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The comparison of root caries experience between HIV-positive patients and HIV-negative individuals in a selected Iranian population

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Abstract: *Objectives:* Human immunodeficiency virus (HIV) infection is a concerning problem in dentistry and HIV-infected patients may experience root caries due to different risk factors. The aim of this study was to find the prevalence of root caries in a selected Iranian HIV-positive population. *Methods:* One hundred and seven IV drug users, based on ELISA and Western Blot test, were divided into two groups: group 1: HIV-positive patients and group 2: HIV-negative individuals. According to the T-CD4⁺ cell count, subjects in group 1 were placed in two subgroups: Moderate immunodeficiency (200 mm⁻³ < T-CD4⁺ cells <500 mm⁻³) and Severe immunodeficiency patients (T-CD4⁺ cells <200 mm⁻³). Teeth were examined by an examiner under suitable light to detect any changes in colour, texture or contour. The values of DMFT, DMFS, decayed root surfaces and total decayed surfaces were calculated. Data were analysed by independent *t*-test and chi-squared test. *Results:* The mean DMFT, DMFS and decayed root caries in group 1 and 2 had no significant difference. The mean value of total decayed surfaces of HIV+ patients was significantly higher compared with HIV- individuals ($P = 0.03$). The comparison of all parameters between two subdivisions of group 1 showed no significant difference. *Conclusions:* The results indicate that HIV+ patients experienced more dental caries, but not more root caries than healthy ones. Along with decreasing T-CD4⁺ cell count, tooth caries' prevalence did not increase. *Clinical relevance:* Based on our findings, root caries prevalence is almost the same in HIV-positive and negative individuals; however, it is necessary to decrease tooth caries by continual monitoring and periodic dental examination.

Key words: dental caries; drug users; human immunodeficiency virus infection; root caries

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Introduction

Currently, HIV infection is one of the most concerning problems in dentistry. The increasing rate of HIV infection in Iran, like in many other countries, makes it a major public health issue (1). In many developed countries, there are different antiviral treatments that decrease the mortality and morbidity from AIDS, but in developing countries, there is still a little chance to take a suitable therapy (2).

Acquired immune deficiency syndrome (AIDS) has different adverse effects on oral health and may cause numerous oral or mucosal lesions.

Oral manifestations that may be found in the HIV-infected patients include fungal, bacterial or viral infection, hairy leukoplakia, gingivitis, periodontitis and lesions that upon biopsy are diagnosed as Kaposi's sarcoma (2, 3). Salivary flow rate and composition are also affected by the disease (4).

Tooth caries is a chronic infectious disease (5) that its prevalence differs, depending on a variety of important factors including age and socioeconomic level; however, the overall oral health status of Iranian adults is dissatisfactory (6, 7). Different factors such as host condition, oral microbiota and diet may affect tooth caries (8). The cariostatic activity is highly related to the salivary flow rate (9). Xerostomia which may occur in HIV-positive patients due to the infection, immunosuppression or the use of HAART (highly active antiretroviral therapy) for treatment, is the most important non-microbial salivary parameter that leads to increase the prevalence of dental caries (8, 10, 11).

Root caries is a soft irregularly shaped lesion that may be situated totally on the root or may be situated on both enamel and cementum, but clinically indicating that the lesion initiated on the root (12). It happens only if the root is exposed to the oral cavity (13).

Ageing may cause gingival recession (14). As reported by NHANES III (15), about half of the elderly population has had recession of greater than 3 mm and exposed root caries to the oral cavity. Additionally, xerostomia may often appear due to the systemic diseases or medications in many older adults (16). Therefore, coincidence of gingival recession and xerostomia in older adults may increase root caries prevalence.

Because of the high prevalence of gingivitis and periodontitis (17), reduced salivary flow rate (18) and poor oral hygiene among HIV-positive individuals (19), HIV-infected patients are supposed to experience root caries more than HIV-negative subjects. According to the possibility of high prevalence of root caries in HIV-positive patients, considering the fact that only one study (3) has been conducted in this regard, we aimed to determine the prevalence of root caries in a selected Iranian HIV-positive population.

Materials and methods

In this retrospective study, 107 persons of both genders who were heavy smokers (smoked more than 20 cigarettes per day) (20) and IV drug users were participated. All participants were addicted to use morphine intravenously for more than 3 years and had no systemic illness like diabetes or renal failure.

Prior to gathering information and examining oral health status, an informed consent was obtained from every individual. Based on the results of ELISA and Western Blot tests, Subjects were divided into two groups as follows: group 1 or test group that was composed of HIV-positive patients ($n = 36$) and group 2 (control group) included HIV-negative individuals ($n = 71$). The inclusion criterion for HIV-positive patients was T-CD4⁺ cell count fewer than 500 mm⁻³.

The patients in group 1 according to the T-CD4⁺ cell count, were placed in two different subgroups: moderate

immunodeficiency (200 mm⁻³ < T-CD4⁺ cells < 500 mm⁻³) and severe immunodeficiency patients (T-CD4⁺ cells < 200 mm⁻³). These HIV-infected patients had regular medical care, receiving HAART at least 3 months in Shahid Ghazi institute in Kermanshah, Iran, that is under supervision of WHO.

In the second group, there were 71 HIV-negative IV drug users who were under a precise medical care in Shahid Ghazi institute.

Oral examination for disclosing root caries was performed by an expert examiner in a blind manner. Before teeth examination, to eliminate the debris, plaque and calculus on root surfaces and the cervical third of the crown prophylaxis and scaling (if needed) were performed.

For detecting the root caries, the gingiva was displaced gently using an air syringe and then retracted with a hand instrument. After retraction, using an explorer and a mirror, the root surfaces around the teeth in all aspects were examined under suitable light to detect any changes in colour, texture or contour (indicators for caries). Wisdom teeth were excluded from the examination. After dental examination of each participant, the number of decayed (D), missed (M) and filled (F) teeth was recorded in a questionnaire, as well as the values of DMFT, DMFS, decayed root surfaces and total decayed surfaces.

All data were gathered and analysed using spss 16.0. The age of the participants in two main groups was compared using the independent *t*-test analysis. Chi-squared test was used to examine gender difference between these two groups. Caries experience was compared between test and control group as well as two subdivisions of group 1 using independent *t*-test. *P*-value of <0.05 was considered statistically significant in all analysis.

Results

The demographical data of the participants are presented in Tables 1 and 2. Comparing gender and age between group 1 and 2, no significant difference was found ($P > 0.05$).

The mean value of DMFT and DMFS, the average of decayed root surfaces and the mean value of total decayed surfaces of group 1 and 2 are shown in Table 3, as well as the mean number of D, M and F teeth. The difference between the mean value of total decayed surfaces of HIV-positive patients compared with HIV-negative individuals was significant ($P = 0.03$).

Table 1. Demographical data of the participants

Group	No.	Range of ages in years	Mean age in years	Gender (%)
HIV positive	36	20–51	36.97	Female = 32.4 Male = 67.7
HIV negative	71	22–51	35.87	Female = 30.6 Male = 69.4

Table 2. Demographical data of HIV+ patients

HIV+ patients	No.	Range of ages in years	Mean age in years	Gender (%)	Range of CD4 ⁺ cell count	Mean CD4 ⁺ cell count
Moderate immunodeficiency	13	20–35	42.8	Female = 34.78 Male = 65.22	227–475	374.26
Severe immunodeficiency	23	21–51	30.41	Female = 40 Male = 60	48–118	80.88

Table 3. Mean DMFT, D, M, F, DMFS, decayed root surfaces and total decayed surfaces in HIV-positive and HIV-negative individuals

Variables	Groups	Mean	P-value*
DMFT	HIV+	23.61	0.82
	HIV–	23.16	
D	HIV+	8.30	0.09
	HIV–	8.83	
M	HIV+	12.80	0.07
	HIV–	11.43	
F	HIV+	2.16	0.19
	HIV–	2.60	
DMFS	HIV+	97.13	0.10
	HIV–	102.80	
Decayed root surfaces	HIV+	4.16	0.65
	HIV–	4.88	
Total decayed surfaces	HIV+	16.37	0.03*
	HIV–	11.37	

*P-value of <0.05 considered significant.

D, decayed; M, missed; F, filled.

Figure 1 illustrates the number of D, M and F teeth, the mean DMFT, DMFS, decayed root surfaces and total decayed surfaces of HIV-positive patients. Neither the mean number of D, M and F teeth ($P > 0.05$), nor the mean value of DMFT ($P = 0.57$), DMFS ($P = 0.79$), decayed root surfaces ($P = 0.65$) and total decayed surfaces ($P = 0.68$) of HIV-positive patients with moderate and severe immunodeficiency had significant differences.

Discussion

Analysis of the results of our study indicated that the mean value of decayed root surfaces, DMFT and DMFS in HIV+ and HIV– individuals had no significant difference. Although HIV+ individuals experienced more total decayed surfaces including roots and crowns, the average number of D, M and F teeth of them was not significantly higher than HIV-negative ones. The difference can be as a result of the immunodeficiency and a great risk for microbial infection (21, 22), salivary dysfunction and xerostomia (4, 8). Taking HAART including sucrose (8) may increase the H⁺ concentration of saliva, which leads to faster demineralization of tooth structure. HIV+ patients with moderate and severe immunodeficiency had no significant difference in teeth caries experience.

To eliminate the probable effects of age and gender on caries experience (23), before analysing the parameters, age and

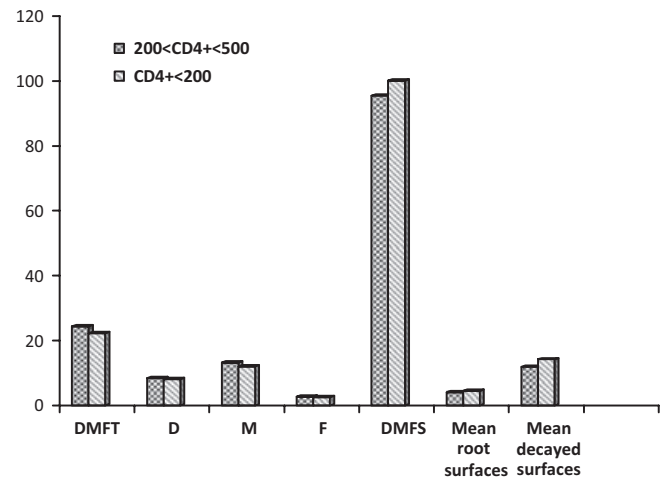


Fig. 1. Mean DMFT, DMFS, D, M, F, decayed root surfaces and decayed surfaces in HIV-positive patients with moderate and severe immunodeficiency.

gender distribution of the participants were compared using *t*-test and chi-squared test respectively. The results of an epidemiological study (1) on the prevalence HIV infection in west of Iran indicated that a majority of HIV-infected patients were aged between 20 and 49 years with a peak incidence in 30 to 34-year-old individuals. The study also concluded that the main transmission route of HIV in Iran is IV drug use. In the present study, the age of participants is very similar to the epidemiological profile of HIV infection in the society and they were not selected from an old population to eliminate the probable effects of ageing including gingival recession and xerostomia (14, 16). To eliminate the possible effects of IV drugs on root caries and select HIV+ patients infected via the same transmission route, both HIV+ and HIV– individuals were IV drug users.

In the current study, we selected individuals who were heavy smokers and addicted to the same drug to minimize the differences between the participants. To overcome the limitation in patient selection, we increased the number of HIV– patients. All participants in our study were under medical care in the same institute and hence they all received good medical care and had the same opportunity to have a routine dental examination.

Previous studies on caries' prevalence in healthy Iranian population showed different results (6, 7, 24). Hamissi *et al.* (24) showed that tooth caries prevalence in Iran is more than

in some countries, but Momeni *et al.* (7) indicated that the prevalence of dental caries in Iran is the same as in developed countries; however, the prevalence of tooth decay in HIV-infected patients was not measured in Iran. The comparison between the results of the present study and the results achieved by Hamissi *et al.* (24) and Momeni *et al.* (7) showed that dental caries in Iranian IV drug users (both HIV-negative and HIV-positive) is much more than tooth decay in healthy individuals.

As mentioned above, there was no significant difference between the mean value of decayed root surfaces of test and control groups, which is in accordance to the findings of Phelan *et al.* (3). In the present study, all participants were IV drug users and smokers. Smoking increases the prevalence of dental caries and periodontal diseases (25, 26). Possibly, the adverse effects of smoking on dental caries occurrence are more than HIV infection. It is valuable to consider that the HIV+ patients who participated in the present study were under medical care in a suitable institute; probably, they were encouraged to have a good oral hygiene or guided to get dental care.

The results of our study similar to the findings of Phelan *et al.* (3) showed that there is no association between dental caries and CD4⁺ cell count. It seems that the low level of CD4⁺ lymphocyte count, fewer than 500, does not increase the risk of caries in HIV+ patients.

On the contrary, Filho *et al.* (8), Mulligan *et al.* (21) and Phelan *et al.* (3) observed that DMFT index was higher in HIV+ patients.

In contrast to the present study, Filho *et al.* (8) did not use IV drug users or smokers as a control group. This may explain the lower incidence of caries in HIV- individuals in their study. Medigan *et al.* (23) conducted their study on children with prenatally acquired HIV. All children were in Newark, an unfluoridated area. The area in which the present study was performed has fluoridated water, which may reduce caries experience. This fact may explain the difference between the results of these two studies. As dental caries are multifactorial, age also may be another cause of the differences between the results of the two studies. Gender, as well as different methods of case and control group selection may cause the difference among the results of different studies. Hicks *et al.* (27) found an inverse relationship between caries in primary teeth and T-CD4⁺ cell count, which is in contrast to the findings of the present study. Tooth caries experience in HIV-infected patients may be different in primary and permanent dentition. Age of population is another probable factor that makes the results different.

According to our findings, however, no difference was found in DMFT and DMFS scores between HIV+ and HIV- patients, but higher mean values of decayed surfaces including roots and crowns in HIV+ patients shows that HIV+ patients in our study experienced more tooth caries than HIV- individuals. Root caries prevalence is not significantly different in HIV-positive and HIV-negative individuals; however, it is necessary to decrease tooth caries by continual monitoring,

periodic dental examination, using topical fluoridation, early detection and restoring caries lesions. Human immunodeficiency virus infection may remain with patients for a long time and by introducing new drugs, its prognosis becomes better; therefore, it seems necessary to increase oral health status to enhance the quality of life.

Conclusions

Under the condition of the present study, HIV+ patients experienced more dental caries than healthy persons; however, the prevalence of root caries in HIV+ patients was not more than in healthy persons. Furthermore, along with decreasing T-CD4⁺ cell count, caries experience did not increase in HIV+ patients. Based on the current findings, further longitudinal research studies in this area are needed to compare the flow rate and composition of saliva along with caries experience in HIV-infected patients on/not on HAART with normal population.

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