Abstract: This study aimed at determining whether oral health behavior differs between patients regularly checked by male and female dentists. The analysis was based on a cross-sectional survey of 354 Japanese community residents (median age = 54 years; 145 men and 209 women) conducted in a municipality from January to February 2017. Data on demographic characteristics and factors associated with oral health behavior were obtained through self-administered questionnaires. The association between regular dentist gender and patients’ regular dental care check-up and interdental cleaning performance was examined after adjusting for potential confounders. Among respondents, 88.7% and 11.3% reported having male and female regular dentists, respectively. In a multivariate logistic regression model, patients regularly checked by female dentists had an increased likelihood of visiting their dentist for dental care check-up at least once every year (odds ratio [OR] = 2.23, 95% confidence interval [CI] = 1.09-4.55) and using an interdental cleaner (OR = 2.62, 95% CI = 1.03-6.71) compared to those regularly checked by male dentists. Patients regularly checked by female dentists tended to have more preventive oral health behaviors than those regularly checked by male dentists. These findings suggest that dentist gender has important clinical implications for patients’ oral health behavior.

Keywords; dentists, epidemiology, gender difference, patients, practice patterns, prevention

Introduction

Over recent decades, the proportion of female dentists has gradually increased in the traditionally male-dominated dentistry field in the United States and the European Union [Kratzivitz A et al., EU Manual of Dental Practice 2008 (version 4), 1-406, Counc Eur Dent, 2008] [1]. Even in Japan, the percentage of female dentists doubled in almost 40 years, from 11.7% in 1978 to 23.3% in 2016, which now comprise >40% of new dental practitioners [Takeuchi K et al., A tendency for the supply of dentists using Medicare beneficiaries suggested that differences in practice patterns between male and female physicians affect patient outcomes, such as mortality and readmission rates [11]. However, only a small number of studies have focused on practice pattern differences between male and female dentists. In addition, these studies have not examined patients’ oral health behavior, which is arguably the most important feature when oral health maintenance is considered. Therefore, whether patients’ oral health behavior differs between male and female dentists remains largely unknown.

The aim of this study was to investigate whether oral health behavior of patients residing in a single community differs between those regularly checked by male and female dentists. This study’s hypothesis was that patients regularly checked by female dentists have a greater likelihood of adopting preventive behaviors regarding oral health.

Materials and Methods

Study population

This cross-sectional study was conducted from January to February 2017 in a single municipality, a suburb of the Shizuoka metropolitan area in the Chūbu region, in Japan. In Japan, healthcare insurance covers a variety of disease screenings, infectious disease control, and other services including basic dental treatments, such as regular dental care, scaling and polishing, and fillings. This type of insurance is included in a universal healthcare insurance system, which enables people who need medical and dental treatment to only pay 10% to 30% of the total treatment cost.

A flow diagram of study participant selection is presented in Fig. 1. Self-administered postal questionnaires were sent to 1,500 residents who were randomly sampled by age strata (20-29, 30-39, 40-49, 50-59, and 60-69 years), 637 of which were returned. The response rate was 42.4%, which is comparable to or better than those of other surveys of similar-generation residents in Shizuoka (36.5%) or other prefectures (36.4%) [12,13]. After excluding 236 respondents who did not have a regular dentist and 47 respondents with incomplete data, analyses were performed for 354 participants (145 men and 209 women; median age = 54 years). All participants provided informed consent for use of their personal information in the study. The study was approved by the Ethics Committee of the University of Shizuoka (28-35). All methods were in accordance with approved guidelines and regulations.

Measurements

Study participants completed a questionnaire that comprised items dealing with patients and their regular dentist factors. Patient factors included demographic characteristics, socioeconomic status, medical history of diabetes mellitus (yes or no), hypertension (yes or no), dyslipidemia (yes or no), dental health status, and oral health behavior. Gender, age, marital status, and body height and weight were used as demographic characteristics. Marital status categories were married, widowed/divorced, and never married. Body mass index (BMI) was calculated as body weight in kilograms divided by the squared value of body height in meters (kg/m²). Educational attainment and annual household income were used to stratify patients into socioeconomic strata. A low education level was defined as less than 10 years of formal education. Annual household income was cat-
Randomly recruited community residents aged 20-69 years from a single municipality of Shizuoka prefecture, \( n = 1,500 \)

\[ \text{Non-response, } n = 863 \]

\[ \text{Respondents, } n = 637 \text{ (response rate: 42.4\%)} \]

\[ \text{Respondents who do not have a regular dentist, } n = 236 \]

\[ \text{Respondents who have a regular dentist, } n = 401 \]

\[ \text{Does not submit complete data, } n = 47 \]

**Fig. 1** Flow diagram of study participant selection

### Table 1: Patient characteristics according to regular dentist gender

| Patient characteristic                      | Male (\( n = 314 \)) | Female (\( n = 40 \)) | \( P \)-value |
|--------------------------------------------|-----------------------|-----------------------|--------------|
| Female, %                                  | 58.3                  | 65.0                  | 0.496        |
| Age, years                                 | 54.5 (21.0-69.0)      | 53.0 (23.0-67.0)      | 0.425        |
| Marital status, %                          |                       |                       |              |
| Married                                    | 73.9                  | 82.5                  | 0.446        |
| Widowed/divorced                           | 10.2                  | 5.0                   |              |
| Never married                              | 15.9                  | 12.5                  |              |
| Body mass index                            | 22.7 (16.8-40.0)      | 22.4 (15.2-38.0)      | 0.610        |
| Educational attainment < 10 years, %       | 51.6                  | 42.5                  | 0.316        |
| Annual household income, %                 |                       |                       |              |
| <$40,000                                   | 24.2                  | 17.5                  | 0.629        |
| $40,000-59,999                             | 29.9                  | 30.0                  |              |
| $60,000-79,999                             | 17.5                  | 25.0                  |              |
| $80,000-99,999                             | 11.8                  | 7.5                   |              |
| >$100,000                                  | 16.6                  | 20.0                  |              |
| Diabetes mellitus, %                       | 5.1                   | 10.0                  | 0.263        |
| Hypertension, %                            | 23.9                  | 20.0                  | 0.694        |
| Dyslipidemia, %                            | 13.7                  | 15.0                  | 0.809        |
| Number of remaining natural teeth, %       |                       |                       |              |
| <10                                        | 5.1                   | 5.0                   | 0.998        |
| 10-19                                      | 15.3                  | 15.0                  |              |
| >20                                        | 79.6                  | 80.0                  |              |
| Regular dental care check-up at least once a year, % | 39.5                  | 60.0                  | 0.017        |
| Use of an interdental cleaner, %           | 68.2                  | 85.0                  | 0.028        |

Categorical variables expressed as percentages; continuous variables expressed as median (range)

egorized as <$40,000, $40,000-59,999, $60,000-79,999, $80,000-99,999, and ≥$100,000 (US $1 = ¥100). Number of remaining natural teeth, an indicator of dental health status, was categorized as 20 or more natural teeth, 10-19 natural teeth, and 9 or less natural teeth. Patients’ oral health behavior was evaluated as a primary outcome measure through regular dental care check-up and interdental cleaning performances, considered essential prerequisites for caries and periodontitis management. Regarding regular dental visits, patients were categorized as visiting or not visiting their regular dentist for dental care check-up at least once a year. Use of an interdental cleaner was measured by the question “Do you use dental floss or an interdental brush?”, to which respondents answered “yes” or “no.” Regular dentist factor comprised dentist gender, which was considered the primary predictor for patient’s oral health behavior.

**Statistical analyses**

Patient characteristic differences between male and female regular dentists were determined using the Pearson’s chi-squared test for categorical variables and the Mann-Whitney \( U \) test for continuous variables. To examine the association between regular dentist gender and patient regular dental care check-up and interdental cleaning performance, crude and adjusted odds ratios (OR) were estimated, with 95% confidence intervals (CIs) for regular dental care check-up and use of interdental cleaners based on their regular dentist gender, using logistic regression models. In a multivariate analysis, patient’s age; marital status; BMI; educational attainment, annual household income, diabetes mellitus, hypertension, and dyslipidemia status; and the number of remaining natural teeth were added to the univariate model. To assess public health impact of dentist gender on patients’ regular dental care check-up and interdental cleaning performance, the population attributable fraction (PAF) (%) was calculated. PAF is generally defined as the fraction of population disease (or risk factor) incidence (or prevalence) that can be attributed to a particular cause [Rothman KJ et al., Modern Epidemiology, 51-70, Philadelphia, PA: Lippincott Williams & Wilkins, 2008]. In this study, PAF was treated as the increase in the number of patients visiting their regular dentist for oral care at least once a year or using an interdental cleaner that would be achieved if the entire population was regularly checked by female dentists, compared with its current exposure pattern, as previously described [14]. All analyses were performed using IBM SPSS version 24 statistical software (IBM Corp., Armonk, NY, USA).
In all cases, STROBE statement guidelines for observational studies were followed for the study report.

Results

Characteristics of study patients according to regular dentist gender are listed in Table 1. Of all patients, 314 (88.7%) reported having male regular dentists, and 40 (11.3%) reported having female regular dentists. The proportion of patients who visited their regular dentist for oral care at least once a year and who used an interdental cleaner was significantly higher for patients who were regularly checked by female dentists compared to that by male dentists. By contrast, gender; marital status; educational attainment, annual household income, diabetes mellitus, hypertension, and dyslipidemia status; and the number of remaining natural teeth distribution were not significantly different between patients regularly checked by male or female dentists. Likewise, age and BMI did not significantly differ between both groups.

Results of the logistic regression analysis for the association between regular dentist gender and patients’ regular dental care check-up and interdental cleaning performance are presented in Table 2. OR for patients who visited their regular dentist for oral care at least once a year was significantly higher for patients regularly checked by female dentists compared to that by male dentists (OR = 2.30, 95% CI = 1.17-4.50). Likewise, OR for patients who used an interdental cleaner was significantly higher for patients regularly checked by female compared to that by male dentists (OR = 2.62, 95% CI = 1.03-6.71). In the multivariate analysis, after adjusting for all covariates, patients regularly checked by female dentists had an increased likelihood of visiting their regular dentist for dental care check-up at least once every year (OR = 2.23, 95% CI = 1.09-4.55) and using interdental cleaner (OR = 2.62, 95% CI = 1.03-6.71) compared with patients regularly checked by male dentists. Corresponding PAF for prevalence of regular dental care check-up at least once a year and use of interdental cleaner due to participants’ regular visits to their female dentists in this population were 28.9% and 30.7%, respectively.

Discussion

This study indicates that patients regularly checked by female dentists significantly tend to have more preventive behaviors regarding oral health than patients regularly checked by male dentists. This significant association was observed even after adjusting for possible confounders. Importantly, as far as is known, this study provides the first evidence of an association between regular dentist gender and patients’ preventive oral health behaviors.

Study findings suggest that male and female dentists may practice differently. Few studies have examined differences in practice patterns between male and female dentists. Although an analysis of general dentist data in Washington State reported no gender differences in practice patterns [15], other studies have specifically reported female dentist practice patterns [16,17]. A cross-sectional Australian survey indicated that female dentists had a significantly higher rate of preventive services than that of male dentists [16]. Similarly, a survey about the general dentist population practicing in the United States reported that female dentists seem to have greater overall preventive orientation than male dentists toward caries management in both adult and pediatric patients [17]. Therefore, the positive association between female dentists and preventive services may provide a plausible mechanism linking dentist gender with patient oral health behavior. Another suggested mechanism is the presence of dental hygienists, who play a central role in providing preventive services and motivating patients’ oral health behavioral changes. It is possible that attitude differences toward preventive orientation between male and female dentists may be associated with dental hygienist motivation because most dental hygienists are female in many countries including Japan [18]. Thus, collaboration of dental hygienists with same-gender (female) dentists may be smoother than with other-gender (male) dentists. Therefore, through collaboration with dental hygienists, female dentists may encourage their patients to visit their regular dentist for oral care at least once a year and use interdental cleaner as part of oral health guidance for preventing dental disease.

Present study findings have public health implications. One of its goals was to calculate PAF associated with patients being regularly sourced by female dentists (compared with those checked by male dentists) for having more preventive oral health behavior. PAFs in this population were 28.9%-30.7%, implying that in almost one-third of cases, patients having preventive oral health behavior may be attributed to being regularly checked by female dentists. Consequently, if male regular dentists, who account for the majority of dentists, could achieve the same practice patterns as female regular dentists, an increase in the number of patients having preventive oral health behavior would predictably be expected.

This study has several limitations and strengths. First, the lack of information regarding potential confounding factors, such as dentist age, may have to some extent reduced the accuracy of findings. As suggested in a previous study [16], the positive association between young dentists and preventive services indicates that preventive orientation is a source of observed differences in patients’ oral health behaviors. However, as the proportion of female dentists in this study (11.3%) is almost identical to that in the 60-69-year age group of dentists across Japan (13.1%) in 2016, it is unlikely that female dentists were much younger than male dentists in this study. Second, information regarding the type of preventive care dentists provided was not retrieved in this study. Thus, the present study did not consider the implications of undergraduate dental training and continuing professional development. Third, this was a cross-sectional study; this makes it impossible to rule out the reverse causation that people with good oral health behavior tend to choose female dentists. However, the chance of this being true is very low, since choosing a dentist can be difficult. Finally, this analysis was limited to community residents from one medium-sized municipality in Japan. Thus, caution should be exercised when generalizing its findings to other populations. However, the population sample may also be considered to be an advantage, as data were less affected by geographic, cultural, historical, and political factors among municipalities, providing some assurance of study’s internal validity.

In conclusion, this study indicates that patients regularly checked by female dentists have a greater likelihood of visiting their regular dentist for dental care check-up at least once every year and using interdental cleaner. These findings suggest that dentist gender has important clinical implications for patients’ oral health behavior.

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Conflict of interest
The authors declare that they have no competing interest.

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