A survey of oral health status, subjective oral symptoms and oral health behaviors among first-year dental students at a Japanese university

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Abstract

Purpose: The rapid deterioration of oral health in young adults is an alarming problem in Japan. The aim of the present study is to investigate the oral health status, subjective oral symptoms and oral health behaviors of dental students.

Methods: Participants were 108 first-year students attending dental school in 2018-2019. Oral examinations were performed to assess dental caries indices, oral hygiene status, gingival bleeding on probing (BOP) and pocket depth. A self-administered questionnaire was used to assess subjective oral symptoms and oral health behaviors.

Results: The prevalence of decayed teeth (DT) and gingivitis (BOP ≥ 10%) were 43.5% and 50.0%, respectively. Having DT and gingivitis were significantly associated with poorer oral hygiene. No association was observed between DT and subjective symptoms.

Conclusion: Since a relatively high ratio of students had DT and gingivitis without clear subjective symptoms, they require regular dental visits for early treatment and oral hygiene maintenance from the start of their time at university.

Keywords: dental school, oral health behaviors, oral health status, subjective oral symptoms, university students

Introduction

Recent studies have demonstrated that oral diseases are related to systemic diseases such as diabetes and cardiovascular diseases [1-3], and that oral health has a significant impact on holistic health as well as quality of life [4,5]. Dental caries and periodontal disease are major oral diseases faced by patients worldwide, and are the two major causes of tooth loss. One health problem is the rapid deterioration of dental and periodontal conditions in young adults. The prevalence of dental caries reaches its peak at 25 years of age [6,7], and that of periodontal disease becomes an increasing trend in the early 20s [8]. This oral health problem might be caused by several factors in Japan. One is the poor oral health behavior of young adults, as shown in the lower proportion of people in their 20s who received dental checkups in the past year (29.1%), when compared to the proportions of Japanese people aged 30-60 years (37.4%) [Ando et al., J Dent Hlth 62: 41-52, 2012] and Australian people aged 15-24 years (66.6%) [https://www.aihw.gov.au/getmedia/57922dca-62f3-4bf7-dn/JST.JSTAGE/josnusd/21-0420].

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Oral examination
Oral examinations were conducted using dental units in the dental school of the university. For dental caries status, the numbers of decayed teeth (DT), missing teeth, and filled teeth (FT) due to dental caries were examined by three experienced dentists using the caries diagnostic criteria of the World Health Organization (http://www.who.int/cari/content/publications/WHO-Oral-Health-Surveys-Basic-Methods-5th-Edition-2013.pdf. Accessed on September 10, 2021). To assess periodontal status, gingival bleeding on probing (BOP) and pocket depth (PD) were measured at six sites (mesio-occlusal, mid-buccal, disto-buccal, mesio-lingual, mid-lingual and disto-lingual) in all teeth, and the percentage of BOP and the maximum PD were determined. In participants younger than 20 years, the second molars (17, 27, 37, and 47) were excluded from the evaluation. In addition, the dental plaque score and dental calculus score were measured at six target teeth (11, 16, 26, 31, 36, and 46), using the following criteria, which were originally determined to be a more appropriate for this age range. Plaque adhesion was evaluated as 0 = no plaque, 1 = plaque detectable with periodontal probe, and 2 = visible plaque. The deposition of dental calculus was evaluated as 0 = no calculus, 1 = supragingival calculus only, and 2 = subgingival calculus. The total score of the six teeth was taken as the individual plaque score or calculus score.

Examinations of periodontal and dental hygiene statuses were performed by six experienced dental hygienists. In a preliminary check, the intraclass correlation coefficient (2, 1) was 0.822, showing a high interexaminer reliability.

Questionnaire survey
To investigate the relationship between oral health status and subjective symptoms or oral health behaviors, all participants answered a self-administered questionnaire before undergoing oral examinations. The questionnaire included age, gender, medical history, smoking history, and the following items regarding subjective oral symptoms and oral health behaviors. Questions on oral symptoms included occurrences of spontaneous toothache, hypersensitivity of teeth to cold stimuli, hypersensitivity of teeth to sweet foods, stomatitis, halitosis, swelling of gums, gingival bleeding during tooth brushing, xerostomia, mouth-breathing and food stuck between the teeth. The response options were “never”, “rarely”, “sometimes”, and “quite frequently”, or “yes and no”. Questions on oral health behaviors included regular dental visits, and having a family dentist with the options of “yes and no”, as well as the frequencies of tooth brushing, the use of dental floss or interdental brush, and consumption of beverages containing sugar with the applicable options for each question.

Statistical analyses
The collected data were tabulated and analyzed to clarify the relationships among oral health statuses and questionnaire responses. Participants were classified into two groups based on the presence of DT or gingivitis. BOP ≥ 10% was used as the cutoff value for the presence of gingivitis according to a report by Trombelli et al. [15]. For quantitative variables, after the evaluation of normality in the data distribution with the Shapiro-Wilk test, the differences between the two groups were analyzed using the Mann-Whitney U test. Differences in categorical variables between the two groups were analyzed with the Mann-Whitney U test and chi-squared test.

Multiple logistic regression analysis using a stepwise method was conducted to further identify the factors associated with gingivitis. Before the analysis, independent variables were validated and a correlation coefficient of <0.8 was confirmed to avoid multicollinearity.

A P-value of <0.05 was considered to indicate statistical significance. All statistical analyses were performed using SPSS version 26 for Windows (IBM Japan, Tokyo, Japan).

Results
One hundred and eight students voluntarily participated in this study (participation rate: 63.5%). No participants had a medical history of systemic disease and only one participant was a current smoker. The mean ± SD (median, quartile range) of age of the participants was 19.2 ± 1.7 (19, 18-19) years and 28.7% of them were male. Table 1 summarizes the results of the oral examination. The mean numbers of DT, FT, and decayed, missing and filled teeth (DMFT) of overall participants were 1.2 ± 1.9 (SD), 1.3 ± 2.4, and 2.5 ± 3.1, respectively. No participants had any missing teeth. The percentages of overall participants with DT, DMFT, BOP ≥ 10%, and maximum PD ≥ 4 mm were 43.5%, 60.2%, 50.0%, and 25.9%, respectively. The mean plaque score was 7.1 ± 3.5 and the mean calculus score was 3.6 ± 3.1, with the maximum score for each being 12. The comparison between male and female groups showed no significant differences in all examined indices relevant to oral health status. Table 2 summarizes the responses to the questionnaire on subjective oral symptoms and oral health behaviors. The comparison between females and males demonstrated that females showed more frequent hypersensitivity of teeth to cold stimuli (P = 0.031) and less occurrences of stomatitis (P = 0.012) than males did. Any significant differences by gender were not observed in oral health behaviors.

Table 3 shows the associations of DT with oral hygiene status, subjective oral symptoms related to dental caries and oral health behaviors. The group with DT demonstrated significantly higher plaque (P = 0.005) and calculus (P = 0.007) scores than the group without DT, indicating that the DT group had poorer oral hygiene. However, there were no differences in subjective oral symptoms and oral health behaviors between the two groups.

Table 4 shows the associations of gingivitis defined by BO ≤ 10% with oral hygiene status, subjective oral symptoms related to periodontal diseases, and oral health behaviors. The gingivitis group had significantly higher plaque (P < 0.001) and calculus scores (P = 0.002) as well as larger maximum PD (P = 0.006) as compared with the non-gingivitis group. Moreover, the gingivitis group showed significantly higher frequency of xerostomia (P = 0.011) and less frequency of the use of interdental cleaning tools (P < 0.001).

In addition, multiple logistic regression analysis of gingivitis yielded an odds ratio of 1.41 (95% confidence interval (CI), 1.19-1.67; P < 0.001) for the plaque score, 2.75 (95% CI, 1.27-5.98; P = 0.010) for xerostomia, and 0.72 (95% CI, 0.50-1.06; P = 0.096) for the use of interdental cleaning tools (Table 5).
Discussion

The present study investigated the oral health status, subjective oral symptoms and oral health behaviors and analyzed the relationships between these factors in first-year students attending a dental school. The mean DMFT of the present participants was 2.5, which was comparable with the findings of previous studies among a larger population of first-year university students, reporting a mean DMFT of 2.3 [10] and 2.0 [11]. The mean DMFT of females appeared to be higher than that of males, no significant difference by gender was observed, which might result from the small sample size. A further longitudinal survey by annual oral examinations among students in a university is required. Kojima et al. reported that female students showed significantly higher plaque and calculus scores in the DT group. This result supports the association between oral hygiene status and caries risk during the early 20s, and interventions to prevent an increase in DMFT at this stage are important for maintaining oral health over the life course. In order to fully understand chronological changes in dental caries status, a further longitudinal survey by annual oral examinations among students in a university is required. Kojima et al. reported that female students showed higher DMFT than male students [10]. In the present study, while the mean DMFT of females appeared to be higher than that of males, no significant difference by gender was observed, which might result from the small sample size.

A comparison between participants with DT and without DT showed differences in responses regarding subjective symptoms relevant to dental caries were not observed between the DT and non-DT groups. This result may reflect the fact that the extent of caries in participants with DT was mild and hence the presence of DTs was not linked to awareness of tooth pain or hypersensitivity.
sitivity to cold stimuli. Only 3.7% of participants answered that they felt tooth pain sometimes and 11.1% of students answered that their teeth were sensitive to cold stimuli sometimes or quite often; however, the ratio of students with DT was as high as 43.5%. These results suggest that regular dental checkups and earlier treatments are needed before any subjective symptoms occur.

The comparison of periodontal condition and oral hygiene status between male and female participants resulted in no significant differences in %BOP, maximum PD, plaque score, or calculus score. Although the frequency of stomatitis was significantly lower in females, no significant differences were observed in other subjective symptoms or oral health behaviors relevant to periodontal diseases. These results were mostly inconsistent with previous studies reporting that females had better oral health behaviors and oral health statuses than males [19,20]. The reason for this discrepancy might be the small number of males in the present study.

Inconsistent with previous studies reporting that females had better oral health as compared with the participants in previous studies. In fact, the present participants demonstrated a higher ratio of students undergoing regular dental checkups (38.9%) and using interdental cleaning tools (34.3%) in comparison with the ratios (16.7% and 12.8%, respectively) in a previous study [11].

Based on the recent criterion for gingivitis, BOP ≥ 10% [15], 50% of the present participants were assigned to the group with gingivitis. The gingivitis group showed higher plaque and calculus scores as well as larger maximum PD compared with the non-gingivitis group. Additionally, the gingivitis group reported a higher frequency of xerostomia, reduced frequency of interdental cleaning and a higher ratio of mouth-breathing. Multiple logistic regression analysis for gingivitis further demonstrated significant associations with plaque score (odds ratio = 1.41) and frequency of xerostomia (odds ratio = 2.75). These results suggest that a relatively high ratio of students have gingivitis, and that gingivitis is associated with poor oral hygiene and xerostomia. Furthermore, one possible cause of xerostomia is mouth-breathing, because students with a mouth-breathing pattern are more vulnerable to gingival inflammation. The other reason for the discrepancy is that the participants in the present study were limited to dental school students, which suggests that they had better attitudes toward oral health as compared with the participants in previous studies. In fact, the present participants demonstrated a higher ratio of students undergoing regular dental checkups (38.9%) and using interdental cleaning tools (34.3%) in comparison with the ratios (16.7% and 12.8%, respectively) in a previous study [11].

Table 3  Associations of DT with oral hygiene status, subjective oral symptoms and oral health behaviors

| Question | DT = 0 (n = 61) | DT ≥ 1 (n = 47) | P-value |
|----------|----------------|----------------|---------|
| Do you feel tooth pain? | | | |
| never | 38 (62.3) | 27 (57.4) | 0.712 |
| rarely | 20 (32.8) | 19 (40.4) | |
| sometimes | 3 (4.9) | 1 (2.1) | |
| quite often | 0 (0) | 0 (0) | |
| Are your teeth sensitive to cold food or drink? | | | |
| never | 25 (41.0) | 20 (42.6) | 0.992 |
| rarely | 30 (49.2) | 21 (44.7) | |
| sometimes | 3 (4.9) | 4 (8.5) | |
| quite often | 3 (4.9) | 2 (4.3) | |
| Are your teeth sensitive to sweet foods? | | | |
| never | 52 (85.2) | 39 (83.0) | 0.810 |
| rarely | 7 (11.5) | 8 (17.0) | |
| sometimes | 1 (1.6) | 0 (0) | |
| quite often | 1 (1.6) | 0 (0) | |
| Do you feel dryness in your mouth? | | | |
| never | 22 (36.1) | 13 (27.7) | 0.986 |
| rarely | 27 (44.3) | 30 (63.8) | |
| sometimes | 10 (16.4) | 2 (4.3) | |
| quite often | 2 (3.3) | 2 (4.3) | |
| Do foods stick between your teeth? | | | |
| never | 8 (13.3) | 12 (25.5) | 0.103 |
| rarely | 33 (55.0) | 24 (51.1) | |
| sometimes | 14 (23.3) | 10 (21.3) | |
| quite often | 5 (8.3) | 1 (2.1) | |
| Do you take drinks containing sugar? | | | |
| never | 8 (13.1) | 6 (12.8) | 0.632 |
| rarely | 27 (44.3) | 24 (51.1) | |
| sometimes | 19 (31.3) | 12 (25.5) | |
| quite often | 7 (11.5) | 5 (10.6) | |
| Do you regularly visit a dental clinic? | | | |
| yes | 26 (42.6) | 16 (34.0) | 0.364 |
| no | 35 (57.4) | 31 (66.0) | |
| How often do you brush your teeth daily? | | | |
| < once | 1 (1.6) | 1 (2.1) | 0.636 |
| once | 1 (1.6) | 3 (6.4) | |
| twice | 50 (82.0) | 32 (68.1) | |
| ≥ three times | 9 (14.8) | 11 (23.4) | |
| How often do you use dental floss or interdental brush? | | | |
| never | 23 (37.7) | 27 (57.4) | 0.197 |
| once/month | 16 (26.2) | 5 (10.6) | |
| once/week | 9 (14.8) | 5 (10.6) | |
| 2-3 times/week | 7 (11.5) | 4 (8.5) | |
| every day | 6 (9.8) | 61 (2.8) | |

* Mann-Whitney U test, ** Chi-squared test, **P < 0.01
habit exhibited a higher frequency of experiencing xerostomia, and mouth-breathing has been reported to be associated with a decrease in salivary flow [21]. Since any other subjective oral symptoms such as gum swelling, bleeding from the gum and frequent stomatitis were not associated with gingivitis, it may be difficult for students to become aware of their gingivitis from the subjective symptoms.

Another important point is that interdental cleaning may reduce the risk of gingivitis, because the gingivitis group demonstrated less use of interdental cleaning tools although the multiple logistic regression analysis did not show a significant association between gingivitis and the use of interdental cleaning tools. As previous studies suggested that adjunctive use of interdental cleaning tools to tooth brushing is effective for removing dental plaque and reducing gingivitis [22,23], the present result also supports the efficacy of interdental cleaning in mitigating gingivitis. In addition to the direct effect of interdental cleaning, there is a possibility that students who use interdental cleaning tools may have better knowledge and skill of tooth brushing, which may result in prevention of gingivitis.

Another index of periodontal disease is maximum PD and a PD of ≥4 mm indicates the possibility of periodontitis [24]. The maximum PD among all teeth was measured in the present study, and the result showed that 25.9% of students had a maximum PD of 4 mm or more. Among these students, 3.7% were determined to have mild periodontitis based on the definition put forward by Eke et al. [24]; however, the rest of them were assessed as only having a risk of periodontitis, although attachment loss was not measured taking into consideration the information that people in their early 20s have attachment loss less than 1 mm [25].

### Table 4  Associations of gingivitis with oral hygiene status, subjective oral symptoms and oral health behaviors

| Oral hygiene index | Non-gingivitis (n = 54) | Gingivitis (n = 54) | P-value |
|--------------------|-------------------------|--------------------|---------|
| Plaque score*      | Mean ± SD | Median (25%, 75%) | Mean ± SD | Median (25%, 75%) | <0.001*** |
| Calculus score*    | 5.4 ± 3.1 | 6 (3.7) | 8.9 ± 2.9 | 9 (8.1) | 0.002** |

| Question Options   | n (%)    | n (%)    | P-value |
|--------------------|----------|----------|---------|
| -Do your gums ever appear swollen? a
  never             | 32 (59.3) | 35 (64.8) | 0.365  |
  rarely            | 15 (27.8) | 17 (31.5) |
  sometimes         | 6 (11.1)  | 2 (3.7)   |
  quite often        | 1 (1.9)   | 0         |
| -Do you have halitosis? a
  never             | 22 (40.7) | 23 (42.6) | 0.957  |
  rarely            | 25 (46.3) | 23 (42.6) |
  sometimes         | 6 (11.1)  | 7 (13.0)  |
  quite often        | 1 (1.9)   | 1 (1.9)   |
| -Do you get stomatitis easily? a
  never             | 14 (25.9) | 9 (16.7)  | 0.594  |
  rarely            | 30 (55.6) | 37 (68.5) |
  sometimes         | 10 (18.5) | 7 (13.0)  |
  quite often        | 0         | 1 (1.9)   |
| -Do you feel dryness in your mouth? a
  never             | 24 (44.4) | 11 (20.4) | 0.011* |
  rarely            | 24 (44.4) | 33 (61.1) |
  sometimes         | 5 (9.3)   | 7 (13.0)  |
  quite often        | 1 (1.9)   | 3 (5.6)   |
| -Do your gums bleed when you brush your teeth? b
  yes                | 30 (55.6) | 35 (64.8) | 0.326  |
  no                 | 24 (44.4) | 19 (35.2) |
| -Do you breathe through your mouth? b
  yes                | 8 (14.8)  | 19 (35.2) | 0.046* |
  no                 | 36 (66.7) | 26 (48.1) |
  unknown            | 10 (18.5) | 9 (16.7)  |
| -Do you regularly visit a dental clinic? b
  yes                | 25 (46.3) | 17 (31.5) | 0.114  |
  no                 | 29 (53.7) | 37 (68.5) |
| -How often do you brush your teeth daily? b
  < once             | 35 (63.0) | 0         | 0.644  |
  once               | 2 (3.7)   | 2 (3.5)   |
  twice              | 7 (13.0)  | 4 (7.4)   |
  ≥ three times      | 12 (22.2) | 8 (14.8)  |
| -How often do you use dental floss or interdental brush? b
  never              | 16 (29.6) | 34 (63.0) | <0.001*** |
  once/month         | 13 (24.1) | 8 (14.8)  |
  once/week          | 8 (14.8)  | 6 (11.1)  |
  2-3 times/week     | 7 (13.0)  | 4 (7.4)   |
  every day          | 10 (18.5) | 2 (3.7)   |

The presence of gingivitis was determined by BOP ≥ 10%. aMann-Whitney U-test, bChi-squared test, ***P < 0.001, **P < 0.01, *P < 0.05

### Table 5  Multiple logistic regression analysis using a step-wise method for gingivitis

| Variables | Odds ratio | 95% CI | P-value |
|-----------|------------|-------|---------|
| Plaque score | 1.41 | 1.19-1.67 | <0.001 |
| Xerostomia   | 2.75 | 1.27-5.98 | 0.010  |
| Gingival swelling | 0.60 | 0.30-1.21 | 0.154  |
| Stomatitis    | 1.57 | 0.70-3.54 | 0.272  |
| Halitosis     | 0.55 | 0.25-1.22 | 0.140  |
| Regular visit to a dental clinic | 0.49 | 0.18-1.35 | 0.166  |
| Use of interdental cleaning tool | 0.72 | 0.50-1.06 | 0.096  |

95% CI, 95% confidence interval
Collectively, the current comprehensive investigation of oral health among first-year students attending dental school demonstrated that 44% of participants had DT and 50% had gingivitis; however, the statuses of dental caries and periodontal disease were in the early phase, without any subjective symptoms. Additionally, it was demonstrated that dental plaque and calculus were significantly associated with both dental caries and gingivitis. These results suggest that regular dental visits for the early detection and treatment of oral diseases and receiving professional instructions on tooth brushing and the use of interdental cleaning tools from the early years of university life are needed to prevent disease progression and improve oral health status. Since a relatively low ratio of participants (38.9%) was attending a dental clinic for regular checkups, the observed oral health status suggests that the oral health promotion among these ages may have not progressed even though the Law Concerning the Promotion of Dental and Oral Health emphasizes making efforts for prevention of dental diseases and motivating people to regularly visit a dental clinic in all age groups. Furthermore, the present findings provide important insights about actual oral health status among people in this stage, which has not emerged from the survey of dental diseases in Japan.

This study has a few limitations. One is that participants were first-year students attending dental school in a university. Since dental school students are considered to have a higher awareness of oral health, the oral health status and behaviors of the present participants may be better than those of students in other schools. In addition, the oral health status among upper-class students of other schools is predicted to get worse, as indicated in the study by Kubota et al. [16]. Therefore, it is difficult to generalize the present findings to the overall population of Japanese university students. Another limitation is the small number of participants, which might be related to the lack of significant differences by gender in the present study showing an inconsistency with previous studies [19,20]. Instead of a small sample size, measurements of BOP and PD were conducted at six sites of all teeth, which enabled a more precise evaluation of periodontal conditions.

Consequently, this study revealed that the oral health status and behaviors of first-year students at a university dental school were in situation with many problems, even though the students may have better oral health status and behaviors than those of students at other schools. In order to fully understand the oral health problems of university students, further investigations among a larger number of university students from a variety of schools are needed. Based on these investigations, effective interventions by dental professionals should be conducted to promote the oral health of university students.

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Conflict of interest
The authors declare no conflict of interest.

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