruction. Due to the significance of these complications, the term "meth mouth" was allocated to these unique manifestations.

Meth mouth is characterized by carious teeth, discolored teeth and broken teeth. Methamphetamine decreases the salivary flow and aggravates the effect of acids on the enamel leading to extensive caries. Following development of obsessive teeth grinding and bruxism, methamphetamine users excessively use sugary foods and drinks and less commonly brush and floss their teeth. In other words, they progressively neglect oral hygiene, which further aggravates their dental health such that extensive and severe caries is a common symptom in methamphetamine users. Methamphetamine users with meth mouth often have black carious teeth than cannot be saved even in short-term or young users.

The exact cause of meth mouth has not been fully understood. Smoked or snorted methamphetamine may damage the protective layer of the enamel. However, it is highly probable that extensive carious lesions in meth mouth occur due to a combination of side effects of "being high". When swallowed, methamphetamine causes vasoconstriction and limits the blood supply to the teeth. Repetition of vasoconstriction causes necrosis of blood vessels and mucosal tissues.

Moreover, methamphetamine use causes xerostomia and decreases the saliva flow; thus, acids attacking the enamel are no longer neutralized by the buffering capacity of the saliva. Consequently, acids dissolve the enamel and damage the gingiva and cause cavitation in tooth structure, which is further aggravatedby adverse habits such as craving sugary foods and drinks, obsessive grinding and bruxism and negligence of oral hygiene. Rate of caries highly varies among methamphetamine users. The oral and dental complications and clinical manifestations of amphetamine use are still largely unknown. This narrative review aims to review the oral and dental complications caused by long-term methamphetamine use.

Materials and Methods

An electronic search of the literature was carried out in Google Scholar, PubMed and SID academic databases. Google Scholar is an extensive database that enables easy access to numerous scientific articles. PubMed database specifically focuses on medial and biological studies and SID enables access to dissertations and articles published in Farsi language. For search of Google Scholar database, three search strategies were applied including (A) use of filters such as publication time, study design and desired keywords, (B) advanced search of scientific articles and (C) use of boolean operators such as NOT, OR and AND; these operators enable the use of keywords in different combinations to reach the desired result. Keywords used in this review were (A) methamphetamine and its other scientific names such as meth, chalk and glass and (B) related oral and dental complications such as "oral health" and "dental health". Moreover, we selected articles published between 2010 and 2017. Keywords were searched both in the titles and in the body of manuscripts. In general, meth mouth refers to all dental complications due to the use of methamphetamine. This term was also searched as a keyword. PubMed database was also searche dusing two search strategies: (A) search of keywords mentioned in Table 1 and (B) search by topic. In the latter method, we first found the equivalent MeSH term of our keywords and then found articles by combining the MeSH terms using boolean operators. The SID database was used to search Farsi articles using keywords. All articles published until February 2016 were searched and no article was found. First, titles and abstracts were reviewed and those on oral and dental complications of methamphetamine were chosen. Full texts were retrieved and read and irrelevant articles were excluded. Articles listed in Table 2 were finally selected.

Results

In this study, the results of previous studies were collected with regard to demographic characteristics of target groups such as age, gender, duration of methamphetamine use, supportive treatments and level of education. The mean and other statistical parameters were extracted and reported. The reported results belonged to 703 subjects who used methamphetamine for more than six months. The Frequency percentage of oral and dental complications of methamphetamine use were Xerostomia (94%), Bad taste in the mouth (91%), Extensive caries (89%), Facial muscle stiffness (73%), Increased acidity of saliva (pH<6) (68%), Dental esthetic problems (68%), Dental wear (60%), Missing of one or more teeth (59%), Clenching (58%), Tooth fracture or mobility (58%), Gingival ulcers (33%), Burning sensation of oral mucosa (21%), Toothache (15%), Temporomandibular joint disorders (13%), respectively [4-7] Figure 1.

Website	Keyword	Searched in	Document Type
Google Scholar	«Methamphetamine» AND «Dental caries»	Whole document	Original article or Review
Google Scholar	All in title: «methamphetamine» AND (dental caries OR cavities)	Title	Original article or Review
Google Scholar	allintitle: "methamphetamine» AND «dental caries»	Title	Review
Google Scholar	«Methamphetamine» AND «Dental diseases»	Whole document	Original article or Review
Google Scholar	allintitle: «Methamphetamine» AND «Dental diseases»	Title	-
Google Scholar	«Methamphetamine» AND «Dental health»	Whole document	Original article or Review
Google Scholar	allintitle: «Methamphetamine» AND «Dental health»	Title	Original article or Review
Google Scholar	allintitle: «Methamphetamine» AND «Dental problems»	Title	Review
Google Scholar	allintitle:(Methamphetamine OR Crystal OR Glass OR Chalk) AND (dental problems OR Dental caries OR dental health)	Title	Original article or Review
Google Scholar	«Methamphetamine» AND «gingival disease»	Whole document	Original article or Review
Google Scholar	«Methamphetamine» AND «Gum disease»	Whole document	Original article or Review
Google Scholar	Methamphetamine AND (Gum disease OR Gingival disease OR periodontal disease)	Whole document	Original article or Review
Google Scholar	«Methamphetamine» AND «xerostomia»	Whole document	Original article or Review
Google Scholar	(Bruxism OR Clenching OR Grinding) AND (Methamphetamine OR ecstasy)	Whole document	Original article or Review
Google Scholar	«Methamphetamine» AND «Bruxism»	Whole document	Original article or Review
Google Scholar	(Methamphetamine OR Glass OR crystal OR chalk) AND «Dental erosion»	Whole document	Original article or Review
Google Scholar	(Methamphetamine OR Glass OR crystal OR chalk) AND «Trismus»	Whole document	Original article or Review
Google Scholar	(Methamphetamine OR Glass OR crystal OR chalk) AND «Mucosal dysplasia»	Whole document	Original article or Review
Google Scholar	(Methamphetamine OR Glass OR crystal OR chalk) AND (Mucosal dysplasia OR Trismus OR Dental erosion)	Whole document	Original article or Review
Google Scholar	allintitle: «Meth mouth»	Title	Original article
PubMed	«Methamphetamine/adverse effects»[Mesh]	Whole document	Original article or Review
PubMed	Methamphetamine AND oral health	Whole document	Original article or Review
PubMed	«Methamphetamine/adverse effects»[Mesh] AND «Dental Caries/epidemiology»[Mesh]	Whole document	Review
PubMed	(Methamphetamine OR Crystal OR Glass OR Chalk) AND (dental problems OR Dental caries OR dental health)	Whole document	Original article or Review
SID	All Keywords	Whole document	-

Table 1: Search strategies.

Author (S)	Complication
Ravenel et al.	Meth mouth
Maxwell et al.	Prevalence of methamphetamine abuse
Shetty et al.	Dental caries
Comer et al.	General complications
Saini et al.	Xerostomia and dental caries
Shaner et al.	Rampant caries
Hamamoto et al.	Oral diseases
Durell et al.	Prevalence of methamphetamine use
Schramm et al.	Xerostomia
Kidwell et al.	Salivation
Klasser et al.	General complications
Shaner et al.	Dental caries
McGrath et al.	Oral health
Richards et al.	Tooth wear
Lindsay et al.	Attrition
Chen et al.	Bruxism
Arrue et al.	TMJ disorder

Table 2: Selected articles.

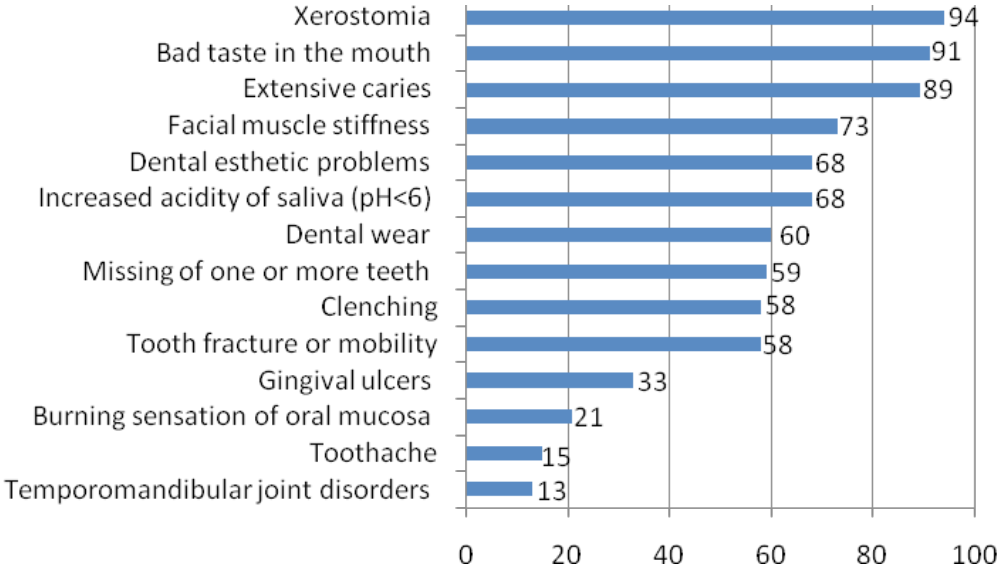

Figure 1. The Frequency percentage of oral and dental complications of methamphetamine use.

Methods of methamphetamine use: Based on the data of 703 users, smoking was the most common method of methamphetamine use (70%). The least common method was nasal inhalation (snorting) (13%) [8].

Dental and oral status of methamphetamine users in their first dental visit: Most methamphetamine users do not visit a dentist or seek dental treatment when it is too late. Thus, their oral and dental status is often very poor and irreversible. Based on the results, about 5% of users have severe conditions such as infection, bleeding, inflammation and halitosis when visiting a dentist. Missing of one or more teeth is the most common condition noticed in the first dental visit of these subjects (60%). Since these patients more commonly visit a physician, physicians can play a role in referring them to a dentist in early phases of dental problems. Obviously, management of oral and dental conditions in early phases is more efficient, easier and cheaper.

The saliva quality and quantity undergo significant changes in methamphetamine users. These changes further aggravate dental status. Saliva alterations in these patients include: (A) significant reduction in saliva secretion: Evidence shows that saliva secretion often decreases by half in these subjects causing xerostomia, which is the most common complication of methamphetamine use. (B) Significant reduction in buffering capacity of the saliva also occurs. As the result, oral environment becomes highly acidic, which further enhances the development of dental caries. (C) Acidity of the secreted saliva also increases such that saliva pH in about half of the methamphetamine users decreases to less than 6, which further enhances dental caries development [9,10]. Saliva secretion in methamphetamine users compared to healthy individuals was 21 and 49 respectively (milliliters per hour).

Discussion

Oral and dental status of methamphetamine users is very poor. They often suffer from oral and dental complications such as xerostomia, high acidity of the oral cavity, low volume of the secreted saliva, decreased buffering capacity of the saliva, bruxism, enamel wear, extensive caries, temporomandibular joint disorders, gingival inflammation, oral mucosal bleeding and rare complications such as squamous cell carcinoma and infectious diseases. Although the exact mechanism of some of these complications has yet to be fully understood, recent studies have discussed several physiopathological mechanisms for these symptoms. In general, the main reasons for these symptoms are as follows: [1] Chemical composition of methamphetamine stimulates or inhibits some specific receptors in different tissues such as the blood vessels in salivary glands and decreases the secretion of saliva [2]. Poor oral hygiene of these individuals, their negligence of oral hygiene and not seeking dental treatment further add to this problem [3]. Methamphetamine users often have inadequate nutrition and suffer from many nutritional and mineral insufficiencies. Also, they tend to drink carbohydrate-rich drinks. As stated earlier, xerostomia is the most common complication in methamphetamine users, and it is believed to be the main cause of oral and dental conditions in methamphetamine users. Decreased secretion of saliva is a major mechanism suggested for development of caries. Methamphetamine is a sympathomimetic amine, which exerts its effects through alpha- and beta-adrenergic receptors. Stimulation of alpha receptors of blood vessels in salivary glands causes vasoconstriction and decreases salivary secretion [11].

This reduction in saliva secretion decreases the protective capacity of saliva and increases the risk of caries. Due to xerostomia as the result of effect of drug on vascular receptors and dehydration due to increased basic metabolism of the body and increased physical activity, these subjects often crave sugary drinks [12]. Other risk factors such as acidic composition of methamphetamine and its potential to increase motor activities such as excessive chewing and grinding further aggravate oral and dental conditions [13]. In general, these risk factors cause tooth destruction, gingival inflammation, extensive caries and dental cavitation, leading to tooth loss.

Tooth wear due to grinding and bruxism is another common complication in methamphetamine users [14,15], the exact mechanism of which has yet to be fully understood. Several mechanisms have been suggested for this purpose. The interaction of dopaminergic and serotonergic neurons has been suggested as one possible mechanism for this purpose [16]. Moreover, motor neurons of the trigeminal nerve that control position, jaw movement and masticatory reflex are over-excited by the serotonin and norepinephrine released by the activity of methamphetamine. This is another possible mechanism for bruxism, tooth wear and temporomandibular joint problems [17]. Thus, methamphetamine use is a serious problem requiring prompt attention. In long-term, methamphetamine causes extensive caries and tooth loss. Thus, clinicians should have adequate knowledge about the underlying mechanisms causing

extensive caries and tooth loss in methamphetamine users to suggest more efficient preventive and therapeutic strategies to promote oral and dental health and decrease the health care costs of these patients. The related burden on the health care system would also decrease as such. Physicians can also play an effective role in promoting oral and dental health in these patients by early referral of these patients to dentists.

Conflict of Interest

There is no conflict of interest to declare.

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