Smoking, Tooth Brushing and Oral Cleanliness among 15-year-olds in Tehran, Iran

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Purpose: To assess smoking, tooth brushing and oral cleanliness and their relationships among 15-year-olds in Tehran, Iran.

Materials and Methods: A cross-sectional study based on World Health Organization criteria and the methods of the Second International Collaborative Study was carried out in autumn 2004 among 15-year-olds (n = 502) in Tehran. Data were based on a self-administered questionnaire and a clinical dental examination.

Results: Smokers comprised 5% of the boys and 2% of the girls ($p = 0.02$). Smoking was more common among students of less-educated parents (50% vs. 30%, $p < 0.05$). Of all students, 26% reported twice-daily tooth brushing; those of higher socio-economic backgrounds and girls did so more frequently. Of the smokers, 11% reported no tooth brushing compared to 6% of the non-smokers. Oral cleanliness was good for 13%, moderate for 32%, and poor for 55%; the rates associated positively with female gender ($p = 0.002$), having higher-educated parents ($p = 0.03$), and reporting a higher frequency of tooth brushing ($p < 0.001$). Those students reporting twice-daily tooth brushing had less dental plaque and gingival bleeding ($p \leq 0.01$) on both anterior and posterior teeth. In multivariable analyses, the best predictors for a good level of oral cleanliness were female gender (OR = 2.0) or twice-daily tooth brushing (OR = 1.7).

Conclusion: Oral cleanliness and tooth brushing among 15-year-olds were at poor levels, particularly among boys. Such poor levels call for intensive attempts to enhance rates of twice-daily tooth brushing and to improve its quality. For this age group, anti-smoking purposes should be combined into school-based oral health promotion programmes as well.

Key words: adolescents, oral cleanliness, smoking, tooth brushing

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The causes of major dental diseases and their mostly preventable nature are well known (Blinkhorn, 1998; Kidd and Fejerskov, 2003; Sheiham and Watt, 2003) and strongly affected by individual life styles (Honkala, 1993; Inglehart and Tedesco, 1995; Petersen, 2003). During adolescence, young people are able to assume responsibility for learning and maintaining health-related attitudes and behaviours that carry over into adulthood (Åstrom and Jakobsen, 1998; Åstrom and Samdal, 2001; Honkala et al, 2002). Such learning can lead to stable patterns of physical activity, positive dietary habits, and the avoidance of smoking (Kelder et al, 1994; Singer et al, 1995).

Smoking is a global problem among adolescents and young adults: 10% to 30% of 13–15-year-olds worldwide are smokers (Machay and Eriksen, 2002; Petersen, 2003). Recent studies have shown that smoking, a cause of several general diseases, is also a predictor for periodontal disease (Epping-Jordan et al, 2005; Bergström, 2006).

Effective removal of dental plaque is essential to dental and periodontal health throughout one's lifetime (Löe, 2000; Albandar and Tinoco, 2002). Dental

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professionals generally agree that tooth brushing, as a mechanical measure for removing dental plaque, is the most appropriate and effective oral hygiene habit (Honkala, 1993; Löe, 2000; Vehkalahti and Widström, 2004). Consequently, twice-daily tooth brushing is generally recommended (Löe, 2000; Pine et al, 2000). Tooth brushing is not only an oral health behaviour, but is also a predictor for the future lifestyle of adolescents (Macgregor et al, 1996; Koivusilta et al, 2003).

In Europe and North America, 18% to 86% of adolescents report twice-daily tooth brushing (Maes and Honkala, 2006), whereas in the Eastern Mediterranean region, in countries such as Jordan, Saudi Arabia, and Sudan, corresponding rates range from 33% to 62% (Rajab et al, 2002; Farsi et al, 2004; Darout et al, 2005). No corresponding data are available for Iran.

The present study investigated smoking, tooth brushing, oral cleanliness and their relationships among 15-year-olds in Tehran, Iran.

MATERIALS AND METHODS

The present cross-sectional study was carried out among 15-year-olds at public schools in Tehran, Iran (Yazdani et al, 2006). Our sampling procedure included a random selection of 17 public schools from a list provided by Tehran's Head Office for Education (HOET). One class of 15-year-olds was randomly selected from each school and all students were invited to participate. Participation was voluntary, and each student provided his or her informed consent. All completed a questionnaire, but three students refused to attend the clinical dental examination, and were thus excluded. The final sample comprised 502 students: 260 boys and 242 girls. The present study was approved by the Ethics Committee and by the Iran Center for Dental Research at the School of Dentistry, Shaheed Beheshti University of Medical Sciences.

Data collection included clinical examination based on World Health Organization (WHO) criteria and a self-administered structured questionnaire, the framework of which was based on the Second International Collaborative Study (ICSII) (WHO, 1997; Chen et al, 1997). The questionnaire, which inquired about smoking, tooth brushing, demographic and socio-economic background, was completed and returned in the class prior to the clinical dental examination.

Smoking status was enquired with the following questions: 'Do your parents or relatives living in your home smoke cigarettes?', 'Do any of your friends smoke cigarettes?', 'Do you smoke cigarettes?' and 'How old were you when you first tried smoking?'

Tooth brushing was enquired about with the following two questions: 'How often do you usually brush your teeth?' (five alternative answers were available: irregularly or never, once a week, a few (2–3) times a week, once a day, and more than once a day) and 'When do you usually brush your teeth?' (the following alternatives were to be answered either yes or no: in the morning, in the evening, after meals, after eating sweet snacks, and I do not brush).

The students' socio-economic background was defined on three dimensions: 1) the wealth status of the family (good = living in own house, poor = living in a rented house), 2) location of the school (affluent and non-affluent, based on HOET information), and 3) the highest level of education attained by either parent. The latter was obtained separately for father and mother by offering six alternatives, which in the analyses were categorised into three: low (illiterate, primary, or secondary school degree), medium (high school, diploma degree), and high (university degree).

The clinical dental examination was performed during school hours in the health office of the school in a comfortable chair with the use of a headlamp, a mouth mirror, and a WHO probe (Yazdani et al, 2006). Findings on dental plaque and gingival bleeding were recorded separately for each of the index teeth (16, 11, 26, 36, 31, and 46) using the bleeding on probing index (BI) and a modification of the plaque index (PI). The BI recordings as a dichotomy on the presence or absence of bleeding followed the same criteria as described for the Community Periodontal Index of Treatment Needs (CPITN) (WHO, 1997). For the present study, the original PI (Silness and Löe, 1964) was modified to include the following scores: 0 = no plaque, 1 = plaque on the gingival margin only, and 2 = plaque elsewhere. Furthermore, the sums of the six PI scores and of the six BI scores separately served to describe individual oral cleanliness (with a maximal PI sum of 12) and bleeding (with a maximal BI sum of 6). In addition, the sum of PI scores was later categorised as three levels of oral cleanliness: good (scores up to 4), moderate (scores from 5 to 9) and poor (scores from 10 to 12).

Statistical evaluation of the differences between the subgroups included ANOVA for mean values and the chi-square test for frequencies. Three logistic regression models were fitted to the data, to explain factors related to: a) reporting twice-daily tooth brushing, b) being a non-smoker and c) exhibiting a good level of oral cleanliness. Controlling for socio-economic backgrounds, the models produced odds ratios (OR) and their 95% confidence intervals. Goodness of fit was evaluated by means of the Hosmer and Lemeshow test.

Table 1 Distribution (%) of 15-year-olds (n = 502) in Tehran, Iran, by their frequency of tooth brushing, according to gender and socio-economic backgrounds

Frequency of tooth brushing	Location of school		Wealth status of family[1]		Levels of parental education			Gender	
	Non-affluent n = 226 %	Affluent n = 276 %	Poor n = 137 %	Good n = 351 %	High n = 165 %	Moderate n = 181 %	Low n = 156 %	Girls n = 242 %	Boys n = 260 %
Twice daily	18	32	18	30	33	27	17	38	15
Once daily	43	43	54	38	43	46	40	44	42
Less than daily	39	25	28	32	24	27	43	18	43
	p < 0.001		p = 0.004		p = 0.001			p < 0.001	

[1] Good = living in own house; Poor = living in a rented house.
Statistical evaluation by chi-square test for differences in tooth brushing.

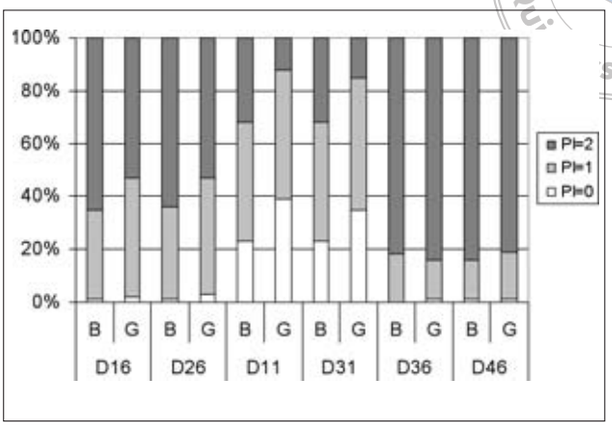

Fig 1 Distribution (%) of plaque index (PI) scores for each index tooth (D), among 15-year-olds (n = 502) in Tehran, Iran, separately for boys (B) and girls (G).

RESULTS

Smokers comprised 5% of the boys and 2% of the girls (p = 0.02). Half of the smokers had recently begun smoking at 15 years of age. Smoking rates were higher for students of less-educated parents (50% vs. 30%, p < 0.05). Of all students, 43% reported having smokers in the family; 24% of boys and 8% of girls (p < 0.001) had smokers among their friends.

Of all students, 26% reported brushing their teeth twice daily, 42% once daily, and 32% less than daily and never. Table 1 shows tooth-brushing frequencies according to the students' background information. Higher rates of twice-daily tooth brushing were reported by girls, by students from families with a good wealth status or a high level of parental education, and by students attending affluent schools.

The most common time for brushing was in the evening (65%), followed by the morning (40%), after meals (20%) and after eating sweet snacks (10%). More girls than boys reported brushing in the morning (56% vs. 28%, p = 0.01) and after eating sweet snacks (13% vs. 7%; p = 0.02).

Non-smokers reported twice-daily tooth brushing more frequently than did the smokers (26% vs. 11%); 11% of the smokers and 6% of the non-smokers reported no tooth brushing at all.

Dental plaque was found on at least one index tooth of all the students. Figure 1 shows distributions of the PI scores for each index tooth, separately for boys and girls. For boys, 22% of the anterior teeth were free from plaque, and for girls, 35% to 39%; for posterior teeth, these figures were below 5%.

Table 2 Oral cleanliness and gingival bleeding according to frequency of tooth brushing, indicated by sums of plaque index (PI) scores and bleeding index (BI) scores, and reported separately for anterior and posterior teeth of 15-year-olds (n = 502) in Tehran, Iran

	Twice daily Mean (SD)	Once daily Mean (SD)	Less than daily Mean (SD)	P
Boys (n = 260)	n = 39	n = 110	n = 111	
Anterior teeth				
PI sum	1.6 (1.4)	1.9 (1.4)	2.6 (1.3)	0.000
BI sum	0.5 (0.8)	0.7 (0.9)	1.1 (0.9)	0.007
Posterior teeth				
PI sum	6.4 (1.9)	6.7 (1.6)	7.2 (1.3)	0.005
BI sum	3.0 (1.2)	2.9 (1.4)	3.4 (1.1)	0.014
Girls (n = 242)	n = 89	n = 108	n = 45	
Anterior teeth				
PI sum	1.2 (1.2)	1.5 (1.2)	2.0 (1.4)	0.009
BI sum	0.3 (0.7)	0.5 (0.8)	0.9 (0.9)	0.002
Posterior teeth				
PI sum	6.3 (1.5)	6.7 (1.5)	7.2 (1.2)	0.004
BI sum	2.6 (1.4)	3.1 (1.2)	3.6 (0.9)	0.000

SD = Standard Deviation

Table 3 Factors related to non-smoking and reporting twice-daily tooth brushing among 15-year-olds in Tehran, Iran according to gender and socio-economic backgrounds, by means of logistic regression modelling

Dependent variable and parameters	Estimate of strength	SE	OR	95% CI	P
Reporting non-smoking					
Gender: 0 = Boy, 1 = Girl	1.489	0.581	4.4	1.4–13.8	0.010
Level of parental education	-0.097	0.196	0.9	0.6–1.3	0.620
Wealth status of the family[1]: 0 = Poor, 1 = Good	0.766	0.496	2.1	0.8–5.6	0.123
Location of the school:					
0 = Non-affluent area, 1 = Affluent area	0.106	0.051	1.1	1.0–1.2	0.038
Constant	-0.527				
Goodness of fit[2], p-value = 0.470					
Reporting twice-daily tooth brushing					
Gender: 0 = Boy, 1 = Girl	1.240	0.245	3.4	2.1–5.6	0.000
Level of parental education	0.234	0.093	1.2	1.0–1.5	0.012
Wealth status of the family[1]: 0 = Poor, 1 = Good	0.485	0.268	1.6	0.9–2.7	0.071
Location of the school:					
0 = Non-affluent area, 1 = Affluent area	0.021	0.022	1.0	0.9–1.7	0.349
Smoking: 0 = Yes, 1 = No	0.554	0.785	1.7	0.3–8.1	0.480
Constant	-5.894				
Goodness of fit[2], p-value = 0.119					

[1] Good = living in own house; Poor = living in a rented house.[2] Hosmer and Lemeshow test.

Oral cleanliness expressed as the sum of PI scores was good for 13%, moderate for 32%, and poor for 55%. Poor oral cleanliness was most common among boys (63%; $p < 0.001$) and among students of less-educated parents (64%; $p = 0.03$). On average, the PI sum (maximum = 12) was 8.2 for girls and 9.1 for boys ($p < 0.001$), and the BI sum (maximum = 6), was 3.6 for girls and 4.0 for boys ($p = 0.03$).

Table 2 shows oral cleanliness separately for anterior and posterior teeth, according to the tooth-brushing frequency reported. For those boys and girls who reported twice-daily tooth brushing, both their anterior

Table 4 Factors related to good oral cleanliness among 15-year-olds (n = 502) in Tehran, Iran, according to gender, socio-economic background, tooth-brushing frequency and smoking status, by means of logistic regression modelling

Parameters in the model	Estimate of strength	SE	OR	95% CI	P
Gender: 0 = Boy, 1 = Girl	0.702	0.314	2.0	1.0–3.7	0.025
Level of parental education	0.060	0.119	1.0	0.8–1.3	0.614
Wealth status of the family[1]: 0 = Poor, 1 = Good	0.036	0.327	1.0	0.5–1.9	0.913
Location of the school:					
0 = Non-affluent area, 1 = Affluent area	0.046	0.029	1.0	0.9–1.1	0.112
Frequency of tooth brushing:					
0 = Less than twice daily, 1 = Twice daily	0.544	0.119	1.7	1.3–2.1	0.000
Smoking: 0 = No, 1 = Yes	0.864	0.769	2.4	0.5–10.7	0.261
Constant	-4.254				
Goodness of fit[2], p-value = 0.815					

[1] Good = living in own house; Poor = living in a rented house.

[2] Hosmer and Lemeshow test.

and posterior teeth exhibited better oral cleanliness than did the teeth of those brushing their teeth less frequently, as indicated by the lowest values of the PI and BI sums. Consequently, the PI and BI sums were highest both on anterior and posterior teeth for those reporting less than daily tooth brushing. All differences were statistically highly significant.

Table 3 shows the results of two logistic regression models controlling for the students' socio-economic backgrounds. Non-smoking was more likely for girls (OR = 4.4, p = 0.01) and for students attending affluent schools (OR = 1.1, p = 0.04). Twice-daily tooth brushing was more likely for girls (OR = 3.4, p < 0.001) and for students whose parents have a high level of education (OR = 1.2, p = 0.01).

Table 4 shows the strength of the subjects' twice-daily tooth brushing (OR = 1.7, p < 0.001) and female gender (OR = 2.0, p = 0.03) for belonging to the category of having a good level of oral cleanliness, after controlling for their socio-economic backgrounds.

DISCUSSION

Despite our positive findings of low rates of smoking among 15-year-olds, the present results revealed huge gaps in achieving the recommended level of tooth brushing and, consequently, in levels of oral cleanliness. However, twice-daily tooth brushing showed its impact on oral cleanliness regardless of the students' socio-economic backgrounds. Because schools can provide platforms for the provision of preventive oral health services and programmes for this age group (Petersen, 2003) and because most of 15-year-olds still attend school, authorities should take advantage of this age group's accessibility for such activities.

The promotion of oral health among adolescents is a priority in the objectives set by the WHO (Petersen, 2003), with 15-year-olds being one of the index age groups the WHO suggests including in oral health studies (WHO, 1997). Unfortunately, data on oral self-care and oral hygiene among 15-year-olds in general seem scarce (Corbet et al, 2002). With regard to the Middle East, some reports from countries other than Iran have been published (Vigild et al, 1999; Rajab et al, 2002; Farsi et al, 2004). In Iran, no previous studies have examined the relationship between oral self-care and smoking among adolescents.

Compared to other countries (Almas et al, 2002; Machay and Eriksen, 2002; Yorulmaz, 2002), the rates of smoking among the 15-year-olds in the present study were exceptionally low. Traditional, social, and cultural beliefs in Iran may, however, have led to underreporting of smoking. Nevertheless, more smokers than non-smokers reported having smoking friends. This indicates the importance of the role of one's friends in his or her likelihood to become a smoker, and should, therefore, be taken into consideration while organising anti-smoking activities for adolescents.

Our finding on the commencement of smoking at 15 years of age is in agreement with those of previous

studies (Yorulmaz et al, 2002; Sarrafzadegan et al, 2004). Because half of those who begin smoking in adolescence will continue their smoking for the next 15 to 20 years (WHO, 2002), anti-smoking programmes for this age group should be organised either to postpone or to totally discourage them from becoming smokers, and thus avoid the long-term health hazards of smoking.

Fewer girls than boys reported as being smokers, which is in line with previous studies (Åstrom and Samdal, 2001; Yorulmaz et al, 2002; Sarrafzadegan et al, 2004). In addition, attending school in an affluent area remained a significant factor in the logistic regression model for reporting non-smoking. These results call for greater emphasis on targeting anti-smoking activities, especially among boys and those adolescents living in less affluent areas.

Twice-daily tooth brushing in the present study was more frequent among girls than boys, a finding which seems universal among adolescents (Chen et al, 1997; Kuusela et al, 1997; Maes and Honkala, 2006). Also in line with previous studies (Albandar, 2002; Maes and Honkala, 2006), twice-daily tooth brushing was more frequent among students of higher socioeconomic backgrounds, thus reflecting the value such families place on proper oral self-care. In the present study, fewer smokers than non-smokers reported twice-daily tooth brushing, which is in line with a recent Japanese study (Harada et al, 2005). This shared finding again indicates the importance of comprehensive oral health education, including anti-smoking activities and vice versa.

As in previous studies, more than half of the students in the present study were diagnosed with poor oral hygiene (Albandar and Tinoco, 2002; Corbet et al, 2002; Pakshir, 2004). An important result, however, was the clear relationship between a higher frequency of tooth brushing and fewer findings of dental plaque and gingival bleeding, which was confirmed separately for boys and girls, both on their anterior and posterior teeth. This can be considered a positive sign of the role of the frequency of tooth brushing, yet at the same time calls for improvement in the quality of brushing. Based on the logistic regression analyses, boys in particular appear to need intensive instructions on tooth brushing.

CONCLUSION

Oral cleanliness and tooth brushing among 15-year-olds were at poor levels, particularly among boys. Such poor levels call for intensive attempts to enhance rates of twice-daily tooth brushing and to improve its quality. For this age group, anti-smoking purposes should be combined into school-based oral health promotion programmes as well.

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