

# Evaluation of gingival bleeding awareness by comparison of self-reports and clinical measurements of freshman dental students

Ulku Baser<sup>1</sup>, Meliha Germen<sup>1</sup>, Yelda Erdem<sup>2</sup>, Halim Issever<sup>3</sup>, Funda Yalcin<sup>1</sup>

**Correspondence:** Dr. Ulku Baser  
Email: baserulku@hotmail.com

<sup>1</sup>Department of Periodontology, Faculty of Dentistry, Istanbul University, Istanbul, Turkiye,  
<sup>2</sup>Undergraduate Student, Faculty of Dentistry, Istanbul University, Istanbul, Turkiye,  
<sup>3</sup>Department of Public Health, Faculty of Medicine, Istanbul University, Istanbul, Turkiye

## ABSTRACT

**Objective:** The aims of this descriptive, cross-sectional investigation were to evaluate the gingival health awareness of dental students by comparing their clinical gingival bleeding scores and self-reports, and to compare differences in awareness between males and females. **Methods:** In total, 100 (51 males, 49 females) freshman dental students were included in the study. Periodontal indices recorded were: Presence of plaque percentage (plaque index [PI], %), percentage of sites of bleeding on probing (BOP, %), probing depth, and community periodontal index (CPI). Percent agreement, kappa agreement, sensitivity, and specificity were calculated by comparing their self-reported gingival bleeding and BOP%. **Results:** The self-reports of gingival bleeding exhibited statistically significant correlations with BOP% in females ( $r = 0.42$ ,  $P = 0.003$ ). Female students showed a higher degree of awareness when kappa agreement, 0.23 (males: 0.16, females: 0.39), sensitivity, 48% (males: 42%, females: 51%), and specificity, 95% (males: 90%, females: 100%) were calculated. Although male dental students had higher PI and CPI scores, there was no significant difference by gender in the clinical measurements. **Conclusions:** According to our results, the validity of self-reported gingival bleeding was higher among dental students than in previous population-based studies. Female dental students showed a higher degree of awareness than males of their gingival health. Half of the included dental students could not differentiate whether they had gingival bleeding when there was actual bleeding. More emphasis should be given to the education of dental students regarding the relationship between gingival bleeding and active periodontal disease.

**Key words:** Awareness, dental, gingival bleeding, gingivitis, self-report, sex differences, students

## INTRODUCTION

Gingivitis, inflammation of gingival tissues in the absence of clinical attachment loss, is one of the most common human diseases. Redness, edema, and bleeding on probing (BOP) characterize the condition. Gingival bleeding has been used to indicate the presence of an inflammatory lesion, and is considered the most sensitive indicator of early gingival pathology.<sup>[1-3]</sup>

Self-report is a widely used method to assess the prevalence of various medical conditions.<sup>[4,5]</sup> It has

also been investigated as a possible alternative to clinical periodontal assessment.<sup>[6,7]</sup> Self-reported periodontal measures, if found to be valid, would be very useful. However, self-report has rarely been used as a diagnostic measure for periodontal disease (PD).

Clinical data are the gold standard for determining PD prevalence. This is because the disease often lacks pain and symptoms are subjective and the disease is often dismissed even in subjects with already established PD. However, self-reporting might be useful as a tool

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to measure the awareness of subjects by comparing it with clinical measurements.

There are reports of studies from various countries on dental students' oral health, knowledge and behaviors.<sup>[8-15]</sup> Khami *et al.*<sup>[8]</sup> and Al-Omiri *et al.*<sup>[12]</sup> indicated that oral health behavior in female students was better than in male dental students. In Turkey, Peker and Alkurt showed that dental health care in female dental students was better than in males according to the HU-DUBI survey.<sup>[14]</sup> However, none of the studies evaluated the gingival health awareness of dental students by comparing their self-reports with actual gingival bleeding.

Validation of self-reported gingival bleeding in dental students in terms of awareness of their gingival health might be an important measure as a determinant of positive health behavior. Thus, efforts to improve dental students' awareness of personal periodontal health status could affect their perspective in performing dentistry as future health promoters. The purpose of this study was to assess the gingival health awareness of dental students by comparing self-reported gingival bleeding and clinical BOP values by calculating the sensitivity and specificity and also comparing male and female dental students' awareness levels.

## METHODS

The study was conducted among freshman dental students from Istanbul University University, Faculty of Dentistry. In total, 51 male and 49 female students were included. The data were collected between December 2011 and April 2012.

Oral and systemic anamnesis were performed and a questionnaire form was used to assess knowledge of oral health and lifestyle. Students; with systemic diseases such as diabetes, hypertension, autoimmune diseases, having antibiotic or anti-inflammatory drugs within the last 6 months, with history of periodontal therapy within the last 6 months were not included in the study.

Clinical measurements were recorded to evaluate the students' periodontal status. According to the self-report and clinical measurements of the subjects, sensitivity, specificity, percent agreement and kappa agreement were calculated. The study was approved by the Ethics Committee of Istanbul University, Faculty of Medicine (2012/891-1085).

## Questionnaire

A questionnaire was used to examine the following variables: Lifestyle, dental knowledge, dental attitude, and oral health behaviors.

### *Lifestyle*

The subjects reported the seven general health habits in daily life (yes/no) suggested by Belloc and Breslow.<sup>[16]</sup> The lifestyle score was determined by the sum of positive responses to the following items: (1) No experience of smoking, (2) no experience of drinking alcohol, (3) regular physical exercise, (4) maintaining proper weight, (5) sleeping regularly, (6) eating breakfast every day, and (7) not eating between meals.

### *Dental knowledge*

The subjects were asked if they knew the following dental terms: Dental floss, dental plaque, calculus, temporomandibular joint disorder, PD.

### *Oral health behaviors*

Questions were asked about tooth-brushing frequency, use of dental floss, an interdental brush, a toothpick, and dental check-up frequency in the last year.

## Periodontal examination

Periodontal condition was assessed using the community periodontal index (CPI).<sup>[17]</sup> In total, 12 teeth were selected for periodontal examination (one incisor, one premolar, and one molar from each quadrant). Clinical recordings included presence of plaque percentage (plaque index [PI]),<sup>[18]</sup> percentage of sites BOP,<sup>[18]</sup> and probing pocket depth. WHO probe (CPI probe) was used for CPI measurements and Williams periodontal probe (Hu-Friedy, Chicago, IL) was used for other periodontal clinical indices. A single calibrated periodontist performed all clinical evaluations.

### *Sensitivity and specificity calculations*

Sensitivity calculations were determined as the proportion of the subjects who answered the question "Do you have bleeding gums?" as "positive" to the proportion of subjects who had >10% gingival bleeding during the periodontal examination.

Specificity calculations were determined as the proportion of the subjects who answered the question "Do you have bleeding gums?" as "negative" to the subjects who had <10% gingival bleeding during the periodontal examination.

### Statistical analysis

Data were evaluated with the SPSS software (SPSS Inc., Chicago, IL). The Chi-squared and *t*-tests were used to identify statistically significant differences between distributions or means. Pearson's correlation coefficients (*r*), percentage agreement, kappa statistics and sensitivity/specificity analyses were used to assess the validity of self-assessments. The analysis between self-reports of gingival bleeding and BOP% was made after dichotomizing as less and >10% bleeding sites. The Chi-squared and Mann-Whitney U-tests were used to compare periodontal clinical measurements between male and female students.

## RESULTS

Data from systemically healthy 100 dental students (51 males, 49 females) were analysed in this study. The results of the questionnaire about lifestyle score, dental knowledge, and oral health behaviors are presented in Table 1. All of the students knew the dental terms in the questionnaire. While 46 of 49 female students brushed their teeth at least twice daily, only 34 of 51 males did so ( $P = 0.02$ ). Males more frequently used toothpicks than females ( $P = 0.01$ ). The prevalence of smoking students was 27%. The duration of smoking and number of cigarettes smoked were significantly higher in male than female students. Gum swelling complaints were more frequent among female than male students ( $P = 0.09$ ). The median of the female students' lifestyle score was 4; the males' was 3 ( $P = 0.05$ ).

Males had higher PI scores than females but the difference was not statistically significant ( $P = 0.06$ ). % BOP was similar between the groups:  $29 \pm 0.20$  for females and  $31 \pm 0.21$  for males [ $P = 0.6$ ; Table 2]. Female and male students both had one subject with CPI Code 3. There were 33 female and 40 male subjects with CPI Code 2. There was no significant difference between males and females [ $P = 0.06$ ; Table 3].

Gingival bleeding and the self-reported distribution of female and male students are shown in Table 4.

The levels of correlation, percentage agreement, kappa agreement, sensitivity, and specificity between BOP percentage and self-reported bleeding of males, females, and all dental students are shown in Table 5. Separate calculations revealed that gender was a significant determinant of the agreement between self-reported bleeding and BOP%. Female dental students' sensitivity and specificity results were

**Table 1: Questionnaire responses regarding lifestyle score, dental knowledge, and oral health behaviors of female and male students**

Smoking Habits	Females (n=49)	Males (n=51)	P value
Smoking	6	21	0.001*
Nonsmoking	43	30	
Duration of smoking (years)			
0-1	3	5	0.01*
1-5	5	14	
Cigarette smoking (days)			
1-10	5	15	0.04*
≥10	1	6	
Dental visit frequency			
None	35	42	0.06
Every 6 months	9	2	
Within every 2 years	5	7	
Coping with pain			
Dental visit	31	30	0.7
Taking medicine	8	7	
Brushing	4	4	
None	6	6	
Tooth-brushing (≥twice daily)	46	34	0.02*
Dental floss (usage)	17	15	0.5
Toothpick (usage)	14	26	0.01*
Interdental brush usage	3	2	0.6
Gum swelling complaints	12	3	0.09
Lifestyle (score of general health habits) (median)	4	3	0.05

\*Significantly different between males and females,  $P < 0.05$

**Table 2: Periodontal clinical parameters of male and female students (mean±SD)**

Periodontal measurements	Female (n=49)	Male (n=51)	P value
PI score	0.46±0.28	0.57±0.29	0.06
BOP (%)	29±0.20	31±0.21	0.64
PPD (mm)	1.72±0.24	1.79±0.23	0.15
CPI score	1.65±0.63	1.78±0.54	0.06

SD: Standard deviation, PI: Plaque index, BOP: Bleeding on probing, PPD: Periodontal pocket depth, CPI: Community periodontal index

higher than those of male dental students. There was a correlation between self-reported gingival bleeding and BOP% after dichotomizing as less and more than 10% bleeding sites in females ( $r = 0.42$ ,  $P = 0.003$ ). The sensitivity/specificity analyses of self-reported bleeding revealed lower sensitivity than specificity values.

## DISCUSSION

In this study, we sought to evaluate the awareness of self-oral health status in a group of dental students. This is important in two aspects: (1) This

**Table 3: Cumulative distribution of CPI scores of male and female students**

CPI	Sex		Total
	Female	Male	
Code 0			
<i>n</i>	3	2	5
%	6.1	3.9	5
Code 1			
<i>n</i>	12	8	20
%	24.5	15.7	20
Code 2			
<i>n</i>	33	40	73
%	67.3	78.4	73
Code 3			
<i>n</i>	1	1	2
%	2	2	2

Chi-squared test,  $P > 0.05$ . CPI: Community periodontal index

**Table 4: Gingival bleeding and distribution of self-reporting in female and male students**

Self-report distribution	Subjects who had more than 10% gingival bleeding <i>n</i> =80	Subjects who had less than 10% gingival bleeding <i>n</i> =20
Subjects reported gingival bleeding		
Female	20	0
Male	17	1
Total	37	1
Subjects did not report gingival bleeding		
Female	19	10
Male	24	9
Total	43	19

**Table 5: Degree of correlation, percentage agreement, kappa agreement, sensitivity, and specificity between self-reported bleeding and BOP**

BOP % versus self-reported bleeding	<i>r</i>	Agreement %	Kappa	Sensitivity %	Specificity %
Males	0.26	52	0.16	42	90
Females	0.42*	60	0.3*	51	100
All	0.34*	56	0.23*	48	95

Statistical evaluation for correlation coefficient (*r*), \* $P < 0.01$ . In the calculation of percentage agreement, kappa, sensitivity, and specificity, BOP% was dichotomized as less and more than 10% bleeding sites. BOP: Bleeding on probing

homogeneous group of young students represents suitable subject models who might be expected to have high awareness, (2) the awareness levels of these students will directly effect their attitudes during their future patients' oral health education. High awareness of self-reported oral health in a dental student may have a direct impact on the future dentist for patient

education, and this may help to create oral health awareness in the patient population.

Blicher *et al.*<sup>[7]</sup> reviewed 16 studies that assessed the validity of self-reported gingivitis and periodontitis measures against clinical gold standards. According to the review, two measures from the category "Bleeding from gums" showed good validity. The first was from the study of Gilbert and Nuttall,<sup>[19]</sup> with a sensitivity of 35% and specificity of 88%, and the other was by Buhlin *et al.*<sup>[20]</sup> with a sensitivity of 42%, specificity of 76%. No reported study evaluating dental students was found among those of the sensitivity and specificity of BOP% and self-reported bleeding. Our results demonstrated higher sensitivity (48%), and specificity (95%) compared with the previously mentioned population-based studies. The better diagnostic accuracy of these self-reports might be due to the specification of our patient population: Young university dental students.

Dental students are generally motivated to maintain good oral health. However, when examined in details, 80 of 100 dental students had gingival bleeding, according to the threshold that we chose, and of this 80, only 37 reported that they had gingival bleeding; the remaining 43 were apparently unaware of their situation. Unfortunately, only about half of the students with gingival bleeding correctly identified themselves as having gingival disease. Even though self-reported gingival bleeding is unlikely to be a useful diagnostic indicator of periodontal disease (PD is probing depth), we measured the level of awareness of the students using self-reporting, rather than its diagnostic potential.

Several reports support the idea that females possess greater interest in oral health and perceive their oral health to be good to a higher degree than males in young populations.<sup>[21-23]</sup> Female dental students have also been shown to have better oral health knowledge, attitudes, and behaviors than males.<sup>[8,12,14]</sup> Our results are consistent with previous reports that female students had better oral health behaviors and lifestyles than males. Furthermore, we demonstrated that female dental students' self-reports showed higher sensitivity and specificity than males. Moreover, there was a significant correlation between self-reported gingival bleeding and BOP% after dichotomizing as less and more than 10% in females ( $r = 0.42$ ,  $P = 0.003$ ). No significant correlation was seen in male students.

There is general agreement among studies that the sensitivity of self-perceived periodontal health is



fairly poor.<sup>[6,7,19,20]</sup> In their study Dietrich *et al.* they found that self-perceived PD had higher specificity than sensitivity.<sup>[6]</sup> Our results are consistent with previous studies. All female dental students who had <10% gingival bleeding were able to recognise that they did not have gingival bleeding. One male dental student out of 10 reported having gingival bleeding when <10% gingival bleeding was present.

Even though male dental students had higher PI and CPI scores, there was no statistically significant difference between males and females in clinical periodontal measurements (PI:  $P = 0.06$ , CPI:  $P = 0.06$ ). Having a similar BOP% ( $P = 0.6$ ) could be related to the male students' smoking habits. Smoking may be one possible factor masking symptoms, such as gingival bleeding, of PD in males in this study.<sup>[24]</sup> In contrast, swelling was complained of more frequently by females, although they had similar BOP results, and lower PI and CPI scores than males. This may be due to fluctuations in sex hormones during the menstrual cycle that may cause swelling experiences on a monthly cycle.<sup>[25]</sup>

Bleeding on probing percentage was used as the primary outcome of our study for a number of reasons. First, our CPI scores revealed that most students do not have bone resorption, but do have inflammation; this is expected because BOP is widely encountered in the younger age groups and indicates inflammation. One problem is providing objective measures during the assessment of gingival inflammation. In the literature, BOP has been demonstrated as a predictor of the progression of PD<sup>[26]</sup> and a risk factor in PD.<sup>[27]</sup> Additionally, the absence of gingival bleeding has been reported as an indicator of periodontal stability.<sup>[28]</sup> Gingival bleeding is quantitative, objective, and less confusing than gingival swelling or change of gingival contour in terms of measuring gingival health. However, gingival inflammation has no clear cut-off point beyond which the condition should be considered a disease that requires intervention. Sensitivity and specificity depend on the threshold used to define periodontal or gingival disease and are inversely related. In this case, we used a gingivitis threshold of 10% BOP, as described by Offenbacher *et al.*<sup>[29]</sup>

One likely limitation of our study was not determining the menstrual period of female students. However, we have done the measurements and asked the awareness questions at the same day. Therefore, we believe that our results were minimally affected

from the monthly fluctuation of the sex hormones. Furthermore, the sample size of our study is comparatively limited. Another limitation of the study was being a cross-sectional study, which precludes definitive conclusion. Longitudinal studies are necessary to understand the sex differences on oral health awareness and behavior.

## CONCLUSIONS

The behavior of oral health providers and their attitudes towards their own oral health reflect their understanding of the importance of preventive dental procedures and their efforts to improve the oral health of the patients. Within the limitations of this work, we demonstrated higher levels of sensitivity and specificity than previous population-based studies. Although female dental students showed a higher degree of awareness, the percentage of students who were unaware of their gingival bleeding was high in both females and males. More emphasis should be given to the education of dental students regarding the relationship between gingival bleeding and active PD.

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