

Prevalence and risk indicators of periodontal disease among high-school students in Tehran

A. Kazemnejad,¹ F. Zayeri,² A.R. Rokn³ and M.J. Kharazifard⁴

انتشار مرض دواعم الأسنان ومؤشرات اختطاره بين طلبة المدارس الثانوية في طهران
أنوشيروان كاظم نجاد، فريد زاييري، أمير رضا ركن، محمد جواد خرازي فرد

الخلاصة: لتحديد مدى انتشار مرض دواعم الأسنان ومؤشرات اختطاره بين طلبة المدارس الثانوية في طهران، بجمهورية إيران الإسلامية، تم تقييم حالة دواعم الأسنان لدى 867 طالباً تتراوح أعمارهم بين 15 و19 عاماً، باستخدام مَنسَب دواعم الأسنان المجتمعي للاحتياجات العلاجية. وبيّنت النتائج أن حالة 88.7% من هؤلاء الطلاب بالنسبة لصحة دواعم الأسنان غير جيدة. وبيّن تحليل التحوُّف المتعدّد أن الجنس، والمستوى التعليمي للوالدين، وتكرار تنظيف الأسنان بالفرشاة وبالخيط، وعدد الزيارات الوقائية لطبيب الأسنان، ووجود أسنان مقلوعة، كل هذه مؤشرات يُعتدُّ بها على اختطار مرض دواعم الأسنان. وخلصت الدراسة إلى الحاجة إلى برامج مدرسية لتعزيز صحة الأسنان ووقايتها من الأمراض.

ABSTRACT To identify the prevalence and risk indicators of periodontal disease in high-school students in Tehran, Islamic Republic of Iran, the periodontal condition of 867 students aged 15–19 years was assessed using the community periodontal index of treatment needs (CPITN). The results showed that 88.7% of these students had less than perfect periodontal health. Multiple regression analysis revealed that sex, parents' educational level, frequency of toothbrushing and flossing, preventive dental visits and presence of extracted teeth were significant risk indicators for periodontal disease. School-based oral health promotion and prevention programmes are needed.

Prévalence et indicateurs du risque de parodontopathie chez les lycéens de Téhéran

RÉSUMÉ Afin de déterminer la prévalence et les indicateurs du risque de parodontopathie chez les lycéens de Téhéran en République islamique d'Iran, la santé parodontale de 867 lycéens âgés de 15 à 19 ans a été évaluée sur la base de l'indice communautaire des besoins en traitements parodontaux. Les résultats montrent que la santé parodontale de 88,7 % de ces adolescents était loin d'être parfaite. L'analyse de régression multiple a révélé que le sexe, le niveau d'instruction des parents, la fréquence des brossages de dents et de l'utilisation de fil dentaire, ainsi que des visites préventives chez le dentiste et l'existence d'extractions dentaires sont autant d'indicateurs significatifs du risque de maladie parodontale. La promotion de la santé bucco-dentaire à l'école et la mise en place de programmes de prévention sont indispensables.

¹Department of Biostatistics, School of Medical Sciences, Tarbiat Modarres University, Tehran, Islamic Republic of Iran.

²Department of Social Sciences, Faculty of Medicine; ³Department of Periodontology, Faculty of Dentistry;

⁴Dental Research Centre, Faculty of Dentistry, Tehran University of Medical Sciences, Tehran, Islamic Republic of Iran (Correspondence to A. Kazemnejad: aklii@yahoo.com).

Received: 15/02/05; accepted: 27/11/05

Introduction

Implementation of community-oriented oral health promotion programmes is an important duty of public health policy-makers in different countries. In the Islamic Republic of Iran a limited budget is available for these programmes. Limited budgets for health promotion are best spent on school-based programmes in order to increase the level of knowledge, and to change attitudes and practices in relation to oral health among young people. Studies in some other developing countries show that the oral health in their young populations tends to be considerably better, probably due to their better school-based oral hygiene programmes [1].

The community periodontal index of treatment needs (CPITN), developed jointly by Fédération Dentaire Internationale (FDI) and the World Health Organization (WHO), was until recently the most widely used tool for the assessment of periodontal health [2]. In 1997, the CPITN was replaced by the community periodontal index (CPI) as the WHO-recommended measure of periodontal condition [3]. The index enables worldwide comparisons to be made in the profile of periodontal conditions and identify risk indicators of periodontal disease in different communities.

In view of the lack of proper school-based health programmes and elementary oral health studies in our country, this epidemiologic survey was designed to evaluate the periodontal condition of high-school students in Tehran, Islamic Republic of Iran. The main purpose was to identify the prevalence and risk indicators of periodontal disease among high-school students aged 15–19 years in the capital city and provide general information about oral health behaviours (such as frequency of tooth-

brushing, flossing and preventive dental visits) of these students in order to compare our students' oral hygiene level with that in other developed and developing countries throughout the world. The results would aim to attain the World Health Organization (WHO) goals for 15–19-year-olds and provide a baseline for future health planning in our country.

Another motivation for this study was to illustrate the application of some recent statistical approaches such as marginal modelling and generalized estimating equations (GEE) methodology for multivariate analysis of periodontal data. It is clear that similar methodology could be utilized for the analysis of other correlated oral and dental outcomes.

Methods

Sampling technique

This cross-sectional study was conducted during 2004 in Tehran high schools. To select the study sample, a multistage sampling technique was used. In the first stage, we numbered all the 22 districts in Tehran (from 1 for the north end district to 22 for the south end) and chose 6 districts using systematic sampling. In the second stage, 4 high schools were randomly selected in each district. To do this, the list of high schools in these districts was prepared and then 4 high schools were randomly selected in each district using simple random sampling. Finally, a list of students aged between 15–19 years in the selected high schools was prepared in alphabetical order and a random sample of 867 students was chosen using the probability proportional to (population) size sampling method and a table of random numbers.

Questionnaire and clinical examinations

In this study, the required information for each student was obtained via a questionnaire and oral examination. The questionnaire had 3 parts: demographic characteristics (such as sex, date of birth, parents' educational level and occupation and some socioeconomic variables); oral health behaviours (such as frequency of toothbrushing and flossing, use of toothpaste, preventive dental visits and other aspects of care that may have influenced the student's oral health); and periodontal condition. Parent's educational level was classified as follows: low (illiterate or primary school); moderate (secondary school) and high (academic). The content validity of this questionnaire was confirmed by a number of periodontists and epidemiologists in the departments of periodontology and epidemiology of Tehran University of Medical Sciences.

The periodontal health status of the students was assessed using the CPI [3], utilizing 6 index teeth (Ramfjord teeth) to represent the 6 sextants of the mouth. This ordinal index has the following scores: 0 = healthy gingiva, 1 = bleeding on gentle probing, 2 = calculus at any supra- or sub-gingival site, 3 = shallow pocket (4–5mm) and 4 = deep pocket (6 mm or more). A periodontal probe and disposable dental mirror were used to assess the periodontal condition for each student. No advance notice was given to any of the students and each was examined under the same conditions, in an outpatient clinic room under artificial light. The student was seated on a high backrest chair with the examiner positioned behind the student. The examination was visual only and no radiographs were taken. All examinations were undertaken by 2 qualified dentists, who had previously undergone a familiarization exercise with an experienced epidemiologist and periodon-

tologist. Before starting the examinations, a pilot study was performed on 50 volunteers to evaluate the interexaminer agreement between these 2 dentists. The zed kappa statistic [4] was 0.88 ($P < 0.001$) indicating high agreement between the 2 examiners. After filling out the questionnaires, the obtained data were coded using *SPSS*, version 11.5 software.

Risk indicators

After univariate analyses (such as chi-squared test, *t*-test and one-way ANOVA test), the following factors were considered potential risk indicators for periodontal disease in this population: sex (1 = female, 2 = male), parents' educational level (1 = low, 2 = moderate, 3 = high), toothbrushing (1 = never, 2 = irregularly, 3 = once a day, 4 = twice or more a day), flossing (1 = never, 2 = irregularly, 3 = once a day, 4 = twice or more a day), visits to dentist (1 = emergency only, 2 = regular preventive visits). We also considered the number of extracted teeth in each sextant as the only sextant-specific risk indicator. In this sample, as no more than 1 extracted tooth in each sextant was observed, this risk indicator was read as: 1 = presence, 2 = absence.

Statistical analysis

Since the CPI scores for 6 sextants of each student are correlated and ordinal response data, a marginal model, also called the population-averaged (PA) or the proportional odds regression model was used to describe the relationship between CPI scores and the risk indicators given above [5]. In addition, the generalized estimating equations (GEE) methodology was used to estimate regression parameters and account for repeated outcomes (6 CPI scores for each student) [6, 7]. More detailed explanation about marginal modelling of the repeated outcomes and estimating methods can be found in

Agresti [4]. The statistical software *SAS* supports GEE analysis. In this software, the Genmod procedure is a well-designed statistical tool for fitting the described model.

Results

The study sample consisted of 446 (51.4%) male and 421 (48.6%) female students. The proportion of students whose fathers had low, moderate or high educational level was 6.2%, 85.6% and 8.2% respectively. The proportions for mothers were 12.8%, 83.0% and 4.2% respectively.

It was found that 2.7% of students never used a toothbrush, 26.0% used it irregularly, 51.1% once a day and 20.3% twice or more a day. For flossing, these proportions were 62.7%, 30.2%, 5.8% and 1.3% respectively. Use of both toothbrush and floss at least once a day was reported for 5.8% of students. Only 14.4% of students reported having regular preventive dental visits. None of the schools were reported to organize regular preventive dental visits or school-based oral hygiene programmes.

A total of 45 students (5.2%) had 1 extracted tooth and 4 students (0.5%) had 2 extracted teeth. Periodontal examinations revealed that only 11.3% of students (17.3%

of males and 5.0% of females) had a healthy periodontium (CPI score 0 for all sextants), while 12.0% had bleeding on probing, 46.0% had gingival calculus, 30.4% had shallow pockets and 0.3% had deep pockets in their jaw sextants (Table 1).

A proportional odds regression model was used to identify the significant risk indicators of periodontal disease in this population (Table 2). The results of GEE analysis showed that all the described factors, except level 3 of the brushing variable (using toothbrush once a day), were significantly associated with the presence of periodontal disease. In other words, periodontal disease was more prevalent in females [odds ratio (OR) = 1.83, 95% CI: 1.55–2.16], students who had fathers with low (OR = 4.81, 95% CI: 2.91–7.97) or moderate educational level (OR = 1.46, 95% CI: 1.05–2.03), mothers with low (OR = 4.97, 95% CI: 3.93–6.30) or moderate educational level (OR = 1.91, 95% CI: 1.06–3.44), students who did not use a toothbrush (OR = 7.0, 95% CI: 4.23–11.60) or floss regularly (OR = 12.76, 95% CI: 8.87–18.38), and students who referred to dentists only in emergency situations (OR = 1.82, 95% CI: 1.44–2.30). Moreover, presence of an extracted tooth in each sextant was another significant risk

Table 1 Community periodontal index (CPI) scores of 867 students aged 15–19 years in Tehran, Islamic Republic of Iran

CPI score	Sextant												Maximum CPI scores	
	Upper right		Upper anterior		Upper left		Lower right		Lower anterior		Lower left			
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
0	368	42.4	598	69.0	348	40.1	458	52.8	347	40.0	445	51.3	98	11.3
1	122	14.1	152	17.5	104	12.0	147	17.0	121	14.0	153	17.6	104	12.0
2	253	29.2	70	8.1	257	29.6	159	18.3	332	38.3	171	19.7	398	45.9
3	122	14.1	47	5.4	158	18.2	103	11.9	66	7.6	98	11.3	264	30.4
4	2	0.2	0	0.0	0	0.0	0	0.0	1	0.1	0	0.0	3	0.3

Table 2 Estimates from the multivariate proportional odds regression model

Parameter	Est ^a	SE	P-value ^b	OR	95% CI
<i>Sex</i>					
Female	0.604	0.084	< 0.001	1.83	1.55–2.16
Male	Reference				
<i>Father's educational level</i>					
Low	0.786	0.252	0.002	4.81	2.91–7.97
Moderate	0.378	0.165	0.022	1.46	1.05–2.03
High	Reference				
<i>Mother's educational level</i>					
Low	0.802	0.118	< 0.001	4.97	3.93–6.30
Moderate	0.649	0.294	0.027	1.91	1.06–3.44
High	Reference				
<i>Toothbrushing</i>					
Never	0.649	0.252	0.010	7.01	4.23–11.60
Irregular	0.298	0.122	0.014	1.82	1.42–2.32
Once a day	0.056	0.101	0.581	1.06	0.86–1.29
Twice or more a day	Reference				
<i>Flossing</i>					
Never	0.849	0.182	< 0.001	12.76	8.87–18.38
Irregular	0.501	0.182	0.006	2.72	1.89–3.92
Once a day	0.334	0.154	0.031	1.40	1.03–1.90
Twice or more a day	Reference				
<i>Dental visits</i>					
Emergency only	0.599	0.117	< 0.001	1.82	1.44–2.30
Preventive	Reference				
<i>Extracted teeth</i>					
Yes	1.673	0.236	< 0.001	5.33	3.32–8.54
No	Reference				

^aEstimate of the model parameter; ^b2-sided P-value.

SE = standard error of the estimate; OR = odds ratio; CI = confidence interval.

indicator for periodontal disease (OR = 5.33, 95% CI: 3.32–8.54).

Discussion

In previous decades, a large number of dental studies were undertaken to assess the prevalence of periodontal disease in different populations. Our findings indicated that only 11.3% of sample students had healthy gingiva. In a study in west Malaysia

involving 762 secondary school students aged 15–18 years, the results showed that 66.8% of students had healthy gingiva, 2.6% had bleeding on probing and 30.6% had gingival calculus. None of the students was found to have shallow or deep gingival pockets [8]. In another oral health study in Latvian 15-year-olds, 90.7% of children had incomplete periodontal health; calculus was recorded in 26.1%, gingival pockets in 25.9% of the sample and 38.7% had gin-

gival bleeding [9]. The results of another study among children aged 11–13 years in Bhopal, India, showed that 50% of the children had healthy gingiva [10]. In Uganda, a survey of oral health among primary and secondary school pupils indicated that 59% of sample students had a healthy periodontium [11]. Another cross-sectional survey in Ghana showed that the prevalence of gingival calculus among children aged 13–16 years was about 67% [12]. Comparing these results with our findings shows poor periodontal hygiene in our high schools, even compared with some other developing countries.

Our findings about self-care behaviour such as toothbrushing and flossing showed that about 71% of the students used a toothbrush once or more a day, while only 8% of them used floss regularly. In a study in Portugal, toothbrushing twice a day was reported for 31% of 6-year-olds and 55.6% of 12-year-olds [13]. In another cross-sectional research in Nigeria, using a toothbrush and toothpaste was reported in 20% of schoolchildren in an urban area and 10.4% in a rural area [14]. Also, it was demonstrated that 49% of male and 89% of female students aged 14–16 years in Jordan brushed their teeth on a regular basis [15].

In our study, less than 15% of students were reported to have regular preventive dental visits. This result shows poor prevention dental services in Tehran high schools. Other research in Portugal [13] and Singapore [1] showed that substantial proportions of schoolchildren receive preventive dental services in their schools.

The results of multivariate regression analysis showed that sex, parents' educational level, using toothbrush and floss, preventive dental visits and presence of extracted teeth had a significant effect on

periodontal condition in high-school students. Other studies in different age groups showed that factors such as plaque score, number of missing teeth, age, race, current smoking status, regularity of dental visits, brushing and flossing frequency, nationality and educational level were significant risk indicators for periodontal disease [8,13,15–17]. Our study showed that periodontal disease was more prevalent in female students. Hormonal changes in this age group may explain this finding. In another survey, however, the researchers revealed a slightly higher prevalence of calculus formation in male students [8]. In addition, other studies showed that males had higher risk for periodontal disease compared with females, especially in older age groups [17,18].

Smoking is another important risk factor for periodontal disease [16,17,19]. In our country, because of traditional and cultural beliefs, teenage smokers are unlikely to admit the habit, so obtaining reliable information about this factor is almost impossible. For this reason, we did not include this factor in our analysis.

To summarize, our study showed poor periodontal hygiene among high-school students in Tehran. Lack of school-based preventive dental health programmes is a crucial health problem in this city. The high prevalence of periodontal disease and lack of dental health services in Tehran high schools are worrisome, because, as the capital of Islamic Republic of Iran, Tehran has better health facilities as well as higher socioeconomic level compared to other cities and rural areas in our country. As the final conclusion, we emphasize that further implementation of school-based oral health promotion and instigation of preventive strategies are urgently needed in our country.

References

1. Lam LG, Bagramian RA, Peng LL. Periodontal health of Singapore school children over two decades from 1970 to 1994. *Singapore dental journal*, 2000, 23:18–23.
2. Ainamo J et al. Development of the World Health Organization (WHO) community periodontal index of treatment needs (CPITN). *International dental journal*, 1982, 32:281–91.
3. Cutress TW, Ainamo J, Sardo-Infirri J. The community periodontal index of treatment needs (CPITN) procedure for population groups and individuals. *International dental journal*, 1987, 37:222–33.
4. Agresti A. *Categorical data analysis*. New York, John Wiley and Sons, 1990:347–85.
5. McCullagh P. Regression models for ordinal data (with discussion). *Journal of the Royal Statistical Society, Series B*, 1980, 42:109–42.
6. Liang KY, Zeger SL. Longitudinal data analysis using generalized linear models. *Biometrika*, 1986, 73:13–22.
7. Lipsitz SR, Kim K, Zhao L. Analysis of repeated categorical data using generalized estimating equations. *Statistics in medicine*, 1994, 13:1149–63.
8. Abdul-Kabir R. Periodontal profile of 15- to 19-year-old West Malaysian secondary school students. *Journal of Nihon University School of Dentistry*, 1994, 36:34–9.
9. Bjarnason S, Berzina S, Care R. Oral health in Latvian 15-year-olds. *European journal of oral sciences*, 1995, 103:274–9.
10. Christensen LB, Petersen PE, Bhambal A. Oral health and oral health behavior among 11–13-year-olds in Bhopal, India. *Community dental health*, 2003, 20:153–8.
11. Wandera M, Twa-Twa J. Baseline survey of oral health of primary and secondary school pupils in Uganda. *African health sciences*, 2003, 3:19–22.
12. Bruce I, Addo ME, Ndanu T. Oral health status of peri-urban schoolchildren in Accra, Ghana. *International dental journal*, 2002, 52:278–82.
13. De Almeida CM et al. Changing oral health status of 6- and 12-year-old schoolchildren in Portugal. *Community dental health*, 2003, 20:211–6.
14. Sofola OO, Shaba OP, Jeboda SO. Oral hygiene and periodontal treatment needs of urban school children compared with that of rural children in Lagos State, Nigeria. *Odonto-stomatologie tropicale*, 2003, 26:25–9.
15. Taani DS, Al-Wahadni AM, Al-Omari M. The effect of frequency of toothbrushing on oral health of 14–16 year olds. *Journal of the Irish Dental Association*, 2003, 49:15–20.
16. Sbaralia M, Turnbull RS, Locker D. Risk indicators for periodontal disease in a remote Canadian community: a dental practice-based study. *Journal of public health dentistry*, 2002, 62:51–6.
17. Dye BA, Vargas CM. The use of a modified CPITN approach to estimate periodontal treatment needs among adults aged 20–79 years by socio-demographic characteristics in the United States, 1988–94. *Community dental health*, 2002, 19:215–23.
18. Frencken JE et al. National oral health survey Zimbabwe 1995: periodontal conditions. *International dental journal*, 1999, 49:10–4.
19. Amarasena N et al. Tobacco use and oral hygiene as risk indicators for periodontitis. *Community dentistry and oral epidemiology*, 2002, 30:115–23.