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Lifestyle and Psychosocial Factors Associated with Tooth Loss in Mexican Adolescents and Young Adults

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Abstract

Objective: The aim of the present study was to examine: (1) the prevalence of tooth loss in persons living in community dwellings and (2) the strength of the association identified between tooth loss experience and the psychosocial factors of lifestyle, stress, and anxiety.

Material And Methods: A cross-sectional study was carried out in a convenience sample where data were collected by means of self-administered questionnaires of lifestyle and psychosocial factors (stress and anxiety) and a clinical examination. A total of 516 subjects aged 14-30 years of age were included in the study. Subjects had a visual dental examination. Prevalence and mean of tooth loss were calculated excluding third molars, and their related factors were adjusted in a binary logistic regression.

Results: Mean age of participants was 17.4±3.0 years; 45.5% were men. The prevalence of tooth loss (when at least one tooth was lost) was 20.5%. Among the 516 persons, a total of 201 teeth were lost with a mean tooth loss 0.39±0.95 overall. Mean tooth loss in subjects with at least one missing tooth was 1.90±1.26 teeth. Results adjusted by anxiety in the multivariate logistic regression model showed tooth loss was associated with lifestyle (OR=1.95, 95% CI=1.17 – 3.24), age (OR=2.65, 95% CI=1.64 – 4.26), and Angle's malocclusion II and III (OR=2.86; 95% CI=1.67 – 4.90). A slight association toward tooth loss was observed ($p<0.10$) in the sex and stress variables.

Conclusions: Lifestyle and tooth loss have a substantial association. According to age group, these results suggest tooth loss is an oral health problem in the study population.

Keywords: Dental health, tooth loss, psychosocial factors, epidemiology, Mexico

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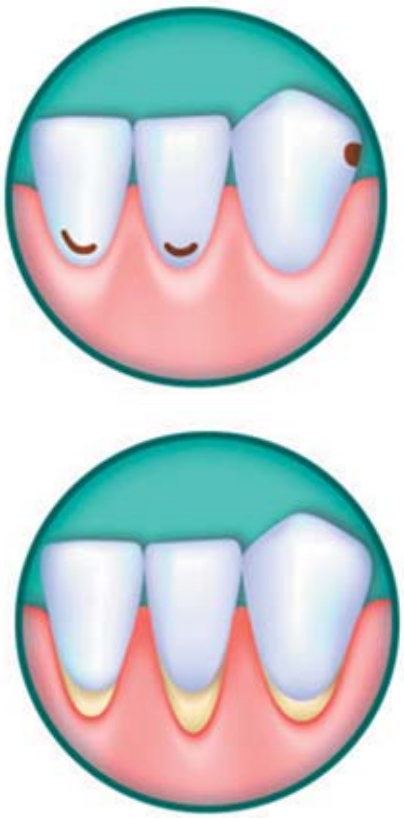
Introduction

Dental caries and chronic destructive periodontal diseases are two of the most salient problems for dental public health systems worldwide. Tooth loss is particularly important due to the functional, psychological, social, and financial impact that may result from the substantial number of teeth being lost. While dental caries appears to be the main cause of tooth loss, chronic destructive periodontal diseases also contributes to this problem.[1-9] The relative impact of either caries or periodontal etiologies for tooth loss seems to vary across countries, age groups, levels of access-to-care, and opportunities to use different care-delivery models. Diverse studies have examined the tooth loss phenomena from various perspectives in different countries.[10-14] There is scant information, however, on the impact of certain variables that may modify tooth loss, such as concurrent psychosocial factors.

With few exceptions, there are obvious socio-economic status (SES) gradients to overall mortality and morbidity.[15, 16] Recently, more sophisticated interpretations attempting to explain health differences have come to the conclusion disease occurrence is modified by a combination of factors. Generally speaking, stimuli from daily living require the individual to make homeostatic changes to adapt to new, evolving environmental demands.[17] Among others, these factors are: social status[8], empowerment[19], stress (both positive and negative)[20], genetic makeup[21], lifestyle (its many forms)[22], cultural/ethnic resources at various stages in life[23], and anxiety, which may result from mismatches in performance and demands and lead to a pathological condition if sufficiently severe.[24] For many diseases, including oral conditions, the exact contribution of each factor to disease frequency and severity in a specific population group remains unclear.

An example of poorly defined contributions is lifestyle. Lifestyles are defined as collective roles in health behavior relating to life opportunities. Those conditions are the social, economic, and physical environments in which individuals live, relate, and work. In some circumstances stress and other psychosocial factors may greatly impact health status[25], including oral health. Hayashi et al.[26] reported an extreme example when they found alexithimia (a condition characterizing persons unable to express their feelings) and age were associated with tooth loss.



An abundance of studies that look at oral health in relation to psychosocial factors vary markedly. They tend to emphasize periodontal health as opposed to oral and dental features. To better delineate an understanding of the association of selected psychosocial factors and tooth loss, the aim of the present study set out to examine (1) the prevalence of tooth loss in community dwelling persons and (2) the strength of the association identified between tooth loss experience and the psychosocial factors of lifestyle, stress, and anxiety.

Materials and Methods

Study Population

The study design followed the ethical review guidelines customarily laid out by the relevant authorities at the University of Campeche, México. This was a secondary analysis of a database from an oral health epidemiologic study on temporomandibular (TMD) disorders.[27] A cross-sectional study was conducted in individuals with permanent teeth, between 14 to 30 years of age, attending the University of Campeche. Because we have no pretence to extrapolate results to a larger population, contact with our study population was based on convenience and the homogeneity of the population of full-time students. Data was collected at the schools after administrative issues and logistic hurdles had been cleared with school authorities. An invitation to participate in the study was made to students. People accepting the invitation were provided with an official letter describing the study and ethical implications of data handling, privacy, and confidentiality issues; their consent to have a dental exam undertaken and its results communicated to each interested party; and likely dates for dental exam and written instrument administration. In this study both researchers as well as participants spoke the same language.

Oral Examinations

The subjects had an oral exam by one of four dentists calibrated and standardized in the diagnoses criteria (kappa >0.85). A pilot study was conducted on a sub-sample of 50 subjects (not included in the main study) to test the reliability and applicability of the survey methods, with similar distribution by age and sex. Participants received their summarized clinical findings both verbally and in writing. The clinical exam included missing teeth (dependent variable), defined when the subject had one or more teeth lost (excluding third molars) to caries or periodontal disease. Evidence of clinical bruxism[28], using the criteria proposed by Johansson et al., and the occlusion class, as per Angle's classification, were also established.

Stress, Anxiety, and Lifestyle

Stress and anxiety were assessed using separate questionnaires with five response options, including Likert-type scales. Options ranged from 0 (of little consequence) to 4 (very important) and were designed to be age and culturally appropriate in cognitive somatic anxiety and psycho physiologic stress evaluation.[29, 30] These instruments were developed to measure the clinical impact of psychosocial factors on health in adolescents and younger adults. The instruments include 44 items targeting stress and 14 items targeting anxiety, with total scores ranging from 0 (not anxious at all) to 56 (extremely anxious) and from 0 (not stressed at all) to 176 (extremely stressed). The instrument for the lifestyle assessment was part of the same battery of questionnaires, developed using similar procedures, and validated for use in the age, language, and cultural groups participating in the present study. The lifestyle questionnaire included numeric scales from 0 (favorable) to 11 (unfavorable) evaluating factors related to lifestyle and health in 20 items. Total scores ranged from 0 (favorable lifestyle) to 220 (unfavorable lifestyle).[29, 30] Click below to view the questionnaires. Ancillary support information is available from the corresponding author.

English translation from the Spanish questionnaire

STRESS SYMPTOMS INVENTARY

NAME:_____ DATE:_____
AGE:_____ SEX:_____ LEVEL OF STUDIES:_____
STATUS:_____ CURRENT ACTIVITY:_____

DIRECTIONS: MARK WITH AN "X", THE PARENTHESIS THAT INDICATE THE INTENSITY OF YOUR COMPLAIN DURING THE LAST MONTHS, CHOOSE FROM THE FOLLOWING SYMPTOMS.

REACTIONS		NONE	FEW	REGULAR	FREQUENT	ALWAYS	
1.	Depression	( )	( )	( )	( )	( )	
2.	Strong heart beat	( )	( )	( )	( )	( )	
3.	Mouth Dryness	( )	( )	( )	( )	( )	
4.	Angry bursts	( )	( )	( )	( )	( )	
5.	Need to hide	( )	( )	( )	( )	( )	
6.	Need to cry	( )	( )	( )	( )	( )	
7.	Unable to concentrate	( )	( )	( )	( )	( )	
8.	Weakness, dizziness	( )	( )	( )	( )	( )	
9.	Fatigue	( )	( )	( )	( )	( )	
10.	Feel tied-up	( )	( )	( )	( )	( )	
11.	Nervous ticks	( )	( )	( )	( )	( )	
12.	Tend to be scare by noises	( )	( )	( )	( )	( )	
13.	Nervous laugh	( )	( )	( )	( )	( )	
14.	Stuttering	( )	( )	( )	( )	( )	
15.	Bruxism	( )	( )	( )	( )	( )	
16.	Tight Mandible	( )	( )	( )	( )	( )	
17.	Insomnia	( )	( )	( )	( )	( )	
18.	Headache produced by stress	( )	( )	( )	( )	( )	
19.	Migraine	( )	( )	( )	( )	( )	
20.	Excessive sweating	( )	( )	( )	( )	( )	

English translation from the Spanish questionnaire

ANXIETY QUESTIONNAIRE

NAME:_____

AGE:_____ SEX:_____ LEVEL OF STUDIES:_____

MARITAL STATUS:_____ CURRENT OCCUPATION_____

Direction: Mark with an X the parenthesis that shows the rate of intensity in which you have suffered the following feelings or complains.

REACTIONS	NONE	FEW	REGULAR	FREQUENT	ALWAYS	
43. Difficulties to concentrate	( )	( )	( )	( )	( )	
44. Heart beats faster	( )	( )	( )	( )	( )	
45. Worry too much	( )	( )	( )	( )	( )	
46. Body tremors	( )	( )	( )	( )	( )	
47. Imagine upsetting scenes	( )	( )	( )	( )	( )	
48. Need to go to the toilet	( )	( )	( )	( )	( )	
49. Remember images that produce anxiety	( )	( )	( )	( )	( )	
50. Stomach is tense	( )	( )	( )	( )	( )	
51. Come to mind thoughts that upset you	( )	( )	( )	( )	( )	
52. Walk nervously	( )	( )	( )	( )	( )	
53. Can't think enough faster	( )	( )	( )	( )	( )	
54. Get paralyzed	( )	( )	( )	( )	( )	
55. Come to mind thoughts that make you anxious	( )	( )	( )	( )	( )	
56. sweat excessively	( )	( )	( )	( )	( )	

LIFESTYLE QUESTIONAIRE – PERSONALITY A/B

NAME:_____ID:_____EXAMINER:_____

DIRECTIONS: **THE FOLLOWING SCALE INCLUDES 2 LIFESTYLE RELATED SENTENCES, EACH PAIR REPRESENT TWO OPPOSITE TYPES OF CONDUCT. MARK THE NEAREST NUMBER TO THE SENTENCE THAT IDENTIFY THE TYPE OF PERSON YOU CONSIDER TO BE YOURSELF.**

1. Work the normal working hours	0 1 2 3 4 5 6 7 8 9 10	I work after normal working hours or take it home.
2. Wait peacefully	0 1 2 3 4 5 6 7 8 9 10	Wait impatiently
3. Rarely judge or value things by quantity.	0 1 2 3 4 5 6 7 8 9 10	Judge or value things by quantity.
4. I am passive	0 1 2 3 4 5 6 7 8 9 10	I am competitive
5. I usually do not feel accountable.	0 1 2 3 4 5 6 7 8 9 10	I feel accountable.
6. I do not rush to be on time to my appointments.	0 1 2 3 4 5 6 7 8 9 10	I rush to be on time to my appointments.
7. I never feel on a rush.	0 1 2 3 4 5 6 7 8 9 10	I always feel on a rush.
8. I have many personal interests.	0 1 2 3 4 5 6 7 8 9 10	I have only one main interest (e.g. my work)
9. I satisfy myself.	0 1 2 3 4 5 6 7 8 9 10	I satisfy others.
10. I do not pay attention to details.	0 1 2 3 4 5 6 7 8 9 10	I pay attention to details.
11. I can leave things unfinished.	0 1 2 3 4 5 6 7 8 9 10	I must finished things.
12. I am satisfied with my job	0 1 2 3 4 5 6 7 8 9 10	I am unsatisfied with my job.
13. Allow people to talk to me.	0 1 2 3 4 5 6 7 8 9 10	I do not allow anyone to talk to me.
14. I analysis things before taking action.	0 1 2 3 4 5 6 7 8 9 10	I am impulsive.
15. I do things calmly.	0 1 2 3 4 5 6 7 8 9 10	I do things swiftly.
16. I do one thing at a time.	0 1 2 3 4 5 6 7 8 9 10	I do many things at the same time.
17. I never get angry	0 1 2 3 4 5 6 7 8 9 10	I get angry easily.
18. My pitch voice is lower.	0 1 2 3 4 5 6 7 8 9 10	My pitch voice is higher.
19. I express my feelings easily	0 1 2 3 4 5 6 7 8 9 10	I hide my feelings
20. I never establish deadlines.	0 1 2 3 4 5 6 7 8 9 10	I frequently establish deadlines.

Statistical Analyses

The independent variables were stress, lifestyle, and anxiety scores as well as variables for sex, presence or absence of bruxism, and the occlusion class. Data were entered in a database in SPSS® and analyzed in STATA 7®. The scores obtained from the psychosocial instruments were divided in quartiles to compare the first, second, and third quartiles vs. the fourth quartile. In the first stage of the analyses data were analyzed with bivariate tests, namely Mann Whitney-U, x^2, and non-parametric test for trends. Odds ratios (OR) were calculated with confidence interval (95% CI). For the second stage of the analysis, a multivariable model of logistical regression was fitted (Pearson's goodness-of-fit test) to ascertain the independent variables' simultaneous impact. Only the variables that were $p<0.15$ in the bivariate analysis were included in the final model. A variance inflation factor (VIF) test with the purpose of analyzing and avoiding multicolinearity between independent variables was conducted. All possible interactions were tested and included if their statistical significance was less than 0.15. The specification error test *(linktest)* was used to verify the assumption the *logit* of the response variable was a linear combination of the independent variables. Finally, we evaluated the global quality of the model by means of an analysis of residuals (results not presented).[31]

Results

Basic Results

A total of 516 subjects were examined; their mean age was 17.4±3.0 years. The descriptive results are in Table 1. The prevalence of tooth loss at the individual level (when at least one was lost) was 20.5% (n=106). The number of teeth lost ranged from 0 to 7. The proportions of subjects in the study population that had one, two, or three teeth lost were 11.0% (n=57), 4.8% (n=25), and 1.6% (n=8), respectively. Only 3.1% (n=16) had lost four or more teeth. Among the 516 persons, a total of 201 teeth were lost with a mean tooth loss 0.39±0.95 overall. Mean tooth loss in subjects with at least one tooth lost was 1.90±1.26 teeth.

Bivariate Analyses

Table 2 shows the distribution of subjects and teeth lost across sex and age. Women lost more teeth than men: 24.2% in women vs. 16.2% in men ($p<0.05$). The prevalence of tooth loss by age group was 16.1% for the adolescents (< 19 years-old) and 34.7% for the young adults (> 19 years of age) ($p<0.05$). A significant correlation between age and missing teeth ($r=0.2732$; $p<0.0001$) was observed.

Tooth loss experience was different across subjects that have been identified as having

Table 1. Frequency distribution of variables in the study sample.

Variable	Category	n	Percentage
Age (years)	Adolescents (14 – 19)	392	76.0
	Young adults (> 19)	132	24.0
Sex	Men	235	45.5
	Women	281	54.5
Clinical bruxism	No present	295	57.4
	Present	219	42.6
Malocclusion	Angle I	425	82.8
	Angle II	48	9.4
	Angle III	40	7.8
Life-style	1, 2, 3 quartile	392	76.0
	4 quartile	124	24.0
Stress	1, 2, 3 quartile	392	76.0
	4 quartile	124	24.0
Anxiety	1, 2, 3 quartile	403	78.1
	4 quartile	113	21.9

Table 2. Distribution of subjects with tooth loss (at least one) and mean tooth loss by sex and age groups in study population.

Variable	Category	n	Subjects with at least one tooth lost (%)	Mean number of teeth lost±SD
Sex	Men Women	235 281	38 (16.2) * 68 (24.2)	0.26±0.74 † 0.50±1.09
Age (years)	14 - 19 > 19	392 124	63 (16.1) * 43 (34.7)	0.28±0.80 † 0.73±1.28

*xs p< 0.05
† U de Mann Whitney test p<0.05

normal occlusion, malocclusion type II, or malocclusion type III; each one of these sub-groups had different proportions of people who had suffered from tooth loss – 17.4%, 39.6%, and 30.0%, respectively (p<0.001). Within participants that had been diagnosed with signs of bruxism, the prevalence of tooth loss (24.2%) was marginally higher (p=0.084) than in participants who had no signs of bruxism (18.0%).

With regard to the psychosocial variables, descriptive statistics for stress, anxiety, and lifestyle scores were 23.08±16.06 (median=20; Q_{25}-Q_{75}=11-31), 11.45±7.48 (median=10 Q_{25}-Q_{75}=6-15), and 102.17±22.55 (median=104 Q_{25}-Q_{75}=90-116), respectively. Through dummy variables, values were contrasted from the first, second, and third quartiles with the value of the fourth quartile. Significant differences linking unfavorable lifestyle and more teeth lost and between higher stress and more teeth lost (p<0.05) were found. The experience of tooth loss and anxiety scores did not appear to have association under the present research conditions (p>0.05).

In the bivariate logistic regression analysis with tooth loss only lifestyle and stress were significant, with odds ratios of 1.78 for both. Women were at increased risk of tooth loss compared to men (OR=1.65) just as older participants were more likely to have lost at least one tooth than younger participants. Values from young adults >19 years old – OR=2.77 — with adolescents <19 years-old were contrasted and found participants with bruxism were more likely to have lost teeth than those without bruxism (OR=1.46). Participants who had malocclusion in the Angle class II and class III were substantially more likely to have lost teeth (OR=3.11 and OR=2.03, respectively) than those with class I occlusion.

Multivariate Analyses

The results of the multivariate analysis of logistic regression (Table 3) are based on the best-adjusted model. Age, lifestyle, and malocclusion were variables associated (p<0.05) with tooth loss. Young adults (> 19 years old) were 2.65 (95% CI=1.64 – 4.26) times more likely to have suffered tooth loss than adolescents (> 19 years old).

Subjects with an unfavorable lifestyle were twice (OR=1.95; 95% CI=1.17 – 3.24) as likely to have lost at least one tooth, compared to those who had a favorable lifestyle. Researchers also note subjects with Angle's malocclusion II and III have more tooth loss than those with Angle's I malocclusion by a factor of 2.86 (95% CI=1.67 – 4.90). A slight association toward tooth loss was observed (p<0.10) in the sex (OR=1.57; 95% CI=0.97 – 2.52) and stress (OR=1.76; 95% CI=0.99 – 3.15) variables.

The model adjustment was tested with the Pearson's goodness-of-fit test and was not found to be significant ($X^2(45)=38.82$; p=0.7299). This indicates the observed probabilities are similar to the predicted probabilities by the logistic model. In the specification error test we obtained satisfactory results; the outcome *logit* was a linear combination of the independent variables. With regard to analysis of residuals done on the model, no influence covariable patterns were detected (results not reported).

Table 3. Results of tooth loss (0 vs. at least one tooth lost) regressed on socio-demographic and psychosocial factors (n=521).

Variable	Category	OR (crude)	AOR*	95%CI	p value
Sex	Men Women	1 † 1.65[a]	1.57	0.97 – 2.52	0.064
Age (years)	14 - 19 > 19	1 † 2.77[b]	2.65	1.64 – 4.26	0.000
Life-style	1,2, 3 quartile 4 quartile	1 † 1.78[a]	1.95	1.17 – 3.24	0.010
Stress	1,2, 3 quartile 4 quartile	1 † 1.78[a]	1.76	0.99 – 3.15	0.055
Malocclusion	Angle I Angel II & III	1 † 2.58[a]	2.86	1.67 – 4.90	0.000

[a] p<0.05, [b] p<0.001
* Odds ratio adjusted for the variables included in the table and anxiety.
† Reference category.
Goodness-of-fit test - Pearson's chis (45)=38.82; p=0.7299
Specification error test: predictor=0.000, predictors =0.173

Discussion

The present research describes the association between psychosocial features and tooth loss in a teenage and young adult population in Mexico. Using culturally relevant and age appropriate psychosocial measures researchers were able to corroborate reports[46-48] relevant to other populations that report4[46-48] there is an association between unfavorable lifestyle, increased stress, and tooth loss. Results from the present study are one of the first explorations into the role of social features effecting tooth loss and oral health in the Mexican environment. While suggestive of well-defined trends within this specified study population, the present results should be interpreted cautiously due to methodological limitations. Among these, the study framework resorted to secondary analysis of an existing database.[27] This resource did not attempt to provide population-level data within a probabilistic assessment of the health status of the Campeche population. Because the data collection was cross-sectional and, thus, may be effected by temporary ambiguity, the researchers could not discern whether tooth loss preceded increased stress or unfavorable lifestyle or vice versa.

No reliable tooth loss incidence studies are available for the Mexican setting, but longitudinal studies in other countries indicated a substantial proportion of people lose at least one tooth within a three-year interval.[32-34] Periodontal problems were often associated with tooth loss, and the proportion of people at risk of losing teeth due to periodontal breakdown increases with age[35] and is associated with lower SES.[36] The role of caries[4, 37, 38] in tooth loss is unclear when contrasted with the role of periodontal diseases,10 particularly in adults.[3, 7, 8] Most teeth, however, are lost due to caries (crown and root lesions), periodontal diseases, or a combination of pathosis and judgments that culminate in a decision made by clients and clinicians.[39]

While it is believed, among older persons, poor oral health is a concomitant of aging and nothing can be done to improve this situation[40, 41], tooth loss will likely diminish the quality of life when all functional, psychosocial, and economic implications are considered. It has been postulated, however, depending on specific circumstances and outcomes, losing a tooth can be either an improvement or a worsening of health status.[42] For younger persons with reasonable access to dental health care, it is

speculated tooth loss would generally be a negative outcome. The proportion of our study population who had lost at least one tooth was somewhat low (21.4%, with an average tooth loss of 0.42) compared to other studies on Latino adults, which found a prevalence of 59% and a mean of 2.64 teeth lost.[43] When contrasts are limited to comparable age groups, however, findings from other studies and the present study are similar.[44, 45]

This is not surprising; tooth loss is the result of complex interactions between clinical, patho-physiological, and socio-behavioral factors.[11, 36] The strength of the association between psychosocial factors and tooth loss has not been as thoroughly evaluated. Lifestyle is dependent on specific circumstances and social milieu. The findings of the present study suggest an unfavorable lifestyle is associated with increased tooth loss – just as Sakki et al.[46], Schou et al.[47], and Yoshida et al.[48] have found. It is not known, however, whether people with negative lifestyles lose more teeth due to direct patho-physiologic causes or if they have behavior patterns that are less efficacious to maintain good oral health by themselves or through the timely use of dental care services.[49, 50] It is likely various combinations of contributing factors are at play in different social settings and at different stages in a lifetime. The present study found stress was associated with tooth loss. Interactions between stress levels and immune responses that have been characterized with, e.g., periodontal diseases[51, 52] open the possibility the contribution of stress to tooth loss was mediated by periodontal breakdown. However, it is not known whether such a pathway is the only explanation linking the two phenomena or merely a contributing factor. Unrelated studies have found depressed cellular immunity under conditions of severe stress, especially when coupled with poor social support[53] or signs of worse gingival status under psychosocial duress.[54] Such changes may allow increased vulnerability to infectious agents such as periodontopathogenic bacteria.[55]

As in many studies, age was an associated factor for tooth loss in our (adolescents and youth adults) population[10, 45, 26, 14]; more teeth are lost in older age groups. This can be explained by teeth being in contact with acidic environments for longer periods of time, being subject to repetitive cycles of dental treatment that may have added a measure of iatrogenic weakening, and/or having a longer history of periodontal undermining. The increased likelihood of women losing teeth in the present study population at the bivariate analysis level was not consistent with the importance ascribed in the final model. It is difficult to place these findings in the context of reports on tooth loss because some studies have found women lose *more* teeth then men[10, 11], some studies have found women lose *fewer* teeth[44, 46] than men, and some studies had ambiguous results.[56]

Conclusion

Because the number of teeth inside the mouth is a good indicator of oral health, the decline of tooth loss is often mentioned as a health goal.[39, 57] In conclusion, according to age, these results suggest tooth loss is an oral health problem in the study population. Lifestyle and tooth loss have a substantial association. The prevalence of tooth loss in this study exceeds the global goal for oral health in the year 2000 established by the World Health Organization (WHO) in 1985 that proposed 85% of the population around the world not having missing teeth. The WHO global goal for oral health in the year 2010 proposed no missing teeth for 18 year old individuals. Our study observed a prevalence of tooth loss of 15.3% in subjects < 18 years old. Clearly, if preventive oral health care measures are not instituted, the results of this study suggest this population will fall far short of the WHO oral health goals.[58, 59]

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