

A Cross-Sectional Study on the Association between Oral Health and Vitamin D Levels in Methadone Maintenance Treatment Program of Iranian Population

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Abstract

Aims: The aim of this study was to investigate the relationship between oral health and Vitamin D levels in patients undergoing methadone maintenance treatment in addiction treatment centers in Kashan. **Materials and Methods:** This cross-sectional study was performed on 202 patients aged 18–60 years who were referred to methadone maintenance treatment clinics in Kashan. The measurement tool included a demographic information checklist and a modified oral health form of the World Health Organization. 2cc of blood was taken from patients to measure Vitamin D levels. **Findings:** Out of 181 patients in the study, 73.8% of patients had a methadone dose of <20 cc per day. One hundred twenty-six patients had a history of drug use. In 86.4% of patients, Vitamin D deficiencies were observed. In these patients, moderate gingival problems and moderate-to-severe dental plaque were 60.2% and 71.9%, respectively. Furthermore, the range of decayed, missing, and filled teeth (DMFT) index in these patients was 23.57 ± 7.90 . No significant relationship was indicated between DMFT index and Vitamin D level. **Conclusions:** It is difficult to determine the main causes of oral problems among addicts. Apart from the direct effects of addiction, these patients exhibit a wide range of unhealthy behaviors such as poor oral hygiene, high sugar intake, and poor nutrition. On the other hand, most patients experience reduces in Vitamin D status.

Keywords: Dental health, methadone, oral health, substance-related disorders, Vitamin D

INTRODUCTION

Substance abuse has been estimated to be common among 246 million people (or one in 20 people) aged 15–64 in 2013.^[1] Drug dependence or substance use disorders (SUDs) have been reported in approximately 10% of subjects. Previous studies have focused more on the serious side effects of drug abuse, such as overdose, hepatitis C or HIV/Acquired immunodeficiency syndrome, and less on oral diseases as a SUD,^[2] such as oral cancers, periodontal problems, tooth decay, or dental wear. The mode of abuse and the type of substance

are decisive for the exact dental consequences. For instance, cannabis abuse is associated with xerostomia,^[3,4] high rate of decay,^[5] and increased risk of oral cancers.^[6] Amphetamine abusers exhibited an increase in the risk of dental wear due to bruxism, acute xerostomia, severe decay, and poor overall dental hygiene.^[7,8] Opioid dependence is associated with side effects such as personal inattention, poverty, increased

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consumption of sugary foods, elevated periodontal problems, dental caries, and poor oral health care.^[9] The strong tendency to consume sugary foods can be attributed to the activation of the mu-opiate receptor, altering glucose intake, and blood sugar control. It should be noted that people under methadone maintenance treatment experience such side effects, which may even be exacerbated by the use of high-sugar methadone medications.^[10] The snorted, smoked gums, and intravenously injected could be applied by the cocaine. Dental side effects of cocaine abuse include nasal defects, oral disorders, and increased tooth wear due to bruxism.^[11,12] The fact is that the abuse of these substances alone occurs rarely.^[4] The majority of abusers reported the simultaneous use of two or more such illicit drugs.^[2,13] For example, substance abuse is typically accompanied with alcohol consumption and smoking, which together have adverse impacts on the oral cavity.^[14] The SUD can influence the oral state directly through physiological mechanisms such as xerostomia, increased appetite for snacking, sympathetic activation, dental grinding or clenching, and chemical tooth erosion due to cocaine abuse. The indirect SUD effects are lack of or poor oral health. In addition, difficulty in accessing dental care can exacerbate the development of oral disease.^[4,13] Other aggravating factors include a lack of attention to malnutrition treatment, poor oral hygiene, the use of high-sugar diets, and sporadic dental visit patterns. The dependence and tolerance of these people on analgesics further endangers dental care.^[2]

Special attention has been paid to the status of Vitamin D in oral health. Vitamin D deficiency in adults and adolescents leads to a variety of oral health disorders, some of which may be exacerbated by impaired Vitamin D synthesis.^[15,16] Vitamin D, as a steroid hormone, is normally formed by sunlight exposure, or is obtained through dietary supplements.^[15,17] There are limited natural foods that contain Vitamin D, some of which include mackerel, herring, salmon, and cod liver oil.^[17] Vitamin D is commonly referred to as Vitamin D2 and Vitamin D3 (cholecalciferol). Vitamin D2 is produced from yeast through the ultraviolet rays of ergosterol. Vitamin D3 is derived from the ultraviolet radiation of 7-dehydrocholesterol from lanolin,^[18-20] which means the bioactivity of Vitamin D3 and is formed in human skin. Plasma levels of Vitamin D are a popular biomarker for these disorders.^[21] The purpose of this preliminary study was to determine the correlation between Vitamin D levels and oral health among the Iranian population under methadone maintenance treatment.

MATERIALS AND METHODS

The study was conducted on the cases available from February 2020 to May 2020. The target population comprised patients with SUDs who met the DSM-IV criteria for opioid dependence, receiving methadone maintenance treatment in rehabilitation centers. This cross-sectional study was performed on patients aged 18–60 years who were referred to methadone maintenance treatment clinics in Kashan by random sampling method. The current project was approved by the Ethical Committee of

Kashan University of Medical Sciences (IR.KAUMS.MEDNT.REC.1398.120) and participants were enrolled after getting signed informed consent. The measurement tool included a demographic information checklist and a modified oral health form of the World Health Organization.^[22] Questionnaires were filled by interviewing the patients about age, history of addiction, smoke status, daily cigarette usage, cigarette usage duration, methadone usage duration, methadone usage dose, employment, educational level, and marital status. After the interview, the clinical examinations were performed by the dentist to assess the decayed, missing, and filled teeth (DMFT) indices. Before the oral examination, one toothbrush and toothpaste were given to each subject. After brushing, patients were examined on a regular chair using a flashlight, a WHO probe, a Williams graded catheter, and a disposable mirror. The DMFT index is a formula that determines the number of rotten, dropped, and filled teeth, the checklist of which is completed for each individual. Blood samples were also taken from 2 cc patients to measure Vitamin D levels with enzyme-linked immunosorbent assay reader. Vitamin D status <20 ng/mL obtained as Vitamin D deficiency.^[23] Results for continuous variables were presented as means and standard deviation or as medians and interquartile ranges if the distributions were skewed and as percentages for categorical data. Data were tested for normal distribution with the Kolmogorov–Smirnov test. The independent *t*-test or the Mann–Whitney U test was used to evaluate differences in continuous variables between the two groups. Comparisons between categorical variables were performed with the Chi-square test. Differences were considered significant when $P < 0.05$.

RESULTS

Totally, 181 (males) cases with a mean age of 41.64 ± 9.54 years were enrolled in this study. Demographic information of participants is presented in [Table 1]. About 73.8% of patients had a methadone dose of <20 cc per day. One hundred and twenty-six patients had a history of drug use. 86.4% of patients were observed Vitamin D deficiency. In these patients, moderate gingival problems and moderate-to-severe dental plaque were 60.2% and 71.9%, respectively. In addition, the range of DMFT index in these patients was 23.57 ± 7.90 [Table 2]. No significant relationship was indicated between Vitamin D level and DMFT index [Table 3]. DMFT just only associated with age ($P < 0.0001$), employment ($P = 0.003$), daily cigarette usage ($P = 0.021$), cigarette usage duration ($P < 0.0001$), and methadone usage duration ($P < 0.0001$).

DISCUSSION

The effectiveness of Vitamin D in the management and prevention of infectious and chronic inflammatory diseases, including periodontitis, has shown contradictory results. Vitamin D deficiency and oral diseases are two common medical conditions worldwide, which exert significant effects on quality of life and general health.^[24-27] Accordingly, there is a need for further studies in this area using different designs.^[28]

Table 1: Demographic characteristics and clinical features of participants

Variable	n (%)	Average
Age (years)		
<30	15 (8.3)	32.76±12.32
30–40	79 (43.6)	
41–50	51 (28.2)	
>50	36 (19.9)	
Smoke status		
Yes	171 (94.5)	
No	10 (5.5)	
Daily cigarette usage		
≤10	81 (47.4)	13.8±9.34
11–20	80 (46.8)	
>20	10 (5.8)	
Cigarette usage duration (years)		
<10	34 (19.8)	18.09±10.41
10–15	46 (26.7)	
15–20	40 (23.3)	
>20	52 (30.2)	
Methadone usage duration		
<5	88 (48.6)	5.87±4.45
5–10	64 (35.4)	
>10	29 (16)	
Methadone usage dose (cc)		
<10	47 (28)	16.61±10.60
10–20	77 (45.8)	
>20	44 (26.2)	
Marital status		
Single	48 (26.5)	
Married	121 (66.9)	
Divorced	12 (6.6)	
Education		
UD	123 (68)	
D	46 (25.4)	
UE	12 (6.6)	
Employment		
UnE	141 (77.9)	
S	18 (9.9)	
SE	22 (12.2)	

UD: Under diploma, D: Diploma, UE: University education, UnE: Un-employment, S: Staff, SE: Self-employment

Therefore, the present study aimed to determine the correlation of oral health with Vitamin D levels among the Iranian population underwent with methadone maintenance treatment, the results of which did not find significant correlations between Vitamin D levels and DMFT index. However, the results show an association of DMFT with age, daily smoking, employment, duration of methadone use, methadone dose, and duration of smoking. Direct comparison of these results was difficult with previous findings. Some of the reported direct functions of Vitamin D include protective effects against oral pathogens, a central role in bone metabolism, and disruption of inflammatory mediators leading to oral tissue damage, thus demonstrating the role of this vitamin in maintaining

Table 2: Level of vitamin D and decayed, missing, and filled teeth in the study population

Marker	n (%)	Average
DMFT		
DT		4.71±3.9
MT		18.29.31
FT		0.59±1.62
Overall		23.57±7.9
PI		
Very good	0	1.8±0.59
Good	51 (28.2)	
Moderate	85 (42)	
Weak	45 (24.9)	
GI		
Rare inflammation	36 (19.9)	1.57±0.34
Moderate inflammation	109 (60.2)	
Sever inflammation	36 (19.9)	
Vitamin D levels (ng/ml)		
<20	170 (86.4)	13.26±4.48 ng/ml
20–30	11 (5.6)	
>30	0	

DMFT: Decayed, missing, and filled teeth, GI: Bleeding index, PI: Plaque index, DT: Decayed teeth, MT: Missing teeth, FT: Filled teeth

oral health.^[29,30] Despite these benefits, some findings indicate some disadvantages for this vitamin, including participation in the development of oral diseases at specific concentrations.^[31] According to observations, alveolar bone loss and severe oral disease were less common among men receiving high concentrations of Vitamin D.^[32] In addition, susceptibility to gingivitis can be alleviated following Vitamin D supplementation by exerting anti-inflammatory effects.^[33] The analysis of database related to the US National Health and the Nutrition Examination Survey found that men and women over the age of 50 experienced greater periodontal losses in the lower quintile of serum Vitamin D than in the maximum quintile.^[34] However, this study did not find any significant association between DMFT index and serum Vitamin D status among SUD patients. Reportedly, there was a more significant association between Vitamin D and the measure of acute inflammation, including gingival bleeding, rather than with the measure of alveolar bone loss among normal postmenopausal women.^[35] Contrary to these reports, many studies have not found the beneficial effects of Vitamin D on oral health. The results of a study (recorded on IRCT) reported no association between periodontal illnesses and Vitamin D concentrations, consistent with findings from periodontal pockets and gingival hemorrhage.^[36] One study analyzed the Korea National Health and Nutrition Examination Survey database, and found that there was no significant association between Vitamin D deficiency and oral health status.^[37]

Vitamin D deficiency and the risk of oral diseases are strongly related to each other, which can lead to failure of oral treatments, dental defects, caries, and periodontitis.^[15] Proper Vitamin D status can reportedly lead to better life expectancy

Table 3: Correlation between oral health index and vitamin D levels

Oral health index	Vitamin D levels	
	Correlation coefficient value	P
DT	-0.086	0.25
MT	0.089	0.23
FT	-0.024	0.74
DMFT	0.055	0.46
PI	-0.087	0.24
GI	0.064	0.39

DT: Decayed teeth, MT: Missing teeth, FT: Filled teeth, DMFT: Decayed, missing, and filled teeth, GI: Bleeding index, PI: Plaque index

and oral growth. However, there is a need for more evidence to reach a definitive conclusion and issue clinical guidelines on the positive effects of Vitamin D supplementation on oral health.^[15] Although our data support the lack of definitive results on the association between Vitamin D and DMFT, the results are of low validity because of having severe Vitamin D deficiency and poor DMFT score. In addition to the normative assessment of oral health and Vitamin D levels, clinicians should consider the patients' self-reported oral problems, and the social and mental aspects of oral conditions.^[38]

CONCLUSIONS

It is difficult to determine the main causes of oral problems among addicts. Apart from the direct effects of addiction, these patients exhibit a wide range of unhealthy behaviors such as poor oral hygiene, high sugar intake, and poor nutrition. On the other hand, most patients experience reduces in Vitamin D levels. Therefore, there is an urgent need to plan for Vitamin D supplementation and dental treatments and to include oral health programs in the general care programs of addicted people.

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Conflicts of interest

There are no conflicts of interest.

REFERENCES

1. Merz F. United nations office on drugs and crime: World Drug Report 2017. SIRIUS-Zeitschrift für Strategische Analysen 2018;2:85-6.
2. Baghaie H, Kisely S, Forbes M, Sawyer E, Siskind DJ. A systematic review and meta-analysis of the association between poor oral health and substance abuse. *Addiction* 2017;112:765-79.

3. Darling MR, Arendorf TM. Effects of cannabis smoking on oral soft tissues. *Community Dent Oral Epidemiol* 1993;21:78-81.
4. Joshi S, Ashley M. Cannabis: A joint problem for patients and the dental profession. *Br Dent J* 2016;220:597-601.
5. Di Cugno F, Perce CJ, Tocci AA. Salivary secretion and dental caries experience in drug addicts. *Arch Oral Biol* 1981;26:363-7.
6. Zhang ZF, Morgenstern H, Spitz MR, Tashkin DP, Yu GP, Marshall JR, et al. Marijuana use and increased risk of squamous cell carcinoma of the head and neck. *Cancer Epidemiol Biomarkers Prev* 1999;8:1071-8.
7. Hamamoto DT, Rhodus NL. Methamphetamine abuse and dentistry. *Oral Dis* 2009;15:27-37.
8. Parish CL, Pereyra MR, Pollack HA, Cardenas G, Castellon PC, Abel SN, et al. Screening for substance misuse in the dental care setting: Findings from a nationally representative survey of dentists. *Addiction* 2015;110:1516-23.
9. Titsas A, Ferguson MM. Impact of opioid use on dentistry. *Aust Dent J* 2002;47:94-8.
10. Mysels DJ, Sullivan MA. The relationship between opioid and sugar intake: Review of evidence and clinical applications. *J Opioid Manag* 2010;6:445-52.
11. Blanksma CJ, Brand HS. Cocaine abuse: Orofacial manifestations and implications for dental treatment. *Int Dent J* 2005;55:365-9.
12. Driscoll SE. A pattern of erosive carious lesions from cocaine use. *J Mass Dent Soc* 2003;52:12-4.
13. Riemer L, Holmes R. Under the influence: Informing oral health care providers about substance abuse. *J Evid Based Dent Pract* 2014;14(Suppl):127-35.e1.
14. Ravenel MC, Salinas CF, Marlow NM, Slate EH, Evans ZP, Miller PM. Methamphetamine abuse and oral health: A pilot study of "meth mouth". *Quintessence Int* 2012;43:229-37.
15. Botelho J, Machado V, Proença L, Delgado AS, Mendes JJ. Vitamin D deficiency and oral health: A comprehensive review. *Nutrients* 2020;12:1471.
16. Kim IJ, Lee HS, Ju HJ, Na JY, Oh HW. A cross-sectional study on the association between vitamin D levels and caries in the permanent dentition of Korean children. *BMC Oral Health* 2018;18:43.
17. Holick MF, Chen TC. Vitamin D deficiency: A worldwide problem with health consequences. *Am J Clin Nutr* 2008;87:1080-6.
18. Wilson LR, Tripkovic L, Hart KH, Lanham-New SA. Vitamin D deficiency as a public health issue: Using vitamin D2 or vitamin D3 in future fortification strategies. *Proc Nutr Soc* 2017;76:392-9.
19. Holick MF. Vitamin D deficiency. *N Engl J Med* 2007;357:266-81.
20. Lanham-New SA, Wilson LR. Vitamin D has the new dawn for dietary recommendations arrived? *J Hum Nutr Diet* 2016;29:3-6.
21. EFSA Panel on Dietetic Products; Nutrition and Allergies (EFSA NDA Panel); Turck D, Bresson JL, Burlingame B, Dean T, Fairweather-Tait S, et al. Update of the tolerable upper intake level for vitamin D for infants. *EFSA J* 2018;16:05365.
22. Solomons YF, Moipolai PD. Substance abuse: Case management and dental treatment. *SADJ* 2014;69:298-300.
23. Saied-Moallemi Z, Taheri A, Hatami H. Investigating the relation of drug abusing and oral health in addicts. *J Isfahan Med Sch* 2015;33:643-52.
24. Pereira LJ, Gazolla CM, Magalhães IB, Ramos-Jorge ML, Marques LS, Gameiro GH, et al. Treatment of chronic periodontitis and its impact on mastication. *J Periodontol* 2011;82:243-50.
25. Park JH, Hong IY, Chung JW, Choi HS. Vitamin D status in south Korean population: Seven-year trend from the KNHANES. *Medicine (Baltimore)* 2018;97:11032.
26. Amrein K, Scherkl M, Hoffmann M, Neuwersch-Sommeregger S, Köstenberger M, Tmava Berisha A, et al. Vitamin D deficiency 2.0: An update on the current status worldwide. *Eur J Clin Nutr* 2020;74:1498-513.
27. Meehan M, Penckofer S. The role of vitamin D in the aging adult. *J Aging Gerontol* 2014;2:60-71.
28. Lee MR, Han SJ, Kim HE, Choi JS. Relationship between vitamin D deficiency and periodontitis in Korean adults aged ≥60 Years: Analysis of data from the Korea national health and nutrition examination survey (2013-2014). *Int J Environ Res Public Health* 2021;18:4181.
29. Anand N, Chandrasekaran SC, Rajput NS. Vitamin D and periodontal health: Current concepts. *J Indian Soc Periodontol* 2013;17:302-8.

30. Gropper SS, Smith JL. *Advanced Nutrition and Human Metabolism*. Yolanda Cossio, USA: Cengage Learning; 2012.
31. Bischoff-Ferrari HA, Giovannucci E, Willett WC, Dietrich T, Dawson-Hughes B. Estimation of optimal serum concentrations of 25-hydroxyvitamin D for multiple health outcomes. *Am J Clin Nutr* 2006;84:18-28.
32. Alshouibi EN, Kaye EK, Cabral HJ, Leone CW, Garcia RI. Vitamin D and periodontal health in older men. *J Dent Res* 2013;92:689-93.
33. Dietrich T, Nunn M, Dawson-Hughes B, Bischoff-Ferrari HA. Association between serum concentrations of 25-hydroxyvitamin D and gingival inflammation. *Am J Clin Nutr* 2005;82:575-80.
34. Dietrich T, Joshipura KJ, Dawson-Hughes B, Bischoff-Ferrari HA. Association between serum concentrations of 25-hydroxyvitamin D3 and periodontal disease in the US population. *Am J Clin Nutr* 2004;80:108-13.
35. Millen AE, Hovey KM, LaMonte MJ, Swanson M, Andrews CA, Kluczynski MA, *et al.* Plasma 25-hydroxyvitamin D concentrations and periodontal disease in postmenopausal women. *J Periodontol* 2013;84:1243-56.
36. Antonoglou GN, Suominen AL, Knuuttila M, Ylöstalo P, Ojala M, Männistö S, *et al.* Associations between serum 25-hydroxyvitamin d and periodontal pocketing and gingival bleeding: Results of a study in a non-smoking population in Finland. *J Periodontol* 2015;86:755-65.
37. Lee HJ, Je DI, Won SJ, Paik DI, Bae KH. Association between vitamin D deficiency and periodontal status in current smokers. *Community Dent Oral Epidemiol* 2015;43:471-8.
38. Amiri S, Shekarchizadeh H. Oral health-related quality of life among a group of patients with substance use disorders in rehabilitation treatment: A cross-sectional study. *BMC Oral Health* 2021;21:409.