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

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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.

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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 toothbrushing, 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. 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 and then 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 subgingival 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 periodontologist. 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>
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<tr>
<th>Table 1</th>
<th>Community periodontal index (CPI) scores of 867 students aged 15–19 years in Tehran, Islamic Republic of Iran</th>
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</thead>
<tbody>
<tr>
<td>CPI</td>
<td>Upper right No. %</td>
</tr>
<tr>
<td>0</td>
<td>368 42.4</td>
</tr>
<tr>
<td>1</td>
<td>122 14.1</td>
</tr>
<tr>
<td>2</td>
<td>253 29.2</td>
</tr>
<tr>
<td>3</td>
<td>122 14.1</td>
</tr>
<tr>
<td>4</td>
<td>2 0.2</td>
</tr>
</tbody>
</table>
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


