HHS Public Access

Author manuscript

J Am Dent Assoc. Author manuscript; available in PMC 2019 July 01.

Published in final edited form as:

J Am Dent Assoc. 2018 July ; 149(7): 599–607. doi:10.1016/j.adaj.2018.02.026.

Cohort Study of HIV-Positive and HIV-Negative Methamphetamine Users

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Abstract

Background—The effects of methamphetamine on dental caries have been well documented. Little, however, is known about its effects on the periodontium. The purpose of this study is to determine the prevalence and severity of periodontal disease in an urban population of HIV-positive methamphetamine users.

Methods—This cross-sectional survey was conducted in one of the most populous urban areas of Los Angeles County beset with high rates of methamphetamine use. Participants were recruited by a combination of street outreach methods, referral from drug treatment centers and word of mouth. Participants were eligible if they were over 18 years of age, spoke English or Spanish, used methamphetamine in the past 30 days, were willing to undergo a dental examination and psychosocial assessments and were willing to provide a urine sample. Periodontal assessments were completed on 541 participants by three trained and calibrated dentists.

Results—The prevalence and severity of periodontal disease was extremely high in this population of HIV-positive and negative methamphetamine users. Cigarette smoking and age were identified as risk factors.

Conclusions—The HIV-positive and -negative cohorts were remarkably similar suggesting that their lifestyle contributed more to their destructive periodontal disease than methamphetamine use.

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Disclosure. None of the authors reported any disclosures.

Practical Implications—Methamphetamine users are at high risk for destructive periodontal disease and badly broken-down teeth. The clinician should plan accordingly for timely patient management knowing that methamphetamine users have extensive periodontal and restorative treatment needs.

Keywords

Attachment loss; pocket depth; HIV; methamphetamine use; periodontal disease; epidemiology

INTRODUCTION

The life style of methamphetamine (MA) abusers places them at risk to acquiring human immunodeficiency virus (HIV) infection. When HIV first emerged some of the earliest oral signs were painful, bleeding gingival lesions resembling acute necrotizing ulcerative gingivitis superimposed on rapidly progressive periodontitis. Other oral signs included linear erythema on the gingival tissues with spontaneous bleeding, necrotizing gingival and periodontal diseases of fungal origin, oral candidiasis, hairy leukoplakia and mucosal ulcerations and osseous necrosis.[1-4] None of these conditions responded to conventional periodontal therapy.[5]

The advent of antiretroviral therapies (HAART) had a dramatic effect on decreasing the severe signs and symptoms of HIV. Currently the highly active antiretroviral therapies have dramatically decreased the incidence and severity of oral manifestations and mortality due to HIV infection.[6] Yin et al.[7] suggested that “antiretroviral therapies have led to increased life expectancies”…there is an increased probability that HIV+ “patients will develop more aggressive forms of chronic periodontitis”. Some investigators have found enhanced rates of periodontal attachment loss in HIV+ patients associated with decreased $CD4^+$ cell counts.[8-10] Ndiaye et al.[11] found sites of attachment loss ≥6 mm that was significantly higher in HIV+ subjects.

In a previous study we determined the prevalence and severity of periodontal disease in a large urban population of MA users, but we did not investigate the subgroups of HIV positive and negative participants.[12] We wanted to characterize the nature and extent of periodontal conditions and explore the disease pattern in MA subgroups with regards to sociodemographic, MA user patterns and other relevant variables. The purpose of this survey is to examine the prevalence and severity of periodontal disease of this cohort of the HIV- and HIV+ participants in this urban population of methamphetamine users. We hypothesized that the HIV+ cohort will have a higher prevalence and severity of periodontal disease than the HIV- cohort.

METHODS

Sample Size

Sample size considerations were based on providing sufficient power to relate patterns of MA use to health consequences. A significance level of 0.01 was used to mitigate false-positive risk while allowing for multiple comparisons on different outcomes with separate

analyses for the HIV- and HIV+ samples. For the HIV- sample using a significance level of 0.01, a sample of 350 was determined with at least 80% power. For the HIV+ cases, a sample size of 150 was determined with at least 80% power. A sample size of N=500 was needed to satisfy the power calculation, but we exceeded this.

Study Setting

This cross-sectional survey was conducted in Los Angeles County. It is one of the most populous urban areas in the country and beset with high rates of MA use.[13,14] Comprehensive oral examinations and psychosocial assessments were conducted by trained and calibrated dentists at two community health centers: the AIDS Project Los Angeles, that serves a sociodemographically diverse group of people infected with HIV; and the Mission Community Hospital in the San Fernando Valley, that serves a large underserved migrant population. These sites were chosen because they provide a diverse cohort of Angelinos with a broad range of MA use behaviors.

Participants

Participants were recruited by using a combination of street outreach methods and snowball sampling techniques (i.e., posting flyers in the community, local newspapers, bars and restaurants).[15] Referral from drug treatment centers and word of mouth added to the outreach. Inclusion criteria for enrollment included being 18 years or older, spoke either English or Spanish, having used MA in the past 30 days, able to undergo a detailed dental examination and psychosocial assessments, and willing to provide a urine sample

Of the 1,793 prospective participants who contacted the research team, 1,120 were found eligible, and 571 completed the assessments. Of these participants,19 were completely edentulous and six more were excluded because they were edentulous in randomly selected quadrants for the half-mouth examination. In all, 546 dentate participants completed the periodontal examinations. Informed consent was completed according to the procedures of the University of California, Los Angeles Institutional Review Board. In addition, a federal Certificate of Confidentiality was obtained to ensure unconditional confidentiality to the interviews, minimizing participant concerns regarding the disclosure of sensitive drug-use behaviors. Participants received $60 for completing the study.

Periodontal Assessments

The periodontal examinations were conducted using the examination protocols of the National Health and Nutrition Examination Survey (NHANES). After a thorough examination of the soft tissues of the oral cavity, gingival recession (GR) and probing depth (PD) were measured in millimeters using the PCP2 periodontal probe. Measurements between the gradations were rounded down to avoid over estimation. Bleeding on probing (BOP) was also recorded. Attachment loss (AL) was calculated as the difference between PD minus GR. Gingival recession and pocket depth measures were made at four sites per tooth, specifically the disto-facial (DF), mid-facial (B), mesio-facial (MF), and the disto-lingual (DL) sites. Excluding third molars, measurements were made on randomly selected half-mouth arches according to the NHANES protocol.

In addition to the standard approach to presenting periodontal data, the definitions recommended by the Center for Disease Control and Prevention and the American Academy of Periodontology (CDC/AAP) for disease surveillance were also used in describing the periodontal status of our MA population.[16,17] The CDC/AAP case definitions require information from two interproximal sites [disto-facial (DF), mesio-facial (MF), mesio-lingual (ML), and/or disto-lingual (DL)]. *Severe Periodontitis* was defined as the presence of two or more interproximal sites with AL ≥6 mm (not on the same tooth) and one or more interproximal sites(s) with ≥5 mm PD. *Moderate periodontitis* was defined as two or more interproximal sites with ≥4 mm clinical AL (not on the same tooth) or two or more interproximal sites with PD ≥5 mm (not on the same tooth). *Mild periodontitis* was defined as two or more interproximal sites with AL ≥3 mm and ≥2 interproximal sites with PD ≥4 mm (not on the same tooth) or one site with PD ≥5 mm. Although a participant may have the periodontal conditions that cover two or more of the CDC/AAP classification, each participant is classified exclusively and based on the most advance stage.

In addition to the dental examination, participants also completed a set of interviewer-facilitated questionnaires covering various psychological, substance-use, medications, and dietary attributes linked to the development of dental and periodontal disease. Participants were grouped based on their self-reported history and patterns of MA use (quantity, frequency, mode and duration of use). Participants who indicated that they had used methamphetamine for less than 10 days of the past 30 days at the time of screening were classified as being “light” MA-users. Participants who used MA for 10 to 15 days over the past 30 days were classified as moderate users. Heavy users were defined as 16 or more days over the last 30 days. Moderate and heavy users were grouped together for purposes of data analysis and classified as “moderate +” users. Drug use reports were verified by means of random urine drug tests performed in a subset of the participants.

Dental Examiners

All of the dental examinations were conducted by three dentists who were trained and calibrated by the reference examiner for the NHANES. All of the examinations were conducted in a dental operatory using all barrier measures. A resident dental epidemiologist provided ongoing quality assurance by monitoring the dentists on a monthly basis by evaluating their assessments by performing duplicate examinations on approximately 9% sample. This minimized any drifting from the criteria throughout the duration of the clinical examinations. Interclass correlations (ICCs) were used to measure inter-rater agreement, to ensure conformity and comparability with NHANES practices.[18] ICCs for gingival recession were 0.89; 0.80 for pocket depth; and 0.88 for attachment loss. ICCs closer to 100 % indicate greater inter-rater reliability.[18]

Statistical Analysis

Software analysis (SAS Version 9.3; SAS Institute) was used for data management and statistical analysis. Descriptive statistics were calculated for the prevalence and severity of attachment loss (AL), pockets depth (PD) and gingival recession (GR) at specific cutoff points and according to the CDC/APA definitions of periodontal disease by demographic and behavioral variables for HIV- and HIV+ participants. Multiple simple linear regressions

were used to examine AL, PD and GR by independent variables. Collinear independent variables were examined from multiple regressions (method of ordinary least squares) after correlational analysis but none of the variables were eliminated because there wasn't much correlation between the variables. Normality (PD, AL, GR) and regression lines were examined by quantile-quantile plots and residual analysis.

RESULTS

The final sample size for the participants who completed the periodontal examination was 546.

Table 1 summarizes the sociodemographic profile and substance-use habits of the HIV- and HIV+ participants. The participants were predominantly male and over 30 years of age. The average age of the HIV+ participants was 45.5 years (SE 0.7) and 43.8 years (SE 0.5) for the HIV- participants. Hispanics and African-Americans made up 77% of the HIV+ group and 74% of the HIV- group. Approximately 70% of both groups graduated from high school or had some college education. There were slightly more cigarette smokers (70%) in the HIV- group than the HIV+ group (61%). The use of medium methamphetamines was approximately 55% in both groups. Among the HIV+ group, 12% had CD4 counts below 20 and 38% had viral loads above 50 (copies/milliliter) of blood.

Table 2 presents the severity of attachment loss by the demographic variables for the HIV+ and HIV- participants, respectively. For the 140 HIV+ participants, the mean attachment loss was 2.58 (SE 0.08) millimeters. The prevalence of attachment loss ≥4 mm was 89.3% (SE 2.6%) and ≥ 6 mm 50.7% (SR 4.2%) for the HIV+ group. The 406 HIV- participants presented with a similar level of severity: 2.66 (SE 0.06) millimeters of attachments loss. For the HIV- group, the prevalence of attachment loss ≥4 mm was 87.4% (SE 1.6%) and for ≥ 6 mm was 48.07% (SE 2.5%). There were no significant differences between the two groups by sex, race/ethnicity, education, cigarette smoking history or methamphetamine use. Non-Hispanic Blacks had the most severe attachment loss, followed by Non-Hispanic Whites and Hispanics. The Other group was too small a sample size for legitimate comparisons. A large number of the participants were current cigarette smokers (68.1%, n=372). Of the HIV+ MM cohorts, 61.4% (n=86) were current smokers; 14.3% (n=20) were former smokers; and 24.2% (n-34) never smoked. Of the HIV- MM cohorts, 70.4% (n=386) were current smokers; 7.9% (n=32) were former smokers; and 21.7% (n=88) never smoked. There were no significant differences between the percentage of smokers and attachment loss for the HIV+ and HIV- cohorts.

Using the CDC/AAP prevalence definitions of mild, moderate and severe periodontitis, the comparison of the HIV+ and HIV- groups is presented in Table 3. The overall prevalence of *mild periodontitis* for the HIV+ group was 78% (SE 4%) and the HIV-group 82% (SE 2%). For *moderate periodontitis* the prevalence for the HIV+ group was 51% (SE 5%) and for the HIV-group 56% (3 %). For *severe periodontitis* the prevalence for the HIV+ group was 29% (SE 5%) and the HIV-group was 23% (SE 2%). There were no statistically significant differences between the HIV+ and HIV- groups by race/ethnicity, cigarette smoking history and methamphetamine use.

Table 4 presents the regression coefficients from multiple regression analysis (ordinary least squares), standard errors, p-values and adjusted R^2 for mean attachment loss for the HIV+ and HIV- groups. All of the independents variables were used in the multiple regressions with the addition of CD4 Counts and viral load counts for the HIV+ group. Severe periodontitis and moderate periodontitis were both highly significant ($p<0.001$) in both groups. Severe periodontitis made a stronger contribution to the regression coefficient over moderate periodontitis and the strongest contribution over all of the other independent variables. In the HIV+ group, former smokers were significant ($p<0.04$) but not in the HIV- group ($p<0.06$). Lesions were significant ($p<0.01$) only in the HIV- cohort.

None of the viral load and CD4 variables were significant. Oral lesions were significant ($p<0.01$) in the HIV- group, but not in the HIV+ group. The oral lesions considered were: intraoral abscess or fistula, pseudomembranous candidiasis, erythematous candidiasis, leukoplakia, hairy leukoplakia, oral papilloma, herpetic ulcer intraoral, apthous ulcer and ulcers of unknown etiology. Ten percent (42/406) of the HIV- group had oral lesions compared to 15% (21/140) of the HIV+ group. The most common lesion in both groups was leukoplakia (27% in HIV-; 21% in HIV+). Oral papilloma was present among 21% of the HIV+ group whereas it was only 10% in the HIV- group. There were no significant differences between the groups in the other lesions.

DISCUSSION

The purpose of this study was to examine the prevalence and severity of periodontal disease in a cohort of HIV- and HIV+ participants in an urban population of methamphetamine users that was described previously.[19] The prevalence and severity of periodontal disease was found to be extremely high in both groups. Regression analysis revealed that severe and moderate periodontitis also were both statistically significant ($p< 0.001$) covariates in both the HIV positive and negative cohorts.

Being a cigarette smoker was a risk factor for attachment loss in our HIV+ cohort. Tomar et al.[9] also found cigarette smoking to be a risk factor. A variable specific analysis (data not included) using attachment loss as a dependent variable against all of the independent demographic and behavioral variables reinforced the significance of current smoking in both cohorts.

In the HIV- cohort, oral lesions was a risk factor. Even though the distribution of oral lesions was similar for both cohorts, it was surprising that it was significant in the negative cohort and not the HIV+ cohort. Oral lesions have been reported by other investigators in HIV patients taking HAART.[20-22] Not surprisingly, age was a risk factor and was significant in both cohorts. Lastly, there was no relationship between viral load, CD4 counts and high methamphetamine use and attachment loss. Approximately 12% of the HIV+ group had CD4 ≤ 200 with 62% having viral loads ≥ 50.

The severity of attachment loss between the two cohorts was remarkable similar reflecting the beneficial effect of antiretroviral medications in the HIV+ cohort. All of the HIV+ cohorts were on HIV antiretroviral medications. To date, no other survey of this magnitude

has examined a cohort of HIV+ and HIV- who are methamphetamine users. Comparing the cohorts by demographic and behavioral variables did not reveal any significant difference between the groups. Both groups had a high percentage of cigarette smokers and medium/high MA use.

Even when crude comparisons are made to the NHANES (1999-2004),[23] or uncontrolled diabetes or heavy cigarette smoking, the severity of attachment loss was remarkably high. Lamster et al.[2] found AL measures in the magnitude of 4 mm for HIV+ and 3.39 in HIV- intravenous drug users, but the sample size was small (N=20). Ndiaye et al.[11] found a much lower prevalence (26%) of AL > 6 mm than our study with 51% in HIV+ sex workers in Senegal. McKaig et al.[24] observed millimeters of attachment loss (3.24 mm SD 1.13) higher than we observed, but only in a sample of 15 individuals. None of the previous references, however, were describing urban populations using methamphetamines.

Classifying the prevalence of periodontal disease by the CDC/APA definitions for mild, moderate and severe periodontitis by HIV status did not reveal any significant differences. The prevalences of all classifications were unusually high in the range of 6% to 55%. Even NHANES, which used the same definitions, found prevalences to be in the magnitude of only 9 to 10%.

The high prevalence and severity of periodontal disease requires comment. Clinically, the standard for measuring periodontal disease is to measure six sites per tooth for the entire dentition, excluding third molars. In large surveys, time restraints require that fewer sites per tooth and fewer teeth be examined which is referred to as partial recording protocols (PRP). The PRP in this study examined four sites (MB, B, DL and DL) in randomly selected half-mouth examinations (i.e., maxillary right half mouth and mandibular left half mouth versus the maxillary left half mouth and mandibular right half mouth). Even with large sample sizes, the prevalence and severity of attachment loss and pocket depth are underestimated because of the PRP. Investigators have examined this approach and documented varying degrees of underestimates.[25-28] Eke et al.[29,30] found that the PRP underestimated the prevalence and severity of periodontitis by 50% or more. The implication of these underestimates suggests that the high prevalence and severity of periodontal disease that we observed in our urban population of HIV methamphetamine users was likely to be even higher than our clinical findings.

It was surprising that there were no statistically significant associations between methamphetamine use and periodontal disease. For the HIV positive cohort, anti-viral medications mitigated even more severe attachment loss than experienced. For both cohorts, the severity of attachment loss, were remarkably similar. Even the classifications of prevalence by mild, moderate and severe periodontitis were similar. The HIV+ cohort had access to dental treatment, but they did not appear to be better off periodontally than the HIV- cohort. In our large Los Angeles sample of MA users, the finding of severe periodontal disease as a co-morbidity may be explained by behavioral and determinant risk factors and lifestyle decisions. It is a complex problem that requires a comprehensive approach that includes MA addiction, medical and dental care and life counseling.

Acknowledgments

This study was funded by NIH/National Institute on Drug Abuse (R01 DA026014: PI: Dr. Vivek Shetty) which had no role in the design of the study, in the collection, analysis and interpretation of data, or in the writing of the report. In addition to thanking our participants, we would like to thank Rachel Fintzy, for her administrative assistance, Peter Cabezas, for conducting the interviews, and Leslie Hanson, for the preparation of the manuscript. We want to acknowledge the clinical contributions of the three examiners: Steve Vitero, DDS, AIDS Project Los Angeles, CA; Alexis Gutierrez, DDS, Mission Community Hospital, San Fernando, CA; and Benjamin Freed, DDS, Mission Community Hospital, San Fernando, CA. We thank Dr. Bruce Dye for training the dental examiners, Centers of Disease Control and Prevention, National Center for Health Statistics, Hyattsville, MD.

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Biographies

Vladimir W. Spolsky, DMD, MPH

Conceived the idea of the paper on the periodontal status of the MA users; directed the data analysis and interpretation of the data, contributed to the quality assurance of the clinical examinations; wrote the manuscript.

Jason Clague, MS

Conducted the analysis of the data, assisted in the interpretation of the data, read and approved the final manuscript.

Vivek Shetty, DDS, DrMedDent

Conceived the idea for the design of the comprehensive methamphetamine project, wrote the grant; read and approved the final manuscript.

Table 1

Demographic and Behavioral Variables of 546 HIV-Positive and -Negative Methamphetamine Users

	HIV-Positive		HIV-Negative	
	n	**%**	**n**	**%**
Age *				
<30 years	4	2.9%	44	10.8%
≥ 30 years	136	97.1%	362	89.2%
Sex				
Male	133	95%	308	75.9%
Female	7	5%	98	24.1%
Race/ethnicity				
Hispanic	53	37.9%	121	29.8%
African-Americans	55	39.3%	178	43.8%
White	20	14.3%	82	20.2%
Other	12	8.5%	25	6.2%
Education				
Less than High School	41	29.3%	118	29.1%
High School Graduate	55	39.3%	139	34.2%
More than High School	44	31.4%	149	36.7%
Smoking History				
Current smoker	86	61.4%	286	70.4%
Former smoker	20	14.3%	32	7.9%
Never smoked	34	24.3%	88	21.7%
Methamphetamine Use				
Light	64	45.7%	178	43.8%
Medium/High	76	54.3%	228	56.2%

* The average age of the HIV+ participants was 45.5 years (SE 0.7) and 43.8 years (SE 0.5) for the HIV- participants.

Table 2

Periodontal Disease Severity for HIV-Positive and HIV-Negative by Demographic, Smoking and Level of Methamphetamine Use.

Variables	HIV-Positive							HIV-Negative						
	Attachment Loss (AL)							Attachment Loss (AL)						
		millimeter		AL ≥ 4 mm.		AL ≥ 6 mm.			millimeter		AL ≥ 4 mm.		AL ≥ 6 mm.	
	n	mean	SE	%	SE	%	SE	n	mean	SE	%	SE	%	SE
Age														
<30 years	4	2.05	0.38	75.0%	25.0%	25.0%	25.0%	44	1.52	0.08	59.1%	7.5%	11.4%	4.8%
≥ 30 years	136	2.60	0.08	89.7%	2.6%	51.5%	4.3%	362	2.79	0.06	90.9%	1.5%	52.5%	2.6%
Sex														
Male	133	2.57	0.08	88.7%	2.8%	49.0%	2.4%	308	2.65	0.06	89.0%	1.8%	48.7%	2.9%
Female	7	2.85	0.31	100%	0%	71.4%	18.4%	98	2.69	0.15	82.7%	3.8%	45.9%	5.1%
Race/ethnicity														
Hispanic	53	2.34	0.10	88.7%	4.4%	49.1%	6.9%	121	2.38	0.09	85.1%	3.2%	35.5%	4.4%
Non-Hispanic Black	55	2.77	0.12	94.5%	3.1%	56.4%	6.7%	178	2.82	0.09	90.4%	2.2%	57.3%	3.7%
Non-Hispanic White	20	2.53	0.28	70.0%	10.5%	30.0%	10.5%	82	2.71	0.14	87.8%	3.6%	47.6%	5.5%
Other	12	2.86	0.20	100%	0%	66.7%	14.2%	25	2.72	0.32	76.0%	8.7%	44.0%	10.1%
Education														
< High School	41	2.53	0.13	87.8%	5.2%	61.0%	7.7%	118	2.77	0.12	93.2%	2.3%	53.4%	4.6%
High School	55	2.47	0.11	89.1%	4.2%	38.2%	6.6%	139	2.76	0.11	87.1%	2.9%	50.4%	4.3%
> High School	44	2.78	0.16	90.9%	4.4%	56.8%	7.6%	149	2.48	0.09	83.2%	3.1%	41.6%	4.1%
Smoking History														
Current smoker	86	2.81	0.10	87.2%	3.6%	58.1%	5.4%	286	2.78	0.07	89.2%	1.8%	53.1%	3.0%
Former smoker	20	2.12	0.13	95.0%	5.0%	35.0%	10.9%	32	2.39	0.17	84.4%	6.5%	40.6%	8.8%
Never smoked	34	2.82	0.13	91.2%	4.9%	41.2%	8.6%	88	2.36	0.13	83.0%	4.0%	34.1%	5.1%
Methamphetamine Use														
Light	64	2.46	0.12	84.4%	4.6%	39.1%	6.1%	178	2.63	0.09	83.7%	2.8%	41.0%	3.7%
Medium / High	76	2.69	0.10	93.4%	2.9%	60.5%	5.6%	228	2.68	0.08	90.4%	2.0%	53.5%	3.3%
Total	140	2.58	0.08	89.3%	2.6%	50.7%	4.2%	406	2.66	0.06	87.4%	1.6%	48.0%	2.5%

Table 3

Prevalence of Periodontal Disease by CDC-APP Definitions* for HIV-Positive and HIV-Negative

Variables	HIV-Positive							HIV-Negative						
		Mild Periodontitis		Moderate Periodontitis		Severe Periodontitis			Mild Periodontitis		Moderate Periodontitis		Severe Periodontitis	
	n	%	SE	%	SE	%	SE	n	%	SE	%	SE	%	SE
Age														
<30 years	4	75%	25%	50%	29%	25%	25%	44	57%	8%	30%	7%	0%	-
≥ 30 years	136	78%	4%	54%	4%	21%	4%	362	85%	2%	56%	3%	24%	2%
Sex														
Male	133	77%	4%	53%	4%	21%	4%	308	83%	2%	54%	3%	21%	2%
Female	7	86%	14%	57%	20%	29%	18%	98	78%	4%	51%	5%	21%	4%
Race/ethnicity														
Hispanic	53	74%	6%	53%	7%	17%	5%	121	82%	4%	50%	5%	19%	4%
African-American	55	85%	5%	51%	7%	31%	6%	178	84%	3%	54%	4%	25%	3%
White	20	55%	11%	45%	11%	10%	7%	82	78%	5%	55%	6%	17%	4%
Other	12	100%	-	83%	11%	17%	11%	25	80%	8%	56%	10%	16%	7%
Education														
< High School	41	78%	7%	54%	8%	20%	6%	118	88%	3%	55%	5%	24%	4%
High School	55	75%	6%	56%	7%	18%	5%	139	80%	3%	53%	4%	25%	4%
> High School	44	82%	6%	50%	8%	27%	7%	149	79%	3%	52%	4%	15%	3%
Smoking History														
Current smoker	86	83%	4%	51%	5%	29%	5%	286	85%	2%	56%	3%	23%	2%
Former smoker	20	80%	9%	75%	10%	0%	-	32	88%	6%	53%	9%	22%	7%
Never smoked	34	65%	8%	47%	9%	15%	6%	88	72%	5%	44%	5%	16%	4%
Methamphetamine Use														
Light	64	67%	6%	41%	6%	22%	5%	178	80%	3%	53%	4%	17%	3%
Medium / High	76	87%	4%	64%	6%	21%	5%	228	83%	2%	54%	3%	24%	3%
Total	140	78%	4%	54%	4%	21%	3%	406	82%	2%	53%	2%	21%	2%

*CDC/AAP case definitions.[16,17] Participants without periodontal disease are not included in the table.

Table 4

Regression analysis using attachment loss as the dependent variable against the independent demographics and behavioral variables by regression coefficient, SE, confidence interval and p-value

	HIV-Positive				HIV-Negative			
Variable	**Regression Coefficient**	**SE**	**95% Confidence Interval**	**p-value**	**Regression Coefficient**	**SE**	**95% Confidence Interval**	**p-value**
Intercept	1.91	0.55	(0.82,3.01)	<0.001	1.63	0.26	(1.11,2.14)	<0.001
Severe Periodontitis	1.66	0.18	(1.30,2.02)	<0.001	2.28	0.14	(2.00,2.55)	<0.001
Moderate Periodontitis	0.78	0.15	(0.47,1.08)	<0.001)	0.91	0.11	(0.69,1.13)	<0.001
Mild or No Periodontitis	Reference				Reference			
Brush 1-3/day	-0.12	0.18	(-0.47,0.24)	0.53	-0.14	0.14	(-0.40,0.13)	0.32
Soda (log transformed) *	-0.02	0.04	(-0.09,0.06)	0.63	-0.003	0.03	(-0.05,0.05)	0.90
Education								
High School	-0.13	0.16	(-0.44,0.18)	0.41	-0.02	0.11	(-0.24,0.20)	0.87
> High School	0.04	0.16	(-0.27,0.36)	0.79	-0.11	0.11	(-0.33,0.12)	0.35
< High School	Reference				Reference			
Race/Ethnicity								
Hispanic	-0.35	0.19	(-0.73,0.03)	0.07	-0.24	0.13	(-0.50,0.01)	0.06
African-Americans	-0.17	0.20	(-0.56,0.22)	0.39	-0.08	0.12	(-0.31,0.16)	0.52
Other	-0.09	0.27	(-0.63,0.44)	0.73	0.11	0.20	(-0.29,0.51)	0.59
Caucasian/White	Reference				Reference			
Smoking History								
Current Smoker	Reference				Reference			
Former Smoker	-0.39	0.18	(-0.75,-0.02)	0.04	-0.32	0.17	(-0.65,0.01)	0.06
Never Smoker	-0.23	0.16	(-0.55,0.10)	0.17	-0.09	0.11	(-0.31,0.13)	0.42
Lesions	-0.05	0.16	(-0.36,0.26)	0.77	0.26	0.10	(0.06,0.47)	0.01
Sex	-0.16	0.27	(-0.70,0.38)	0.55	-0.04	0.10	(-0.24,0.17)	0.71
≥ 30 years of age	0.58	0.36	(-0.13,1.29)	0.11	0.45	0.15	(0.15,0.76)	0.004
MethH (High Meth use)	0.001	0.12	(-0.24,0.25)	0.99	-0.10	0.09	(-0.28,0.08)	0.27
Viral Load Over 50	-0.09	0.20	(-0.48,0.30)	0.65				
Viral Load Below 50	-0.01	0.18	(-0.37,0.35)	0.96				
Viral Load NA	Reference							

	HIV-Positive				HIV-Negative			
Variable	**Regression Coefficient**	**SE**	**95% Confidence Interval**	**p-value**	**Regression Coefficient**	**SE**	**95% Confidence Interval**	**p-value**
CD4 Less than 200	0.01	0.26	(-0.51,0.53)	0.98				
CD4 Above 200	0.04	0.17	(-0.29,0.37)	0.82				
CD4 NA	Reference							
Adjusted R^2			0.4729				0.4299	

*Soda with sugar consumption within the last 30 days.