

Methadone and Oral Health – A Brief Review

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Introduction

The University of British Columbia Professionalism and Community Service (PACS) module¹ lists community service learning as its main pedagogy, and is taught at the Doctor of Medical Dentistry undergraduate program. Community service learning is also offered at the University of British Columbia Dental Hygiene undergraduate program separately from the PACS module. In both cases, however, the community service learning initiatives are supported by didactic lectures and cases discussions. In one of these community activities, students reach underserved communities, including methadone maintenance therapy patients, at the Portland Dental Clinic.^{2,3} The clinic is located in the Vancouver Downtown East Side, the poorest postal code in Canada, and employs dental hygienists and dentists who focus on a population of individuals with special needs and a variety of medical challenges, including those enrolled on a methadone maintenance therapy.⁴ The clinic also offers opportunities for senior dental and dental hygiene students to engage on clinical rotations and on health promotion activities. In the academic year of 2008/2009, a PACS group of 8 second year junior dental students and a dentist tutor from the University of British Columbia Faculty of Dentistry were assigned to the Portland Dental Clinic as a community site to develop a collaborative, non-clinical community class project about the side effects of methadone. This manuscript incorporates parts of that class project as it reviews the literature on the oral side effects of methadone, and offers some recommendations and considerations when providing dental and dental hygiene treatment to methadone users.

The authors believe that such a manuscript would be of benefit not only to community dental and dental hygiene clinics similar to the Port-

Abstract

Purpose: Methadone is a prescription drug used to help individuals overcome withdraws from highly addictive illicit substances, such as heroin, but it has detrimental oral health effects. This manuscript reviews the oral health manifestations of methadone maintenance therapy, and considers its implications to oral care. It hopes to raise awareness among health care professionals, regulating bodies and the population at large about the oral side effects of methadone, the implications for dental treatment and considerations to better enhance the oral health of methadone users. The role of professional teams, particularly dentists and dental hygienists, is illustrated.

Keywords: Methadone, Dentistry, Dental Hygiene, Community Services, Dental Education, Oral Health

This study supports the NDHRA priority area, **Health promotion and disease prevention:** Investigate how environmental factors (culture, socioeconomic status–SES, education) influence oral health behaviours

land Dental Clinic, but also to other health units, students, health professionals and the community at large. As discussed by Farnsworth (2004),⁵ this manuscript hopes to:

- Increase the knowledge of oral health care professionals and staff working with methadone users on appropriate health promotion strategies and practices to integrate oral health into health promotion strategies
- Raise awareness of the appropriate oral health promotion information and education for clients under methadone maintenance therapy programs

Review of the Literature

A brief literature review using OVID (MEDLINE), Google Scholar and STATRef was undertaken into the context of "methadone and dental considerations," and on "methadone and adverse effects on oral health."^{2,3,6–32} The review was not done systematically, but to synthesize relevant literature. We now discuss methadone and other opiates and oral manifestations of methadone therapy, and consider

the provision of dental and dental hygiene treatments and access to care for methadone users.

Understanding Methadone

It is estimated that between 60,000 to 90,000 Canadians are addicted to illicit opiates, such as heroin. Methadone is a prescription drug used to help individuals overcome withdraws from highly addictive illicit substances, such as heroin, and was first used as such in Vancouver in 1959.³³ According to the North American Opiate Medication Initiative, "chronic, untreated opiate addiction is associated with overdose, infection risks and epidemics, loss of regular social functioning, drug-related and drug acquisition crime, and extensive costs to the public health, welfare and criminal justice systems."³⁴ This report also states that the average cost of untreated heroin addiction exceeds \$45,000 USD per person annually. The use of methadone can then be seen as a harm-reduction approach, which decreases the financial burden of drug addiction to the health care system.

Opiates like heroin and morphine act on the μ -receptors in the brain to release dopamine. Methadone is a synthetic long-acting agonist opioid on this receptor, and can be administered as maintenance therapy for opioid dependence.³⁴ Methadone prevents cravings while blocking the euphoric effects of heroin to establish abstinence.³ Methadone has an onset of action of less than 30 minutes, and its effects last between 24 to 36 hours.^{34,35} The objective is to maintain a low dose to prevent tolerance, while controlling cravings.^{21,22} Although still addictive, methadone is typically administered orally via a highly concentrated sucrose-syrup preparation,^{2,34} a method believed to decrease the seroprevalence of infectious diseases as it eliminates intravenous use and potential for needle sharing. However, the current methadone preparation has detrimental effects, particularly when associated with poor oral hygiene, high sugary diet and other illicit drug use.

General Health and Methadone

According to world wide reports, methadone maintenance therapy (MMT) patients tend to be between 25 and 35 years old, undernourished, cachexic in appearance and with general health problems including asthma, diabetes and clinical depression.^{2,19,35} MMT patients are often vague or guarded with their replies to medical history or medication questions. A poor diet, homelessness and past heroin abuse further contribute to the decline in general health.²¹ Poor self-esteem, low income and depression may lower the standards of general and oral hygiene even though not all drug users are within

the lower socio-economic groups.² Methadone users with poor general health, lowered immune response and increased risky sexual behavior are also at risk for HIV, hepatitis B and C and bacterial infections, including endocarditis.^{20,27}

Oral Manifestations of Methadone Maintenance Therapy (MMT)

Xerostomia

Methadone and other opioids suppress salivary secretion,² which is mediated by disordered peripheral signalling at parasympathetic muscarinic receptors, or centrally at primary salivary centers.¹¹ Since MMT patients can be often medicated with anti-depressants that further inhibit salivary flow, xerostomia is a common finding. With low saliva flow, generalized bacterial plaque accumulation from poor oral health and buccal cervical highly stained caries of the lower canines and premolars teeth are often present and pathognomonic on MMT patients (Figure 1),⁶ even though the mechanism of this particular pattern of decay is not fully understood.³⁶

Immunosuppression

Although MMT patients might be susceptible to immunosuppression, secondary to chronic infection (such as HIV), as well as poor nutrition, conflicting evidence exists as to whether or not methadone treatment can lead to immunosuppression.^{30,37} Exogenous opioids have been linked to immunosuppression, whereas endogenous opioids have been related to physiological immune signalling.³⁰

With respect to innate immune response, *in vitro* studies demonstrated that the exogenous opioid morphine suppresses macrophage activity for the fungus *Candida albicans*.²⁰ Recent animal studies have suggested that a central mechanism appears to be involved in immunosuppression, as opioids crossing the blood brain barrier might suppress natural killer cells and T-cell proliferation.³⁰ A human study compared heroine users with MMT patients to conclude that the latter showed a significant increase in T-cell proliferation.³⁷ This suggests that methadone seems to restore immune function,³⁸ conflicting with other studies.³⁹

Cell cycle dysfunction

Opioids have been related to derangement in cell cycling (e.g., apoptosis), while methadone seems to act as an effective cancer chemotherapeutic drug.²² Animal studies have indicated that chronic methadone treatment and repeated withdrawal impair cognitive function further and increase expression

of apoptosis-related proteins.^{14,29} Increased apoptosis may have oral implications including the disruption of natural microbial defence.^{21,22}

Increased sugar craving

The activation of μ and κ -opioid receptors has been shown to enhance the reward pathways generated by food ingestion.⁸ Methadone users seem to favour a high intake of sugars and low intake of fibre, which might result in a high prevalence of plaque biofilm accumulation and dental decay as seen in any individual who favours a high sugary diet and carbonated beverages in the absence of proper oral hygiene.^{18,32}

Analgesic Effect

Although methadone does not act as a potent analgesic, it does cause some analgesia through activation of the μ -opioid receptors,⁶ making it a valuable option in the management of chronic pain.²⁸ This analgesic effect may also mask the pain caused by oral diseases which might contribute to the seriousness, severity and high incidence of oral problems.²¹ When dental treatment is performed, however, the reduced responsiveness to analgesia might require higher doses of local anaesthetics and the need for more potent painkillers after treatment.^{13,21}

Dental Anxiety

Studies worldwide have found that nearly half of MMT patients have co-occurring mood, personality and anxiety disorders.^{2,23} Such disorders may contribute to a higher incidence of dental anxiety and needle phobia, discouraging dental or dental hygiene visits for cleanings or treatments.²¹

Bruxism

A higher incidence of bruxism has been seen in opioid-dependent patients.³¹ The exact mechanism is unclear, but may be related to the increased neurosis experienced by this population.¹⁰ Bruxism may lead to a higher risk of enamel wearing, temporomandibular joint disorders and myofascial pain.

Dental and Dental Hygiene Considerations for MMT patients

MMT patients might present with behavioral and psychosocial challenges that create barriers to accessing oral health care. Such disparity makes this population further vulnerable to dental diseases and in need of special attention and proper treatment. Charnock et al showed that 68% of drug users reported oral health problems, compared to 51% of

non-drug users.⁹ Almost 60% of the non-drug users made use of dental services regularly, compared to only 29% of the drug users – drug users may give low priority to their oral health. Charnock et al also revealed that about half of drug users sought dental treatment only when in severe pain, whereas only 30% of non-drug users visited the dentist under the same circumstances.^{2,13}

Barriers that might prevent access to dental and dental hygiene services include homelessness, prolonged drug binges, being waitlisted for drug treatments and rehab, low self-esteem and poor acceptability of services.²⁶ MMT patients might perceive and experience great marginalization and avoidance behavior by service providers. Sheridan, Aggleton and Carson found that 20.8% of drug users reported having treatment refused by dentists compared with 1.6% of non users.²⁵ The reasons for refusal by the dentist/dental team's perspective include patients' snobbish behavior, the need for blood tests prior to the appointment, arriving late or under the influence of alcohol and not making payments in a timely fashion. From the patients' perspective, issues of fear, perceptions that dental professionals are unsympathetic, being negatively labelled as a drug user and the inability to afford dental treatment remain the main reasons for not receiving care. Some patients even feared that others in the waiting room would "look at [them] and know [they were] user[s]."⁹

Lewis highlighted that generalized cervical buccal heavily stained carious lesions can be pathognomonic in both methadone and heroin addicts, similar to those who have undergone radiotherapy of the head and neck and those who take multiple xerostomic medications.¹³ Sheedy compared the detrimental effect of methadone to the oral cavity and coined the term "Methadone Mouth" to characterize the extreme poor oral health conditions of most long-term MMT individuals, particularly with rapid tooth destruction due to aggressive carious activity (Figure 1).²⁴ Methadone Mouth should not be mistaken, however, with "Meth Mouth" (Figures 2 and 3).

Meth Mouth is a term associated with the use of the illicit drug methamphetamine.⁴⁰ Although some methadone and methamphetamine users can present with the same oral condition, the later tend to be more often associated with higher gross decay to the extent that the "teeth are in such disrepair that they are unsalvageable and must be extracted."⁴¹

Although methadone users tend to have a higher prevalence and severity of oral disease, methadone is not the only contributing factor.²⁴ Clinical depres-

Figure 1: Methadone Mouth



Figure 2: Meth Mouth



sion, for example, may lead to significantly higher apathy towards dental treatment. In all, methadone users have a greater need for holistic dental and oral care and education, and dental rehabilitation has been shown to play an important role in the reconstruction of one's identity which contributes positively to recovery.²¹

Dental Hygiene and Dental Care

Robinson found that MMT patients respond best to dental hygiene and scaling and dental treatment when they are put at ease, are well informed about the procedures and are encouraged to maintain regular appointments.²¹

The provision of a less elaborate course of dental or dental hygiene procedures, while still maintaining an acceptable standard of quality and professionalism, has been suggested.^{6,7,12,13} A simple dental scaling is suggested for the first appointment, and thorough subgingival calculus and plaque removal could then follow at a subsequent visit. Removable partial dentures and fillings could be favoured over

crowns and fixed partial dentures. Tooth extractions should be avoided when restorations are possible. However, it is not uncommon for methadone users to require multiple tooth extractions and complete maxillary and mandibular lower and upper dentures, due to the severity of dental disease.²⁴

As per the length of the appointments, 20 minute visits and a minimal number of follow-ups are recommended. Hence, as pain is exacerbated during withdrawal periods, dental hygiene and subgingival scaling and treatment should be planned outside this event. Some MMT patients may need to be placed on antibiotic or antifungal prophylaxis prior to dental and dental hygiene appointments.²

Discussion

Interprofessional care has an important role in reconstructing patients' identity towards recovery. Dentists, dental hygienists, dieticians, social workers, case managers, physician and others should work closely. Prevention becomes extremely important, and proper oral hygiene should be reinforced

daily, as in any high-risk caries group. Dietary advice should be given as MMT individuals tend to favour meals composed of sugary foods and beverages. Such dietary intake can result from suppression of appetite and increased craving for sweet foods. If at all possible, a low carbohydrate diet with sugar-free snacks should be encouraged,²⁴ and sugar craving should be understood within its effects on oral health.^{2,32} Advocating for cooking food should, however, be cautiously suggested, as it may be dangerous when judgment is impaired secondary to drug use.²¹ For xerostomia, sialogogues can be given and sugar-free chewing gum containing xylitol suggested to stimulate salivary flow. Salivary flow can be restored through the use of parasymphomimetics, such as pilocarpine.²⁴ To counteract the cariogenic effect of the sucrose syrup, methadone can be prepared in sugar-free or sorbitol solutions (an artificial sugar) or methylcellulose (less cariogenic carbohydrate).^{2,24} Hence, remineralizing and desensitising agents, such as fluoride and potassium nitrate, respectively, could be applied in conjunction with restorative and other preventive measures. As part of the interprofessional team, dental hygiene and dental treatment should be integrated into the rehabilitation process to reduce drug-related harm and improve re-socialization. For example, information about proper oral care should be emphasised by both professions to avoid mixed or contradictory messages as per importance or proper daily oral hygiene and frequency of dental and dental hygiene visits. Dentists and dental hygienists can improve oral care in MMT patients through education and advice, and through alternative and less intensive approaches to dental treatment. For example, they can both advocate for less elaborate dental and dental hygiene procedures under an acceptable standard of quality and professionalism.^{6,7,12,13}

Conclusion

We believe that this review adds positively to the knowledge of community dental and dental hygiene clinics, students, health professionals and the community at large. With the highlighted points for consideration, we hope to have increased the knowledge of oral health care professionals and staff working with methadone users. Hence, we hope to have raised awareness of the appropriate oral health promotion information and education for clients under methadone maintenance therapy programs.

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Acknowledgments

The authors are grateful to the undergraduate DMD students Morvarid Aletomeh, Stephanie Cheng, Angela Chiu, Tammy Chu, Kevin Lee, Chris Shon and Ehsan Taheri for their ideas and engagement in building the class project that originated this manuscript. Special thanks goes to Dr. Sean Peter Sikorsky from the Portland Dental Clinic, for his enthusiasm and guidance.

Disclosure

Support for this manuscript has been provided by S Wah Leung Endowment Fund 2008 through the Faculty of Dentistry at University of British Columbia.

References

1. Brondani MA, Clark C, Rossoff L, Aleksejuniene J. An Evolving Community-Based Dental Course on Professionalism and Community Service. *J Dent Educ.* 2008;72(10):1160–1168.
2. Titsas A, Ferguson MM. Impact of Opioid use on Dentistry. *Aust Dent J.* 2002;47(2):94–98.
3. Farnsworth N. Oral Health Project for people on Methadone programs & with substance use issues in the Outer Eastern Metropolitan Region. Department of Health [Internet]. 2004 [cited 2009 Jan 23]. Available from: www.health.vic.gov.au/healthpromotion/downloads/fr_knox.pdf
4. Olds K. Mass evictions in Vancouver: the human toll of Expo '86. *Can Housing* 1989;6:49–53.
5. Farnsworth, N. Oral Health Project for people on Methadone programs & with substance use issues in the Outer Eastern Metropolitan Region 2004. Available at www.health.vic.gov.au/healthpromotion/downloads/fr_knox.pdf [Retrieved 12 Jan 2009]
6. Bigwood CS, Coelho AJ. Methadone and Caries. *Br Dent J.* 1990;168(6):231.
7. Birnbaum W. Public dental health: Dental health access – are drug users encouraged to use our services? *Br Dent J.* 2001;191:446.
8. Carr KD, Papadouka V. The role of multiple opioid receptors in the potentiating of reward by food restriction. *Brain Res.* 1994;639(2):253–260.
9. Charnock S, Owen S, Brookes V, Williams M. A community based programme to improve access to dental services for drug users. *Br Dent J.* 2004;196(7):385–388.
10. Colon PG Jr. Dental disease in the narcotic addict. *Oral Surg Oral Med Oral Pathol.* 1972;33(6):905–910.
11. Götrick B, Akerman S, Ericson D, Torstenson R, Tobin G. Oral pilocarpine for treatment of opioid-induced oral dryness in healthy adults. *J Dent Res.* 2004;83(5):393–397.
12. Hutchinson S. Methadone and Caries. *Br Dent J.* 1990;168(11):430.
13. Lewis DA. Methadone and Caries. *Br Dent J.* 1990;168(9):349.
14. Mao J, Sung B, Ji RR, Lim G. Neuronal apoptosis associated with morphine tolerance for an opioid-induced neurotoxic mechanism. *J Neurosci.* 2002;22(17):7650–7661.
15. Meaney PJ. Methadone and Caries. *Aust Dent J.* 1997;42(2):138.
16. Mercadante S, Calderone L, Villari P, et al. The use of pilocarpine in opioid-induced xerostomia. *J Palliat Med.* 2000;14(6):529–531.
17. Molendijk B, Ter Horst G, Kasbergen M, Truin GJ, Mulder J. Dental Health in Dutch drug addicts. *Community Dent Oral Epidemiol.* 1996;24(2):117–119.
18. Nathwani NS, Gallagher JE. Methadone: dental risks and preventive action. *Dent Update.* 2008;35(8):542–544, 547–548.
19. Alonzo NC, Bayer BM. Opioids, immunology, and host defenses of intravenous drug abusers. *Infect Dis Clinics North Am.* 2002;16(3):553–569.
20. Reece AS. Dentition of addiction in Queensland: poor dental status and major contributing drugs. *Aust Dent J.* 2007;52(2):144–149.
21. Robinson PG, Acquah S, Gibson B. Drug users: Oral health related attitudes and behaviours. *Br Dent J.* 2005;198(4):219–224.
22. Rosenstein DI. Effect of long term addiction to heroin on oral tissues. *J Public Health Dent.* 1975;35(2):118–122.
23. Scheutz F. Anxiety and dental fear in a group of parenteral drug addicts. *Scand J Dent Res.* 1986;94(3):241–247.
24. Sheedy JJ. Methadone and Caries. Case reports. *Aust Dent J.* 1996;41(6):367–369.
25. Sheridan J, Aggleton M, Carson T. Dental health and access to dental treatment: a comparison of drug users and non-drug users attending community pharmacies. *Br Dent J.* 2001;191(8):453–457.
26. Sheridan J, Carson T, Aggleton M. Providing dental health services to drug users: testing a model for a community pharmacy advice and referral scheme. *Pharmaceutical J.* 2003;271:180–182.

27. Szabo I, Rojavin M, Bussiere JL, Eisenstein TK, Adler MW, Rogers TJ. Suppression of peritoneal macrophage phagocytosis of *Candida albicans* by opioids. *J Pharmacol Exp Ther.* 1993;267(2):703-706.
28. Toombs JD, Kral LA. Methadone Treatment for Pain States. *Am Fam Physician.* 2005;71(7):1353-1358.
29. Tramullas M, Martínez-Cué C, Hurlé MA. Chronic methadone treatment and repeated withdrawal impair cognition and increase the expression of apoptosis-related proteins in mouse brain. *Psychopharmacology (Berl).* 2007;193(1):107-120.
30. Vallejo R, de Leon-Casasola O, Benyamin R. Opioid Therapy and Immunosuppression – a review. *Am J Ther.* 2004;11(5):354-365.
31. Winocur E, Gavish A, Volfin G, Halachmi M, Gazit E. Oral motor parafunctions among heavy drug addicts and their effects on signs and symptoms of temporomandibular disorders. *J Orofacial Pain.* 2001;15(1):56-63.
32. Zador D, Lyons Wall PM, Webster I. High sugar intake in a group of women on methadone maintenance in South Western Sydney, Australia. *Addiction.* 1996;91(7):1053-1061.
33. Status Report 2008. NAOMI [Internet]. [cited 2008 October 30]. Available from: http://www.naomistudy.ca/pdfs/NAOMI_Update_October_2008%20.pdf
34. Krantz MJ, Mehler PS. Treating Opioid Dependence: Growing Implications for Primary Care. *Arch Intern Med.* 2004;164(3):277-288.
35. Fiellin DA, O'Connor PG. Clinical practice. Office-based treatment of opioid-dependent patients. *N Engl J Med.* 2002;347(11):817-823.
36. Scheutz F. Dental health is a group of drug addicts attending an addiction-clinic. *Community Dent Oral Epidemiol.* 1984;12(1):23-28.
37. Sacerdote P, Franchi S, Gerra G, Leccese V, Panerai AE, Somaini L. Buprenorphine and methadone maintenance treatment of heroin addicts preserves immune function. *Brain Behav Immun.* 2008;22(4):606-613.
38. Neri S, Bruno CM, Pulvirenti D, et al. Randomized clinical trial to compare the effects of methadone and buprenorphine on the immune system in drug abusers. *Psychopharmacology (Berl).* 2005;179(3):700-704.
39. Alonzo NC, Bayer BM. Antagonism of N-methyl-D-aspartate receptors reduces the vulnerability of the immune system to stress after chronic morphine. *J Pharmacol Exp Ther.* 2003;307(2):793-800.
40. Shaner JW. Caries associated with methamphetamines abuse. *J Mich Dent Assoc.* 2002;84(9):42-47.
41. Klasser GD, Epstein J. Methamphetamine and its impact on dental care. *J Can Dent Assoc.* 2005;71(10):759-762.